Staleen Water Treatment Plant Outage Review

22nd September 2017
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1. Key Findings

The key findings of this review recognise that this was a major incident for Irish Water which underlined the risks presented by the condition of the assets. It identifies key priorities for action by Irish Water which will, over time, improve the preparedness for, and response to, any similar incident occurring in the future, as follows:

- Identify the most critical assets and ensure, as far as possible that the spares and resources necessary to effect a repair in the event of failure are readily available.
- Establish a central store, together with the transportation resources required, to facilitate the rapid deployment of equipment to support the provision of alternative water supplies in future incidents.
- Develop and enhance on a prioritised basis, together with the LAs, existing contingency plans for the provision of alternative water supplies in the event of a major supply disruption.
- Develop, in consultation with the CER, an enhanced Vulnerable Customer register.

2. Executive Summary

A comprehensive review has been undertaken to establish the facts relating to the Staleen Water Treatment Plant (WTP) outage in July 2017 which led to prolonged water supply interruptions for households and businesses in the Drogheda, South Louth and East Meath areas. The review has also been undertaken to identify lessons which can be learned as to any factors which caused and contributed to the incident and to make recommendations which when implemented would improve the response to any similar incident occurring in the future. This will enable Irish Water (IW) to consolidate and further enhance both generic incident management and specific incident preparedness and response.

In addition to setting out the background and a description of the incident that lead to the outage and subsequent actions taken, the review considered:

i) The level of preparedness for this type of incident and outage.
ii) The technical/engineering background and response to the pipe repair.
iii) The response in distributing the available water and providing alternative water supplies
iv) The interactions with the two local authorities in the affected areas under their Service Level Agreements with Irish Water.
v) The role of support agencies and other organisations.
vi) The communications response to consumers including vulnerable households and to all other stakeholders.

The Staleen Water Treatment Plant (WTP) provides drinking water to a population of approximately 90,000 in the Drogheda, South Louth and East Meath area. The larger of two rising mains (600mm diameter) between the Roughgrange intake/pumpstation, abstracting water from the River Boyne, and the Staleen WTP burst on the afternoon of Thursday 20th July
2017. As the smaller (450mm diameter) rising main from Roughgrange to the Staleen WTP remained operational for the most part throughout the incident, the treatment plant continued to produce approximately 45% of its normal production. This was further supplemented by increasing supplies from other sources and connecting new sources over the course of the incident response.

After two initial attempts to repair the burst pipe failed, IW established its Incident Management team on Sunday 23rd July to support the management of the repair and respond to households’ and businesses’ water supply needs. After a third repair failed the incident was further escalated and IW’s Crisis Management and the Local Authorities (LA) Incident Management Teams were convened on the morning of Monday 24th July, recognising the scale and impact of the incident on the communities affected.

IW has a comprehensive suite of incident management plans and procedures in place which have been regularly tested, audited, benchmarked and enhanced since first developed. LAs have prepared Drinking Water Incident Response Plans (DWIRP) in accordance with a 2009 Department Circular (L4/09) which set out the LA strategy and protocols for responding to water contamination incidents or other incidents such as a significant supply disruption.

It is important to note that watermain bursts are, and will continue for some time, to be a common occurrence across the water network. In the first seven months of 2017, there have been 2,050 watermain bursts recorded on the public networks which equates to an average of almost 10 per day. In the vast majority of these cases it is possible to quickly repair the main using standard repair methods and without significant interruption to water supplies. Where there is the expectation that the burst can be readily repaired, the burst is treated as a repair and typically does not get escalated as an incident under the DWIRP or IW Incident Management Procedures.

What differentiated this incident was that three repair attempts using standard and modified standard couplings did not result in an effective repair and a prolonged outage ensued. There was a previous burst on the 600mm diameter rising main on Friday 3rd June, 2016. IW have no records of any bursts occurring on this pipe before that; the pipeline was laid in the mid-1980s. The June 2016 repair was effected using standard couplings with modifications and a successful repair was completed at the first attempt. Subsequently, two sets of stepped couplings were ordered and held in stock for future use when required.

Following an initial delay in accessing the field, due to landowner issues from the previous repair that had not been appropriately closed out by Irish Water, a Louth County Council (LCC) crew commenced excavating to make the repair at 05:00 approx. on Friday 21st July. The first repair was completed but failed on refilling the pipe on Friday evening. It was decided to attempt a second repair on Saturday 22nd July but this too failed that evening.

Following this failure, the assistance of a specialist engineer from Fingal County Council (FCC), who had previous experience in the repair of large diameter pipes, was sought. Three options were identified and it was decided to progress all three in parallel over the following days.

The first option was to strengthen the existing fittings and commence a third repair attempt on the morning of Sunday 23rd. An engineering firm was sourced which was prepared to modify the
fittings on Sunday morning. The modified coupler held better but began to leak just before it reached the required operating pressure.

The second option was to modify the infill ductile iron pipe section to match the outer diameter of the turned ends of the AC pipes and use straight couplings. This option would require until Tuesday evening to manufacture and was the basis for the successful fourth repair on the morning of Wednesday 26th July.

The third option was to fabricate a steel infill pipe section with an outer diameter to match the outer diameter of the asbestos cement pipe and use straight couplings to suit a 692mm outer diameter pipe. This option would take the most time and was essentially a backup if needed for a follow on repair.

The fourth repair attempt commenced mid-morning on Wednesday 26th July and was successfully effected by early afternoon with the recharging of the 600mm rising main completed and the combined flow from both the 600mm and 450mm diameter reaching normal operating conditions by approx. 17:30.

It was decided early on in the management of the incident that provision of water to Our Lady of Lourdes Hospital was a critical priority. The Drogheda Network was then configured to ensure that a continuous supply of water could be maintained to the Hospital and the town centre area with water being distributed to an additional four suburban areas of Drogheda on a three hourly rotational basis i.e. each of the four areas received a piped water supply for approximately three hours during daylight hours.

In addition, alternative water supplies were made available through water stations throughout the Drogheda, South Louth and East Meath areas effected by road tanker, bowsers and Integrated Bulk Containers (IBCs). In this regard, assistance was received from a number of other local authorities, Northern Ireland Water, the Fire Service, the Defence Forces, the Civil Defence and private companies. Bottled water was delivered to vulnerable households through the Civil Defence and other community groups. In addition the output from some small borehole supplies was increased with network reconfigurations and provision of short network connections being undertaken and improving supply to areas in Meath.

The Rosehall WTP was the first water supply system for Drogheda and when in use was producing approx. 2.3 ML/day in Q1 2016. The existing raw water source was identified as problematic, there were regular compliance issues at the plant and the existing processes were deemed insufficient to ensure consistent compliance with the Drinking Water Regulations. Predominately based on the water quality issues at the plant and the available capacity of the Staleen WTP (where planning of upgrade works was well underway), it was decided by IW in consultation with LCC to close the Rosehall plant. The plant ceased operation in March 2016 and in 2017 the chlorine dosing equipment was decommissioned and other actions were taken to make the plant safe. It was not feasible within the timescale of the response to the Staleen WTP Outage to bring the plant back into operation given that some key elements of the treatment process had been decommissioned and removed and the condition of the slow sand filters after 12 months without a flow of water was not suited to treating water. It is also worth
noting that even at its reduced throughput, Staleen WTP was producing significantly more water than Rosehall WTP was able to produce during the previous incident.

A comprehensive communications response was put in place to deliver the key information about the Staleen WTP Outage, in a timely, relevant and accurate manner to ensure those affected locally were aware of the incident and aware of what would happen to support the local communities during the incident and keep them up to date on the resolution of the Incident. IW’s responsibility was to ensure that the public were kept up-to-date and to provide the latest information to local elected representatives, key stakeholders and vulnerable households in line with IW commitments under the Commission for Energy Regulation Customer Handbook. This commenced on Friday 21\textsuperscript{st} July and was dealt with at that stage as a routine burst incident by issuing a notification to the media and update to www.water.ie; the Irish Water Call Centre was also briefed.

On Sunday morning 23\textsuperscript{rd} July, when the IW Incident Management Team was convened (triggered by the duration of the outage and the developing impact at that stage) an integrated communications team comprising of Media Relations Manager, Stakeholder and Communications Manager, Customer Service Manager was put in place and liaison with the Website and Digital and Communications Manager commenced. On Monday morning 24\textsuperscript{th} July when the IW Crisis Management Team was convened, communications resources were supplemented to provide consumer communication, media and stakeholder communication, Press and Media Relations, briefing and liaison with the Irish Water Call Centre, communication to all key stakeholders, all website updates and social media updates and liaison with the relevant Local authority personnel. A summary of all the communications relating to the Incident is provided in this review report.

The Staleen WTP returned to normal production capacity on the evening of Wednesday 26\textsuperscript{th} July. Normal supply to households and businesses was restored over the following two days, with the bulk of properties in Drogheda serviced by Wednesday evening and elsewhere by Thursday evening but with properties on high ground and furthest from the plant being the last to receive a normal supply.

Based on a review of the available documentation and information gained through the review process it seems reasonable in hindsight that the incident could have been formally escalated from an operational incident to a high severity incident (in accordance with the IW Incident Procedures and LA DWIRPs) prior to Sunday the 23\textsuperscript{rd}. It’s important to note that this would not have shortened the overall time to repair or allowed tankers to be mobilised any sooner, however it may have enabled detailed contingency planning to have been more developed coming into Monday the 24\textsuperscript{th} and potentially supported a more comprehensive communications response to be established on Saturday the 22\textsuperscript{nd}. At the time the focus was on achieving an interim repair that would restore service, even if only for a short period to fill reservoirs.

A major upgrade of the Staleen WTP is planned with construction expected to commence in late 2017. The purpose of the upgrade is to improve the quality of water supply to Drogheda, South Louth and East Meath so as to ensure consistent compliance with the most recent Irish Water drinking water standards and current Drinking Water Regulations. The works will also comprise of the supply and installation of a range of mechanical, electrical, instrumentation, control and
automation equipment at the Roughgrange PS, including new high lift pumps, control panels, pipework and associated equipment. Work has now also commenced on the design of a replacement rising main which will be provided in parallel with the previously approved works.

Given the technical difficulties involved in the repair, the duration, scale and geographical spread of the outage, the incident was effectively managed by IW and the LAs involved. The review report has identified a number of lessons learned and made a number of recommendations to improve the preparedness, management and response to a similar incident in the future.

The key recommendations are:

- The IW and LA Incident Management Procedures should be reviewed and revised to:
  - Ensure incident classifications, escalation protocols and roles and responsibilities are clear and consistent throughout.
  - Ensure classification guidance and escalation thresholds are set at appropriate levels.
  - Formally include the role of IW Incident Liaison Engineer which was found to be extremely effective once in place on Monday the 24th. This person would join the LA Incident Management Team in location and act as a point of contact between the IW and LA Incident Management Team.

- IW should continue to develop a national emergency response and repair capability which is aligned with international best practice. In particular IW should:
  - Establish a central stores to provide for the quick deployment of equipment to support the provision of alternative water supplies in future incidents. Equipment to include road tankers of various sizes, IBCs, standpipes, flatpack water containers, bottled water.
  - Establish frameworks with suppliers, complete with out of hours arrangements, to provide and operate tractor units for tankers and trailers for IBC deployment, to provide and operate additional tanker units to supplement IW stock and to provide additional stocks of bottled water. This will need regional provision for adequate response.
  - Investigate the feasibility of establishing mutual aid arrangements with other water utilities e.g. Northern Ireland Water.
  - Develop a stores and inventory management system to cover the purchase, recording, storage, maintenance and distribution of critical spares.
  - Develop Standard Operating Procedures (SoPs) for the Repair of Large Diameter Mains and support its implementation with the necessary resources and equipment. Frameworks should be established with contractors, complete with out of hours arrangements, to carry out complex repairs where necessary.

- IW should work together with the LAs on a prioritised basis to develop and enhance existing contingency plans for the provision of alternative water supplies in the event of a major supply disruption. These plans should include high level contingency tankering plans, identification of priority/institutional customers, and advance planning for the initial establishment of key water stations which can then be supplemented as needed. Opportunities to increase network resilience should continue to be identified and put in place where practicable.
- IW should continue to improve its asset information, with a particular focus on its critical assets, through sourcing of original design and construction documents, information gained through pipeline interventions, and collate local knowledge.
- IW in consultation with the CER should consider how the Vulnerable Customer register can be enhanced. As part of this process IW should engage with the local authorities, HSE and other agencies, subject to data protection requirements, who have more specific knowledge of vulnerable groups and personnel.
- It is recommended that clear and simple guidance be developed to help support personnel (volunteer or otherwise) providing response to the public.

IW recognises and deeply regrets the disruption and hardship caused to the people of Drogheda, South Louth and East Meath during this incident. IW also recognises and is extremely grateful for the enormous efforts made by the many people within IW, Ervia, Meath and Louth LAs, the wider LA sector, State Agencies, Non-Governmental Organisations, Community groups and private companies who worked incredibly hard to achieve the repairs, provide emergency support during the outages and assist the communications effort.
3. Introduction

A rising main between the Roughgrange Pumping Station (PS) and the Staleen Water Treatment Plant (WTP) burst on the afternoon of Thursday 20th July 2017. The Staleen WTP, which has a capacity of 31.5 Ml/day, provides drinking water to Drogheda, South Louth and East Meath, supplying approximately 90,000 people. After initial attempts to repair the burst pipe failed, an incident was declared to manage the repair and respond to customer’s water supply needs. The Staleen WTP returned to normal operational throughput on Wednesday evening of 26th July. Normal supply to customers was restored over the following days, with customers on high ground and furthest from the plant being the last to receive a normal supply. The IW Crisis Management team was stood down on Tuesday 01st August.

A team, consisting of two personnel from Ervia and two from Irish Water, was established to review the event in accordance with the Terms of Reference (ToR) included in Appendix 2 of this report.

The review also addressed the requirements of the IW Incident Management Procedure and Crisis Management Plan to carry out a post incident review.

The approach taken by the review team included the following:

- Meetings with personnel in Irish Water (IW), Louth County Council (LCC), Meath County Council (MCC) and Ervia. In total the review team met with 32 people.
- Review of incident records, including the Log Book and Situation Reports
- Review of records and data collated by IW, LCC and MCC relating to the repair and provision of water to customers and communications to customers and key stakeholders during the event
- Site visit to Staleen WTP and Roughgrange PS
- Review of asset data on the fixed assets and operational data e.g. flows and records
- Review of a number of reports on the Staleen WTP and Roughgrange PS
- Consideration was given to issues raised in feedback to Irish Water during and post the event

A key focus of the review was to identify lessons which can be learned as to any factors which caused and contributed to the incident and to make recommendations which when implemented would improve the response to this and any similar incident occurring in the future.

A brief outline of the structure of the report is included below.

Section 4 on the Background and Description of the Incident describes the water supply area affected by the Staleen WTP outage, the key water supply assets, a previous burst to the rising main in June 2016.

Section 5 on the Incident Recovery and Repair of the Pipe addresses Item (2) of the ToR and outlines the timeline and actions taken in the repair of the rising main.

