



# Drinking Water Audit Report

<b>County:</b>	Wicklow	<b>Date of Audit:</b>	25 <sup>th</sup> February 2019
<b>Plant visited:</b>	Ballinaclash Water Treatment Plant  (Avoca Ballinaclash public water supply; Scheme code 3400PUB1024)	<b>Date of issue of Audit Report:</b>	26 <sup>th</sup> February 2019
		<b>File Reference:</b>	DW2019/44
		<b>Auditors:</b>	Aoife Loughnane Daryl Gunning
<b>Audit Criteria:</b>	<ul style="list-style-type: none"> <li>• The <i>European Union (Drinking Water) Regulations 2014 (S.I. 122 of 2014), as amended.</i></li> <li>• <i>The EPA Handbook on the Implementation of the Regulations for Water Services Authorities for Public Water Supplies (ISBN: 978-1-84095-349-7)</i></li> <li>• The recommendations specified in the <i>EPA Drinking Water Report.</i></li> <li>• EPA Drinking Water Advice Notes No.s 1 to 15.</li> <li>• The recommendations in any previous audit reports.</li> </ul>		

## MAIN FINDINGS

- i. **There is very poor management and an absence of operational control of the treatment processes at Ballinaclash Water Treatment Plant. The main issues include:**
  - a. **Lack of knowledge of chemical dosing controls and disinfection controls by the plant operators;**
  - b. **SCADA data shows significant operational difficulties at the plant in January & February 2019, with unstable final water turbidity levels spiking above 1 NTU and the UV Disinfection system operating below its minimum validated operating range, meaning that the *Cryptosporidium* barriers (DAFF & UV) have been compromised for a prolonged period.**
  - c. **No maintenance programme for servicing and calibration of monitors; colour monitor (which controls the coagulant dose) is out of specification and requires re-calibration;**
  - d. **No routine jar testing to determine the optimum coagulant dose;**
  - e. **No monitoring of treated water for residual aluminium between 03/12/18 and 25/02/19;**
  - f. **No documented procedure for the communication and escalation of incidents.**
  
- ii. **The progress of plant upgrade works to enable the removal of Avoca Ballinaclash public water supply from the Remedial Action List (RAL) has been further delayed from the current completion date of March 2019. This supply is on the RAL for elevated levels of THMs, and will be added under a second category ‘EPA Audit Observation – Treatment & Management Issues’ when the Q1 2019 RAL update is published.**
  
- iii. **A Direction has been issued by the EPA under separate cover, legally requiring specific actions to be taken by Irish Water to address the deficiencies identified during the audit.**

## 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. This audit was carried out in response to the notification by Irish Water dated 08/02/19 of the failure to meet the Aluminium parametric value (as specified in Table C of Part 1 of the Schedule of the Regulations) in the Avoca Ballinaclash public water supply.

The source of Avoca Ballinaclash public water supply is a mountain stream tributary of the Avonbeg River. Treatment at the plant consists of coagulation, dissolved air flotation and filtration, and disinfection by UV and chlorination. The plant produces 341 m<sup>3</sup>/day and serves 1,419 people.

Avoca Ballinaclash public water supply has been on the EPA's Remedial Action List (RAL) since 2008 due to elevated levels of THMs. The treatment plant was upgraded from pressure filtration to a new DAFF plant which commenced operating in June 2017. However, the process proving period identified issues with the plant performance. Further upgrade works are required to improve the process controls and to install a balance tank after the DAFF unit.

The opening meeting commenced at 10:30 at Ballinaclash Water Treatment Plant. 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. Photographs taken by Aoife Loughnane during the audit are attached to this report and are referred to in the text where relevant. 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:**

Andrew Boylan, Drinking Water Compliance Specialist  
Aoife Lambe, Drinking Water Compliance Analyst  
Peter Thornton, SLA Lead for County Wicklow  
Catherine Condrot, Capital Programmes

### **Representing EPS**

Pat Lambe, Service Manager, Leinster

### **Representing the Environmental Protection Agency:**

Aoife Loughnane  
Daryl Gunning

## 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. Exceedances of the Parametric Values**

- a. On 08/02/19, Irish Water notified the EPA of an aluminium exceedance (271 µg/l) in a check sample taken in the distribution network on 22/01/19.
- b. While investigating the cause of the exceedance, Irish Water was verbally advised by the contractor, EPS, that the colour monitor (which controls the coagulant dose) was out of specification and required re-calibration. Irish Water also confirmed there was no testing of aluminium residuals in final treated water for the week prior to and since the sample date. During the audit, a review of the plant log book showed the last time this testing was done was on 03/12/18 and it re-commenced on 25/02/19 (the date of the audit).
- c. The plant operator stated there was a problem with an air compressor that supplies saturation air to the DAFF unit on 21<sup>st</sup> & 22<sup>nd</sup> January. This coincides with the date of the aluminium exceedance.
- d. Irish Water confirmed that Wicklow County Council carried out flushing in the distribution network during the week of 18/02/19. Follow up sampling in the network has yet to be undertaken but is scheduled for this week (25/02/19).

