Drinking Water Audit Report

County:	Waterford	**Date of Audit:**	22/03/2018
Plant(s) visited:	East Waterford Water Supply Scheme (Adamstown WTP) 3800PUB1110	**Date of issue of Audit Report:**	17/04/2018
		File Reference:	DW2018/43
		Auditors:	Mr Niall Dunne
Audit Criteria:	• The *European Union (Drinking Water) Regulations 2014 (S.I. 122 of 2014), as amended*. • *The EPA Handbook on the Implementation of the Regulations for Water Services Authorities for Public Water Supplies (ISBN: 978-1-84095-349-7)* • The recommendations specified in the EPA *Drinking Water Report*. • EPA Drinking Water Advice Notes No.s 1 to 15. • The recommendations in any previous audit reports.		

MAIN FINDINGS

i. **On the 10/03/2018 a precautionary boil water notice (pBWN) was placed on the Kilmeaden supply and the water main to Waterford City was closed. These responses were due to low chlorine levels in the treated drinking water leaving the Adamstown plant. These actions were ultimately the result of systematic failures of essential monitoring equipment, emergency responses and monitoring procedures at the plant. Irish Water should conduct a full review of this incident to ensure that remedial measures are put in place to prevent a reoccurrence of a similar incident and to ensure that appropriate response procedures are in place.**

ii. **The new SCADA system failed to detect and alert the plant operators of low chlorine levels in the treated water. The new SCADA system, was not fully commissioned at the time of the incident. Irish Water must ensure that the new SCADA system is fully commissioned and operational to prevent reoccurrence of incidents such as this.**

iii. **Irish Water must ensure that dial out alarms and automatic shut downs for essential drinking water parameters are installed and operational as a matter of urgency.**

1. INTRODUCTION

Under the *European Union (Drinking Water) Regulations 2014, as amended,* the Environmental Protection Agency is the supervisory authority in relation to Irish Water and its role in the provision of public water supplies. The audit of the Adamstown drinking water treatment plant was carried out due to low chlorine levels detected in the treated water, on 10/03/2018. As a result, the water main feeding Waterford City was closed and a precautionary boil water notice (pBWN) was placed on the Kilmeaden supply.

The Adamstown treatment plant serves a population of approximately 53,000 and supplies a volume of 26,000 m^3/day. Treatment consists of coagulation, clarification, filtration and pH control and chlorine

disinfection. The Adamstown plant serves all of Waterford City, Kilmeaden and other areas of East County Waterford. Waterford City and Kilkmeaden are fed from separate mains after the Adamstown reservoir. During the contamination incident the water main to Waterford City was closed but it was not possible to close the water main to Kilmeaden, hence the imposition of a pBWN.

Photographs taken by Niall Dunne during the audit are attached to this report and are referred to in the text where relevant.

The opening meeting commenced at 10.30am at the Adamstown WTP. The scope and purpose of the audit were outlined at the opening meeting. The audit process consisted of interviews with staff, review of records and observations made during an inspection of the treatment plant. The audits observations and recommendations are listed in Section 2 and 4 of this report. The following were in attendance during the audit.

Representing Irish Water: Siobhan Clifford - Drinking Water Compliance Analyst, Irish Water. Brian O'Leary - Operations Lead, Irish Water. Representing Waterford City and County Council (WCCC): Paul Carroll - Executive Scientist, Waterford City and County Council. Colin Kehoe - Senior Executive Engineer, Waterford City and County Council. Michael Maher - Plant Superintendent, Waterford City and County Council. Representing the Environmental Protection Agency: Niall Dunne - Inspector.

2. AUDIT OBSERVATIONS

The audit process is a random sample on a particular day of a facility's operation. Where an observation or recommendation against a particular issue has not been reported, this should not be construed to mean that this issue is fully addressed.