Section 6 on the Incident Response, Distribution of Available Water Supply and Provision of Alternative Water Supplies addresses Item (3) of the ToR. It sets out actions taken to make optimum use of available piped water supplies and the additional measures taken to provide alternative water supplies and the actions taken to address the needs of vulnerable customers.
Section 7 on the Incident Management Procedures and Emergency Preparedness addresses Item (1) and (4) of the ToR and sets out the incident management plans and procedures adopted by IW and the LAs in responding to the incidents.

Section 8 on Working with External Organisations addresses Item (5) of the ToR.

Section 9 on Communications addresses Item (6) of the ToR and reviews the communications during the incident with customers including vulnerable customers and all other stakeholders including the Minister and Department of Housing Planning & Local Government (DHPLG), the CER, the EPA, the HSE, local representatives, local and national media, and the use of the contact centre, website and social media in supporting this response. It also addresses the interactions between IW and the LAs in relation to communications, addressing Item (4) of the ToR.

Section 10 on Findings and Recommendations identifies the findings and lessons learned in the management and response to the incident and makes recommendations which, when implemented, will improve the response to any similar incident occurring in the future.

Supporting information is included in the following Appendices:

Appendix 1  Glossary of Terms and Abbreviations
Appendix 2  Terms of Reference
Appendix 3  High Level Timeline for the Incident
Appendix 4  Extract from Management of Drinking Water Incidents Protocol (IW-PRT-IMT-002)
Appendix 5  Communications – Supplemental Information

3.1 Overview of the Rising Main Burst July 2017

The SCADA flow data for the 450mm and 600mm diameter rising mains indicates normal flows at 13:55 and zero flows at 14:00 on Thursday 20th July, indicating that the burst occurred at some time between 13:55 and 14:00. At approx. 15:00 on the 20th July, it was noticed that the meters recording flows to the Staleen Water Treatment Plant were showing zero flow and the level of the raw water tank was falling. The Plant caretaker travelled to the Roughgrange PS to investigate if there was a problem with the pumps and on arrival could see water on the public road coming from the burst in the rising main, in a field adjacent to the road. It was clear that there was a burst on one of the rising mains and on further investigation it was established that there was a burst on the 600 mm AC rising main. The burst is located approx. 50 metres from the Roughgrange pumping station and approx. 50 metres from the location of a burst on the rising main in 2016.

The actions taken over the following week in repairing the pipe and supplying water to customers are described in detail in the following sections of this report.
4. **Background and Description of the Incident**

4.1 **Drogheda, South Louth and East Meath Water Supply Area**

In this report the descriptor Drogheda, South Louth and East Meath Water Supply Area is used to refer to the area impacted by the Staleen WTP Outage. It includes Drogheda and an area of South Louth and East Meath, extending from Clogherhead, Co Louth in the north to Kilbride, Co. Meath in the south, a distance of approximately 50km. The area includes the main towns (population in excess of 1,000) as shown in Table 4.1 below.

**Table 4.1 Main Towns in the Drogheda, South Louth and East Meath Water Supply Area**

<table>
<thead>
<tr>
<th>Town</th>
<th>Population [Census 2016]</th>
</tr>
</thead>
<tbody>
<tr>
<td>Drogheda</td>
<td>40,956</td>
</tr>
<tr>
<td>Ashbourne</td>
<td>12,679</td>
</tr>
<tr>
<td>Laytown-Bettystown-Mornington-Donacarney</td>
<td>11,872</td>
</tr>
<tr>
<td>Ratoath</td>
<td>9,533</td>
</tr>
<tr>
<td>Duleek</td>
<td>4,219</td>
</tr>
<tr>
<td>Stamullen</td>
<td>3,361</td>
</tr>
<tr>
<td>Clogherhead</td>
<td>2,145</td>
</tr>
<tr>
<td>Termonfeckin</td>
<td>1,579</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>86,344</strong></td>
</tr>
</tbody>
</table>

The main water source for the area is the abstraction from the River Boyne at Roughgrange which feeds the Staleen WTP. The following borehole sources also feed into the Drogheda, South Louth and East Meath Water Supply Area:

- Kiltrough (two boreholes)
- Curragha
- Rath

There are three Water Supply Zones making up the Drogheda, South Louth and East Meath Water Supply Area:

- South Louth & East Meath
- Kiltrough / Bettystown
- Ashbourne / Ratoath
The population provided with a public water supply in the Drogheda, South Louth and East Meath Water Supply Area is approx. 90,000 and the overall distribution input from all sources in the supply area is approx. 30 Ml/day.

Staleen WTP is the primary treatment plant for Drogheda and East Meath Water Supply Schemes and has a design capacity of 31.5 Ml/day. A treatment plant with a capacity of 18 Ml/day was built in the period 1971 to 1973 and this was upgraded to the current plant capacity in 1986.

The treatment process at the Staleen WTP is conventional coagulation using liquid alum plus polymer, upward flow lamella sedimentation, rapid gravity sand filtration, chlorination and fluoridation. There is 5.5 Ml raw water storage and 6.3 Ml of treated water storage at Staleen. After treatment, water gravitates to two storage reservoirs at Donore. The average flow being abstracted and pumped from the Roughgrange PS to the Staleen WTP in the period before the incident was 27.9 Ml/day. The plant is producing 26 Ml/d of treated water, which is split approximately equally between Drogheda and East Meath water schemes.

Water is supplied to the Drogheda and East Meath networks from Staleen WTP via four supply routes:

1. Drogheda & South Louth:
   a. North from the clear water tank at Staleen via a 400mm main to Donore Reservoirs. Donore Reservoirs provide storage for Drogheda town and also supply on to Termonfeckin and Clougherhead.

2. East Meath:
   a. East from the clear water tank at Staleen via a 300mm main to Kiltrough Tower and onto the east coast.
   b. South from the Staleen reservoirs via a 300mm main. These supply Duleek and the supply areas of Carnes and Balloy Reservoirs.
   c. South from the clear water tank at Staleen via a 400mm main to Windmill Hill reservoirs. These supply the south central areas, Ratoath and Rath reservoir, which in turn serves Ashbourne.

A schematic plan showing the sources, reservoirs and key mains in the Drogheda, South Louth and East Meath Water Supply Area is shown in Fig 4.1 below.

The South Louth East Meath WSZ is currently on the EPA’s Remedial Action List under the heading of ‘Poor turbidity removal’. This points to inadequate treatment at the Staleen WTP and an unacceptable risk of failure to meet current drinking water regulatory standards under Irish Water’s risk categorisation. For that reason, the upgrade of the Staleen WTP is an IW investment priority.
Fig 4.1 Schematic Drawing of the Drogheda, South Louth and East Meath Water Supply Area
The upgrade works will be undertaken as part of the Louth Water Supply Schemes – Staleen & Cavanhill Water Treatment Plants Upgrade project. IW has received tenders for this project and it is expected that the contract will be executed in Q3 2017. The purpose of the upgrade to the Staleen WTP is to improve the quality of water supply to Louth and East Meath so as to ensure consistent compliance with the most recent Irish Water drinking water standards and current Drinking Water Regulations. The proposed works will be based on a plant capacity of 31.5 M/day and will include implementation of an enhanced coagulation treatment process to limit trihalomethane (THM) formation potential.

The works will also comprise of the supply and installation of a range of mechanical, electrical, instrumentation, control and automation equipment at the Roughgrange PS, including new high lift pumps, control panels, pipework and associated equipment. Work has now also commenced on the design of a replacement rising main which will be provided in parallel with the previously approved works.

The water supply network includes a number of storage reservoirs, pumping stations and booster pumping stations; a listing of the storage reservoirs is included in Table 4.2.

Table 4.2 Storage Reservoirs in the Drogheda, South Louth and East Meath Water Supply Area

<table>
<thead>
<tr>
<th>Reservoir</th>
<th>Top Water Level m.o.d</th>
<th>Capacity Ml</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clear Water Tank Old</td>
<td>115</td>
<td>1.80</td>
</tr>
<tr>
<td>Clear Water Tank New</td>
<td>115</td>
<td>4.50</td>
</tr>
<tr>
<td>Donore 1</td>
<td>82</td>
<td>4.50</td>
</tr>
<tr>
<td>Donore 2</td>
<td>82</td>
<td>4.50</td>
</tr>
<tr>
<td>Termonfeckin</td>
<td></td>
<td>0.50</td>
</tr>
<tr>
<td>Castlecoo Hill</td>
<td></td>
<td>0.90</td>
</tr>
<tr>
<td>Staleen Reservoir New</td>
<td>112</td>
<td>2.80</td>
</tr>
<tr>
<td>Staleen Reservoir Old</td>
<td>109</td>
<td>1.50</td>
</tr>
<tr>
<td>Kiltrough Tower</td>
<td>75</td>
<td>5.00</td>
</tr>
<tr>
<td>Balloy Reservoir</td>
<td>57</td>
<td>0.75</td>
</tr>
<tr>
<td>Carnes Reservoir New</td>
<td>143</td>
<td>1.50</td>
</tr>
<tr>
<td>Carnes Reservoir Old</td>
<td>140</td>
<td>0.75</td>
</tr>
<tr>
<td>Windmill Hill Reservoir Old</td>
<td>119</td>
<td>0.75</td>
</tr>
<tr>
<td>Windmill Hill Reservoir New</td>
<td>121</td>
<td>0.45</td>
</tr>
<tr>
<td>Windmill Hill Reservoir Supplemental</td>
<td>126</td>
<td>1.75</td>
</tr>
<tr>
<td>Rath Reservoir</td>
<td>101</td>
<td>2.40</td>
</tr>
<tr>
<td><strong>Total Storage</strong></td>
<td></td>
<td><strong>34.35</strong></td>
</tr>
</tbody>
</table>

The overall reservoir capacity in the network at 34.4 Ml equates to approx. 28 hours storage across the Drogheda, South Louth and East Meath Water Supply Area, based on average Distribution Input in advance of the July 2017 event.
4.1.1 Decommissioning of Rosehall WTP

The Rosehall WTP was the first water supply system for Drogheda and was a gravity supply based on upland surface waters in south County Louth. The WTP was supplied by a man made reservoir at Barnattin, north of Drogheda, which in turn fed a smaller storage reservoir at Killineer. The production capacity was estimated at 4.5 Ml/day, and when in use was producing approx. 2.3 Ml/day in Q1 2016. The existing raw water source was identified as problematic with experience of the source running dry during summer months and Staleen WTP having to take over supply. The existing water treatment process at the Rosehall WTP, consists of Slow Sand Filters followed by disinfection.

By 2016 the treatment processes were no longer sufficient to meet the requirements of the Drinking Water Regulations and for that reason the supply was not compliant. A review of the plant determined that significant investment would be necessary to provide the treatment processes to address the water quality risks of the source and ensure consistent compliance. Based on the water quality being produced at the plant, the available capacity of the Staleen WTP (where planning of upgrade works was well underway), and the running costs of the Rosehall plant it was decided by IW in consultation with LCC to close the plant. The plant ceased producing water in late March 2016. The plant was brought back into production at approx. 24:00 on 03rd June, 2016 to supply the hospital area during the burst event in 2016 and continued in operation for approx. 3 weeks after that. In 2017, the chlorine dosing equipment was decommissioned and other actions were taken to make the plant safe. By July 2017 the plant was no longer functional given that some key elements of the treatment process had been decommissioned and removed and the condition of the slow sand filters was no longer suitable for water treatment after 12 months without a flow of water. It was not feasible within the timescale of the response to the Staleen WTP to bring the plant back into operation.

4.2 Raw Water Supply to Staleen WTP

Raw water is abstracted from the canal running parallel to the River Boyne at Roughgrange and pumped to the raw water balance tanks located at the Staleen WTP. The Roughgrange pumping station was constructed in the mid 1930s and a new pumping station, which adjoins the original station, was constructed in the early 1970s. There was some further construction works at the Roughgrange site in the mid 1980s to accommodate an upgrade in the capacity of the Staleen plant from 18 Ml/day to 31.5 Ml/day. Pumps have been installed or replaced on a number of occasions since the construction of the original pumping station in the 1930s by way of increasing pumping capacity or capital replacement.

At this stage there are a combination of pumps and motors in the new and old station, with different flow capacities and different ages. There is a single pipe manifold from both pumping stations that runs to a valve house, constructed in the mid 1980s, located outside the old pumping station. Three rising mains connect from the valve chamber and discharge at the raw water balancing tanks at the Staleen WTP. Each main is approx. 2,260 metres in length and described as follows:

- 12" (300 mm) cast iron pipeline, constructed in the mid 1930s and no longer operational
18" (450 mm) nominal diameter pipe, comprising of approx. 1,350 metres of Ductile Iron (DI) pipeline and 910 metres Asbestos Cement (AC) pipeline, constructed in the early 1970s.

600mm diameter AC pipeline, approx. 1,350 metres of Class 25 (operating pressure 12.5 bar) and 910 metres of Class 15 (operating pressure 7.5 bar), constructed in the mid 1980s.

The static head (lift) for the pumps in the Roughgrange pumping station, that is the height difference between the water level at the abstraction point and discharge level at the raw water balancing tanks, is approximately 118 metres. The total pumping head, inclusive of the static head, friction losses and other losses in the pumping station pipework and rising main, will vary with the flows through the 450mm and 600mm diameter pipelines and is typically of the order of 127.5 metres (12.5 bar).

4.3 Rising Main Burst June 2016

There was a previous burst on the 600mm diameter rising main on Friday 03rd June 2016, at the start of the June Bank Holiday weekend. The burst was located approx. 100metres from the Roughgrange pumping station. A summary of the event including the actions taken to repair the pipe and the measures to provide water to customers, communications and lessons learned are outlined below. The SCADA system shows that the burst occurred at 04:30 approx.; it was reported at approx. 8am on Friday 03rd June, 2016. The repair was carried out early on the Saturday morning and water supply was restored in most areas by 6pm on Saturday.

Repair of the Rising Main

The detailed repair sequence in June, 2016 was as follows:

- On Friday morning two repair crews were diverted to the pipe repair job and a tracked excavator was provided around 12:00.
- Enquiries were made on sourcing a spare pipe and connection fittings required to execute the repair.
- The outside diameter of the existing pipe was confirmed at approx. 17:00 as 692mm, confirming that the pipe was Class 25 AC. Therefore couplings sourced in enquiries earlier in the day were not large enough for the repair.
- A number of further enquiries were made to source fittings and Fingal County Council (FCC), through IW, put LCC in contact with one of their engineers who had previous experience in the repair of large diameter pipes for FCC and other local authorities. The FCC Engineer made contact with a North Dublin Engineering Works on the Friday evening and made arrangements to provide assistance in dealing with the repair. A 738mm OD Ductile Iron (DI) pipe and two fittings were provided by FCC (Step Couplings 738mm x 711mm).
- On the Friday night, the Engineering Works modified the two couplings provided by FCC to match the turned ends\(^1\) of the existing Class 25 AC pipe in accordance with a

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\(^1\) AC pipes were manufactured in 4m lengths and were machined at each end to create a turned end to match an AC coupler joint
design provided by the FCC engineer. This involved cutting, reshaping and welding on the end of the coupling to be used on the AC pipe; it was not necessary to amend the end of the coupling for the DI pipe. LCC made arrangements to collect the new fittings when completed, which was approx. 04:00 on Saturday.