2.	<p><b>Progress of RAL Upgrade Works</b></p> <ul style="list-style-type: none"> <li>a. Avoca Ballinaclesh PWS has been on the RAL since 2008 due to elevated levels of THMs.</li> <li>b. The treatment plant was upgraded from pressure filtration to a new DAFF plant which commenced operating in June 2017. However, the process proving period identified issues with the plant performance. Further upgrade works are required to improve the process controls and to install a balance tank after the DAFF unit.</li> <li>c. In December 2018, Irish Water confirmed the expected completion date for RAL upgrade works as March 2019, with a further 3 month period for verification data to be provided in order to remove the supply from the RAL.</li> <li>d. During the audit, Irish Water confirmed that the RAL upgrade works will not be complete by March 2019, resulting in a further delay. The remaining works include process control upgrades (coagulant dosing based on UVT rather than colour) and the installation of a balance tank after the DAFF unit. At the audit, Irish Water could not confirm a revised completion date for the RAL upgrade works.</li> </ul>
3.	<p><b>Coagulation and Dissolved Air Flotation &amp; Filtration</b></p> <ul style="list-style-type: none"> <li>a. The raw water is monitored continuously for colour, turbidity, ammonium and temperature, however there is no pH monitor on the raw water.</li> <li>b. Sodium hydroxide (caustic soda) is dosed to achieve the target DAFF pH of 5.8 to 6. The dose rate is automatically controlled by a feedback signal from the DAFF pH monitor.</li> <li>c. Aluminium sulphate (coagulant) is dosed prior to water entering the DAFF unit. The dose rate is automatically controlled by a feed forward signal from the colour monitor. The colour monitor is out of specification and requires re-calibration. There is no service label on the monitor, and no record of when it was last calibrated.</li> <li>d. There was a problem with an air compressor that supplies saturation air to the DAFF unit on 21<sup>st</sup> &amp; 22<sup>nd</sup> January. This coincides with the date of the aluminium exceedance detected in a network sample on 22/01/19.</li> <li>e. The caustic and alum dosing pumps are configured in duty &amp; standby arrangement, with automatic switchover. The service labels show the pumps are due for calibration in February 2019.</li> <li>f. There is no routine jar testing to determine the optimum coagulant dose.</li> <li>g. The DAFF process undergoes frequent stop/starts because its operation depends on the water level in Ballinaclesh Reservoir (when the reservoir reaches a certain level, the DAFF switches off). The frequent stop/starts present operational challenges to the water quality produced at the plant, and Irish Water has identified the need to install a balance tank after the DAFF unit, to enable smoother running of the plant.</li> <li>h. The DAFF filter is backwashed twice daily, at 7am and 11pm. After backwashing, the DAFF runs to waste for 90 seconds. It could not be confirmed if this length of time is appropriate to ensure that filtered water turbidity has stabilised and is within a suitable range (i.e. less than 1 NTU) for UV disinfection.</li> </ul>
4.	<p><b>Disinfection - UV</b></p> <ul style="list-style-type: none"> <li>a. The water undergoes primary disinfection by UV treatment in duty/standby Trojan Swift D03 UV units. During the audit, the plant operator did not know the validated operating range of the UV system. However, the UV plates show a maximum flow of 50 m<sup>3</sup>/hr at a minimum of 85% UVT (see photo 1).</li> <li>b. The UV validation certificate was not available during the audit.</li> <li>c. During the audit, the plant operator did not know the alarm settings, if any, on the UV system.</li> </ul> <p><b>Disinfection - Chlorination</b></p> <ul style="list-style-type: none"> <li>d. The water undergoes secondary disinfection by chlorination at Ballinaclesh Reservoir.</li> <li>e. The chlorination system was upgraded as part of the National Disinfection Programme roll-out in County Wicklow and meets the EPA criteria for dosing arrangements.</li> <li>f. The normal dose setting is 0.6 mg/l. The low chlorine alarm is set at 0.3 mg/l. There is no high level chlorine alarm.</li> <li>g. The location of the chlorine injection points could not be confirmed by the audit attendees, however it is thought they may be located outside the secure chlorination compound, accessed via a manhole at the edge of the public road.</li> </ul>

