



# Drinking Water Audit Report

<b>County:</b>	Galway	<b>Date of Audit:</b>	18 <sup>th</sup> August 2015
<b>Plant(s) visited:</b>	Ballygar Water Treatment Plant	<b>Date of issue of Audit Report:</b>	27 <sup>th</sup> August 2015
		<b>File Reference:</b>	DW2015/123
		<b>Auditors:</b>	Ms Derval Devaney
<b>Audit Criteria:</b>	<ul style="list-style-type: none"> <li>• The <i>European Union (Drinking Water) Regulations 2014 (S.I. 122 of 2014)</i>.</li> <li>• The <i>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>• The recommendations in any previous audit reports.</li> </ul>		

## MAIN FINDINGS

- i. The Ballygar PWS was supplemented by the Mountbellew PWS during the time microbiological failures were identified in the Ballygar PWS on 06/08/15 and 11/08/15. The cause of the contamination remains unclear. Investigations are ongoing into the cause and source of contamination.
- ii. There was no survey of the catchment since the microbiological failures were detected on 06/08/15 and 11/08/15 to determine if there are any sources of contamination. There are issues with access to the spring source and the supplementary borehole on-site is not adequately sealed.
- iii. The alarms at the plant do not afford the plant operator time to ensure that inadequately disinfected water does not enter the on-site clear water storage tank, which has 40-45 hours storage, and the distribution network.
- iv. There is no chlorine monitor at the tower in Ballygar town to determine chlorine residuals entering the network post mixing with the Moubtbellw PWS. The tower was not cleaned since its construction, about 50 years ago.

## 1. INTRODUCTION

Under the *European Union (Drinking Water) Regulations 2014* 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 on 13/08/15 of the failure to meet the Enterococci parametric value (as specified in Table A of Part 1 of the Schedule of the Regulations) in the Ballygar PWS. The Ballygar supply is sourced from a spring and on occasion a borehole. The Ballygar supply is also supplemented by the Mountbellew PWS. The treatment plant consists of pre-chlorination (when the borehole is in use), rapid gravity filtration, UV and chlorine disinfection. The plant produces approximately 325 m<sup>3</sup>/day (average daily July volumes) serving a population of 1,344.

The opening meeting commenced at 10.30 am at the Ballygar 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. 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:

Galway Co. Co. (GCC): John McMyler, Senior Executive Engineer, Water Services (O&M, North Division), Brendan McDonagh, Graduate Engineer, Water Services, (O&M, North Division), Pat McDermott, General Services Supervisor (GSS) Water Services North Division, Mike Kililea, Ballyar WTP Caretaker, Paddy Hughes, Mountbellew WTP Caretaker and Tina Ryan, Assistant Scientist, Environment Section.

Irish Water (IW): Gerard Greally Irish Water (O&M North West Region) SLA Lead and Bonner, Water Compliance Liaison Specialist.

Representing the Environmental Protection Agency (EPA):

Derval Devaney – 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. Source Protection

