Chapter 3 – Sewerage Service – Internal Flooding (Table 3) & External Flooding (Table 3a)

1. Background

The information included in Table 3 is used to monitor and compare company performance against the DG indicators. The DG5 – Annual Flooding Summary includes properties internally flooded as a result of overloaded sewers and other causes. The DG5 – Properties on the "at risk" register cover properties at risk of flooding more frequently than once in twenty years and once or twice in ten years, problem status of the properties on the register and annual changes to the register.

The information included in Table 3a is used to measure the frequency of actual flooding of external areas from the public sewerage system by foul water, surface water or combined sewage. The Table 3a – Annual External Flooding Summary includes properties externally flooded as a result of overloaded sewers and other causes. The Areas on the external "at risk" register cover areas at risk of flooding more frequently than once in twenty years and once or twice in ten years, problem status of the external areas on the register and annual changes to the register.

2. Key Findings and Recommendations

2.1 Internal Flooding

Criteria	RAG	Assessment
Independent review of performance and reporting	Amber	No evidence of methodology improving over time
Methodology	Amber	No evidence of methodology improving over time
Assumptions	Green	Assumptions reasonable and appropriately applied
Source data	Amber	Line owners required to fill gaps, which would be better completed on site at the time of the incidents
Clarity of audit trails	Green	Detailed and comprehensive audit trail to all numbers available
Confidence grades	Amber	B2 recommended where A2 given
Governance	Green	Responsibilities for integrity of data and commentary clearly defined. Good evidence of engagement and of final sign-off.

- The number of domestic properties connected for the sewerage service has increased by 1,748 which is to be expected with the number of new connections. The increase is as expected and we note is less of an increase than that observed in Table 2 because Table 2 includes non-households.

2.1.1 AIR15 Incidents

- The overall sewer flooding process for NI Water is broadly unchanged from that applied in previous years and appropriate for AIR reporting. However, although incident reporting has been part of 'business as usual' operations for a number of years now, the quality of data collected is still considered to be very poor.

- We consider there is an increasing disconnect between; the need for the maintenance contractor to attend and clean up all flooding incidents; and the need to capture sufficient data and evidence in order to assess and verify each incident. For the process to be effective, it is important that sufficient levels of detailed information are collected at the time of the incident, to ensure appropriate assessment, and to ensure all affected properties are identified.
- We found that the Wastewater Business Unit (WBU) is regularly required to assess contradictory information from the Maintenance Contractor, the CFM and the Customer. As a result of this, the WBU were often required to 'take a view' on the varying opinions in order to make an assessment. The need to undertake this secondary verification is symptomatic of the poor quality incident records collected by the Maintenance Contractor whilst attending each incident.
- We consider it may be more appropriate, for the Company to take more responsibility for data collection/incident verification away from the maintenance contractor, and for the local Customer Field Manager (CFM) or equivalent, to take ownership of the flooding incidents reported in his/her area. This will result in an improved local understanding of flooding incidents and mechanisms, facilitating improved data confidence, improved network understanding and improved customer service.
- Despite ongoing efforts by the Company to monitor performance of the Customer Response Centre (CRC), the number of 'false' internal flooding contacts referred to the Maintenance Contractor by the CRC is still high. During the year, 545 internal flooding contacts were received (of which 511 were direct contacts to the CRC), of which circa 85% were considered to be 'false' internal flooding contacts. This is significantly higher than we would expect to see, suggesting the CRC is either incorrectly capturing contact details, or the incident is not being appropriately responded to by the Maintenance Contractor.
- During the course of our review, we identified a number of excluded internal flooding contacts that were found to relate to external flooding. However, these incidents were not being referred to the external flooding team for assessment and reporting in Table 3a. We recommend that all external flooding incidents identified as part of the internal flooding verification process are referred to the DG5 Panel for allocation to Table 3a.
- During the course of our audit, we queried the nature of 27 incidents that had been reported in Line 15a of Table 3, and found they predominantly related to actual confirmed incidents of internal flooding. We confirm, that as a result of this challenge the Company has reviewed Table 3 and has now correctly reported the incidents for AIR15. On this basis, NI Water has reported 28 properties in Line 2, 29 incidents in Line 3 and 2 incidents in Line 15a.Despite the increase in confirmed internal flooders reported for AIR15, once the additional flooders identified in Line 15a were accounted for and transferred to Block A of Table 3, NI Water's performance continues to be out of step with the rest of the industry.
- The Company has previously relied on Met Office reports to assess severe weather events. These assessments are expensive to procure and do not always reflect the rainfall conditions experienced. With this in mind the Company has now procured the use of real time radar based rainfall depth and duration data from the Met Office Nimrod system to assess the storm return period for each event. We understand that the new rainfall

assessment system (using real time radar data) is in the process of being implemented, with training currently being rolled out to the business. Going forward however, the Company will need to determine how they intend to apply the data to assess the impact of severe weather events on flooding incidents.

- For AIR15, NI Water has reported 50 incidents of flooding due to other causes, 36 due to blockages, 12 due to collapses and 2 due to equipment failure. As per overloaded incidents, NI Water is an outlier in terms of FOC (blockage) performance. Despite delivering steady year on year improvements in the number of blockages experienced, NI Water are still experiencing 3-4 times more blockages/1000km than comparator companies.