- Repair crews attended site at first light on Saturday morning to commence the repair. The repair was completed by 08:00 and this allowed refilling of the rising mains to commence.
- The two rising mains were charged by 09:00 and water started entering the raw water tanks. Production at the Staleen WTP commenced by 10:00, the Clear Water Tanks commenced filling at approx. 11:00 and by 12:00 was providing water into the network.

**Measures to Provide Water to Customers**

The following measures were taken to provide alternative water supplies to customers:

- Both the 450mm diameter and 600mm diameter rising mains were offline from the occurrence of the burst at approx. 04:30 on Friday 03rd June to approx. 09:00 on Saturday 04th June, when refilling of the pipes was complete, following the repair of the burst\(^2\). Accordingly, piped water supply, during the downtime at the Staleen WTP, relied on water stored in the various treated water reservoirs, water produced at the Rosehall WTP and the various ground water sources listed above.
- At approx. 21:00 on Friday, it was decided to activate the Rosehall WTP and change the valving in the Drogheda network such that the WTP could supply water to 8 DMAs including the DMA which served Our Lady of Lourdes Hospital. This work was undertaken by LCC personnel and was completed by approx. midnight on Friday. Our Lady of Lourdes Hospital received a continuous supply of water throughout the incident.
- The Donore reservoirs emptied just after midnight on Friday and the Drogheda network was no longer supplying water with the exception of the area supplied by Rosehall which did not experience any significant disruption.
- Arrangements were made to provide alternative supplies in Drogheda as follows:
  - Standpipes were located on the Rosehall network at Grennans Pub, Newfoundwell Road, at Mell Car Park and at two primary schools at Bothar Brugha. It was noted that the standpipes had limited use from residents.
  - 2 no. bowsers were deployed at the Recycling Centre on IDA road and at Wheaton Hall on the Dublin road. The LCC Fire Services tender was drafted in to serve water to the two bowsers and to keep them refilled. The bowsers were in high demand.
  - The LCC Fire Services large tanker was brought in to serve water to large users and was used to primarily serve the Beacon Dialysis unit at Donore Retail Park and priority customers e.g. nursing homes.
  - Other businesses did not request water as a number were closed on Saturday.

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\(^2\) As noted later in this report, it was possible to operate the 450mm diameter rising main for the majority of the time during the July 2017 event.
• By 14:00 Saturday water was available at the bottom of the Donore Rd and by 18:00 most areas in Drogheda had water except for higher areas such as Donore Retail Park. All areas in Drogheda had a water supply by midnight Saturday.
• Clogherhead and parts of Termonfeckin served from Castlegohill Reservoir had water until lunchtime Saturday but water supply was not restored until Sunday morning. Some houses on Strandhill Housing estate, which suffered airlocks, still had disruption into Monday morning.
• In relation to the East Meath area, supply was lost to Ratoath/Kilbride in some localised areas.

Communication

• The SLA Lead IW and Senior Executive Engineer MCC were informed of the burst rising main by LCC and were kept informed throughout the Friday and Saturday with regular updates.
• Communication was managed by the LCC Director of Services and IW SLA Lead with consistent messages and updates via LCC Out of Hours and IW Out of Hours, radio, twitter, website, local councillors, senators and TDs
• LCC liaised with Lourdes Hospital and informed Drogheda Fire Station that significant areas of Drogheda would experience no water on Saturday.

Key Recommendations and Follow up Actions from June 2016 Pipe Burst

• The 450mm diameter rising main could not be operated while the 600mm diameter main was being repaired as it was not possible to close the valves between the two mains. This was identified as a priority action and was addressed following the June 2016 incident and prior to the July 2017 incident.
• It was also recommended that critical replacement pipes and fittings, to facilitate repair of a future burst on the pipeline, should be identified, sourced and purchased. This was addressed and described in Section 5 in relation to the repair of the pipe as part of the July 2017 incident.

The response to the burst watermain was handled as a routine pipe repair, albeit with additional measures to provide water and communicate with customers, and neither the Irish Water or local authority incident or crisis response plans were formally activated.
5. Incident Recovery and Pipe Repair (July 2017)

Following the discovery, on the afternoon of Thursday 20th July, of the burst to one of the rising mains from the Roughgrange PS to the Staleen WTP, the LCC Water Inspectors were able to get access to the site to carry out an initial inspection and determine that the burst was on the 600mm rising main. However, there was a subsequent delay in getting landowner agreement to commence excavation works due to an issue related to the previous repair in 2016 that had not been appropriately closed out by IW.

At approx. mid day on Friday 21st July, the LCC Procurement Officer initiated a procurement process to replace the two stepped couplings that were to be used that day, for future stock.

Over the following six days four separate repairs were undertaken to replace the damaged section of AC pipe and these are described below.

5.1 Repair 1

All LCC staff, plant, replacement pipe and fittings were on site at 05:00 Friday 21st July. Work commenced on excavation of the ground at the location of the burst section of rising main; progress was hampered by the ground conditions resulting from the flooding caused by the pipe burst and depth of the pipe (approx. 4 metres to the top of the pipe).

On completion of the excavation a proprietary barrier fencing system was erected on the Friday evening such that the fencing enclosed the excavation and associated spoil heaps.

The materials used for Repair 1 included:

- 5.5m length of 700mm (738 OD) spigot and socket DI pipe cut to approx. 4m length.
- 2 No. step couplings 738mm-691mm (range 693mm x 686mm – 740mm x 733mm), part of a set of four couplings procured in 2016; this was executed by LCC as one of the recommendations following the review of the June 2016 pipe burst.

While the stepped couplings were being tightened it was discovered that the nuts were slipping on the bolt threads. This resulted in damage to the threads and it was necessary to utilise the bolts from the remaining two stepped couplings in order to ensure adequate tightening of the bolts.

At approx. 20:00 on Friday, the repair was complete and the excavation was evacuated. The 600 mm diameter rising main was charged from the 450 mm diameter rising main through the cross connector to the 600 pipe at Staleen WTP.

The repair failed almost immediately, approx.10 minutes after commencement of filling of the main, and the excavation was engulfed with water.

3 This order was subsequently modified to include straight as well as stepped couplings and to change the pressure rating from 16 to 25 bar; the straight couplings were subsequently used in Repair 4 on Wednesday 26th July.
It was realised that it would take a considerable time to pump out the excavation with the two mobile pumps on site due to the volume of the water released from the 600 mm diameter rising main. A local drainage contractor was contacted at approx. 21:00 and they were on site by approx. 22:30 with a larger pump. LCC personnel were stood down and offsite shortly after midnight and the contractor remained onsite until approx. 02:30 on Saturday 22nd July.

On examining the pipe on Saturday 22nd July, it was found that the coupling on one end of the replacement pipe had moved by 75 mm onto the AC pipe.

5.2 Repair 2

Work commenced on Repair 2 on the morning of Saturday 22nd July. Further work was required using the two mobile pumps on site to pump water from the excavation, taking approx. 2.5 hours to drain down. It was also necessary to use the excavator on site to reshape the sides of the excavation, which had been damaged after flooding of the excavation on the previous evening.

LCC purchased 24 number 12mm diameter high tensile threaded bar and associated nuts and washers to address concerns in regard to the tensile strength of the original bolts.

The repair was complete at approx. 13:00 and it was decided to charge the main from Roughgrange rather than from Staleen. This required the actuator valve for the 600mm main in Roughgrange plant room to be opened. However, difficulties were encountered in opening the valve and work was required on the valve and actuator in order to open the valve. The valve was opened and the watermain was charged at approx. 14:30. The repair failed approx. 10 minutes later and again the excavation was engulfed with water.

The Drainage Contractor was back on site at approx. 17:00 to start pumping out the excavation.

Following the failure of Repair 2 the Head of Asset Operations, IW contacted a Director of Services, FCC to request the assistance of the FCC Engineer, referenced above in relation to the repair in June 2016. This was agreed and IW then contacted the FCC Engineer to discuss the situation.

The FCC Engineer met with the LCC personnel on site at approx. 21:00 on Saturday 22nd July. The plumbers carrying out the repair indicated that they had difficulty in tightening the bolts of the couplings to achieve compression of the gaskets between the end rings and the centre sleeve of the couplings onto the surface of the pipe to form an effective, leak-proof seal.

In a follow up discussion with the FCC Engineer three options were outlined as follows:

1. Modify the existing fittings to get a better fit on the pipes based on the feedback from Repairs 1 and 2; this is the basis for Repair 3. It was considered that it might not be fully successful but could help to provide additional flow to the Staleen WTP while waiting for materials to progress either of the other 2 options. This could be executed on Sunday 23rd July following modifications to the couplings and DI pipe.
2. Modify the infill pipe section to match the outer diameter of the turned end of the AC pipes and use straight couplings. This is the basis for Repair 4. It was expected that this could be undertaken on Wednesday 25th July following modifications to a 600 diameter DI pipe and receipt of straight couplings from the UK.

3. Fabricate an infill pipe section with outer diameter to match the outer diameter of the turned end of the AC pipes and use straight couplings. This would take several weeks and was essentially a backup if needed for a follow-on repair. The pipe section has subsequently been fabricated by the North Dublin Engineering Works and straight couplings, to suit a 692mm diameter pipe were procured.

IW decided that work on all 3 options should be progressed in parallel.

Contact was made with the North Dublin Engineering works, used to support the 2016 repair, and it was agreed that the two spare stepped couplings would be delivered to their workshop in Balbriggan for 5am on Sunday morning for alteration.

All staff were off site by 23:30.

5.3 Repair 3

The repair crew staff returned to site on Sunday morning. The Drainage Contractor was on site at 8:00 to continue pumping out the excavation.

At approx. 10.30 the 600mm pipe was scoured, by draining back into the Boyne to ensure it was empty to allow the pipe to be uncoupled without flooding the excavation. Due to the connection of the 600mm and 450mm rising mains at the Actuator valves in the plant room of the Roughgrange PS it was not possible to separate these pipes at scouring stage which resulted in both pipes being scoured simultaneously and taking the 450 mm diameter rising main offline.

The excavation was pumped out at 13:00 and the excavator was used to reshape the sides of the excavation. This operation required careful execution following the repeated flooding of the excavation and took approx. 3 hours to complete.

A local engineering firm attended site and welded cleats onto the DI pipe in order to stabilise the couplings. This operation took 2 hours to complete. The modified couplings were also delivered from the North Dublin Engineering Works.

The materials used for Repair 3 included:

- 5.5m length of 700mm (738 OD) spigot and socket DI pipe cut to approx. 4m length as used in Repair 1 and 2, with the addition of welded cleats as described above.
- 2 No. step couplings 738mm-691mm (range 693mm x 686mm – 740mm x 733mm), part of a set of four couplings procured in 2016 as referred to above. The two couplings were modified by the North Dublin Engineering Works; they were reduced in diameter to create a tighter fit.

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4 Subsequently procured by LCC as a variation to the existing order referenced above.
5 Stepped coupling with range of 686 to 693 mm at one end and 733 to 744 mm at the other end.
At approx. 22:00 the pipe was lifted back into place and the modified couplings were used to connect to the AC pipes. It was found on this occasion that there was a very tight fitting to the outer diameter of the ductile iron pipe.

At approx. 23:55 the DI pipe was reconnected to the AC pipes and ready for the watermain to be charged. At approx. 24:00 the 600 rising main was charged from Roughgrange pumping station. At 00:30hrs the pressure in the pipe was recorded at 12 bar when the gasket on the Staleen side coupler failed.

5.4 Repair 4

Following the failure of Repair 3, preparation continued on Repair 4, which was scheduled for Wednesday; this was estimated based on the scheduled delivery date for two straight couplings from the UK and the time to carry out the modifications to a 600 mm diameter DI pipe.

LCC personnel travelled to the Roughgrange site to get exact dimensions of the DI pipe and AC pipes; these were provided to the Irish agent of the coupling manufacturer with whom an order for couplings had been made on Friday 22nd.

The Drainage Contractor was onsite from 07:00 on Tuesday 25th July to start pumping out the excavation and this was complete by 12:30. The 600mm diameter pipe was then drained down, necessitating the drain down of the 450mm diameter pipe also. When the 600 mm and 450mm diameter rising mains were drained down, the 450 mm diameter rising main was then recharged and continued to supply the Staleen WTP.

3 No. 20 tonne loads of stone material were ordered and delivered to site for the pipe surround. The excavation was made safe by further shaping by the excavator on site. The pipe and couplings, installed under Repair 3, were removed and the preparation works were carried out for the new pipe and associated connections. Plumbers and GO Staff were stood down on rest time at 15:00 on Tuesday until 07:00 Wednesday morning.

The closed valve on the cross connection between the 600mm and 450mm diameter rising mains at Staleen WTP was not fully water tight and water was discharging into the 600mm diameter pipe into the excavation and accordingly, pumping was required on site for the repair on Wednesday the 26th July 2017.

The repair crew returned to site at 7:00 approx. on Wednesday 26th July to commence work on Repair 4.

The materials used for Repair 4 included:

- 5.5 m length of 600 mm (635 mm OD) spigot and socket DI pipe, supplied by FCC, cut to approx. 4m length. This pipe was modified by North Dublin Engineering Works with the addition of a 25mm thick steel collar, 300mm in width at either end of the pipe. The steel collar was manufactured by rolling flat sheet steel to an internal diameter slightly greater than the outer diameter of the 635 mm OD to provide some tolerance to slide the collars over the DI pipe. The outer surfaces of the collars were machined using a lathe to 692 mm OD. A grinder was used on both ends of the DI pipe to remove the
bitumen coating and prepare the surface for fitting of the collars. Following placement of the collars on the DI pipe, steel shims were inserted at each end of the collars between the pipe and collar and welded along the joint between the collar and the DI pipe. The addition of the collars at both ends of the DI pipe resulted in 692 mm OD, matching the turned ends of the existing AC pipes and suitable for use of a straight coupling. In addition a number of 25mm x 25mm x 5mm box sections were spaced around the circumference of the pipe between the collars and welded in place.

- 2 No. straight couplings made to order to suit a 692mm diameter pipe. The fittings had a pressure rating of 25 bar and consisted of 24 no. high tensile connection bolts.

The modified 4m section of pipe and two couplings were all on site by approx. 8:30 on the Wednesday. The excavation was de-watered at 10:00 and the repair work by LCC personnel got underway.

The repair was completed at 12:00 and recharge of the 600mm rising main then commenced using a 150mm by pass pipe on the actuated valve at the Roughgrange pumping station. After 3 hours the main valve on the 600mm pipe was opened 2 no. turns and in all it took just over 4 hours to fully recharge the rising main. Recharging of the 600mm rising main was complete by approx. 16:30 and the combined flow from both the 600mm and 450mm diameter reached normal operating conditions by approx. 17:30 on Wednesday 26th July.

The gaskets on the couplings provided a tight seal between the couplings and both the existing AC and modified DI pipe. There was a small leak between the DI pipe and steel collar. However, it was considered that this was not sufficient to impact on the efficacy of the repair and the rising main could be brought back into operation.