1.	**Incident and pBWN.** a. Waterford City and County Council (WCCC) stated that at 10:30am on the 10/03/2018 the newly installed automated supervisory control and data acquisition system (SCADA) showed that residual chlorine levels on the outlet of the Adamstown reservoir had dropped from approximately 0.7 mg/l to 0.06 mg/l. The new SCADA system did not show any drop in chlorine levels on the inlet of the reservoir, the reading on the inlet was 0.6 mg/l. WCCC stated that the chlorine dosing point is set between 0.5 - 0.7mg/l. b. Manual chlorine readings taken at 11:00 am on the 10/03/2018 on the outlet of the reservoir were recorded as 0.21 mg/l. According to WCCC these manual results were inadvertently recorded incorrectly and should have been lower. c. At approximately 4:30 pm on the 10/03/2018 and to contain the inadequately disinfected water, the water main to Waterford City was shut down, which resulted in approximately 1,000 houses in Waterford City being without water. On the 11/03/2018 at approximately 4:00 pm water supply to Waterford City was reinstated. d. Kilmeaden and Waterford City are both fed from the Adamstown reservoir but from two separate water mains after the reservoir. At the time of incident the Kilmeaden water main could not be closed. On 10/03/2018 at 8:00 pm, Irish Water (IW) placed a pBWN on the Kilmeaden supply. IW stated that they could not make contact with the HSE at the time. e. WCCC stated that they distributed pBWN leaflets to 150 houses in Kilmeaden, this equates to a population equivalent of 450. The pBWN was in place for a week and was lifted on the 17/03/2018. f. Following investigations WCCC found that the low chlorine levels were due to agricultural contamination of the Clodiagh river, one of the four sources for this supply. WCCC stated that they had not identified the exact source of the contamination. Catchment surveys are proposed to be carried out in June 2018.

	g. The Clodiagh River is the only river source and the only source with an ammonia monitor. Ammonia is an indication of contamination. At the time of the incident the sampling lines to the monitor were not properly configured and failed to register elevated ammonia levels in the raw water. WCCC stated that the sampling lines are now properly configured and reading correctly. h. According to WCCC at the time of the incident the SCADA was not fully commissioned. As a result, dial-out alarms were not operational and chlorine readings at the inlet of the reservoir were incorrect. During the audit WCCC stated that chlorine readings are now correct but that the dial out alarms were not operational. The commissioning of the SCADA was scheduled to be completed the week ending the 30/03/2018.
2.	**Coagulation, Flocculation and Clarification** a. The coagulant used at the plant is aluminium sulphate. Dosing is controlled via a streaming current monitor. WCCC carry out floc tests every few weeks to confirm the coagulant dose is correct. b. Poly is used as a coagulant aid. A scum was observed in the mixing chamber after the coagulant aid was added, (see photograph 1). c. There are eight clarifiers in use at this plant. WCCC stated that they have difficulty with clarification in four clarifiers due to the distance from the splitter chamber. d. The clarifiers are flat bottomed and are drained and cleaned out every two months. e. Pin floc and surface scum were on the clarifiers. There was algae in some decanting channels, (see photograph 2).
3.	**Filtration** a. According to WCCC, two of the eight filters are not in service, filters two and eight. Filters five to eight, inclusive, are to be refurbished in Q4 2018. WCCC stated that there are no immediate plans to refurbish filters 1 to 4, but stated that the sand in the filters is replaced approximately every five years. b. A filter back-wash was observed in filter number 3, a dead spot was noted during the filter cycle, (see photograph 3). There appeared to be a crack in the filter and sand was noted in the filter channel. Scum was noted on the walls of the filter, (see photograph 4). c. Scum was observed on some of the filters, according to WCCC it was aluminium carryover, (see photograph 5). d. There were no sand depth gauges in any of the filters.
4.	**Disinfection** a. Chlorine is dosed flow proportionally via duty and standby dosing pumps. There is no automatic switch over between the pumps, switch over is done manually. b. At the time of the audit the chlorine reading at the inlet and outlet of the reservoir was 0.94 mg/l and 0.71 mg/l respectively. c. WCCC stated it is proposed that the plant will shut down at chlorine levels of 0.3 mg/l on the treated water.
5.	**Management** a. During the incident, manual monitoring results taken for both chlorine on the treated water and ammonia on the raw water were documented incorrectly. b. During the audit, the pH of the final water was observed to be 10.36, (see photograph 6). WCCC in an email subsequent to the audit stated that this pH reading was incorrect and the pH monitor required calibration. The final pH reading was confirmed as 8.88.