2.1.2 DG5 Flooding Register

- Over the previous few years, the Company has undertaken to investigate, assess and cleanse all historic flooding records. Through this process (combined with a targeted capital removal programme), NI Water has been able to remove a large proportion of the properties initially included on the historic flooding register, with the Register reducing from 825 properties in 2008/09 to 179 in 2014/15. At year-end, NI Water has reported 56 properties on the 2in10/1in10yr Flooding Registers, with a further 123 properties on the 1in20 Register.
- For 2014/15, the Company completed 7 schemes, removing 18 properties from the 2in10 Register and 10 properties from the 1in20yr Flooding Register. Against a PC13 target of 67 capital removals, NI Water has delivered 39 removals by company action in the 2 years of PC13. On this basis, NI Water has not delivered their PC13 DG5 programme.
- We note that a large number of the properties remaining on the current DG5 Register are associated with large catchment wide problems in Belfast, where the proposed solution is both large and expensive, with a long lead-in time to develop and deliver the solution. In advance of a wider permanent solution to address a number of catchment issues, we recommend the Company should consider offering mitigation, to protect properties from repeat incidents of internal flooding.
- NI Water has reported an average capex cost per output of £69k for the 2in10/1in10 outputs and £81k for the 1in20 outputs in AIR15. When compared to previous years, the average cost per output is considerably lower, suggesting the Company is 'cherry picking' the lower cost solutions in order to provide better value for money (for example, [x]) and ensure outputs are actually delivered in the PC13 period.
- The Company has once again assigned a confidence grade of B2 to Lines 2 to 11, 15a & 17 on the basis that all data is derived from Ellipse, and that the Company undertakes an investigation of all reported incidents. Although we have serious reservations with the quality of the source data and identified a number of errors during the audit, (which were resolved prior to submission), we are minded to continue to support a B2 for Lines 2 to 11, 15a and 17 for AIR15.
- The Company has improved the confidence grades for lines 12–15, 22–24 and 30–32 from B2 to A2 due to better management and control of the DG5 Register. Lines 16, 25-26 and 33-34 have improved from B3 to B2 due to improvements with the modelling process. We do not consider processes have improved materially during the year and the overall

approach is broadly unchanged. On this basis, we recommend a B2 is retained for lines 12 – 34, as all data in Table 3 is captured using the same process.

2.2 External Flooding

Criteria	RAG	Assessment
Independent review of performance and reporting	Amber	No evidence of methodology improving over time
Methodology	Amber	No evidence of methodology improving over time
Assumptions	Green	Assumptions reasonable and appropriately applied
Source data	Amber	Line owners required to fill gaps, which would be better completed on site at the time of the incidents
Clarity of audit trails	Amber	Concerns over numbers of incidents being reported
Confidence grades	Green	Confidence grade appropriate and rationale clearly documented
Governance	Green	Responsibilities for integrity of data and commentary clearly defined. Good evidence of engagement and of final sign-off.

- Historically, there has been very little focus on the management and reporting of external flooding data, and this position has not changed for AIR15. The process is still heavily dependent on the assumption that information provided by the maintenance contractor is accurate and complete. Whilst there is a contractual obligation for maintenance contractor to collect sufficient levels of detail at each incident, we have seen little evidence of improvement over the years, severely restricting the Company's ability to understand and report on the true flooding liability.
- During the year, NIW received 7,805 external flooding contacts, and an additional 1,927 potential incidents, referred to the CRC by Network Operations staff. Of these, 132 contacts were found to relate to external flooding incidents (due to overloaded sewers) and 4,379 contacts related to external flooding incidents (other causes).
- We found that the majority of completed FIRs incorrectly identified the 'area affected', with over 60% of all FIRs defaulting to 'public areas' rather than 'curtilage' or 'highway'. As a result of this Asset Management are regularly required to take a view on the areas affected using 'engineering judgement', which is not appropriate for a data driven process.
- We also found that the Company were only reporting a single incident for each affected area, regardless of the number of external flooding incidents experienced during the year. For example, if an area floods on 3 occasions during the year, NI Water was only reporting 1 affected area and 1 incident. On this basis, the Company were under reporting the number of incidents reported during the year. We confirm that post audit, the Company has reviewed the incidents reported during the year and corrected Table 3a for AIR15.
- We also initially noted a 195 contact discrepancy in the numbers reported, and queried the basis of the variance. As a result of this, the Company undertook a further review of the data and identified a number of external flooding incidents (other causes) that had not been reported in Table 3a. We confirm that the additional FOC incidents have now been appropriately reported.

- The Company initially reported that 30 external flooding incidents (overloaded) were caused by severe weather as a result of 2 separate storms. We reviewed the details of the 2 severe weather events and found that 16 of the incidents related to the heavy rain experienced on the 16th October 2014 in Belfast, that was not found to be a severe event (i.e. >1in20yr)
- Despite identifying a number of properties that were found to have previously suffered from internal flooding, no properties were transferred from the external to the internal register, confirming our observed disconnect between the internal and external flooding mechanism.
- A confidence grade of D6 has been assigned to lines 1 to 15 on the basis that the raw data has been taken from Contractor records with limited investigation completed to verify the Contractor records.

3. Audit Approach

Our review of the Company's AIR15 Table 3 and 3a submissions consisted of a meeting with the key NI Water system holders, including representatives from Wastewater Operations and Asset Management.

In order to assess the effectiveness of the Company's DG5 processes and appropriateness of the allocation of properties to the various Flooding registers we reviewed a selection of properties that were:

- Initially reported as internal flooding, but subsequently deemed to have not flooded internally
- Confirmed as internal flooding due to overloaded sewers
- Confirmed as internal flooding due to severe weather
- Confirmed as internal flooding due to other causes
- DG5 Register additions, removals and movements.

Detailed summaries of our findings and resultant conclusions are contained within the body of our commentary below.

4. Audit Findings – Internal Flooding DG5

4.1 Properties connected at year end (Line 1)

We confirmed this line contains the total number of domestic properties connected to the sewerage system at the end of the Report Year. The number of properties is obtained from the Rapid billing system.

We note an increase of 1,748 properties connected from that reported in 2013/14, while an increase in properties connected to water services is 5,794. We observed that the number reported in this line includes only household (domestic) properties. However we note DG5 includes non-household properties except properties which do not have domestic facilities (e.g. kitchen or toilets).

4.2 DG5 Annual Flooding Summary

4.2.1 General

For 2014/15, the overall sewer flooding process for NI Water is broadly unchanged from that utilised in previous years. Whilst incident reporting has been part of 'business as usual' operations for a number of years now, the quality of data collected is still of very poor quality, and in our opinion, not fit for purpose.

We recognise that NI Water has worked hard over the past few years to establish a process to capture and report incidents of internal flooding, and through the efforts of a small number of individuals have managed to investigate and make judgements on all flooding contacts. However, we would expect further progress to be made in order to ensure the incident data/evidence received is of sufficient quality to make a reasoned assessment, without the need for 'engineering judgement'.