**Fig 5.1 Photograph of Repair 4**
5.5 Review of Repairs

Repair of a burst AC pipe typically involves the removal of the section of pipe and replacement with a section of DI pipe, cut to match the distance between the two existing pipes and allowance for specified gaps, and use of steel couplings at either end to connect the DI pipe with the existing AC pipes. Typically DI and AC pipes of the same nominal diameter have similar internal diameters but different outer diameters due to different wall thicknesses in the case of the two pipes. This results in the need for stepped couplings in order to join the DI pipe to the AC pipes.

Typically, where stepped couplings are used, where there is a small difference in pipe diameters, the pipeline is buried and under normal water pressures, the soil and pipe friction are sufficient to prevent coupling movement.

In the case of Repair 1, 2 and 3 a 700 mm DI pipe (outer diameter 738 mm) was used as the replacement pipe to connect with the 600 mm AC pipes (outer diameter 692 mm), resulting in a difference of 46 mm in the external diameters.

There were a number of factors that resulted in an axial load on the couplings that would not have applied in a typical pipe repair:
- Class 25 AC pipe has an external diameter of 692 mm as compared with 672 mm for a Class 20 AC pipe and 654 mm for a Class 15 AC pipe
- The internal pressure of approx. 12 bar
- Large diameter pipeline

Accordingly, it is likely that Repairs 1, 2 and 3 were unsuccessful due to movement of one of the couplings because of insufficient restraint of the couplings to counter the axial load resulting from the difference in the external pipe diameters. This is supported by feedback from the installation crew after Repair 1 that the coupling on one end of the replacement pipe had moved by 75 mm onto the AC pipe.

In the case of Repair 4 a section of 600 mm DI pipe was modified to provide a collar at each end of the pipe with an external diameter of 692 mm, matching the external diameter of the AC pipe. This facilitated the use of a straight couplings and eliminated axial load on the couplings.

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6 Using a 600 mm DI pipe would result in a difference of 57 mm in external diameter (692 mm – 635 mm)

The provision of water in the Drogheda, South Louth and East Meath Water Supply Area during the Staleen WTP outage is examined under two headings, first the provision of piped water supplies and secondly the provision of alternative water supplies via tanker etc.

6.1 Piped Water Supplies

Following the review of the rising main burst in June 2016, work was undertaken to identify and repair the interconnecting valves between the 600mm and 450mm diameter rising mains. This measure was of great significance in responding to the July 2017 event and ensuring that the Staleen WTP could be operated at reduced throughput for the majority of the time during the event. This can be seen from Table 6.1 which shows the output from the Staleen WTP during the incident in Ml/day and as a % of the average daily output in the weeks preceding the event.

After the burst occurred at approx. 14:00 on Thursday 20th there was no flow to the raw water tanks at the Staleen WTP through either the 450mm or 600m rising mains. LCC were able to isolate the 450mm rising main from the 600mm rising main and by approx. 18:30 on Thursday 20th the 450mm was operational and providing a flow of water to the raw water tanks.

Table 6.1 Staleen WTP Output During the July 2017 Event

<table>
<thead>
<tr>
<th>Date</th>
<th>Staleen WTP Filtered Water Flow (Ml/day)</th>
<th>Staleen WTP Filtered Water Flow as % of Average Flow prior to the Incident</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wednesday 19th July</td>
<td>27.1</td>
<td>105%</td>
</tr>
<tr>
<td>Thursday 20th July</td>
<td>21.7</td>
<td>84%</td>
</tr>
<tr>
<td>Friday 21st July</td>
<td>11.7</td>
<td>45%</td>
</tr>
<tr>
<td>Saturday 22nd July</td>
<td>11.5</td>
<td>44%</td>
</tr>
<tr>
<td>Sunday 23rd July</td>
<td>5.6</td>
<td>22%</td>
</tr>
<tr>
<td>Monday 24th July</td>
<td>10.7</td>
<td>41%</td>
</tr>
<tr>
<td>Tuesday 25th July</td>
<td>10.8</td>
<td>42%</td>
</tr>
<tr>
<td>Wednesday 26th July</td>
<td>15.0</td>
<td>58%</td>
</tr>
<tr>
<td>Thursday 27th July</td>
<td>26.1</td>
<td>101%</td>
</tr>
</tbody>
</table>

The following points should be noted regarding Table 6.1:
1. The Staleen WTP was operating under normal operating conditions on Wednesday 19th July and again on Thursday 27th July.

2. Output from the plant on Thursday 20th July was at 84% of normal output although the burst occurred at approx. 14:00. There were a number of factors in this firstly, the 450mm diameter rising main was operating from approx. 18:30 and secondly, the storage in the raw water balancing tanks helped to sustain flow through the WTP.

3. The output from the Staleen WTP dropped to 5.6 Ml/day, 22% of normal output, on Sunday 23rd July as the 450mm diameter pipeline was offline from approx. 11:00 on Sunday 23rd July to 00:30 on Monday 24th July.

Other measures taken to increase the piped water supply include:

1. The output from the borehole water sources was increased where possible
2. Extended Navan supply into Kentstown
3. Extended Dunshaghlin supply to supply part of the Ratoath network
4. Agreement was made by LCC with Ballymackenny GWS to supply water to the Clogherhead WSZ.
5. It was identified on Monday that it would be possible to provide a supply into Ashbourne by laying a pipeline approx. 100m in length to connect to the Fingal water supply network fed from the Ballycoolen Reservoir. This proposal was reviewed on the IW GIS, discussed and approved by FCC, contractor appointed and proposal approved by MCC and IW during Monday 24th July. The Contractor was on site at 07:00 on the Tuesday morning and the connection was providing approx. 40m$^3$/hour by Tuesday evening. It was clear from a number of the meetings undertaken as part of the incident review that this initiative required a collaborative approach by various parties involved, including IW, MCC, FCC and the Contractor, in order to complete the work in such a short period of time. It facilitated the supply of water to the southern part of Ashbourne which was experiencing problems at that stage.

Through these measures, it was possible, with the exception of Sunday 23rd July, to maintain a Distribution Input of approx. 17.5 Ml/day during the incident, equating to approx. 58% of the normal Distribution Input of 30 Ml/day to the Drogheda, South Louth and East Meath Water Supply Area.

In order to maximise the effective use of the available piped water supplies, media announcements regarding the burst main, from late Thursday 20th July, included a request to the public to conserve water.

It was decided early on in the management of the incident that provision of water to Our Lady of Lourdes Hospital was a critical priority. Given that, with the use of the 450mm diameter rising main, the Staleen WTP could be operated at approx. 45% of its normal operating regime it was decided to configure the Drogheda Network such that a continuous supply of water could be maintained to the Hospital and surrounding area, which also included the Beacon Dialysis Clinic and surrounding commercial district of Drogheda.

In addition a plan was developed to divide the remainder of the network into four separate zones based on the DMA structure that had been established and was in operation for the network. This would provide all areas with water for approx. 3 hours water each day to facilitate...
the filling of storage tanks and allow water availability daily. The details of the water rationing are included in Table 6.2 together with the percentage of properties in each of the zones.

Table 6.2 Staleen Details of Water Rationing in Drogheda

<table>
<thead>
<tr>
<th>Zone</th>
<th>Time of Supply</th>
<th>% of Properties</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>24 Hour Supply</td>
<td>34%</td>
</tr>
<tr>
<td>B</td>
<td>09:00 to 11:30</td>
<td>8%</td>
</tr>
<tr>
<td>C</td>
<td>11:30 to 15:00</td>
<td>22%</td>
</tr>
<tr>
<td>D</td>
<td>15:00 to 18:00</td>
<td>18%</td>
</tr>
<tr>
<td>E</td>
<td>18:00 to 21:00</td>
<td>19%</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>100%</td>
</tr>
</tbody>
</table>

This water rationing regime was put into effect on the afternoon of Friday 21st July.

Due to the disperse and extensive nature of the East Meath network, it was not possible to ration water in a similar fashion to that applied in Drogheda. However, MCC did optimise the available supply from boreholes at Curragha, Rath and Kiltrough as outlined above.

Operational experience indicates that the Meath area is generally affected later than Drogheda when there is a loss of supply from the Staleen WTP and is also later to recover after restoration of supply from the plant. There was a significant drop in the water level in the Donore Reservoir on Saturday 22nd July and a decision was taken to close the outflow to Meath in the early afternoon on Saturday. This decision was made taking account of the water levels in the Meath Reservoirs, the borehole sources supplementing the supply into the East Meath area and that provision of water to Our Lady of Lourdes Hospital was a critical priority. A partial supply, from the Staleen WTP, was restored to the East Meath area on the afternoon of Monday 24th July and was maintained for the remainder of the incident.

6.2 Alternative Water Supplies

Arrangements for the provision of alternative water supplies were ramped up over the course of the incident as it became evident that the initial pipe repairs had failed and in particular on the activation of the IW Crisis Management Team and Incident Management Teams in LCC, MCC and IW on Monday 24th July [Refer to Section 7]. By Monday evening a comprehensive tanker deployment plan was in place and fully operational by the afternoon of Tuesday 25th July.

The measures taken on the provision of alternative water supplies included:

1. Establishment of water stations for the provision of water, directly from tankers or IBCs, to fill customer containers
2. Provision of water to vulnerable customers and nursing homes; in the case of nursing homes this involved the filling of on site storage in some cases.
3. Provision of standpipes in areas where piped supply was available e.g. Drogheda Town Centre
The equipment deployed to support the provision of alternative water supplies is shown in Table 6.3. The mobile tankers were used to fill bowsers and IBCs at the various water stations, filling of storage tanks in customer premises and filling of reservoirs.

**Table 6.3 Equipment Deployed to Provide Alternative Water Supplies**

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There were a number of challenges in managing this deployment including:

- Work commenced on arranging the equipment on Saturday and deployment commenced on Sunday. However, difficulties were experienced in making contact and mobilising equipment over a weekend.
- By Tuesday, the challenge had shifted from sourcing tankers and other equipment to optimising the deployment and dealing with various logistical issues e.g. filling of the tankers from reservoirs outside the Drogheda, South Louth and East Meath Water Supply Area.
- It was difficult to get access to some of the water stations using the larger tankers.
- In many instances customers did not have suitable water containers to fill at the water stations. IW subsequently sourced 5 and 10 litre water bottles to address this problem.
- There was a need for significant number of personnel in operating the mobile tankers, providing assistance at water stations and providing alternative supplies directly to customers. This involved personnel from MCC and LCC from outside of the water
services department and various support organisations and agencies as outlined in Section 8.

- There were challenges in collating a complete list of vulnerable personnel/households for purpose of providing alternative water supplies and the approach taken to address this is set out in Section 8.

### 6.3 Drinking Water Quality Monitoring

While the incident resulted from a partial loss of water supply rather than a problem with drinking water quality, it was recognised from the establishment of the Crisis Management Team that drinking water quality also needed to be considered as part of incident response. The IW Water Compliance Monitor Liaison Specialist made contact with the EPA and HSE at operational level on Monday 24\textsuperscript{th} July and provided regular operational updates to representatives from both organisations over the following week.

The IW Water Compliance Monitor Liaison team developed a comprehensive drinking water quality monitoring plan for the Drogheda, South Louth and East Meath Water Supply Area with a focus on testing water quality on the restoration of full supply at the Staleen WTP. This consisted of two main parts:

- **Testing of chlorine residuals** at a number of sampling points in the supply area on Wednesday and Thursday by members of the IW process optimisation team. The rationale for this approach was to get a quick picture on the drinking water quality in the network across the supply area, which would not have been possible with microbiological testing.

- **Sampling for microbiological testing**, pre and post disinfection at the customer tap, executed from Friday 28\textsuperscript{th} to Monday 31\textsuperscript{st} July. The sampling and testing was carried out by a local private laboratory that was available to provide a service over the weekend e.g. the results from the Saturday sampling were available by Sunday evening. In total 84 samples were collected during this timeframe from approximately 50 separate properties (26 pre disinfection and 58 post disinfection samples). There were a small number of low level non-compliant samples, which on follow up investigations were explained by private side factors and not representative of the drinking water quality in the network. Monitoring in accordance with the drinking water quality monitoring plan resumed from Tuesday 01\textsuperscript{st} August.

7.1 IW Incident Management Procedures

IW have a comprehensive suite of incident management plans and procedures in place. These plans and procedures were developed during the Irish Water establishment programme in 2013 and 2014 and are based on those used by Gas Networks Ireland (formerly Bord Gáis Networks) which have been regularly tested, audited, benchmarked and enhanced over an extended period of time. The IW procedures cover four incident classifications i.e. Environment, Health & Safety, Drinking Water and Wastewater. This report will focus on Drinking Water Incidents.

The IW Incident Management Procedure (HSQE-SOP-24) outlines how drinking water incidents are classified, reported, responded to and escalated. The responses to be taken in the event of an escalated incident are provided in the Crisis Response Plan (HSQE-SOP-036). The Crisis Response plan has been formally activated three times prior to this incident and both the Incident Management Procedure and Crisis Response Plan are subject to testing at regular intervals (currently three times per year) through exercises which also involve the LAs. IW’s principal crisis meeting room is located at headquarters in Colvill House, Dublin. Each of the three regional offices also has an incident/crisis meeting room which has all the necessary telecommunication, IT and support equipment in place (e.g. battle boards, hard copy plans, mapping, contact lists).

The Management of Drinking Water Incidents protocol (IW-PRT-IMT-002) specifically sets out the agreed roles and responsibilities, management procedures and processes between IW and LAs for drinking water incident management, i.e. it is the link between IW and the LA incident management procedures and processes. An overall summary of the Local Authority and Irish Water responsibilities as outlined in the protocol is provided in Appendix 3.

7.2 LA Incident Management Procedures

The Drinking Water Incident Response Plan (DWIRP) sets out the LA strategy and protocols for responding to water contamination incidents or other incidents such as significant supply disruption impacting on water supply.

DWIRPs have been prepared by the LAs in accordance with a 2009 Department Circular (L4/09) and associated guidance documentation. The DWIRPs provide criteria to enable the incident to be classified as an Amber (medium severity) or a Red Incident (high severity) and outline the response to be taken in the event of both incident types. The DWIRPs generally include a number of appendices which contain information used to support the response to a drinking water incident such as; contact lists, sensitive customer lists, information on public and private water schemes, guidance on customer support arrangements and details of contingency equipment.
IW and the LAs have recognised that many of the DWIRPs (and their associated appendices) have become outdated over time and need to be updated. An agreed programme is in place to update the DWIRPs with the majority to be complete by the end of 2017 and the remainder in the first half of 2018.

Under the Major Emergency Framework, all LAs are also required to have a Major Emergency Response Plan in place which sets out its arrangements to respond to major emergencies. A major emergency is any event which, usually with little or no warning, causes or threatens injury or death, serious disruption of essential services or damage to property, the environment or infrastructure beyond the normal capabilities of the principal emergency services. It requires the mobilisation of additional resources to ensure an effective and co-ordinated response.