3. AUDITORS COMMENTS

On 10/03/2018 after low chlorine levels in the treated water were detected, the water main feeding Waterford City was shut and a pBWN was placed on the Kilmeaden supply, both supplies are fed from separate water mains leaving the Adamstown reservoir. It was later found that the reduced chlorine levels were due to agricultural contamination in the Clodiagh River.

At the time of the incident a new SCADA was installed but was not fully commissioned. As a result the chlorine levels were misread at the inlet of the reservoir. Irish Water must ensure that the SCADA system at this plant is fully commissioned and operational. Irish Water must also ensure that any new SCADA system in any other treatment plant is fully commissioned and operational.

At approximately 10:30 am on 10/03/2018 chlorine levels at the outlet of the reservoir dropped from 0.7 mg/l to 0.06 mg/l. The supply was not shut down until 4.00pm and the pBWN was not placed on the Kilmeaden supply until 8:00 pm. The main reason for the delays in shutting down the supply and the placing of the pBWN was due to the incorrect raw water ammonia readings, incorrect chlorine readings on SCADA at the inlet of the reservoir and incorrect manual chlorine sample results taken from the treated water. Irish Water must ensure that plant shut down limits are put in place, dial out alarms installed, that key operational monitoring equipment is maintained and that operational and manual monitoring results are recorded properly. Irish Water should also review incident response procedures at this plant to ensure appropriate safeguards are in place to prevent reoccurrence of such incidents and to ensure incident responses are timely.

4. RECOMMENDATIONS

General

1. Irish Water should review the SCADA system at this treatment plant to ensure it is fully commissioned, working correctly and that dial out alarms and shut down limits for essential parameters such as ammonia, chlorine and turbidity are in place and operational.

Source Protection

2. Irish Water should liaise with Waterford City and County Council in relation to the requirements of Part 3 (Nutrient Management) and Part 4 (Prevention of Water Pollution from Fertilisers and Certain Activities) of the European Union (Good Agricultural Practice for the Protection of Waters) Regulations 2014 (SI No.31 of 2014) to ensure appropriate nutrient management and set-back distances for the protection of the drinking water source. Irish Water and Waterford City and County Council shall have regard to EPA Drinking Water Advice Note No. 11: Technical Assessments and Prior Investigations.

Coagulation, Flocculation and Clarification

3. Irish Water should investigate the cause of the scum where the coagulant aid is added to the treatment stream to determine whether this poses a potential risk to the treatment process and the quality of the treated water. If there is an associated risk, Irish Water should then implement appropriate remedial measures.

4. Irish Water should ensure that the decanting channels and the clarifiers are cleaned on a regular basis to prevent build-up of algae.

5. Irish Water should;
    a. review floc formation after the splitter chamber, prior to clarification, and put remedial measures in place to ensure consistent floc formation is achieved.
    b. investigate the cause of the pin floc formation within the clarifiers and the cause of floc carryover onto the filters. In carrying out these investigations Irish Water should have regard to the EPA Water Treatment Manual: Coagulation, Flocculation and Clarification and EPA Advice Note No. 15: Optimisation of Chemical Coagulant Dosing. Filtration (General)

Filtration

6. Irish Water should;
    a. investigate the cause of the filter media loss into the filter channel and take appropriate action to prevent this loss.
    b. investigate the cause of the cracks in the filter media and take appropriate action to optimise the operation of the filter.
    c. ensure that the air/water backwash is even across all filters and should ensure that air nozzles are fully functional and not blocked or damaged.

Disinfection

7. Irish Water should install;
    a. dial out alarms and automatic shut downs for low residual chlorine levels.
    b. automatic switch over between the duty and standby chlorine dosing pumps.

Management and Control

8. Irish Water should review emergency and shut down procedures to ensure procedures are being adhered and responded to within appropriate timeframes.