- a. The spring source for the Ballygar PWS, approximately 300m NW of the treatment plant was not visited. Galway Co. Co. stated that there were access issues (safety and land not owned by the Water Service Authority). Irish Water's HSQE team has visited the source. The EPA's WFD Groundwater Monitoring Programme Report (dated August 2011) for the Ballygar PWS states the spring flow is reportedly constant at 600-700 m<sup>3</sup>/d.
- b. A borehole on-site is used as backup when levels in the spring are low or demand increases. It was stated during the audit that the borehole is used rarely (and not at all in the winter) as its water is high in iron and colour and there is a connecting line to the Mountbellew PWS trunk main. The EPA's WFD Groundwater Monitoring Programme Report for the supply (dated August 2011) states that the back-up well is believed to be 40m deep but this has not been confirmed as details of well construction have not been found. The report also states the well casing diameter is 12-inch (300 mm) and there was no evidence of grouting. It states that the casing only is about 10-15cm above ground and on the day of the visit water had ponded on the chamber floor area. The report outlines that faint waterline along the walls suggest ingress of surface water or ponded water can occur directly into the borehole. These observations were mentioned during this audit.
- c. The EPA made reference during the audit to the report: "Establishing a Groundwater Source Protection Zone – Ballygar PWS – August 2011" which is available on the EPA and GSI websites. The report states that the total Zone of Contribution (ZOC) area is delineated on the basis of topography and water balance. Most of the ZOC consists of a low vulnerability setting but there are areas of extreme and high vulnerability. The spring discharge it states is probably a combination of water sourced from underlying limestones as well as sub-soils.
- d. Galway County Council stated that they had not communicated with all residents/farmers within the ZOC to advise them on their obligations under the Good Agricultural Practice Regulations.
- e. There has been no survey of the catchment since the microbiological failures were detected on 06/08/15 and 11/08/15 and neither Irish Water nor Galway County Council had assessed the catchment to determine if there were any current sources of contamination.
- f. After the microbial detection on 06/08/15 in Ballygar town and further microbial contamination was found in the supply from samples taken on 11/08/15, mixing water from the Ballygar plant with the Mountbellew PWS ceased and water was abstracted from the borehole on-site instead, which commenced on 13/08/15. Water from the borehole is run to waste initially for 30 minutes to reduce the iron levels and pre-chlorination of the supply only occurs when the borehole is in use.
- g. The raw water colour at the time of the audit was 9.61 Hazen and the turbidity was 0.04 NTU and the pH 6.64. There is a flow meter on the inlet to the plant.

<p><b>2.</b></p>	<p><b>Filtration</b></p> <ul style="list-style-type: none"> <li>a. There is one rapid gravity filter on-site which was installed during 2012. The silica sand filter media is believed to be 600 mm deep and is topped up as necessary.</li> <li>b. The backwash cycle is timed every 72 hours but has been increased to 24 hours after the detection of Enterococci and <i>E coli</i> in the network. Backwash consists of 7 minutes of air scour and 7 minutes of water with a 30 minute rest period prior to going back into production. The backwash water is directed to a backwash water tank underground and the supernatant is directed to a percolation area. The backwash water tank has not been de-sludged since it was installed.