It is envisaged that the DWIRP would generally be activated without activation of the Major Emergency Plan, but that many of the arrangements/protocols and procedures developed, trained for and exercised as part of the major emergency preparedness process would be appropriate and relevant to include and use in a DWIRP. Depending on the circumstances, drinking water incidents (or the consequences thereof) could escalate to a Major Emergency. The Staleen WTP Outage was not classified as a Major Emergency.

**7.3 Use of Incident Management Procedures during Staleen WTP Outage**

Although IW have extensive capital investment plans for watermain replacement and rehabilitation in place, bursts are, and will continue for some time, to be a common occurrence across the water network. In 2017, up to the end of July, there have been 2,050 watermain bursts recorded on the network which equates to an average of almost 10 per day. In the vast majority of these cases it is possible to quickly repair the main using standard repair methods without significant interruption to water supplies. Where there is the expectation that the burst can be readily repaired the burst is treated as a repair and typically does not get escalated as an incident under the DWIRP or IW Incident Management Procedures.

In addition to water main bursts the historical underinvestment in the wider water and wastewater infrastructure gives rise to frequent operational incidents many of which have the potential to escalate requiring formal activation of the various incident and crisis management plans. By way of example the IW East Midlands Regional Operations team managed four serious incidents over a three week period including three Boil Water Notices in Offaly (13th July), a fish kill in the River Tolka (18th July), the Staleen WTP Outage (20th to 27th July) and the Navan trunk main burst (1st August). At a national level there were also significant water main bursts in Galway (6th August) and Ballina (three burst mains over 6th, 7th and 8th August). Given the sheer volume of incidents it has become custom and practice to manage many of these under normal operational structures whilst only escalating those with the most serious impact (or potential impact) as High Severity incidents.

As part of this review it has also been noted that the incident classifications and escalation levels contained within the DWIRP template, the IW Incident Management Procedure and the Management of Drinking Water Incidents protocol do not fully align. It is recommended that
these be reviewed and better aligned to ensure incident classifications, escalation protocols and roles and responsibilities are clear and consistent throughout. It is also noted that the incident classification guidance and escalation thresholds may need to be revised (upwards in some cases) as strict adherence to the criteria in their current form is likely to result in IW being in crisis management mode almost continuously. In addition to this being unsustainable, it also makes it difficult to separate the high severity incidents, or those with the potential to be high severity, from the lower severity incidents which frequently occur across the network.

When the burst to the rising main feeding Staleen WTP occurred at 14:00 on Thursday 20th July, Louth LA immediately assigned an Incident Manager and mobilised repair crews with stock repair fittings to make the repair. IW were promptly notified of the incident. Meath LA also quickly assigned an Incident Manager on Thursday afternoon to coordinate conservation measures and contingency plans. The Water Infrastructure SLA Lead in IW acted as the point of contact between IW and both LAs and remained in that role until the wider IW incident management team was put in place on Sunday morning. The Water Infrastructure SLA Lead updated and was supported through this period by the Regional Media Specialist. The IW Regional Operations Manager for the East Midlands Region and the Head of Operations were also kept informed of developments throughout that period.

Following an initial delay in accessing the field due to a landowner issue from the previous repair that had not been appropriately closed out by Irish Water, an LCC crew commenced excavating to make the repair at approximately 05:00 on Friday 21st July. The first repair was completed that evening and refilling of the main commenced. The repair failed under pressure at approximately 20:10 that night. The second repair attempt failed at approximately 14:40 on Saturday 22nd July and the third repair attempt failed at 00:30 on Monday 24th July (see Sections 5 & 6 for further details on the repair attempts and incident response over that time period).

IW activated their Incident Management Team early on the morning of Sunday the 23rd July and formally met as a team in the Incident Management Room in the Foley Street office at 12:30. The team was comprised of the Incident Liaison Officer, Customer Services Manager, On Call Local Representative & Elected Member Coordinator & Communication Manager, Communications Manager and Tanker Sourcing & Deployment Engineer. A Repairs and Fitting Subject Matter Expert from Fingal LA was engaged to provide specialist technical advice. The IW Regional Operations Manager, the Head of Operations and the Managing Director were also kept informed of developments throughout that period. The Managing Director notified the Ervia Acting CEO at approximately 19:00 on Sunday.

At 07:45 on Monday morning the IW Head of Operations and Managing Director formally escalated the Incident to Crisis level and activated the IW Crisis Response Plan. The Ervia Acting CEO was updated on developments.

Following confirmation that the third repair had failed both LAs held meetings of their Executive Management Teams early on Monday morning (23rd July) and formally established their Red teams, which will be referred to as Incident Management Teams from here on. Louth’s Incident Management team was located in County Hall in Dundalk and Meath’s Incident Management
team was located in their new headquarters at Buvinda House, Navan. Both rooms were pre-equipped as Incident Management Rooms with the necessary telecommunications and support equipment. During the establishment of the Incident Management teams, both LAs instinctively made reference to their Major Emergency Plans rather than the DWIRP even though the incident was not categorised as a Major Emergency but would have met the criteria for a Red Incident (High Severity) under the DWIRPs. This instinctive use of the Major Emergency Plan reflects the better knowledge and experience that the senior management teams within both LAs had through regular participation in Major Emergency exercises. As the strategic response and structures contained in both plans are reasonably consistent it had no impact on the level of response but highlights that further work is needed in refining, aligning and updating the DWIRPs and building knowledge, experience and confidence in their use within the LA sector going forward.

By 10:30 on Monday 24th both LAs had their Incident Management Teams and IW had their Crisis Management Team fully established and operational. At that time, the IW Incident Liaison Officer also appointed two IW Liaison Engineers to join the LA Incident Management teams in Dundalk and Navan and act as a point of contact between the LA and IW Incident Management Team. Both the LAs and IW found the role of the IW Liaison Engineer to be extremely effective during the incident. Given the volume of communications and the scale of the emergency response deployed over Monday and Tuesday it became necessary to dispatch support personnel for the IW Liaison Engineers.

At 13:00 on Monday it was decided to combine the IW Incident Management team (tactical level) with the Crisis Management team (strategic level) in Colvill House in order to streamline communication and accelerate decision making capability. In the early stages of an incident it is typically best practice to keep the tactical and response teams separate to enable them to focus on the different levels of response required. However, the unanimous feedback received during post incident interviews indicated that this was a positive move and increased the overall effectiveness of the team. In this case the tactical team had already worked throughout Sunday and addressed the more technical and detailed aspects of the repair and response which allowed the team not to become overly tactical and maintain a strategic view. In future crisis situations careful consideration needs to be given to the timing and appropriateness of combining incident and crisis management teams to ensure the overall optimum response is maintained.

The IW CMT formally met two or three times per day between Monday 24th and Friday the 28th. Daily conference calls were held with the Meath and Louth CMTs and these were reported to have been very effective by both sides. Daily conference calls of the IW CMT were held over the weekend Saturday 29th and Monday 31st to ensure all affected areas had fully recovered and the IW CMT was formally stood down on Tuesday the 1st of August at 13:00.

Based on a review of the available documentation and information gained through the review process it seems reasonable in hindsight that the incident could have been formally escalated from an operational incident to a high severity incident (in accordance with the IW Incident Procedures and LA DWIRPs) prior to Sunday the 23rd. It’s important to note that this would not have shortened the overall time to repair or allowed tankers to be mobilised any sooner.
However, it may have enabled detailed contingency planning to have been more developed coming into Monday the 24th and potentially supported a more comprehensive communications response to be established on Saturday the 22nd. At the time the focus was on achieving an interim repair that would restore service, even if only for a short period to fill reservoirs.

The sheer volume of incidents being managed by IW, the lack of alignment between the various incident classification and escalation requirement and the expectation that the second repair attempt was going to be successful are additional factors which influenced the approach taken.

### 7.4 Emergency Preparedness

Service level agreements (SLAs) are in place between IW and each local authority which define the Services to be provided to Irish Water by the Local Authority and provides for the relationship and interactions between Irish Water and the Local Authority with respect to the Services.

Section 15 of the SLA states that the LAs are responsible for the day to day operations of plant and water network and the undertaking of remedial/repair works as the LA deems appropriate or as otherwise directed by IW. Spares, consumables and contingency equipment is currently held and managed by the LAs. Following the previous burst on the rising main in June 2016, Louth LA purchased two sets of repair couplings and had these in stock when the burst occurred (See Section 4 for further detail).

Section 15 of the SLA also states that IW are responsible for developing an overall methodology and system to manage spares and consumables to maximise asset availability. In the first quarter of 2017 IW established a new Operational Planning and Emergency Management function to develop and coordinate emergency management capability at a national level. The development of a critical spares strategy comes under this function and the incident highlights the need to prioritise and progress this as a matter of urgency. The strategy should include for the purchase, storage, maintenance and distribution of critical spares on a national basis. Work has commenced on the development of an inventory of spares currently held by all LAs.

The deployment of static and mobile tanks (bowers) and large road tankers is the most common way of providing temporary alternative water supplies. Historically there have been no clear guidelines or requirements for the quantity or type of emergency stock to be held by the LAs (or guaranteed through service level agreements with private industry) in the event of an emergency. As a result there is a lack of consistency across the LAs, some have chosen to purchase their own contingency stock of Integrated Bulk Containers (IBC’s), bowers and a small number of road tankers and some have chosen to depend on privately owned bowers and tankers and/or the ability to borrow equipment from other LAs in emergency situations. The LAs can also generally call on the quick support of the Fire Services and Civil Defence equipment and personnel if needed.

MCC Water Services department typically use 1,000 Ltr Integrated Bulk Containers (IBC’s) and hold an emergency stock of 20 at Dunshaughlin WTP. MCC owns one water tanker with a capacity of 13,000 Ltr and also engage privately owned tankers which have tankers ranging in size from 22,000 Ltr to 36,000 Ltr when needed. Standpipes are also held in stock.
LCC Water Services department have standpipes and two bowsers.

On Saturday (following the first repair failure) the core response team within IW and the LAs began to source tankers. However, they found it difficult to make contact with many of the LAs and private tanker operators as it was the weekend and peak holiday season. In the majority of cases where contact could be made, the private tanker operators and LAs were unable to mobilise tankers and drivers until Monday the 24th. A small number of the operators contacted were able to mobilise on the Sunday 23rd. Once the IW Incident Management Team was established on Sunday 23rd, additional and dedicated resources were put in place to develop and implement a tankering plan which included the sourcing and deployment of large road tankers, bowsers and drivers to support the supply of temporary water supplies to the affected areas. IW had recently developed a contingency tankering plan for pipeline intervention works in Fingal Co Co and this was used as the basis for the plan.

Details of the response over the period of impact are provided in Section 6 and by Wednesday there were 49 road tankers and 11 bowsers deployed to supplement the mains water supply, to replenish temporary water stations and to supply priority customers around impacted communities. 66 IBCs were in place across Louth and Meath. 8,000 five and ten litre foldable water containers were delivered to Louth County Council and Meath County Council for distribution across all impacted communities in Meath and Louth. Additional offers of tankers, IBCs, water containers and bottles of drinking water and resources were made to IW on Tuesday, Wednesday and Thursday but were not called on as sufficient resources were already available. Had the incident been extended in time then these additional resources would have been needed. Tankers and bowsers were secured from Wicklow, Offaly, Fingal, Westmeath, Waterford, Kilkenny Co Councils, Dublin City Council (DCC) and Northern Ireland Water as well as a number of private sources, the Civil Defence, Fire Service and Defence Forces.
8. Working with Support Organisations and Agencies

While IW and the LA Water Services divisions are fully resourced to develop, operate and maintain the water and wastewater networks under regular operating conditions, they do not have (and are unlikely to ever have) the capacity and capability to fully deal with a major water supply interruption on their own. In these events they will also need to draw on the support and expertise of various other State Agencies, Local Government, Non-Governmental Organisations, Community and Voluntary groups to aid the response. The incredibly important and positive role that these groups played in this incident was clearly evident and served to significantly lessen the impact on the affected populations, and in particular the vulnerable. During interviews undertaken as part of this review both IW and LA personnel involved in the incident were extremely appreciative of the help provided over the period.

Over the course of the Incident IW worked with multiple support organisations and external agencies. Whilst the majority of these interactions (most notably with LCC and MCC) are described elsewhere in this report, further details on the support provided by the Defence Forces and the NGO, Community and Volunteer groups are outlined below.

8.1 Defence Forces

At 11:30 on Monday the 24th the IW Chief Technical Advisor notified the National Director for Fire and Emergency Management of the Incident and informed him that IW may request support from the Defence Forces later that day to aid the response. At the 16:00 IW CMT meeting it was agreed that IW would proceed to request support for the following day, Tuesday the 25th. A Defence Forces assistance form was completed and issued to the National Director for Fire and Emergency Management at 17:32 and was subsequently forwarded on to the Defence Forces at 19:43. The request was approved and actioned by the Defence Forces on the morning of Tuesday the 25th and it was later confirmed to IW that they could provide four 1,000 Ltr bowsers, one 10,000 Ltr bowser and twenty personnel to support the manning of water stations. These resources were accepted, dispatched to Drogheda and arrived on site at approximately 17:00. At 17:52 on Tuesday the 25th, IW requested an additional twenty personnel to man water stations within the East Meath area. These personnel were provided and arrived on site in Navan on the morning of Wednesday the 26th.

8.2 Non-Governmental Organisations, Community & Voluntary Groups

The overwhelming response to the incident in the affected communities was excellent. NGOs such as Red Cross, Order of Malta and Scouting Ireland immediately mobilised and provided assistance along with the Civil Defence in distributing bottled water to the vulnerable and helping to set up and man temporary water stations. The Civil Defence also helped distribute water via bowsers and tankers to sensitive domestic and non-domestic premises. It was noted that in some cases voluntary personnel were requested to enter attic spaces to top up water storage tanks and did so; however this gave rise to Health and Safety concerns.
Following activation of the LA Incident Management Teams, the Social and Community Offices were asked to work with the state agencies and community groups in the affected areas to provide support to vulnerable people while the incident lasted and played an absolutely vital role in the overall response.

The Social and Community Office supports the Local Community Development Committee (LCDC), a subgroup of the County Council and made up of state agencies and community and economic interests. The office also supports the Public Participation Network (PPN), a network of registered community groups covering social inclusion, community and environment pillars. Both LAs have strong interagency links with key stakeholders in the community supporting older people. All of the above networks were mobilised during the incident to ensure that vulnerable people in the impacted areas received priority during the emergency.

Using the PPN register, LA staff made personal contact by phone to the community groups who served the most vulnerable, e.g. older people, day care service users, Irish Wheelchair Association, autism support, Men’s Sheds, Special Olympics, Carers Association, Homeless Aid, Cancer Centre service users, MS support groups, and certain community groups. The approach taken was that the LA would arrange for bottled water to be delivered to each group who in turn would deliver to their members with a focus on those vulnerable to infection or house bound through immobility and disability. All groups were appreciative and amenable to supporting their members in this way. In tandem the Civil Defence delivered bottled water to the list of self-declared vulnerable people on the Irish Water list and any others identified through calling IW, the LAs or the HSE primary care team directly.