We consider there is an increasingly apparent disconnect between; the need for the maintenance contractor to attend and clean up all flooding incidents; and the need to capture sufficient data and evidence in order to assess and verify (where appropriate) each incident. We have previously recommended that efforts are focussed on improving performance of the Maintenance Contractor that attends each incident, particularly the non-DG5 incidents, to ensure sufficient information is recorded on the Flooding Incident Report (FIR). However, performance is unchanged from previous years, and emphasis is still only placed on the completion of the FIR and collection of evidence for incidents where there is confirmed flooding and a clean-up is required. For all non-flooding, and non-clean-up incidents, records are often incomplete or non-existent, making it difficult to assess why the contact was made in the first place. For the process to be effective, it is important that sufficient levels of detailed information are collected at the time of the incident and whilst on site, to ensure appropriate categorisation, and to ensure any other affected properties are identified.

We have regularly encouraged the Company to enforce the terms and conditions of the sewer network maintenance contract to ensure that sufficient and appropriate levels of evidence are collected for each 'incident' attended. To their credit, the Company has responded to this by further tightening the contracts terms & conditions and by providing additional refresher training to the maintenance staff, however, this does not seem to have made a material difference to performance. As a result, we consider it may be more appropriate for the Company to take responsibility for data collection/incident verification away from the maintenance contractor, and for the local Customer Field Manager (CFM) or equivalent, to take ownership of the flooding incidents reported in his/her area. The CFM should be able to utilise their operational experience to assess the flooding mechanism, discuss the incident with the customer and fully complete the FIR, providing a comprehensive audit record to assist in incident assessment, including those incidents not deemed to have resulted in flooding. As highlighted in previous years, we have seen evidence of this approach at other companies, resulting in an improved understanding of flooding incidents and mechanisms, facilitating improved data confidence, improved network understanding and improved customer service.

4.2.2 Incidents

Despite ongoing efforts by the Company to monitor performance of the Customer Response Centre (CRC) and provide training to new CRC starters, the number of 'false' internal flooding contacts referred to the Maintenance Contractor by the CRC is still high and broadly similar to the numbers received in previous years. We understand the CRC is subject to high staff turnover, however processes should be in place to ensure staff are able to effectively assess and respond appropriately to calls received.

During the year, NI Water received 545 internal flooding contacts (of which 511 were direct contacts to the CRC). Whilst this is broadly in line with the 490 contacts reported in AIR14, the proportion of 'false' internal flooding contacts (circa 85%) is significantly higher than we would expect to see, suggesting the CRC is either incorrectly capturing contact details or the incident is not being appropriately responded to by the Maintenance Contractor. If it was the latter, however, you would expect to see a significant number of complaints, which is not apparent.

Notwithstanding the above, the Company has continued to review and assess every internal flooding related contact received during the year in order to establish the cause of all 'false' internal flooding contacts. We found, that for every contact, investigations were carried out using information from the Maintenance Contractor, Flood Incident Report (FIR) Forms, Field Manager reports, Customer Field Manager reports and modelling provided by Drainage Area Plan consultants. In addition, Wastewater Operations also contacted the customer, where possible, to establish the nature of the contact and to obtain evidence of flooding. We reviewed the analysis undertaken during the year and found the following.

Of the 545 internal flooding contacts received, we note that:

- 204 related to contacts with no internal flooding (mixture of external & no flooding)
- 156 related to follow on contacts relating to a previously reported incident
- 38 related to cancelled jobs
- 45 related to incidents on private sewers
- 8 related to repeat calls, and
- 13 related to NIHE contacts/FIL referrals

On the basis of the above, 464 internal flooding contacts did not relate to internal flooding.

As part of our AIR15 review, we reviewed a number of the 464 contacts deemed not to relate to internal flooding, the results of which are summarised below:

Incident Location	Date of Contact	Result	Reason for Exclusion
[x]	03/04/2014	Exclude – Blockage	• Initially reported as internal flooding. • FIR stated no flooding • CFM confirmed toilet had backed up as a result of blockage, but did not overflow • Blockage cleared • Correctly reported as blockage only ✓
[x]	05/04/2014	Exclude	• Customer reported overflowing manhole at front of property and surcharging toilet in house • FIR confirmed FOC blockage, but also stated on same FIR there was no evidence of flooding • Unable to contact customer, so excluded incident on basis – no evidence of flooding ✗

Incident Location	Date of Contact	Result	Reason for Exclusion
			• Initial call suggests external flooding, but not reported. Needs to be reported in T3a.
[x]	30/04/2014	Exclude	• Internal flooding was reported as a result of surcharging manhole • Contractor confirmed no flooding on FIR • No other evidence available • Unable to contact customer - incident excluded?
[x]	03/10/2014	Exclude	• Initially reported as internal flooding – blockage causing surcharge. • Maintenance Contractor (and FIR) stated no flooding • Customer subsequently contacted, who confirmed external flooding only • Incident excluded, but could argue incident should be reported as external flooding. ×
[x]	08/10/2014	Exclude	• Customer reported internal flooding from surcharging toilet • Blockage identified in front garden, caused by tree roots • Customer contacted – confirmed no flooding • Incident excluded – private issue ✓
[x]	02/01/2015	Exclude	• Customer reported blockage causing internal flooding. Advised that this occurs frequently • FIR confirmed blockage but no flooding • Customer contacted – confirmed no flooding • Incident correctly excluded – blockage only ✓
[x]	02/01/2015	Exclude	• Customer reported surcharging manhole and flooding into house • FIR confirmed – no flooding • Customer contacted – confirmed external flooding only • Incident excluded as external flooding only • Needs to be reported in T3a

As indicated in the summary above, we identified a number of excluded internal flooding contacts that were found to relate to external flooding. However, these incidents were not being referred to the external flooding team for assessment and reporting in Table 3a. When compared to the total number of external flooding incidents reported during the year (circa 4400), the number of incidents not referred (circa 190) is not material, however this does represent a shortcoming in the methodology. We recommend that all external flooding incidents identified as part of the internal flooding verification process are referred to the DG5 Panel for allocation to Table 3a.

Whilst the Company's process for investigating and understanding of the true nature of the 'false' contacts should be relatively robust, it is very labour intensive, requiring a member of the Wastewater Business Unit (WBU) team to complete a desktop investigation of each contact to identify whether or not flooding has occurred. We found that the WBU was regularly required to assess contradictory information from the Maintenance Contractor, the CFM and the Customer. As a result of this, the WBU were often required to 'take a view' on the varying opinions in order to make an assessment. Whilst it is likely that the correct

assessment is being made, we consider this approach is too reliant on 'engineering judgement' rather than the utilisation of actual fact. The need to undertake this secondary verification is symptomatic of the poor quality incident records collected by the Maintenance Contractor whilst attending each incident.