Monitoring and Sampling Programmes for Treated Water

9. Irish Water should ensure that there are regular checks on essential automated monitoring equipment and that all monitoring equipment is regularly checked and calibrated to ensure plant operators will be appropriately alerted in the event of an incident.

10. Irish Water should put procedures in place to ensure that monitoring results are being properly recorded and documented.

FOLLOW-UP ACTIONS REQUIRED BY IRISH WATER

During the audit Irish Water representatives were advised of the audit findings and that action must be taken as a priority by Irish Water to address the issues raised. This report has been reviewed and approved by Ms Regina Campbell, Drinking Water Team Leader.

Irish Water should submit a report to the Agency within one month of the date of this audit report detailing how it has dealt with the issues of concern identified during this audit. The report should include details on the action taken and planned to address the various recommendations, including timeframe for commencement and completion of any planned work.

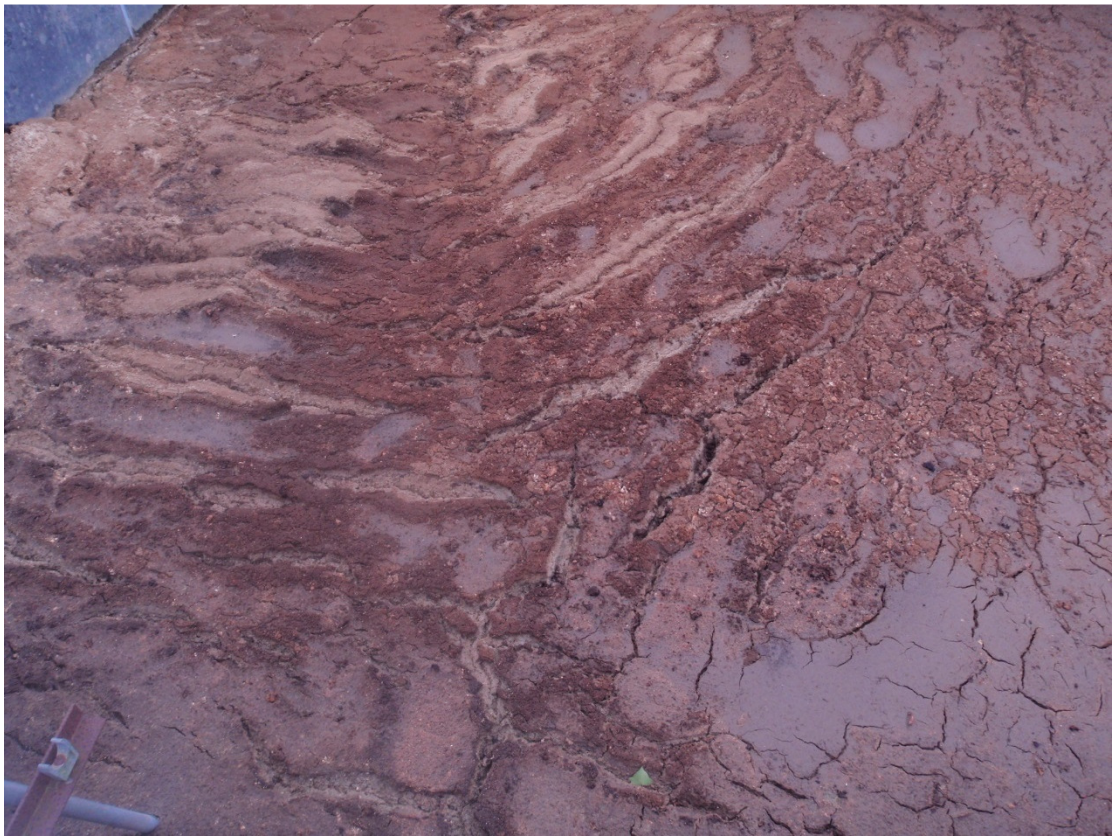
The EPA also advises that the findings and recommendations from this audit report should, where relevant, be addressed at all other treatment plants operated and managed by Irish Water.