</li> <li>c. The turbidity monitor on the treated water is located on the clear water tank and on average ranges from 0.02 to 0.06 NTU. The alarm was set activate by alerting the caretaker by text and shutting down the plant if the turbidity was &gt; 1 NTU for 30 minutes or more. This alarm setting does not afford time for the caretaker to react to a determination in raw water and final water quality and puts consumers at risk of receiving inadequately disinfected water. The setting was changed to 0.5 NTU on the day of the audit but this level is still much higher than the average NTU reading in the final water and the 30 minute timeframe for altering the operators remained.</li> <li>d. The read-out from the filtered water turbidity meter was 0.073 NTU on the day of the audit and treated water was 0.07 NTU, pH 6.94 and colour 5.05 Hazen.</li> </ul>
<p><b>3.</b></p>	<p><b>Chlorination and Disinfection</b></p> <ul style="list-style-type: none"> <li>a. A duty and standby UV disinfection treatment unit (which is validated to 80.2% UVT at flow volume of &lt; 40 m<sup>3</sup>/hr) provides disinfection at the site. A copy of the validation criteria was available on the audit. The flow at the treated water on the day of the audit was 17.99 m<sup>3</sup>/hr.</li> <li>b. The plant is alarmed when the UVT goes below 80% for 30 minutes resulting in a plant shut down. It was requested that this alarm be increased to 81% and this was actioned during the audit.</li> <li>c. The UVT at the time of the audit was 93.3% and is calibrated yearly by EPS with the next calibration due on 09/02/16. More frequent internal calibration checks are carried out and logged by GCC.</li> <li>d. Back-up lamps for the UV units are available on-site.</li> <li>e. Sodium Hypochlorite 14% is dosed post UV treatment. The chlorination system was examined and found to be in compliance with the recommendations of the EPA Advice Note – <i>E. coli</i> in Drinking Water.</li> <li>f. The plant shuts down if the chlorine residual is less than 0.45 mg/l in the final water for more than 30 minutes and the caretaker is alerted by text. It was stated that there can be an issue with signal and texts to the caretaker can be delayed for a number of hours. The hi hi chlorine set point was set at 3.5 mg/l and the target dose is 2.9 mg/l in the clear water tank.</li> <li>g. Post chlorination the water goes to an above ground clearwater tank onsite which has 600m<sup>3</sup> storage and 40-45 hours storage. It was stated if the chlorine dose is altered it takes 48 hours for the change to take effect in the clear water tank.</li> </ul>
<p><b>4.</b></p>	<p><b>Treated Water Storage and Distribution Network</b></p> <ul style="list-style-type: none"> <li>a. The Ballygar supply is supplemented from the Mountbellew PWS. Treated water from the Mountbellew Water Treatment Plant is pumped to the Corgory Reservoir, which was built in the late 1980's and has a 6-7 hour storage time. The Corbally not been cleaned out since it was constructed and this is to be dealt with under the Mountbellew Audit undertaken also on 18/08/15.</li> <li>b. The Mountbellew supply is linked to the Ballygar supply by an interconnecting pipe where the two supplies are fed by separate mains into a tower storing approx. 230m<sup>3</sup> of treated water in Ballygar town. This tower has a storage time of a few hours only.</li> <li>c. There is no chlorine monitor post the tower in Ballygar town to determine the residual entering the network post storage. Chlorine residuals have not been monitored in this tower previously and there is no idea of the mixing efficiencies of this tower.</li> </ul>