	<p>h. One of the three drums of sodium hypochlorite in the storage compound was appropriately labelled with the dates of manufacture, delivery and ‘use by’. The labels on the other two drums were inadequate and showed a date of 20/03/2017 which means the chemical is well past its expiry date.</p>
<b>5.</b>	<p><b>Monitoring and Sampling Programme for treated water</b></p> <p>a. Since the changeover of EPS staff in early December, there was no monitoring of treated water for residual aluminium from 03/12/18 until 25/02/19.</p>
<b>6.</b>	<p><b>Management and Control</b></p> <p>a. The treatment plant is currently being operated by EPS under contract to Irish Water.</p> <p>b. During the audit, there was a lack of knowledge of chemical dosing controls and disinfection controls by the contractor’s representative. The EPS plant operators who visit the site three times a week did not attend the audit. There was a changeover of EPS staff in December 2018, and during the audit the EPS representative stated that the new operators did not receive appropriate training.</p> <p>c. The SCADA data shows significant operational difficulties at the plant in January &amp; February 2019, with very unstable final water turbidity levels spiking above 1 NTU (see Figure 1) and the UV Disinfection system operating below its minimum validated operating range (see Figure 2), meaning that the <i>Cryptosporidium</i> barriers (DAFF &amp; UV) have been compromised.</p> <p>d. There is no maintenance programme for the servicing and calibration of monitors at the plant. The colour monitor (which controls the coagulant dose) is out of specification and requires re-calibration (last calibration date is unknown). There were discrepancies between the monitor readings for final water turbidity (0.262 NTU at the UV building compared to 0.565 NTU at the chlorination compound) and final water pH (8.45 pH at the UV building compared to 10.23 and 2.55 at the chlorination compound).</p> <p>e. There is no documented procedure for the communication and escalation of incidents at the plant. Irish Water was unaware of the operational difficulties at the plant in January &amp; February 2019 until the investigations commenced into the aluminium exceedance after notification to the EPA on 08/02/19.</p> <p>f. During the audit, it could not be confirmed if the overground concrete tank located to the rear of the treatment plant building is a raw water balancing tank or a washwater tank (as shown on the plant drawing).</p>

### 3. AUDITORS COMMENTS

The audit found very poor management and an absence of operational control of the treatment processes at Ballinaclesh Water Treatment Plant. The failure to calibrate the chlorine monitor (which controls the coagulant dose) has seriously compromised the DAFF process and the final treated water quality. The SCADA data for January & February 2019 shows that the plant’s *Cryptosporidium* barriers (DAFF & UV) have been compromised, and this presents an ongoing and persistent risk that the water supply is not adequately disinfected.

The auditors were extremely disappointed to learn of a further delay in the completion of RAL upgrade works at Ballinaclesh Water Treatment Plant, from the expected completion date of March 2019. The most recent update provided by Irish Water in the Q4 2018 RAL update, did not indicate any delays in the expected completion date of March 2019. This supply has been on the RAL since 2008 for elevated levels of THMs. Based on the audit findings, it will now be added under a second category ‘EPA Audit Observation – Treatment & Management Issues’ when the Q1 2019 RAL update is published.

A Direction has been issued by the EPA under separate cover, legally requiring specific actions to be taken by Irish Water to address the deficiencies identified during the audit.

## 4. RECOMMENDATIONS

### RAL upgrade works

1. Irish Water should submit a revised completion date for the upgrade works to enable Avoca Ballinaclesh public water supply to be removed from the Remedial Action List.

### Dissolved Air Flotation & Filtration (DAFF)

2. Irish Water should install a continuous pH monitor on the raw water to allow for better process control in dosing of sodium hydroxide to achieve the target coagulation pH.
3. Irish Water should ensure that the coagulation process at the water treatment works are regularly inspected. Jar testing of the raw and coagulated waters as outlined in Section 3.3.1 and Appendix C of the EPA publication "*Water Treatment Manual: Coagulation, Flocculation and Clarification*" to determine the optimum chemical coagulant dose and pH for the treatment of the water. The frequency of checks should be appropriate to the nature of supply and changing condition. Results should be recorded at the treatment works and used for control of the treatment plant.
4. Following a backwash of the DAFF unit, Irish Water should review the duration of the run-to-waste phase, to ensure the filtered water turbidity has stabilised and is within a suitable range for UV disinfection.