Please quote the File Reference Number DW2018/43 in any future correspondence in relation to this Report.

Report prepared by:  **Date:** 17/04/2018

Inspector

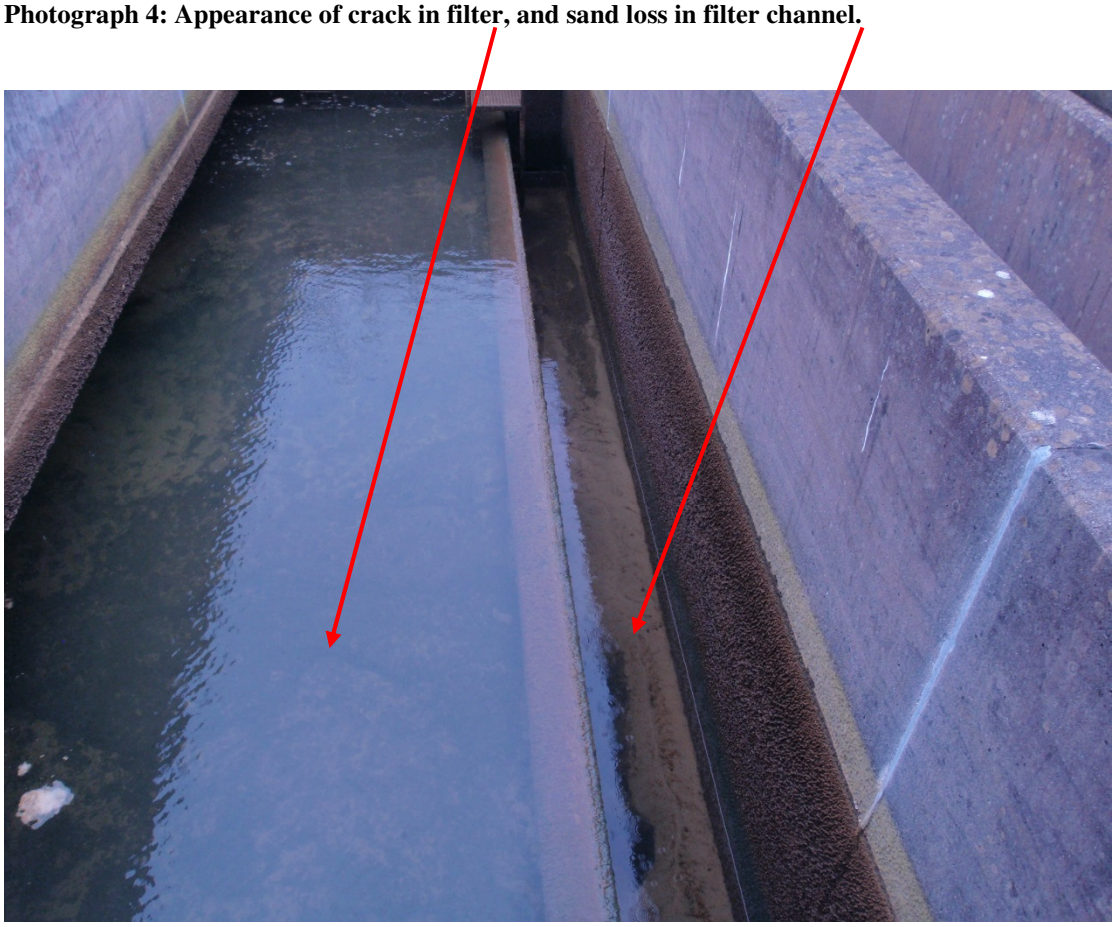
Photograph 1: Scum formed on surface of splitter chamber when coagulant aid is added.



Photograph 2: Scum noted on surface of clarifier and algae noted in decanting channels.

Photograph 3: Dead spot noted during filter no. 3 back wash cycle.

Photograph 4: Appearance of crack in filter, and sand loss in filter channel.



Photograph 5: Appearance of aluminium carry over on water surface in the filter.

Photograph 6: pH monitor reading 10:36 in the final water.