## 5. Exceedances of the Parametric Values

- a. On 06/08/15 ELS monitored at Centra Holmes. The analysis was contracted out by ELS and on Saturday 08/08/15 the results showed an Enterococci failure of 7 per 100ml and a low free chlorine residual of 0.02 mg/l (0.33mg/l total chlorine). On Monday 10/08/15 the contract lab notified ELS of the failure and ELS emailed Galway Co Co at 6.30pm. On 11/08/15 Galway Co. Co. received the email and arranged for CLS to re-sample the supply in Ballygar town that day. It was thought initially that the failure on 06/08/15 was due to a water softener installed at Centra as chlorine residual samples taken by the caretaker in the Ballygar network near the plant were satisfactory on 5, 6 and ,7th August. The environment section stated it was unaware that the Ballygar PWS was supplemented by the Mountbellew supply.
- b. The re-samples taken on the 11/08/15 at three locations in Main Street Ballygar were received by Galway Co. Co. on 11am on the 12/08/15 and showed the presence of E coli (> 201 No. /ml) and inadequate chlorine residual levels in the failed samples. Irish Water and the HSE were immediately notified and it was agreed to put in place a boil water notice on the Ballygar PWS. The notice was issued on 12/08/15 via radio, website and phone calls to vulnerable users. A leaflet drop to all premises commenced on this day also.
- c. On 12/08/15 chlorine residuals were taken in the network 1 mile from the Ballygar plant (Fitzmorris House 0.55 mg/l). Within the town centre the chlorine residuals were 0.19 mg/l however at the end of Ballygar town on the Roscommon side at 4pm chlorine residuals were inadequate at 0.06 mg/l. The tower where the Mountbellew supply mixes with the Ballygar supply was also sampled earlier that day and had chlorine residuals of 0.09 mg/l, at 3.45pm the chlorine residuals were 0.05 mg/l.
- d. At around 4pm on 12/08/15 the tower was shut-off from the Ballygar supply, eliminating the Mountbellew PWS entirely from mixing with the Ballygar PWS and the chlorine dose was increased at the Ballygar plant.
- e. It was estimated that there were 30,000-50,000 gallons of water in the tower which was drained twice since the incident. At 18.23 on 12/08/15 the free chlorine in the tower was measured at 0.1 mg/l and at 18.55 it was 0.02 mg/l. Turbidity readings from the tower ranged from 0.5 to 1.93 NTU. Galway County Council stated that it does not know what the chlorine residuals usually would be at that tower as it was never analysed for chlorine. It was also stated that the tower would not have been cleaned out in 50 years.
- f. At 19:41 on 12/08/15 the chlorine residuals were 0.48mg/l at Fitzmorris House. The little change in residual here is reflective that it usually takes 24 hours for a response to show in the network once treatment at the plant is adjusted. At 19:36 the chlorine residual was 0.51 mg/l on the Tully Thornfield Group Water Scheme on the Roscommon Road.
- g. On 13/08/15 the Ballygar supply was supplemented from the borehole on-site and the increase in chlorine dose at the plant was starting to increase at the Roscommon side of Ballygar town (0.9 mg/l at Roscommon Rd).
- h. On 14/08/15 Ballygar town had chlorine residuals of 2.2 mg/l. The chlorine dose at the Ballygar plant caused the plant to shut down as the residuals had gone above the set point at the plant. The dose was reduced as chlorine levels were being attained in the network and the high level final water chlorine alarm was also increased to 3.5 mg/l.
- i. A review of the UVT results from the SCADA print out provided prior to the audit shows UVT was consistently above 90% and turbidity remained low at 0.06 NTU on average from 03-14 August 2015. However there was a drop in chlorine residuals from approximately 1mg/l to 0.5 mg/l between the 04/08/15 and 10/08/15. There was a change in caretaker from the 04/08/15 and chlorine residuals entered into the daily log book from 04/08 – to 08/0815 were taken at different locations to the usual monitoring locations which are nearer the treatment plant (Kilmor and Post office) and not mixed with the Mountbellew supply. As a result, it is not evident what the chlorine residuals were in Ballygar town in or at the Roscommon Road side of the network around the initial failure on 06/08/15.
- j. On the 12/08/15 and 13/08/15 chlorine residual monitoring was undertaken on the Mountbellew PWS from the treatment plant towards Ballygar. The chlorine dose was increased on the Mountbellew Supply on 13/08/15 and chlorine residuals taken at various points along the network between Mountbellew town and Ballygar were > 0.1 mg/l. It was stated that it takes approx. 40 hours for it to take effect in Newbridge town. On 17/08/15 the chlorine residual was 0.66 mg/l at The Shiven Inn, Newbridge.