An added value to mobilising volunteers through the existing voluntary groups providing services to vulnerable people is that volunteers are trained in vulnerable adult safeguarding and take the correct precautions to protect the vulnerable adult and the volunteer. Volunteers who volunteered individually as a result of the emergency had safeguarding protection explained to them over the phone by the social and community office and were asked to travel in pairs at all times.
9. Communications

9.1 Communications Context

IW has a critical role in informing the public and key stakeholders when there is an incident that in any way disrupts the supply of clean safe drinking water and impacts on and disrupts local communities.

Since the establishment of IW in 2013, a number of agreed protocols are in place to clarify roles and responsibilities between IW and the Local Authorities on overall communications to customers and to key stakeholders.

In relation to communications, The IW/Local Authority Service Level Agreement 2013 Section 30, deals with communications responsibilities;

- Section 30.3.7; that Irish Water is responsible for managing the communications for major incidents.
- Section 30.4.1; that the Local Authority shall support the work of the Regional Communications Manager of Irish Water

In addition, the IW Communications Incident Management High Level Document (CCS-SOP-01-PRO-02) outlines the step by step process to ensure the co-ordination of Incident Management response and the detailed process involved to ensure the communication is both efficient and effective.

IW’s communications responsibilities are also clearly outlined in the Commission for Energy Regulation (CER) Customer Handbook of which a revised version was published on 17th February 2015 to take account of the Water Services Act 2014 and a copy of which is available on the CER website. [www.cer.ie](http://www.cer.ie)

The CER Customer Handbook, outlines in Section 5, IW’s responsibilities around supply interruptions (both planned/unplanned outages) as follows:

5.2

Customer communication during supply interruptions and poor quality supply periods

- For the purpose of this Code a supply interruption is any incident related to Irish Water activities or assets that causes a customer’s supply to be significantly impacted. This may include a complete interruption of supply or a significant drop in pressure at the customer’s premises.

5.2.1

- Irish Water shall ensure regular up to date information is available in advance of and during planned interruptions to normal supply and the anticipated time of restoration of supply. Customers that Irish Water anticipate will be affected during a planned
interruption shall be notified at least 2 days in advance of the event. Notification of a planned interruption may be through direct communication with the customer or through a range of appropriate communication channels and information shall be made available through customer helplines.

5.2.2

- **Irish Water shall ensure regular up-to-date information is available to customers understood by Irish Water to be affected by an unplanned interruption to water supplies. This information shall be publicised through a range of appropriate communication channels and shall be made available to customers through telephone helplines.**

- **Updated information on the notice duration shall be regularly publicised through social media, customer emails, regularly updated website information and local broadcasts, and shall be made available to customers through telephone helplines.**

5.2.4

- **In instances where (for public health and safety reasons, or other emergency reasons) customers are provided with alternative supply arrangements Irish Water shall make provision to communicate with all anticipated affected customers through a range of communication channels to:**
  
  a) Inform them it is not safe to drink the water and explain the reason why,
  b) Inform the customer of any other precautionary measures that should be taken,
  c) Inform them where Irish Water will locate and facilitate alternative water supplies,
  d) Highlight the anticipated duration of the alternative supply and
  e) Provide regular updates on progress to rectify the issue causing substandard supply,
  f) Contact registered vulnerable customers as per the requirements laid out in Sections 8.3 and 8.4 which outlines our Code of Practice for Vulnerable Customers.

A **vulnerable customer is defined as someone who is either:**

- critically dependent on water for their medical needs or is
- someone who for reasons that may include advanced age, or physical, sensory, intellectual or mental health reasons require additional support communicating with, or receiving services from Irish Water.

**Updated information on alternative water supply duration shall be regularly publicised through social media, customer emails, regularly updated website information and local broadcasts, and shall be made available to customers through telephone helplines.**

IW also publishes its own Communications Code of Practice which is available on [www.water.ie](http://www.water.ie) and this section covers our commitments to ensure, on any unplanned interruption, that we provide regular communication updates.

During this Incident, IW was liaising with both Local Authorities, Louth County Council and Meath County Council, simultaneously in order to manage the updates being provided by both local authorities in their support roles in order to ensure IW optimised the information available to our customers, vulnerable customers and our key stakeholders.
9.2 The Communications Task

The communications task was to deliver the key messages, listed below, about the Staleen WTP Outage, in a timely, relevant and accurate manner to ensure that those affected locally were aware of the incident and aware of what would happen to support the local community during the incident and also to keep them up to date on the resolution of the incident. IW’s responsibility is to ensure that the public were kept up-to-date and to provide the latest information to the DHPLG, local elected representatives, key stakeholders and vulnerable customers in line with our commitments under the Commission for Energy Regulation Customer Handbook. The key messages to be delivered were:

- To clearly communicate the facts related to the incident, when it happened, how it happened and why it happened.
- To clearly communicate the size and scale of the challenge and provide re-assurance for customers on the facts relating to the incident and communicate how the local community would be affected.
- To clearly communicate how many people were affected by the incident; customers, vulnerable customers, businesses and large water users and to communicate how quickly IW in partnership with Louth County Council were moving to resolve the incident.
- To communicate that we were prioritising particularly sensitive customers including patients at Our Lady of Lourdes Hospital and other sensitive customers including the dialysis unit at a local private hospital (Beacon Care) and the business centre of Drogheda.
- To communicate directly with individual vulnerable customers who have pre-identified themselves on the IW customer database. For those vulnerable customers that we were not aware of, encourage the local community to check in with family and neighbours who may be affected by the incident and help to ensure that these vulnerable customers received water supplies.
- To confirm what exactly was involved in resolving the incident and confirm how soon it was expected that the pipe would be fixed and water supplies restored.
- To confirm how IW and the LAs would provide, during the period of the outage, water to those affected and when and where would we provide water tankers, noting that water supplied by the tankers needed to be boiled in advance of use.
- To advise on how business customers seeking compensation for disruption of water supplies should approach their insurance company.
- To pro-actively communicate directly with local representatives and regulatory stakeholders on the status of the incident and proposed solution and timing.
- To pro-actively respond to all media queries in print and broadcast, to provide trained and briefed spokespeople for broadcast media interviews, to brief all media on the operational response and to correct all published information on the incident, where there were inaccuracies.
9.3 Communications Management through the Incident

The IW Communications team issued its first official notification on the Incident at Staleen WTP, on Friday 21st July 2017. At this stage, the burst was treated as a routine failure and not as a major incident and was dealt with by issuing a notification to the media and update to www.water.ie and the IW Call Centre was briefed.

On Sunday morning 23rd July, the incident was escalated on the basis of the prioritisation of the outage and the IW Incident Management Team was convened at the IW offices located on Foley Street. At this stage, an integrated communications team comprising of Media Relations Manager, Stakeholder and Communications Manager and Customer Service Manager was put in place and liaison was initiated with the Online Marketing Manager who was working remotely. Media updates were issued on Sunday 23rd July.

On Monday morning 24th July, the IW Crisis Management team was mobilised to manage the incident which was escalating. At this point, given the failure of the modified fittings (3rd repair attempt), it was clear that special fittings would be needed for a successful repair and that these could not be provided before late Tuesday 25th July or early on Wednesday 26th July. The team included the following communications resources who are responsible for customer communication, media and stakeholder communication and who have responsibility for Internal Communications, Press and Media Relations, Briefing and liaison with the Irish Water Call Centre, Communication to all key stakeholders, all website updates and social media updates and liaison with the relevant Local Authority personnel.

The full IW communications team in place on Monday 24th July 2017 included;

- Group Head of Corporate Affairs, Media and Stakeholder Communications
- Media Relations Manager
- Customer Service Manager
- Channel Management & Analysis Manager
- Online Marketing Manager
- Online Media Specialist
- Regional Media Specialist
- Stakeholder and Communications Manager
- Head of Group Internal Communications (This resource was involved in the incident but not directly on the Incident Management team)

A summary of all the communications relating to the incident is provided in the table below. Further information is provided in Appendix 5.
### Summary of all communications relating to the incident; Friday 21st July – Friday 28th July 2017

<table>
<thead>
<tr>
<th>Channel</th>
<th>Role</th>
<th>The numbers</th>
</tr>
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</table>
| **Irish Water Press Office** | IW Press Office managed all communication to local and national media informing the media on all issues affecting customers, including updates on the incident, locations of water tankers, details of repairs, progress reports and updates on when water supplies would be restored. | • IW Press Office issued 27 individual press releases.  
• The Press Office also handled 250 media queries handling requests for detailed information on the incident.  
• The Press Office also handled 302 media phone-calls.  
• The Press Office co-ordinated 21 Broadcast (TV & Radio) interviews on local and national media.  
• IW fielded 5 IW Engineering experts as key spokespeople during the incident including the IW Managing Director.  
• As we conducted the review of the incident, we are aware that Meath County Council, on behalf of IW, also updated their own website and communicated directly with RTE Online and LFMFM Radio and with the Meath Chronicle to provide local updates. Meath County Council also updated Local Elected Representatives and their own Facebook page. Detailed joint communiques with IW and Louth Co. Council were issued from Thursday 20th July and included communication to Louth County Council Chief Executive, Council Elected Members, Louth members of the Oireachtas, LFMFM and Louth Twitter (retweeting IW tweets) |
| **Local Elected Representatives** | In the area of the outage, there were 8 Deputies and 69 Local Councillors on the IW database. | • All Elected Representatives on the IW database in the affected areas received all 27 press release updates and information as soon as it was issued to the media. This included 33 Group e-mails, 90 direct e-mails, 80 |

All information managed by the press office was also communicated on the IW website, [www.water.ie](http://www.water.ie) and to key stakeholders and was also communicated on IW social media channels which include Twitter (@irishwater and @irishwatercare and IW LinkedIn page.  

On Tuesday 25th July, a face to face meeting
between elected representatives from both Louth and Meath and IW and the Local Authorities took place to provide a clear update on the issues, the background context, the planned repair and the plans to supply the area with water tankers.

**Liaison with Department of Housing, Planning and Local Government**

Ministerial Media Briefings and updates to the Ministers Press Office were also managed by the Media Relations Manager.

Minister’s Press Officer, Minister’s Programme Manager and Principal Advisor (Water) visited the Crisis Management Room on Monday 24th and were provided with a detailed briefing.

Secretary General, Assistant Secretary General and National Director of Fire and Emergency Management visited the Crisis Management Room on Tuesday 25th and were provided with detailed briefing.

- All press releases went to the Ministers office and to the Departmental Press Office. Constant contact was maintained between the Ministerial Press Advisor and Media Manager where individual queries were answered.
- 4 x Ministerial Media Briefings were provided and circulated to the Departmental press office with a request to circulate to the Government Information Service (GIS) should other Ministers require the information.
- IW Managing Director also met the Minister on site in Drogheda along with Local elected Reps, Engineers from IW and Louth County Council and the CEO’s of Louth and Meath County Councils on the evening of Tuesday the 25th.

**Updates to Regulatory Bodies;**

- **HSE**
  
  Chief Technical Advisor at IW updated key senior level contacts at HSE. IW Water Compliance Monitor Liaison Specialist liaised with HSE at operational level.

- **EPA**
  
  IW Regional Water Compliance Monitoring Liaison Specialist notified the EPA at 12:31 on Monday the 24th and provided regular operation updates following that.

- **CER**

  
  IW Chief Technical Advisor notified HSE Assistant National Director Emergency Management at 12:45 on Monday 24th. Operational updates were provided at regular intervals and at least daily.
CER
The CER made contact with IW in relation to Staleen WTP outage at 12:33 on Tues 25th. After conferring with the CER verbally as to the level of information they were looking for, a detailed update was provided at 18:35. CER Commissioner and the Director of Water, Operations & Customer Care visited the Crisis Management Room on Wed 26th and were provided with detailed briefing.

- Although there is no specific licence obligation for IW in terms of reporting to the CER on Water Supply Incidents it is recognised that more proactive communications to the CER on Monday 24th might have been appropriate.

IW Customer Call Centre
IW currently operates its Call Centre on 1850 278 278. The Call Centre is operational 24/7, 7 days a week. The phone number is clearly communicated on the IW website.

All press releases carried the 1850 278 278 number. Meath County Council also communicated the 1850 278 278 number on its external communication on website updates, however it indicated that this number was only available during normal working hours.

- The call volumes to the Call Centre number 1850 278 278 between Friday 21st July and Friday 28th July totalled 2,985. It is not currently possible to isolate the call volume that directly correlated to the Staleen Outage incident.

- 526 Customers on Vulnerable Customers Register.
- 178 additional personnel contacted the Call Centre to request assistance. In agreement with CER IW will proactively contact these personnel to confirm if they wish to be added to the Vulnerable Customer register.
- The Local Authorities and the Civil Defence managed the distribution of water to vulnerable customers. IW do not have sufficient data to confirm if all vulnerable customers received water and how many times they received supplies.

Vulnerable Customer Management
IW, in line with the CER Handbook has an agreed Code of Practice on Vulnerable Domestic Customers. IW has a vulnerable customer register. In the affected areas, IW had registered vulnerable customers but as the Incident Progressed, additional people called to add their names to the register.

IW provided the contact details of all vulnerable customers to the relevant local authorities.

- 107 Customer Queries were handled directly on @IWCare

@IWCare
IW has a Customer Care Twitter account @IWCare and this is the official customer care
channel. The @IWCare channel has 7,828 followers. The channel handles customer queries and provides service updates 24/7 and provides responses to queries Monday-Friday from 9am-8pm.

<table>
<thead>
<tr>
<th>Irish Water website</th>
<th>IW website was updated with all relevant updates over the period of the outage, peaking on Monday 24th August. Levels of traffic quadrupled during the period.</th>
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</thead>
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<tr>
<td><a href="http://www.water.ie">www.water.ie</a></td>
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- There were 108 outbound tweets which generated 151,541 impressions and 7,213 engagements. This is an engagement rate of 4.76% overall. Of the engagements 36% (2,206) clicked on a url in the tweet, 11% (801) were clicks to view the @IWCare profile, 6% (432) were clicks on a hashtag #, and 2.6% (191) were retweets.

Notes: The engagement rate is the number of engagements divided by impressions or put another way, out of everyone who saw the tweet, what percentage of people did something with it, so like it, share it by retweeting it.

<table>
<thead>
<tr>
<th>Irish Water LinkedIn</th>
<th>IW have a LinkedIn page with 7,340 followers and the page gives IW updates. It is not used for Customer outages given its role and audience profile. We did however leverage it twice during the Staleen Outage to update wider community on the status of the outage.</th>
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<td><a href="http://www.linkedin.com/iw">www.linkedin.com/iw</a></td>
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- 68,168 site visits to IW.ie between 21st – 28th July 2017
- Updates and maps of water tanker locations. The google map generated tanker location map had 7,695 views

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<thead>
<tr>
<th>Irish Water @IrishWater</th>
<th>In addition to the @IWCare Customer Care channel, IW also has an overall brand twitter communication channel called @IrishWater</th>
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</table>

- Update 1 on repairs and on the arrival of specially commissioned parts and featured photos of the arrival of the pipe. This update received 182 likes and 6 comments
- Update 2 on the fact that Staleen Water Treatment Plant was up and running and that reservoir levels would take a number of days to replenish. The update received 53 likes and 5 comments.