4.2.3 AIR15 Flooding Incidents (overloaded sewers)

For AIR15, NI Water initially reported 4 incidents of internal flooding (due to overloaded sewers), of which 3 were attributed to severe weather.

During the course of our audit, we queried the nature of 27 incidents that had been reported in Line 15a of Table 3, and found they predominantly related to confirmed incidents of internal flooding. It appears that the majority of the incidents initially reported in Line 15a (22 of the 27) occurred in the Belfast area on the 16th October 2014 during a period of extremely heavy rainfall. Despite anecdotal evidence suggesting the flooding occurred as a result of severe weather, the associated Met Office report only confirmed a 1in1yr storm event (and therefore not severe weather). The Company advised that allocation of these incidents to the flooding register had been deferred in the hope additional rainfall data could be obtained, however, this had not occurred by year-end. We advised the Company that Line 15a should only act as a holding line for properties potentially at risk of flooding, pending further investigation, and not for actual confirmed flooders. On this basis we advised the Company that all confirmed, in-year incidents of internal flooding should be reported in Lines 2 and 3 of Table 3. Should further evidence of severe weather come available, for example, following the acquisition of real time radar data (see Section 4.2.4 below), the properties may then be removed from the Flooding Register during the current year. Of the remaining incidents reported in Line 15a, we found 2 properties in Belfast had also been incorrectly included, one of which had flooded twice in the year. A further 2 incidents, affecting 2 properties in Lisburn and Newtonards were suspected of occurring on private sewers and were still subject to further investigation. On this basis, we consider it appropriate that these 2 incidents remain on Line 15a, although we would have expected incidents occurring in December 2014 to have been resolved by year-end.

We confirm, that as a result of this challenge the Company has reviewed Table 3 and has now correctly reported the incidents for AIR15. On this basis, NI Water has reported 28 properties in Line 2, 29 incidents in Line 3 and 2 incidents in Line 15a.

Despite the increase in confirmed internal flooders reported for AIR15, once the additional flooders identified in Line 15a were accounted for and transferred to Block A of Table 3, NI Water's performance continues to be out of step with the rest of the industry, further supporting our view that the overall sewerage design and network configuration may be the main explanatory factor for the low levels of internal flooding reported in NI. We discussed this further with the Company and they cited the high frequency of WwPS (with integral overflow) within the province, serving small drainage areas, as a potential reason for the relatively small number of incidents.

4.2.3.1 Audit Checks

In order to test the process adopted by NI Water to assess and correctly verify all properties that have flooded during the year we undertook a detailed review of 16 of the properties

identified as suffering from internal flooding during the year, details of which are summarised below:

Incident Location	Date of Incident	Incident Summary
[x]	08/06/2014	• Internal flooding reported on 08/06/14 • FIR stated external flooding only due to blockage • This is a known internal flooder, with a confirmed capacity issue, having flooded in 2013 as well. • Flooding extent assessment completed, confirming no other properties were affected • Model confirms flooding 1in5yrs. Property already on the 2in10 Register • Retain on 2in10 Register • Scheme proposed for delivery in 2015/16 ([x]) – offline storage
[x]	10/6/2014	• FIR completed, but confirmed FOC (blockage) • No evidence of flooding Extent Assessment being completed • CFM confirmed property had suffered internal flooding due insufficient capacity • Modelling confirmed flooding 1in5yrs • Added 2in10yr Register • Property added to Scheme [x]
[x]	03/08/2014	• Internal flooding reported at 2 props • FIR not completed for incident, but comments on FIR inferred internal flooding and heavy rainfall • Met Office report confirmed severe weather • Severe Weather Event – see below
[x]	16/10/2014	• Internal flooding reported at 12 props • Flooding caused by 2 surcharged manholes on road. • FIR confirmed external flooding only, however, CFM confirmed internal flooding at all 12 properties and very heavy rainfall at time of flooding • Met Office report confirmed 1in1yr storm, although radar station not close to incident. • Modelling confirms flooding 1in10yrs • Initially reported in Line 15a, but added to 1in20 Register, pending DG5 Panel assessment.

On the basis of our findings and subsequent challenges, we believe the correct assessments have now been made, although it continues to highlight that the FIR is not being consistently completed and nor is sufficient levels of evidence collected at the time of the incident. It also provides examples of where the WwBU are often required to 'take a view' on the varying 'opinions' in order to make an assessment, highlighting the poor quality of the incident records collected by the Maintenance Contractor whilst attending each incident.

4.2.4 AIR15 Flooding Incidents (overloaded sewers attributed to severe weather)

For AIR15, NI Water has reported 3 incidents of internal flooding (overloaded sewers) that were attributed to 2 severe weather events at 2 separate locations

The severe weather events occurred on the 3rd and 5th August 2014, and resulted in flooding to 5 properties around Lough Neagh. We reviewed the Met Office rainfall reports obtained for each of the affected areas, and as summarised below, confirm a storm event >1in20yrs was recorded.

Date of Event	Location	Met Office Result	Properties Affected
03/08/14	Lurgan	1 in 35 yrs	2
05/08/14	Magherafelt	1 in 7058 yrs	1
		Total	3

As part of our audit we reviewed the details for the 2 severe weather incidents. In the case of the Magherafelt incident we found that the property had in fact flooded previously, however, the previous incident was FOC - Blockage and as such it is appropriate to exclude this incident. For the Lurgan incident (affecting 2 neighbouring properties), we found that an FIR was not fully completed and neither was any photographic evidence provided, however the comments on the FIR suggested internal flooding had occurred during very heavy rainfall. We note that the property had previously suffered from external flooding, so it is reasonable to assume the property had experienced internal flooding as a result of the severe rainfall.

As highlighted previously, the Company has relied on Met Office reports to assess severe weather events. These assessments are expensive to procure and do not always reflect the rainfall conditions experienced. The Belfast storm event on the 16th October 2014 (discussed in Section 4.2.3 above) is a good example of this. A highlighted above, anecdotal evidence from site suggested severe weather, but the Met Office report from the Castor Bay weather centre, confirmed a 1in1yr storm event.