	<ul style="list-style-type: none"> <li>k. It was stated during the audit that the network mains pipe is quite large serving Mountbellew town and is of a narrower diameter (4 inch main) around Newbridge and prior to the connector pipe linking the Mountbellew PWS to the tower in Ballygar. Further investigations are to be made into pressures on this line and water quality and this will be dealt with under the Audit which was also carried out on 18/08/15 on the Mountbellew PWS.</li> <li>l. Flushing has yet to be carried out on the network and it is proposed to undertake network monitoring studies initially to determine the source of the contamination.</li> <li>m. The Mountbellew PWS was not sampled on 11/08/15 upon detection of the Enterococci failure in the Ballygar PWS on 06/08/15 as it was reported that there was a water softener at the failed location and it was thought that this was the reason for the failure. As a result, it is unclear if there were microbiological failures also in the Mountbellew PWS where customers were at risk from potentially inadequately disinfected water from 06/08/15 – 11/08/15 and that the cause for failures in the Ballygar PWS were as a result of inadequately disinfected water from the Mountbellew PWS.</li> <li>n. There was no illness reported to Galway Co Co or Irish Water for this area by the HSE however the HSE had stated that illness could yet take effect due to incubation periods involved.</li> <li>o. Galway Co Co stated that there was a lead failure on the sample taken on 06/08/15 which had not been reported to the EPA. The EPA noted that there was a closed lead file for this supply which documented lead service pipes. Irish Water stated that there were no lead mains in the supply (mains were either of cast iron or plastic). Irish Water was requested to submit details of this lead failure to the EPA.</li> </ul>
<p><b>6.</b></p>	<p><b>Management and Control</b></p> <ul style="list-style-type: none"> <li>a. The caretaker does not have access to a system whereby trends in raw treated and final water can be observed and chlorine residuals post the reservoir can be checked.</li> <li>b. There was no programme in place for maintenance of the supply's reservoirs, filters and the network (e.g. a network flushing programme).</li> </ul>
<p><b>7.</b></p>	<p><b>Monitoring and Sampling Programmes for Treated Water</b></p> <ul style="list-style-type: none"> <li>a. Monitoring results for 14/08/15 were provided during the audit for the Mountbellew and Ballygar PWS. Samples were taken of the raw and treated water, at Kenny's and Fallon's Pub, the Health Care Centre and Tully Thoronfields on the Ballygar PWS. The raw water had E coli of 8 MPN/100ml, Coliforms of 18 MPN/100ml and 0 cfu/100ml Enterococci and a turbidity of 0.3 NTU. The treated water and network points were free from microbial presence and had adequate chlorine residuals. The turbidity in the network was elevated however at 3.8 NTU at Tully Thoronfields and 1.4 at the Health Centre Ballygar.</li> <li>b. The Mountbellew PWS was also sampled at the raw water, treated water, St Annes B&amp;B Mountbellew, Siopa n Phobail, Newbridge and S. Connolly, Woodbrook, Newbridge on 14/08/15. The raw water had E coli of 62MPN/100ml, Coliforms of 145 MPN/100ml and 5 cfu/100ml Enterococci and a turbidity of 2.2 NTU. The treated water and network points were free from microbial presence and had adequate chlorine residuals. The treated water turbidity was &lt; 0.2 NTU.</li> <li>c. Galway County Council is continuing to take samples in the network and is in consultation with the HSE on the sampling programme and monitoring results and the outcome will be reported to the EPA.</li> <li>d. Galway Co. Co has is to include iron in the sampling programme for the duration that the borehole is in use. Galway Co. Co. are also going to monitor for iron pre and post filtration to determine if the pre-chlorination is decreasing iron levels sufficiently in the final water.</li> </ul>
<p><b>8.</b></p>	<p><b>Sludge Management</b></p> <ul style="list-style-type: none"> <li>a. The backwash water is discharged to an underground tank. The supernatant flows to a percolation area on-site.</li> </ul>

### 3. AUDITORS COMMENTS

The cause of the contamination on 06/08/15 and 11/08/15 remains unclear. The Ballygar PWS was supplemented by the Mountbellew PWS during the time microbiological failures which could have attributed to the source however a drop in chlorine residual at the Ballygar plant is also observed during the time of the failures (from 04/08/15 to 11/08/15).

The alarms at the plant do not afford the plant operator time to ensure that inadequately disinfected water does not enter the distribution system via the on-site clear water storage tank which has 40-45 hours storage and the tower in Ballygar town where the supply is mixed with the Mountbellew PWS. In addition the tower has not been cleaned in 50 years and has no chlorine residual monitor on it pre and post mixing to ensure adequate residuals are present in the network.

Irish Water must investigate all possible avenues for the source of contamination and review the treatment and disinfection controls at this plant and its storage facilities to ensure a safe and secure water supply is provided.