### Disinfection

5. UV Disinfection System
  - a. Irish Water must ensure that the UV disinfection system at Ballinaclesh Water Treatment Plant operates within its validated range at all times.
  - b. Irish Water should submit a copy of the validation certificate for the UV disinfection system. Irish Water should also confirm the following details:
    - (i) Is the UV system controlled using UV Intensity (UVI) or UV Transmissivity (UVT);
    - (ii) Is there automatic changeover in the event of failure of one of the UV units;
    - (iii) Is the UVI or UVT monitor alarmed? If so, confirm the alarm & shutdown set-points, and provide a copy of the alarm response procedure.
6. Chlorination System
  - a. Irish Water should confirm if the chlorine injection points are located within the secure chlorination compound.
  - b. Irish Water should configure a high chlorine alarm on the chlorination system.
  - c. Irish Water should ensure that drums of sodium hypochlorite are appropriately labelled with a 'use-by' date, and remove any expired chemicals from the site for appropriate disposal.

### Management and Control

7. Irish Water should review the reasons behind the fluctuating final water turbidity levels and drop in UVT levels (post DAFF) during January and February 2019, and ensure that appropriate actions are taken to improve the performance of Ballinaclesh water treatment plant.
8. In accordance with Irish Water's *Cryptosporidium* Monitoring Rationale, Irish Water should immediately commence *Cryptosporidium* monitoring of the treated water because the performance of the *Cryptosporidium* barriers at the plant could not be verified. If any oocysts are detected, Irish Water should consult with the HSE immediately regarding potential risk to public health.

9. Plant Operations
  - a. Irish Water should ensure that plant operators are appropriately trained to manage and control the operation of Ballinaclash water treatment plant.
  - b. Irish Water should ensure that plant operators have access to the SCADA data relating to the performance of the plant. Specifically, access should be provided to raw and treated water quality trends.
  - c. Irish Water should implement daily monitoring of the final treated water for residual aluminium. The results should be recorded in the plant log book.
  - d. Irish Water should prepare and implement a documented procedure for the communication and escalation of incidents affecting drinking water quality in Avoca Ballinaclash public water supply. The procedure should cover the responsibilities (plant operator and Irish Water) and criteria where it is necessary to consult with the HSE to determine where there is a potential danger to human health associated with the public water supply.
  
10. Monitoring equipment
  - a. Irish Water should ensure there is a maintenance programme in place for the servicing and calibration of all plant monitors. Monitors should be calibrated in accordance with the manufacturers' instructions, and clearly labelled to show the date of calibration and the next 'calibration due by' date.
  - b. Irish Water should investigate the discrepancies in the monitor readings at the treatment plant and the chlorination compound (final water turbidity and pH).
  
11. Irish Water should confirm if the overground concrete tank located to the rear of the treatment plant building is a raw water balancing tank or a washwater tank (as shown on the plant drawing).

**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 Michelle Minihan, Senior Inspector, Drinking Water Team.

**A Direction has been issued by the EPA under separate cover, legally requiring specific actions to be taken by Irish Water.**

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 in any future correspondence in relation to this Report.