- Tweets related to the incident were seen 62,920 times.
- There were 3,252 engagements in
and this communication channel currently has 19,100 followers. This represented an engagement rate of 5.17% which is relatively high.

- 2.5% retweeted our tweet to their followers, 15% clicked through to the @IrishWater Twitter Profile page, 25% clicked on the tweet to see the tweet in more detail. 45% of engagements were media views and these related to three tweets with images of the repairs as they were happening.

Notes: The engagement rate is the number of engagements divided by impressions or put another way, out of everyone who saw the tweet, what percentage of people did something with it, so like it, share it by retweeting it.

Internal Communication to all Ervia Staff

Staying Connected

Staying Connected is our internal email staff update that goes to 1,621 staff in IW, Ervia, Group Centre, Shared Services Major Projects and Gas Networks Ireland

- Update to all staff on the Staleen Incident went out in Staying Connected, our internal communications channel to update all staff on the incident response and media coverage.

Key lessons, findings and recommendations arising from the review of communications are provided in Section 10. Supplemental information related to the communications response is provided in Appendix 5. In addition to these it is also worth noting the following:

- The overall understanding of who IW is and what the company does is not yet clearly understood by the Irish public. Our role in the transformation, planning, management, upgrading and operational support (of Local Authority operations) of critical water and wastewater infrastructure and services is not clear.
- IW is beginning to solve decades of underinvestment in our water and wastewater infrastructure and services and the sheer size and scale of the challenges facing the transformation of our water and wastewater infrastructure, the technical and engineering expertise that is required is also not clearly understood. This lack of public information has a direct impact on our overall communications effectiveness. The Drogheda incident served to underline this. IW must address these information deficits in order to be fully effective in its role.
10 Findings and Recommendations

10.1 General

IW recognises and deeply regrets the disruption and hardship caused to the people of Drogheda, South Louth and East Meath during this incident. IW also recognises and is extremely grateful for the enormous efforts made by the many people within IW, Ervia, Meath and Louth LAs, the wider LA sector, State Agencies, Non-Governmental Organisations, Community groups and private companies who worked incredibly hard to achieve the repairs, provide emergency support during the outages and assist the communications effort.

The review has identified a number of findings and made a number of recommendations to improve the preparedness, management and response to this and any similar incident in the future.

Recommendations arising from this report should be further scoped, prioritised and assigned clear owners and timelines. Status updates should be provided to the IW Senior Management Team at regular intervals.

10.2 Findings

1 The Drogheda, South Louth and East Meath Water Supply Area provides drinking water to a population of approximately 90,000 and it is estimated that up to 60,000 were impacted at any time during the incident. The larger of two rising mains between the Roughgrange intake/pumpstation, abstracting water from the River Boyne, and the Staleen WTP burst on the afternoon of Thursday 20th July 2017. As the smaller (450mm diameter) rising main from Roughgrange to the Staleen WTP remained operational for the most part throughout the incident, the treatment plant continued to produce approximately 45% of its normal production. This was further supplemented by increasing supplies from other sources and connecting new sources over the course of the incident response.

2 There was a previous burst on the 600mm diameter rising main on Friday 3rd June, 2016. The June 2016 repair was effected using standard couplings with some modifications and a successful repair made at the first attempt approximately 28 hours after the burst. The configuration of the rising mains at the time resulted in both being unavailable and a total loss of supply to the WTP. As a result Rosehall WTP was brought back on line to maintain supply to our Ladies of Lourdes Hospital and surrounding area.

3 Following the review of the rising main burst in June 2016, work was undertaken to identify and repair the interconnecting valves between the 600mm and 450mm diameter rising mains. This measure was of great significance in responding to the July 2017 event and ensured that the Staleen WTP could be operated at reduced throughput for the majority of the time during the event. Two sets of repair fittings were also purchased following the burst in June 2016.

4 Rosehall WTP was the first water supply system for Drogheda and when in use was producing approx. 2.3 Ml/day in Q1 2016. There was regular compliance issues at the plant
and the existing processes were insufficient to ensure consistent compliance with the Drinking Water Regulations. Predominately based on the water quality issues at the plant and the available capacity of the Staleen WTP (where planning of major upgrade works was well underway), it was decided by IW in consultation with LCC to close the Rosehall plant in the March 2016. It was not feasible within the timescale of the response to the 2017 incident to bring the plant back into operation given that some key elements of the treatment process had been decommissioned and removed. Even at reduced throughput Staleen WTP Outage was producing significantly more water than Rosehall WTP was able to produce during the previous incident.

5 Following the burst, there was an initial delay in beginning excavation works due to landowner issues from the previous repair that had not been appropriately closed out by Irish Water. A LCC crew commenced excavating to make the repair at 05:00 on Friday 21st July.

6 It was decided early on in the management of the incident that provision of water to Our Lady of Lourdes Hospital was a critical priority. The Drogheda Network was then configured to ensure that a continuous supply of water could be maintained to the Hospital and the town centre area with water being distributed to an additional four suburban areas of Drogheda on a three hourly rotational basis i.e. each of the four areas received a piped water supply for at approximately three hours during daylight hours.

7 The first repair was completed at 20:00 on Friday the 21st and the second repair was completed at 13:00 on Saturday the 22nd July using the standard step couplings. Both failed during recharging of the pipe. This was most likely due to the unusually high axial forces generated through a combination of the high operating pressure and the large difference in external diameters of the two pipes (a 700 mm nominal diameter ductile iron pipe was used to connect with a 600 mm nominal diameter asbestos cement as it provided a closer match in external diameter compared with a 600 mm nominal diameter ductile iron pipe). This was further exacerbated by the difficulties encountered in tightening the bolts of the couplings to achieve compression of the gaskets between the end rings and the centre sleeve of the couplings onto the surface of the pipe to form an effective seal.

8 For the third repair the standard fittings were modified to get a tighter fit on the pipe. Cleats were also welded onto the DI pipe in order to stabilise the couplings and prevent them moving out of alignment. The repair was completed at 23:55 on Sunday the 23rd. The pipe was recharged and while the repair performed better than the first two repair attempts it ultimately failed; most likely for the same reasons outlined in point 6 above.

9 For the fourth repair, a section of infill DI pipe was modified (through the welding on and machining of collars) to match the outer diameter of the turned end of the AC pipe. This allowed a straight coupling as ordered by LCC to be used. The repair was completed by 12:00 on Wednesday 26th and the pipe was successfully charged and brought back into service.
10 Currently the management of water supplies is based on District Meter Areas (DMAs) and Water Supply Zones (WSZ). Based on the review of the Staleen WTP outage it is clear that there was a difficulty in getting an overall view of the area affected due to the complexity of the supply area, as it covered areas of both Meath and Louth and includes a number of borehole sources in addition to the Staleen WTP. This presented some difficulties in the initial response in accurately communicating the geographical area and number of customers impacted.

11 Both IW and the LAs have a comprehensive suite of incident and crisis management plans and procedures in place. The incident classification and escalation protocols and the roles and responsibilities of both the LAs and IW are however, not entirely consistent across the various plans and procedures.

12 In the first seven months of 2017, there have been 2,050 watermain bursts recorded on the network which equates to an average of almost 10 per day. In the vast majority of these cases it is possible to quickly repair the main using standard repair methods without significant interruption to water supplies. Where there is the expectation that the burst can be readily repaired the burst is treated as a repair and typically does not get escalated as an incident under the DWIRP or IW Incident Management Procedures.

13 IW established its Incident Management team on Sunday 23rd July (after the second repair attempt failed) to manage the repair and respond to households’ and businesses’ water supply needs. After the third repair failed the incident was further escalated and Irish Water’s Crisis Management and the LA’s Incident Management Teams were convened on the morning of Monday 24th July.

14 In this incident, two individual Local Authorities were involved in the operational response which added to the challenge and complexity. There was some initial challenges in tracking all the various operational activities and communicating these but this settled over the course of Monday the 24th. IW merged their Incident Management and Crisis Management teams into one team on Monday afternoon to streamline communications and accelerate decision making capability. IW also appointed two IW Liaison Engineers to join the LA Incident Management teams in Dundalk and Navan and act as a point of contact between the LA Incident Management teams and the IW Crisis Management Team. Both the LAs and IW found the role of the IW Liaison Engineer to be extremely effective during the incident.

15 Based on a review of the available documentation and information gained through the review process it seems reasonable in hindsight that the incident could have been formally escalated from an operational incident to a high severity incident (in accordance with the IW Incident Procedures and LA DWIRPs) prior to Sunday the 23rd. It’s important to note that this would not have shortened the overall time to repair or allowed tankers to be mobilised any sooner, however it may have enabled detailed contingency planning to have been more developed coming into Monday the 24th and potentially supported a more comprehensive communications response to be established on Saturday the 22nd. At the
time the focus was on achieving an interim repair that would restore service, even if only for a short period to fill reservoirs.

16 Under the Service level agreements (SLAs) the LAs are responsible for the day to day operations of plants and water networks and the undertaking of remedial/repair works as the LA deems appropriate or as otherwise directed by IW. Spares, consumables and contingency equipment are currently held and managed by the LAs.

17 IW is responsible for developing an overall methodology and system to manage spares and consumables to maximise asset availability. In the first quarter of 2017, IW established a new Operational Planning and Emergency Management function to develop and coordinate emergency management capability at a national level. The development of a critical spares strategy comes under this function. National and Regional Emergency Response Managers within IW may provide greater consistency and technical expertise in dealing with emergencies.

18 Historically there has been no clear guidelines or requirements for the quantity or type of emergency stock to be held by the LAs (or guaranteed through service level agreements with private industry) in the event of an emergency. As a result there is currently a lack of consistency across the LA sector. This is now being considered as a priority activity.

19 Over the weekend of the incident (which was also peak holiday season) it proved difficult to make contact with many of the private tanker operators and other LAs. In the majority of cases where contact could be made, the private tanker operators and LAs were unable to mobilise tankers and drivers until Monday the 24th.

20 By Wednesday the 26th there was 49 road tankers and 11 bowsers deployed to supplement the mains water supply, to replenish temporary water stations and to supply priority customers around impacted communities. 66 IBCs were in place across Drogheda, South Louth and East Meath.

21 While the high volume of asset failures currently occurring across the water network is impacted by the current condition of the assets, all water utilities face some level of interruptions through pipe bursts. In order to mitigate against this it is vital that robust emergency preparedness and contingency arrangements are put in place to provide temporary water supplies to the affected areas.

22 While IW and the LA Water Services divisions are fully resourced to develop, operate and maintain the water and wastewater networks under regular operating conditions, they do not have (and are unlikely to ever have) the capacity and capability to fully deal with a major water supply interruption on their own. In these events they will also continue to need to draw on the support and expertise of various other State Agencies, Local Government, Non-Governmental Organisations, Community and Voluntary groups to aid the response. The incredibly important and positive role that these groups played in this incident was clearly evident and served to significantly lessen the impact on the affected populations, and in particular the vulnerable.
23 The Social and Community Offices in partnership with the Local Community Development Committee (LCDC) and the Public Participation Network (PPN) played a particularly important role in coordinating the provision of bottled water to sensitive and vulnerable groups and individuals, many of whom had not registered as vulnerable customers with IW.

24 The IW communications response was extensive with 27 press release updates to both local and national media and the press office also mobilised 21 broadcast interviews and five individual spokespeople including the Managing Director taking part in national and local television and radio interviews.

25 Responsibilities for external communication are outlined in the Service Level Agreement. In practical terms, IW managed regular communication during the crisis to Elected Representatives and to both national and local media and were supported directly by both Local Authorities. Individual local authorities also communicated directly with their elected representatives and with local media on operational information around water tankering and locations. Although communications were well aligned between the LAs and IW for this incident, this dual approach has the potential to cause some level of confusion around who is responsible for managing the incident communications.

26 526 people were registered as vulnerable customers within the area affected by this incident (217 priority service and 135 special services). During the incident response it became apparent that some of the people registered as vulnerable did not need or want special assistance. The LAs also had their own lists of vulnerable households which had been developed over time with the help of community organisations. While there was reasonable consistency in both lists, it is clear that not all vulnerable people have registered as vulnerable customers with IW.

27 A major upgrade of the Staleen WTP is currently at tender stage and is expected to commence in late 2017. The purpose of the upgrade to the Staleen WTP is to improve the quality of water supply to Drogheda, South Louth and East Meath so as to ensure consistent compliance with the most recent Irish Water drinking water standards and current Drinking Water Regulations. The works will also comprise of the supply and installation of a range of mechanical, electrical, instrumentation, control and automation equipment at the Roughgrange PS, including new high lift pumps, control panels, pipework and associated equipment. Work has now also commenced on the design of a replacement rising main which will be provided in parallel with the previously approved works.

10.3 Recommendations

Based on the review the following recommendations have been made to improve the preparedness, management and response to this and any similar incident in the future.

1 The IW and LA Incident Management Procedures should be reviewed and revised to;
   • Ensure incident classifications, escalation protocols and roles and responsibilities are clear and consistent throughout.
- Ensure classification guidance and escalation thresholds are set at appropriate levels to ensure that there is sufficient separation between the high severity events, or those with the potential to be high severity, from the lower severity incidents which frequently occur across the network.

- Formally include the role of IW Incident Liaison Engineer which was found to be extremely effective once in place on Monday the 24th. This person would join the LA Crisis Management Team in location and act as a single point of contact between the IW and LA Incident Management Team. Depending on the incident, additional IW personnel to support the Incident Liaison Engineer may also be needed.

2 IW should continue to develop an emergency response and repair capability on a national basis and which is aligned with international best practice. In particular IW should:

   - Establish a central stores to provide for the quick deployment of equipment to support the provision of alternative water supplies in future incidents. Equipment to include as a minimum; Road tankers of various sizes, IBCs with mounting frames loaded on trailers with forklift ready, standpipes, flatpack water containers, bottled water and signage for water stations. IW to identify, catalogue and assess suitability for use of existing equipment used by local authorities in response to drinking water incidents as part of this exercise.

   - Establish frameworks with suppliers, complete with arrangements and contacts for working outside normal working hours, to provide and operate tractor units for tankers and trailers for IBC deployment, to provide and operate additional tanker units to supplement IW stock and to provide additional stocks of bottled water. Also investigate the feasibility of establishing mutual aid arrangements with other water utilities e.g. Northern Ireland Water.

   - Develop a stores and inventory management system to cover the purchase, recording, storage, maintenance and distribution of spares. The initial focus should be on critical spares. IW to continue to collate an inventory of spares equipment currently held by the LAs and assess against requirements. Arrangements to be put in place to procure any custom fittings that may be required based on specific site conditions, and including arrangements for fabrication and modification outside of normal working hours.

   - Develop Standard Operating Procedures (SoPs) for the Repair of Large Diameter Mains. Resources, equipment and technical competency requirements to be determined and put in place to ensure the SOP can be implemented on a national basis. Frameworks should be established with contractors, complete with out of hours arrangements, to carry out complex repairs where necessary.