### 4. RECOMMENDATIONS

1. Irish Water should ensure that a catchment survey of the spring and its' ZOC is carried out to identify any potentially sources of pollution. Irish Water should also ensure the recommendations arising from HSQE's visit are achieved.
2. Irish Water should ensure that the on-site borehole is lined and seals are in place and maintained so as to prevent any ingress of contamination from surface water entering the supply.
3. Irish Water should liaise with Galway County Council in relation to the requirements of:

(a) *The European Union (Good Agricultural Practice for the Protection of Waters) Regulations 2014 (SI No.31 of 2014)* to ensure, unless an alternative setback distance has been set as per Article 17, that catchment users and landowners within the ZOC of the water supply are advised of their obligations as follows:

- i. Organic fertiliser or soiled water is not applied to land within 200 m of the abstraction point; and
  - ii. Farmyard manure held in a field prior to landspreading is not placed within 250 m of the abstraction point.
- and

(b) *The European Communities (Sustainable Use) of Pesticides Regulations, 2012 (SI No. 155 of 2012)*. The EPA's website has information at the following link <http://www.epa.ie/water/dw/sourceprotection/#.Vd3WZWBwZ9P> promoting responsible pesticide use by both professional and household users.

Information should be issued to catchment users on good practice for landspreading and storage of manure and the environmental and public health risks associated with pesticides and best practice for use of pesticides regarding the storage, use and disposal of pesticide products. A map delineating the ZOC should be included in this correspondence with the landowners/catchment users.

4. Irish Water should ensure that all monitors, where appropriate, are alarmed (e.g. raw water, filtered water and final water monitors) to alert plant operators of any changes water quality. The critical set points for alarms should be reviewed so that personnel are alerted to and the alarms are set so that time is afforded to react to such so that the treatment and water quality leaving the plant is not compromised. A timeframe for shut-down of 30 minutes is too long and should be revised to ensure inadequately disinfected water does not enter the supply. A procedure should also be put in place defining the actions to be taken in response to the different levels of alarm.
5. Irish Water should review the chlorination system to ensure (a) there is adequate control in meeting

chlorine residual levels of at least 0.1 mg/l at all locations in the network (b) a fail-safe response is built into the management of the supply so that in the event that chlorine demand increases as a result of raw water deterioration or network demand, there is adequate disinfection and at least 0.1 mg/l in the network at all times (c) the daily chlorine residual network monitoring points are adequately located and incorporate the end of the network and are documented in the daily log book and d) the daily log book has adequate space for the caretaker to document results and any comments/observations made on the day.

6. Irish Water should ensure that the plant operators have access to historic data (via SCADA or HMI or otherwise) which goes back at least 4 weeks so trends in water quality can be observed and the treatment process can be adjusted as necessary.
7. Irish Water should ensure that the tower is inspected and cleaned out on a regular in accordance with the EPA's Advice Note No. 10: Service Reservoir Inspection, Cleaning and Maintenance and submit a timeframe for inspection and cleaning of same. Irish Water should ensure that there is a complete mixing (i.e. no preferential flow) in the clear water tanks and reservoir and that no stagnant areas exist. Any maintenance and repairs completed as soon as possible after the need has been identified. Irish Water should ensure that any vents on the tower are secured against ingress of animals or deliberate introduction of any contaminant or acts of vandalism.
8. Irish Water should instigate a regular programme of flushing and scouring of the mains.
9. Irish Water should investigate the Ballygar PWS network to determine if it was the source of the microbiological contamination on 06/08/15 and 11/08/15 in Ballygar town. This investigation should include raw water source, treatment processes, chlorine demands, water pressure, any ingress of contamination along the line, inadequately sized mains, etc. which could have contributed to the failures.

#### **FOLLOW-UP ACTIONS REQUIRED BY IRISH WATER**

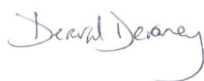
During the audit Irish Water representatives were advised of the audit findings and that action must be taken as a priority by Irish Water to address the issues raised. This report has been reviewed and approved by Mr Darragh Page, Senior Inspector.

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 in any future correspondence in relation to this Report.

**Report prepared by:**



**Date:**

27th August 2015

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Derval Devaney

Inspector