With this in mind the Company has now procured the use of real time radar based rainfall depth and duration data from the Met Office Nimrod system to assess the storm return period for each event. We understand that the new rainfall assessment system (using real time radar data) is in the process of being implemented, with training currently being rolled out to the business. Going forward however, the Company will need to determine how they intend to apply the data to assess the impact of severe weather events on flooding incidents, and we will comment on this for AIR16.

4.2.5 AIR15 Flooding Incidents (other causes)

For AIR15, NI Water has reported 50 incidents of flooding due to other causes, 36 due to blockages, 12 due to collapses and 2 due to equipment failure. As per overloaded incidents, NI Water is an outlier in terms of FOC (blockage) performance. Despite delivering steady year on year improvements in the number of blockages experienced (16,729 in 14/15, 18,062 in 13/14 and 20,801 in 12/13), NI Water are still experiencing 3-4 times more blockages/1000km than comparator companies.

We understand that the Company has continued to proactively target repeat blockages, whereby a dedicated CCTV crew has been assigned to each area to complete CCTV inspections on all blockage hotspots and carry out cleaning, desilting and repairs, where problems are identified.

As highlighted above, the Company has reported a further 8% reduction in blockages for AIR15, which the Company attribute to this continued focus on repeat blockages. Additionally, the Company has undertaken some root causal analysis of FOC – blockages, to assess the primary cause of the flood causing blockages. We reviewed the analysis undertaken and found that 23 of the 36 reported FOC – blockages were caused by 'inappropriate materials' in the

sewer, 6 were caused by FOG (Fats, Oils & Grease) and 7 were caused by siltation, suggesting further customer education of 'what not to flush' would benefit the Company.

4.2.5.1 Audit Checks

As above, we reviewed a selection of FOC incidents reported during the year. As summarised below, our findings, are broadly supportive of the Company's assessment.

Incident Location	Date of Incident	Incident Summary
[x]	28/04/2014	• Internal flooding to 3 properties, following clearance of blockage with a 'jetting' device • Reported as FOC - Blockage • Flooding mechanism uncertain, but if indirectly caused by the jetter clearing the blockage, could argue FOC – Equipment Failure
[x]	07/09/2014	• Internal flooding to 1 property • Initially reported as a blockage, but whilst attempting to clear blockage, a collapse was identified and a faulty Buchan trap, identified as the main cause of flooding • Correctly reported as FOC - Collapse
[x]	09/10/2014	• Internal flooding to 1 property • A manhole was found to be located in the utility room of the property • Manhole surcharged as a result of a blockage, but CFM believed flooding was exacerbated by heavy rainfall • Correctly reported FOC - Blockage
[x]	11/03/2015	• Internal flooding to 1 property caused by failure of a WwPS • Pumps tripped out and telemetry failed to trigger the alarm, causing upstream sewer to back up and flood the adjacent property • During course of investigation, an adjacent river culvert was found to be connected to the sewer, exacerbating the problem • Correctly reported FOC – Equipment Failure
[x]	12/03/2015	• FIR stated FOC – Blockage • Good photographic evidence confirming flooding to property and a blockage • Correctly reported FOC - Blockage

The above sample of incidents reviewed, confirms the poor standard of FIRs completed by the Maintenance Contractor, with the majority of incidents requiring further follow up by the Company, in order to ascertain the root cause and effect of the incident.

4.3 AIR14 DG5 Properties on the At Risk Register

4.3.1 Verification of Historic Risk Register

Over the previous few years, the Company has undertaken to investigate, assess and cleanse all historic flooding records, by completing the following tasks for each property:

- A site visit is completed
- The occupant of the affected property and neighbouring properties are interviewed and a questionnaire completed
- CCTV survey completed of network
- Local operations staff are interviewed
- Historical complaints data (from Ellipse) for the area is reviewed
- DAS model reviewed/updated

Through this process (combined with a targeted capital removal programme), NI Water has been able to remove a large proportion of the properties initially included on the historic flooding register, with the Register reducing from 825 properties in 2008/09 to 179 in 2014/15.

We queried the progress that had been made in assessing the final batch of 'historic' flooders and the Company advised that investigations are still ongoing, but nearing completion. We found that 3 'historic' properties were investigated during the year and found to not be at risk of flooding and subsequently removed from the Flooding Register. A further 13 properties were also removed from the historic register as they had not flooded since 2000, even though a number of severe weather events had occurred in the area in the intervening years.

At year-end, 10 properties were still on the 'historic' register awaiting investigation. We found that all 10 properties are located adjacent to WwPS and it is suspected that previous flooding incidents may have been caused by WwPS performance, rather than hydraulic incapacity.

4.3.2 AIR15 At Risk Summary

For AIR15, NI Water has reported 56 properties on the 2in10/1in10yr Flooding Registers, with a further 123 properties on the 1in20 Register. We reviewed a sample of these incidents, all of which have been presented to the 'DG5 Panel' for review and allocation, and have included summaries below.

Location	B.I Addition	Findings
[x]	Added to 1in20 Register	• Properties flooded on 16/10/14 • FIR indicated external flooding only, and Ellipse records confirmed external, however customer insisted property floods internally • Investigation confirmed NRV had previously been installed, providing protection from internal flooding • Network survey confirmed adequate sewer capacity, but interconnection with road drainage creates a capacity issue. • Added to 1in20 Register on basis of investigation • Reporter agrees
[x]	Added to 2in10 Register	• Property has not reported internal flooding, but evidence of neighbouring properties flooding historically • Customer survey, completed as part of feasibility study, confirmed frequent flooding • Model built for proposed scheme, confirms flooding at this location • Added to 2in10 Register due to BI (modelled), as neighbouring property [x] is already on the 2in10 Register • Reporter agrees, although suggests property should have been identified through FEA when [x] last flooded.
[x]	Added to 2in10 Register	• Internal flooding reported on 16/10/14 • FIR completed, but confirmed FOC (blockage). No evidence of FEA • CFM confirmed property had suffered internal flooding due insufficient capacity • Model built for proposed Scheme[x], confirms flooding at this location • Added 2in10 Register as another nearby property already on 2in10 Register • Reporter agrees although suggests property should have been identified through FEA when [x] last flooded.
[x]	Added to 2in10 Register	• Two new-build properties, constructed adjacent to 4 known DG5 flooders • Model built for proposed scheme, confirmed the 2 new props were also at risk of flooding

Location	B.I Addition	Findings
		• Added to 2in10 Register as neighbouring properties already on 2in10 Register • Scheme ([x]) completed in year resulting in the removal of 6 props from the Flooding Register • This example demonstrates the need for NI Water involvement in the planning approval process to prevent development of this nature in the future.