3 IW should work together with the LAs on a prioritised basis to develop and enhance existing contingency plans for the provision of alternative water supplies in the event of a major supply disruption. These plans should include high level contingency tankering plans, identification of priority/institutional customers, and advance planning for the initial establishment of key water stations which can then be supplemented as needed. IW should also continue to identify and implement measures which can be taken to improve resilience of water schemes, e.g. through linking, where practicable, with neighbouring public or private schemes.
4 IW should continue to improve its information on network assets with a particular focus on its critical assets. Existing information to be supplemented through the sourcing of original design and construction documents, information gained through pipeline interventions, and local knowledge. The collation of operating conditions and design requirements for pipelines and in particular any rising mains with total head in excess of 60 metres supplying significant populations to be prioritised.

5 IW, in consultation with the CER, should consider how the Vulnerable Customer register can be enhanced. As part of this process IW should engage with the local authorities, HSE and other agencies, subject to data protection requirements, who have more specific knowledge of vulnerable groups and personnel.

6 IW should work with the LAs to develop clear and simple guidance to help support personnel (volunteer or otherwise) providing response to the public. This should outline the levels of response that are appropriate and address key Health and Safety risks and safeguarding protection measures to be taken.

7 IW should use the opportunity during broadcast interviews to further reinforce where the public can get further accurate and up-to-date information, directing people to the IW Call Centre and 1850 number and to the IW website and social media accounts.

8 It is recommended that a number of specific actions are taken to improve the resilience and security of supply of piped water in the Drogheda, South Louth and East Meath Water Supply Area in order to improve the response in the case of a future incident similar to the rising main burst in July 2017:
   - Identify the best combination of replacement pipe and coupling for repair of the asbestos cement pipes used in the rising mains from Roughgrange pumping station to the Staleen WTP, namely 600mm Class 15 and 25 and 450mm Class 15. Procure these pipes and fittings as spares.
   - Examine opportunities to connect to other water supplies on the periphery of the Drogheda, South Louth and East Meath Water Supply Area. It is anticipated that some of these can be implemented in the short term, whereas others will take years to implement as part of major capital schemes e.g. future supply from the East and Midlands Water Supply Project.
   - While the SCADA data provided to the IW Incident Management room via the IW Operational Control Centre was very useful to the team, there is an opportunity to improve further by providing more frequent updates and providing better coverage of flows and reservoir tank levels.
   - Review the Drogheda, South Louth and East Meath Water Supply Area as to how the area should be considered for the purpose of network management (DMAs), water quality monitoring, operation of drinking water safety plans, operational risk assessment, water resource planning and incident management.
## Appendix 1  Glossary of Terms and Abbreviations

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>AC</td>
<td>Asbestos Cement</td>
</tr>
<tr>
<td>CER</td>
<td>The Commission for Energy Regulation</td>
</tr>
<tr>
<td>CMT</td>
<td>Crisis Management Team</td>
</tr>
<tr>
<td>DHPLG</td>
<td>Department of Housing, Planning and Local Government</td>
</tr>
<tr>
<td>DI</td>
<td>Ductile Iron</td>
</tr>
<tr>
<td>DMA</td>
<td>District Metering Area</td>
</tr>
<tr>
<td>DW</td>
<td>Drinking Water</td>
</tr>
<tr>
<td>DWIRP</td>
<td>Drinking Water Incident Response Plan</td>
</tr>
<tr>
<td>EPA</td>
<td>Environmental Protection Agency</td>
</tr>
<tr>
<td>FCC</td>
<td>Fingal County Council</td>
</tr>
<tr>
<td>GWS</td>
<td>Group Water Scheme</td>
</tr>
<tr>
<td>IBC</td>
<td>Intermediate Bulk Container</td>
</tr>
<tr>
<td>IMT</td>
<td>Incident Management Team</td>
</tr>
<tr>
<td>IW</td>
<td>Irish Water</td>
</tr>
<tr>
<td>LA</td>
<td>Local Authority</td>
</tr>
<tr>
<td>LCC</td>
<td>Louth County Council</td>
</tr>
<tr>
<td>LCDC</td>
<td>Local Community Development Committee</td>
</tr>
<tr>
<td>MCC</td>
<td>Meath County Council</td>
</tr>
<tr>
<td>Ml/day</td>
<td>million litres per day = 1,000,000 litres/day = 1,000 cubic metres/day</td>
</tr>
<tr>
<td>OD</td>
<td>Outside Diameter, used in the context of this report in relation to a pipe</td>
</tr>
<tr>
<td>PPN</td>
<td>Public Participation Network</td>
</tr>
<tr>
<td>Abbreviation</td>
<td>Description</td>
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<tr>
<td>--------------</td>
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</tr>
<tr>
<td>PS</td>
<td>Pumping Station</td>
</tr>
<tr>
<td>SCADA</td>
<td>Supervisory Control and Data Acquisition</td>
</tr>
<tr>
<td>SOP</td>
<td>Standard Operating Procedure</td>
</tr>
<tr>
<td>THM</td>
<td>Trihalomethane</td>
</tr>
<tr>
<td>ToR</td>
<td>Terms of Reference</td>
</tr>
<tr>
<td>WTP</td>
<td>Water Treatment Plant</td>
</tr>
<tr>
<td>WSZ</td>
<td>Water Supply Zone</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Term</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Abstraction</td>
<td>The removal of water from a river, lake or groundwater usually with the use of a pump.</td>
</tr>
<tr>
<td>Asset</td>
<td>Infrastructure (e.g. buildings, treatment plants) and equipment (e.g. pumps, screens, treatment units, disinfection systems and control panels) controlled and operated by IW to deliver drinking water and wastewater services. They divide these into Below Ground Assets such as pipework and valves and Above Ground Assets such as treatment plants.</td>
</tr>
<tr>
<td>Bar</td>
<td>A bar is a metric unit for the measurement of pressure; 1 bar is equivalent to 10.1972 metres head (water).</td>
</tr>
<tr>
<td>Borehole</td>
<td>A vertically drilled hole into the subsoil and/or bedrock which is used to monitor or abstract groundwater. A borehole is usually lined with a casing and/or screen to prevent it from collapse.</td>
</tr>
<tr>
<td>Coupling</td>
<td>A coupling, in the context of this report, is a steel fitting used to connect an Asbestos Cement pipe to a Ductile Iron pipe</td>
</tr>
<tr>
<td>Distribution Input</td>
<td>The volume of water entering the distribution system at the point of production and includes usage by domestic and non-domestic customers and unaccounted for water.</td>
</tr>
<tr>
<td>Drinking Water Incident</td>
<td>An event or occurrence which IW or the LA, acting in conjunction with the</td>
</tr>
<tr>
<td>Term</td>
<td>Description</td>
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<tr>
<td>-------------------------------------------</td>
<td>---------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>HSE, if necessary, decides is of sufficient seriousness to require the activation of a Drinking Water Incident Response Plan (DWIRP) as defined in the EPA publication “Handbook on implementation for Water Services Authorities for public water supplies”</td>
<td></td>
</tr>
<tr>
<td>Drogheda, South Louth and East Meath Water Supply Area</td>
<td>Drogheda and an area in South Louth and East Meath supplied with water from the piped network that is fed from the Staleen WTP and supplemented by a number of borehole sources adjacent to storage reservoirs on the network</td>
</tr>
<tr>
<td>Groundwater</td>
<td>Water located beneath the ground surface in soil and rock pore spaces and fractures within rock formations.</td>
</tr>
<tr>
<td>Intermediate Bulk Container IBC</td>
<td>An intermediate bulk container is a reusable industrial container designed for the transport and storage of bulk liquid. IBCs have a volume range that is situated between drums and tanks, hence the term “intermediate” and typically with a capacity of 1 m³ (1000 litres).</td>
</tr>
<tr>
<td>Major Emergency</td>
<td>A major emergency is any event which, usually with little or no warning, causes or threatens injury or death, serious disruption of essential services or damage to property, the environment or infrastructure beyond the normal capabilities of the principal emergency services.</td>
</tr>
<tr>
<td>Network</td>
<td>The interconnection of pipes and pumping stations used for the distribution of treated water and the collection of wastewater.</td>
</tr>
<tr>
<td>Priority Service Customer</td>
<td>Vulnerable Customers who are registered as critically dependant on water for their medical needs.</td>
</tr>
<tr>
<td>Raw Water</td>
<td>Water abstracted for drinking water purposes before treatment.</td>
</tr>
<tr>
<td>Resilience</td>
<td>The ability of a system (e.g. water supply zone or wastewater network) to cope with change or stress. In a drinking water and wastewater services context stress to the system or network could result from increased demand, partial failure of operating plant, climate change or local contamination of water sources.</td>
</tr>
<tr>
<td>Rising Main</td>
<td>Also referred to as a pumped main and relies on a pump or pumps to drive flow in the pipeline.</td>
</tr>
<tr>
<td>Term</td>
<td>Description</td>
</tr>
<tr>
<td>-----------------------------</td>
<td>-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Special Services Customer</td>
<td>Vulnerable Customers who are registered for reasons that may include advanced age or physical, sensory, intellectual or mental health reasons requires additional support communicating with, or receiving services from, Irish Water.</td>
</tr>
</tbody>
</table>
Appendix 2  
Terms of Reference

Review of Staleen Water Treatment Plant Outage

Objective
To establish the facts relating to the Staleen Water Treatment Plant (WTP) outage in July 2017 and to identify lessons which can be learned as to any factors which caused and contributed to the incident and to make recommendations which when implemented would improve the response to this and any similar incident occurring in the future so that Irish Water can consolidate and further enhance both generic incident management and specific incident preparedness and response.

Scope
Apart from setting out the background and a description of the outage and subsequent actions taken, the review is to cover six main areas:

1. The level of preparedness for this type of outage generally and for the specific incident affecting Staleen WTP.
2. The technical/engineering background and response to repairing the burst pipe.
3. The response in terms of managing the distribution of available water from Staleen WTP and providing alternative water supplies by tanker/bottled water.
4. The interactions within and between Irish Water and the two local authorities in the affected areas under their Service Level Agreements.
5. The role of support agencies and other organisations in assisting with the response.
6. The communications response to customers including vulnerable customers and to all other stakeholders including the Minister and Department of Housing Planning & Local Government, the CER, the EPA, the HSE, local representatives, local and national media, and the use of the contact centre, website and social media in supporting this response.

Review Report
A report is to be prepared setting out the review findings and any recommendations as to how Irish Water’s preparedness and response to this type of outage could be improved.
Appendix 3 Extract from Management of Drinking Water Incidents protocol (IW-PRT-IMT-002)

Local Authority Responsibilities – Overall Summary

a. Responsible for incident management execution with support from Irish Water
b. Ensure incidents are responded to in at least the same manner as in 2013
c. Incident liaison with HSE as necessary
d. Preparation of incident notifications required for submission to EPA
e. Submission of incident notifications to EPA via online systems
f. Appoint an Incident Controller/Manager where appropriate for DWIRP incidents
g. Have incident response procedures in place (e.g., DWIRP) for activation
h. Notify IW as soon as possible when a high level incident is occurring at a LA operated site
i. Notify IW as soon as possible when a high level incident is occurring at a DBO operated site (i.e., PMS Category A or B Emergencies)
j. Escalate incidents to a higher status (including a Major Emergency) if required
k. Carry out corrective actions/incident containment
l. Keep records of actions and report to IW on actions taken
m. Undertake communications with key stakeholders, including EPA, HSE, HSA
n. Support IW in management of media communications
o. Engage with the IW Regional Operations during an incident (when appropriate)
p. Liaise with the IW Incident Liaison Officer when appointed
q. Ensure quarterly incident reports for low level incidents (i.e., 'Sub-DWIRP') are submitted to IW for LA incidents

Irish Water Responsibilities – Overall Summary

a. Support Local Authorities in the incident management execution process
b. Assist LAs that do not have a DWIRP in place
c. Acknowledge LA incident notifications via the EPA online system
d. Appoint an Incident Liaison Officer where DWIRP is activated
e. Ensure all relevant information is fed back to Irish Water for wider communication as required
f. Lead the management of media communications
g. Co-ordinate external resources where required
h. Conduct Post Incident Review where appropriate
i. IW to participate in Water Quality Liaison Group especially in relation to Drinking Water incidents
### Appendix 4  High Level Timeline

A high level timeline of the key events related to the incident response is provided below. For further detail please refer to the main body of the report.

<table>
<thead>
<tr>
<th>Date</th>
<th>Time</th>
<th>Event/Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>20/07/2017</td>
<td>14:00</td>
<td>600mm Rising Main burst occurs</td>
</tr>
<tr>
<td>20/07/2017</td>
<td>15:00</td>
<td>LCC incident response team mobilised</td>
</tr>
<tr>
<td>20/07/2017</td>
<td>15:20</td>
<td>Incident reported to IW &amp; MCC. IW and MCC incident response teams mobilised</td>
</tr>
<tr>
<td>21/07/2017</td>
<td>05:00</td>
<td>Excavation for repair commences</td>
</tr>
<tr>
<td>21/07/2017</td>
<td>20:10</td>
<td>First repair fails</td>
</tr>
<tr>
<td>22/07/2017</td>
<td>14:40</td>
<td>Second repair fails</td>
</tr>
<tr>
<td>23/07/2017</td>
<td>09:10</td>
<td>IW formally activate Incident Management Plan</td>
</tr>
<tr>
<td>24/07/2017</td>
<td>00:30</td>
<td>Third repair fails</td>
</tr>
<tr>
<td>24/07/2017</td>
<td>08:00 – 09:30</td>
<td>IW formally activate Crisis Management Plan. LCC &amp; DCC formally activate Incident Management Plans.</td>
</tr>
<tr>
<td>26/07/2017</td>
<td>12:00</td>
<td>Fourth repair successfully completed</td>
</tr>
<tr>
<td>26/07/2017</td>
<td>17:30</td>
<td>Flow to Staleen WTP reaches normal operational levels</td>
</tr>
<tr>
<td>26/07/2017</td>
<td>Late evening</td>
<td>Supply returned to majority of properties in Drogheda</td>
</tr>
<tr>
<td>27/07/2017</td>
<td>Evening</td>
<td>Supply returned to majority of remaining properties in South Louth and East Meath. Note it took longer for some properties on high ground and furthest from the plant to receive a normal supply</td>
</tr>
<tr>
<td>01/08/2017</td>
<td>13:00</td>
<td>IW Crisis Management Team formally stood down</td>
</tr>
</tbody>
</table>
Appendix 5  Communications – Supplemental Information

There was a large increase in visits to water.ie during the incident with volumes peaking on Monday the 24th when the story got increased national media coverage.

The water.ie homepage was updated with the latest information and direct links to the key content from Monday morning, 24th July 2017.
The service & supply map was regularly updated throughout the incident and the latest information was also shared on the @IWCare Customer Care Twitter channel.

The news section of water.ie was updated from 6am to 11pm daily during the Staleen Water Treatment Plant outage utilising all press release content to provide accurate customer updates.
The contact us page was updated with the latest information throughout the week to ensure we kept customers updated.

A map showing the temporary water stations locations was created and updated as locations changed. There was almost 8,000 views of the map.
On the @IrishWater channel, there were 62,920 impressions and 3,252 engagements with content related to the burst main. This was key to keeping customers informed and updated.

Updates were posted on LinkedIn and they were highly viewed and engaged with.
A number of specially created graphics were shared on social media.