**Report prepared by:**

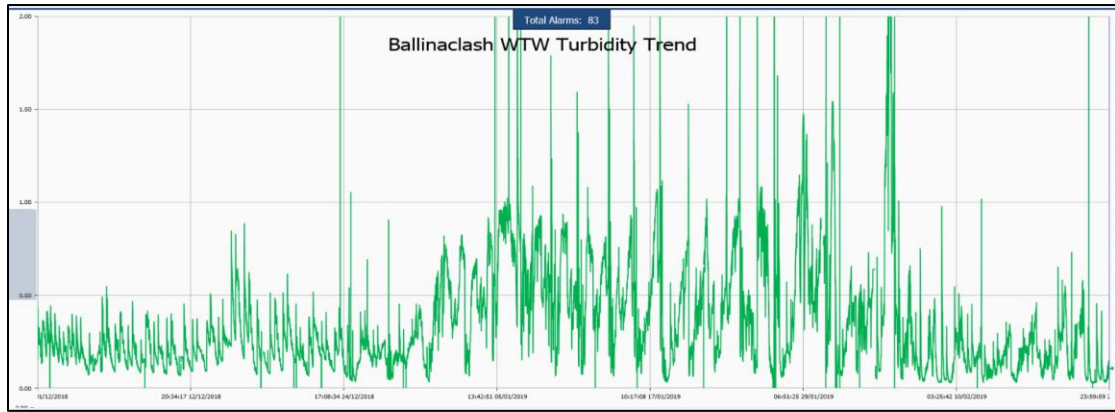
*Aife Laghuane*

**Date:**

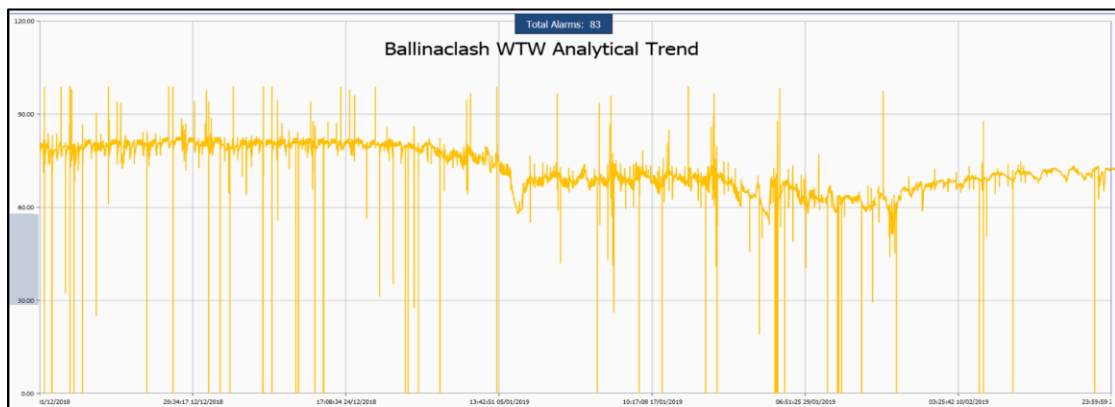
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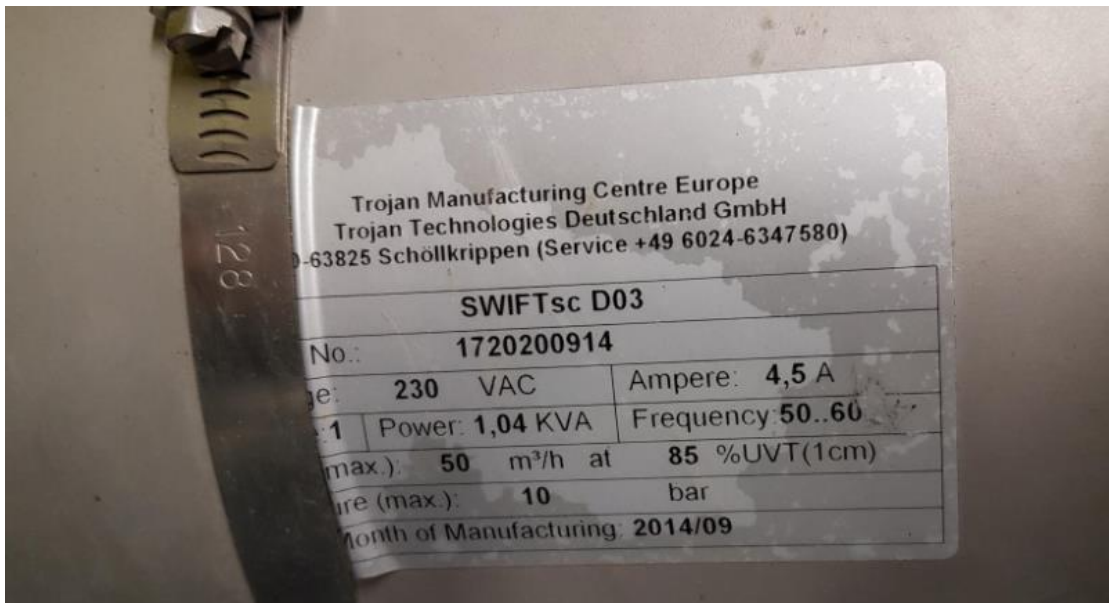
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**Figure 1: SCADA graph of final water turbidity from 01/12/18 to 22/02/19 which shows unstable plant performance with many spikes above 1 NTU.**



**Figure 2: SCADA graph of UVT (measured post DAFF unit) from 01/12/18 to 22/02/19 which shows water quality dropping below the 85% UVT validated operating range of the UV Disinfection system.**



**Photo 1: Label on the UV disinfection system which shows the validated operating range is up to 50 m<sup>3</sup>/hr flow at 85% UVT.**