Overall, we consider the DG5 Panel' decisions have been appropriate and properties have been correctly allocated to the Flooding Register. However, of the incidents we reviewed, there were a number of additions to the flooding register that were only identified during the process of delivering a scheme for neighbouring affected properties. Had the previous flooding incidents been appropriately investigated at the time of the incident, it is likely the properties would have already been identified and added to the Register. Early identification of all affected properties, will ensure Table 3 is a true reflection of the flooding liability and will also enable the Company to better prioritise their allocated DG5 funding, ensuring properties in the worst affected and most cost effective areas are protected first.

4.3.3 AIR15 Annual Changes to the Flooding Registers

Register movements reported during the year related primarily to investigations and capital schemes completed during the year.

In terms of removals due to company action (Lines 22 and 30), the Company has completed 7 schemes during the year, whereby 18 properties were removed from the 2in10 Register and 10 properties from the 1in20yr Flooding Register.

In addition to the 7 schemes delivered during the year, the Company has also been working to group all properties on the DG5 Register into projects and complete feasibility assessments in order to develop solutions for delivery in the future. At year end, we found that 34 separate schemes have been identified by the Company to address 155 properties, and the solutions were at various stages of development.

Against a PC13 target of 67 capital removals, NI Water has delivered 39 removals by company action in the 2 years of PC13 (of which 5 were actually delivered in PC10). On this basis, NI Water has not delivered their PC13 DG5 programme. This apparent poor performance is due to the fact the number of arisals year on year are much lower than were initially anticipated and the fact that over half the properties on the DG5 Register are located within the Belfast/Sydenham drainage network where the overall flooding mechanism is complex and difficult to resolve with simple standalone solutions.

As alluded to above, a large number of the properties on the current DG5 Register are associated with large catchment wide problems in Belfast, where the proposed solution is both large and expensive, with a long lead-in time to develop and deliver the solution. As such, customers will continue to be left at risk of flooding. We have previously highlighted the benefit of providing mitigation to these properties in order to prevent further incidents of internal flooding. Based on the recent constraints on PE funding, we believe there is great benefit in offering mitigation to all confirmed flooders. Whilst mitigation does not resolve the capacity/drainage problem, it does reduce the risk of internal flooding to the particular property at risk. In E&W, companies are funded to provide flooding mitigation to flooders in advance of a permanent solution, and they have found this to be a good, low cost initiative

that both reduces the frequency of internal flooding but also ensures good customer relations. In advance of a wider permanent solution to address a number of catchment issues, we recommend the Company should consider offering mitigation, to protect properties from repeat incidents of internal flooding.

We reviewed the details for 4 schemes delivered during the year, and have summarised our findings below.

Location	Removal due to Company Action	Findings
[x]	Removed from 2in10 Register	• Scheme ([x]) developed to upsize the sewers and construct a new discharge location • Scheme was completed in December 2014 at a cost of [x] • 6 outputs, including 2 new properties recently constructed [x]/output) • No flooding incidents since scheme. Properties removed from 2in10 Register.
[x]	Removed from 1in20 Register	• Scheme ([x]) involved small sewer diversion to connect local sewer to adjacent catchment (with surplus capacity) • Scheme was completed in March 2015 at a low cost of [x] • 5 outputs ([x]/output) • No flooding incidents since scheme. Properties removed from the 1in20 Register
[x]	Removed from 2in10 Register	• Scheme ([x]) developed to upsize the sewers and provide online storage. • Scheme was completed in March 2015 at a cost of [x] • 3 outputs ([x]/output) • No flooding incidents since scheme. Properties removed from 2in10 Register.
[x]	Removed from 2in10 and 1in20 Registers	• Scheme ([x]) developed to upgrade WwPS and construct a new storm WwPS to remove a nominated UID. Pumping main upgraded and 800m3 additional online storage provided • Scheme was completed in May 2014 at a cost of [x], with an allocation to ESL of 16% [x] • 2 x 2in10 outputs and 3 x 1in20 outputs [x]/output) • No flooding incidents since scheme. Properties removed from 2in10 & 1in20 Registers.

NI Water has reported an average capex cost per output of £69k for the 2in10/1in10 outputs and £81k for the 1in20 outputs in AIR15. When compared to previous years, the average cost per output is considerably lower, suggesting the Company is 'cherry picking' the lower cost solutions in order to provide better value for money (for example, [x]) and ensure outputs are actually delivered in the PC13 period. Furthermore, a number of the nominated UID schemes, have associated DG5 outputs, with only the percentage allocation to ESL contributing to the cost of the DG5 outputs (i.e. [x]).

The Company has also reported 16 1in20 removals as a result of better information.

4.3.4 Allocation to the Flooding Register

As reported previously, the DG5 Panel now defaults all first time flooders to the 1in20 Register. Should subsequent investigation/modelling confirm the properties are at a greater risk of flooding, then subject to agreement with the DG5 Panel, properties are moved to the appropriate risk category.

Historically, the Company have also defaulted a number of properties to the Flooding Register pending further investigation and assessment, and Line 15a was created to capture the extent of properties pending allocation. As highlighted above, 27 incidents had initially been reported in Line 15a of Table 3. We queried the nature of these incidents and found they predominantly related to confirmed incidents of internal flooding. It appears that the majority of the incidents initially reported in Line 15a (22 of the 27) occurred in the Belfast area on the 16th October 2014 during a period of extremely heavy rainfall. Despite anecdotal evidence suggesting the flooding occurred as a result of severe weather, the associated Met Office report only confirmed a 1in1yr storm event (and therefore not severe weather). The Company advised that allocation of these incidents to the flooding register had been deferred in the hope additional rainfall data could be obtained, however, this had not occurred by year-end. We confirm that Line 15a should only act as a holding line for properties potentially at risk of flooding, pending further investigation, and not for actual confirmed flooders. On this basis we advised that all confirmed, in-year, incidents of internal flooding should be reported in Lines 2 and 3 of Table 3. Of the remaining incidents reported in Line 15a, we found 2 properties in Belfast had also been incorrectly included, one of which had flooded twice in the year. A further 2 incidents, affecting 2 properties in Lisburn and Newtonards were suspected of occurring on private sewers and were still subject to further investigation. On this basis, NI Water has only retained 2 incidents in Line 15a, although we would have expected incidents occurring in December 2014 to have been resolved by year-end.

4.4 Confidence Grades

The Company has once again assigned a confidence grade of B2 to Lines 2 to 11, 15a & 17 on the basis that all data is derived from Ellipse, and that the Company undertakes an investigation of all reported incidents. We have previously challenged this on the basis the number of reported incidents is so small and any variance in numbers (due to errors) would be considerably greater than +/-5%. Although we have serious reservations with the quality of the source data and identified a number of errors during the audit, (which were resolved prior to submission), we are minded to continue to support a B2 for Lines 2 to 11, 15a and 17 for AIR15.

The Company has improved the confidence grades for lines 12–15, 22–24 and 30–32 from B2 to A2 due to better management and control of the DG5 Register. Lines 16, 25-26 and 33-34 have improved from B3 to B2 due to improvements with the modelling process. We do not consider processes have improved materially during the year and the overall approach is broadly unchanged. On this basis, we recommend a B2 is retained for lines 12 – 34, as all data in Table 3 is captured using the same process.

4.5 Consistency Checks

- Line 14 = Line 14 previous year – (Line 22 + Line 23) + (Line 24 + Line 25)
- Line 15 = Line 15 previous year – (Line 30 + Line 31) + (Line 32 + Line 33)

5. Audit Findings – External Flooding

5.1 General

Historically, there has been very little focus on the management and reporting of external flooding data, and this position has not changed for AIR15.

Whilst NI Water has a written methodology for the collection and reporting of external flooding incidents, the process is still reliant on the assumption that the information provided by the maintenance contractor is accurate and complete. All data reported in Table 3a has been taken directly from the maintenance contractor's monthly returns, with a small number of the incidents independently investigated and verified by the Company each month.

During the year, NIW received 7,805 external flooding contacts, and an additional 1,927 potential incidents, referred to the CRC by Network Operations staff. In order to assess the validity of each flooding contact, NI Water has reviewed the contractor's monthly returns and cross checked with the Flooding Incident Reports (FIR) completed for each incident. Where the FIR has not been sufficiently completed, or the monthly returns do not identify a cause, NI Water has investigated the incident to establish the nature and cause of the flooding. The approach used to investigate each incident is similar to the approach adopted to review historic internal incidents on Table 3.

For AIR15, we found that the Company investigated circa 200 incidents during the year. As the Company only retains hand written, paper records of the investigations completed, it was difficult to review the complete set of investigations completed, however, we discussed the findings from a number of the incidents investigated during the year, the results of which are discussed below and summarised in Section 5.2.1.

On the basis of our audit, we continue to be concerned over the quality and accuracy of the data recorded on the FIR for each external flooding contact at the time of the incident, and our findings below supports this view.

- We found that the majority of completed FIRs incorrectly identified the 'area affected', with over 60% of all FIRs defaulting to 'public areas' rather than 'curtilage' or 'highway', which are the areas we would expect the majority of external flooding incidents to affect. As a result of this Asset Management are regularly required to take a view on the areas affected using 'engineering judgement', which is not appropriate for a data driven process.

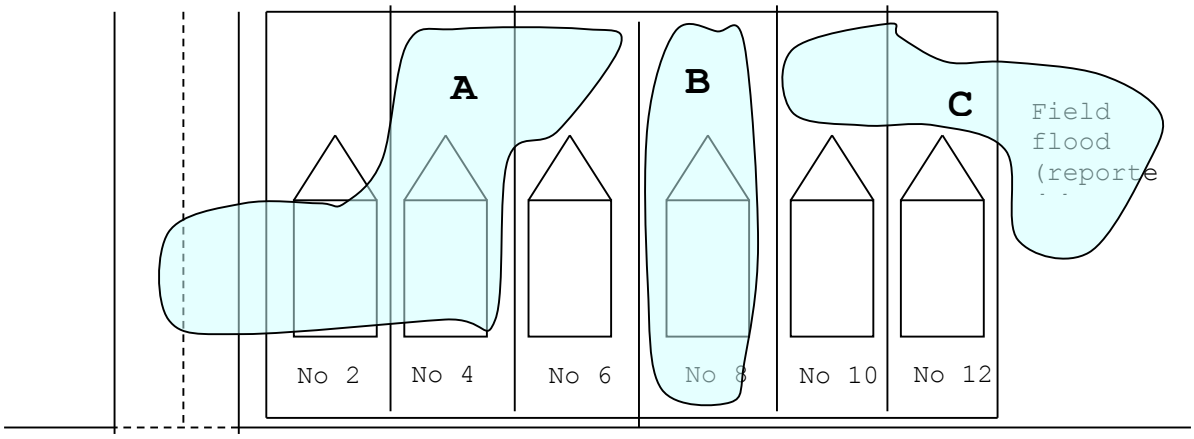
- We also found there were issues with the date coding used by the maintenance contractor to report each incident, with a combination of English and American date formats used. As a result of this there is a risk that incidents may be reported that did not occur in the report year, for example; 11/02/14 compared to 02/11/14.

During the course of our review of the investigation process, we also identified a number of shortcomings in the methodology and incorrect interpretation of the reporting requirements. As a result, the data initially reported in Table 3a for AIR15 was found to be incorrect. In summary, we found that:

- The Company are only reporting a single incident for each affected area, regardless of the number of external flooding incidents experienced during the year. For example, if an area

floods on 3 occasions during the year, NI Water was only reporting 1 affected area and 1 incident. On this basis, the Company were under reporting the number of incidents reported during the year. We confirm that post audit, the Company has reviewed the incidents reported during the year and corrected Table 3a.

- We also found that the Company were uncertain on how to report incidents affecting multiple areas. To help clarify the assessment process going forward, we have included some examples of incidents and our interpretation of how these incidents should be reported, as previously agreed with a comparator E&W Company.



Incident	Number of events reported	Number of properties/areas reported
A	1 internal (Table 3) 1 external (Table 3a)	2 internal properties (Table 3) 1 external curtilage (Table 3a) 1 highway (Table 3a)
B	1 internal (Table 3)	1 internal property (Table 3)
C	1 external (Table 3a)	2 external curtilage (Table 3a) 1 external other area (Table 3a)

We also identified a number of issues with the process that is used to assess and exclude areas flooded as a result of severe weather, however, we discuss these further in Section 5.2 below.

We also initially noted a 195 contact discrepancy in the numbers reported, and queried the basis of the variance. As a result of this, the Company undertook a further review of the data and identified a number of external flooding incidents (other causes) that had not been reported in Table 3a. We confirm that the additional FOC incidents have now been appropriately reported.

On the basis of the high level review undertaken by NI Water, and our subsequent audit challenges summarised above, which resulted in revisions to Table 3a, the Company has now identified that:

- 132 of the 9,732 contacts related to external flooding incidents (due to overloaded sewers)
- 4,379 contacts related to external flooding incidents (other causes), and
- 5,221 contacts were either not deemed to be external flooding incidents, or repeat calls/follow ups.

In previous years, we had identified a number of incidents where small surcharges had occurred, but had not been reported as external flooding, even when the reporting requirements require NI Water to capture and report all incidents of external flooding, regardless of the extent. The Company advised that as a result of this, the maintenance contract has now been amended to ensure all surcharges are reported as external flooding. We consider this to be a significant improvement, ensuring the Company are reporting in accordance with the reporting requirements, although we saw no examples where this had occurred within our audit sample.

As highlighted above and in previous years, the Company continues to place very little importance on the collection and reporting of external flooding data, with only a single FTE staff member committing circa 50% of his time to assess and verify all external flooding incidents. For this to be sufficient, the Company are reliant on the Contractor collecting an appropriate level of evidence/information at the time of the incident. Whilst there is a contractual obligation for the maintenance contractor to collect sufficient levels of detail at each incident, we have seen little evidence of improvement over the years, severely restricting the Company's ability to understand and report on the true flooding liability. For every contact received the Company should collect sufficient information/evidence to identify the true nature of each contact, which would simplify the overall reporting process. As highlighted in previous AIR Reporter Commentaries for T3 and 3a, we consider it may be prudent to take responsibility for data collection away from the maintenance contractor, and for the local Customer Field Manager (CFM) to take ownership of the flooding incidents reported in his/her area. The CFM should be able to utilise their operational experience to assess the flooding mechanism, discuss the incident with the customer and fully complete the FIR, providing a comprehensive audit record to assist in incident assessment. We have seen evidence of this approach at other companies, resulting in an improved understanding of flooding incidents and mechanisms, facilitating improved data confidence and network understanding.

5.2 DG5 Annual Flooding Summary

For AIR15, 4,511 areas were reported to have flooded externally during the year, of which 132 were deemed to have flooded due to overloaded sewers. The balance were deemed to have flooded as a result of 'other causes', primarily blockages.

The Company initially reported that 30 external flooding incidents (overloaded) were caused by severe weather as a result of 2 separate storms. We reviewed the details of the 2 severe weather events and found that 16 of the incidents related to the heavy rain experienced on the 16th October 2014 in Belfast (see Section 4.2.3 above). Despite anecdotal evidence that extremely heavy rainfall fell in the area on the 16th, the Met Office report only confirmed a 1in1yr storm event. As such, we advised that the 16 incidents could not be excluded as a result of severe weather and needed to be reported in Lines 2-4 only. We confirm that Table 3a was

appropriately amended in advance of submission and the 16 incidents occurring on the 16th October were reported in Line 1 and 3.

We also found that the remaining 14 incidents (excluded as a result of severe weather), related to a storm that occurred on the 8th June 2014. Although the 14 incidents occurred across the province (predominantly Londonderry and Ballymena) we found that the Company had based the exclusions on a single Met Office report for Ballymena, where a 1in27yr storm was recorded. Whilst you could argue that a separate Met Office report should have been acquired for the 7 Londonderry incidents, we consider, it is probably reasonable to assume that the storm would have travelled from west to east on the 8th June, affecting properties in Londonderry and Ballymena.

As a result of the above, that Company has reported 14 external flooding incidents (overloaded) severe weather exclusions, as a result of a single severe weather event.

5.2.1 Audit Checks

We reviewed a selection of external flooding incidents investigated during the year. As summarised below, our findings highlight the difficulties in assessing incidents using limited and at times conflicting incident data.

Incident Location	Date of Incident	Incident Summary
[x]	28/10/2014	• Property located adjacent to WwPS • External flooding to property appears to coincide with performance of WwPS, although uncertain whether related to pump failure or insufficient pump capacity • Customer survey confirmed a history of frequent flooding including flooding to integral garage. • Added to external 2in10 Register • Based on evidence provided could argue internal 2in10 (due to flooding of integral garage) or FOC – equipment failure ??
[x]	09/10/2014	• External flooding to 1 property • History of blockages in this road. Sewer laid at a flat gradient - siltation an ongoing issue, which suggests FOC - Blockage • CFM suggests history of internal flooding at this property, although not on DG5 Register • Company recommended addition to External Register, but property not on either flooding register. • Recommend addition as FOC – Blockage
[x]	16/10/2014	• External flooding to 1 property • Customer survey confirmed frequent external flooding • CFM confirmed previous internal flooding, but customer confirmed no internal flooding • No photographic evidence of incident on 16/10 • Added to external 2in10 Register on strength of customer survey, but could argue addition to internal register??

5.3 DG5 Properties on the At Risk Register

For AIR15, those incidents which occurred during the year and were deemed to have been caused by 'hydraulic overloading', and were not due to severe weather have been transferred to the At Risk Register.

On this basis, 103 areas were added to the Register as a result of flooding in 2014/15, all of which were identified as a result of the high level investigation completed by the Company. The Company now has 316 properties on the External Flooding Register.

Despite identifying a number of properties that were found to have previously suffered from internal flooding, no properties were transferred from the external to the internal register, confirming our observed disconnect between the internal and external flooding mechanism.

5.4 Confidence Grades

A confidence grade of D6 has been assigned to lines 1 to 15a on the basis that the raw data has been taken from Contractor records with limited investigation completed to verify the Contractor records.

A confidence grade of A1 has been applied to Lines 20 to 25, as it reflects the total number of properties added and removed each year.