Drinking Water Audit Report

County:	Galway	**Date of Audit:**	18 August 2015
Plant(s) visited:	Mountbellew Water Treatment Plant	**Date of issue of Audit Report:**	27th August 2015
		File Reference:	DW2015/128
		Auditors:	Ms Derval Devaney
Audit Criteria:	• The *European Union (Drinking Water) Regulations 2014 (S.I. 122 of 2014).* • *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*. • The recommendations in any previous audit reports.		

MAIN FINDINGS

i. **The Mountbellew PWS supplied the Ballygar PWS during the time microbiological failures were identified in the Ballygar PWS on 06/08/15 and 11/08/15. It remains unclear if the cause for contamination was due to the Mountbellew PWS. Investigations are ongoing into the cause and source of contamination.**
ii. **The raw water source can deteriorate significantly with high rainfall events. Compliant final water quality is dependent on additional treatment at the plant during these events. The treatment processes and controls at the plant are not adequate to ensure a safe and secure water supply at all times.**
iii. **The filters required cleaning and the Corbally Reservoir was not cleaned since its construction in the late 1980's.There was no maintenance programme in place for cleaning of reservoirs or tanks nor was there a programme for flushing the networks in place.**

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 which is supplemented by the Mountbellew PWS.

The Mountbellew supply is sourced from the Meelick Spring in an area surrounded by forestry and agriculture. The treatment plant was consists of pre-chlorination, rapid gravity filtration, UV disinfection, chlorine disinfection and fluoridation. Treatment using Poly Aluminium Chloride (PAC) was introduced in 2013 and is dosed prior to filtration at times when the raw water turbidity approaches 1 NTU. The plant produces approximately 1,127m^3/day (average daily July volumes) serving a population of 2,988. Photographs taken by Derval Devaney during the audit are attached to this report and are referred to in the text where relevant.

The opening meeting commenced at 2.15pm at the Mountbellew 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 OBSERVATION

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 (Meelick Spring) for the Mountbellew PWS is covered (see Photo 1) to prevent unauthorised human or animal access and is gravity fed to the plant next to the spring. b. The EPA made reference during the audit to the report: "Establishing a Groundwater Source Protection Zone – Mountbellew PWS – Dec 2011" which is available on the EPA and GSI websites. The report states that the total Zone of Contribution (ZOC) area is considered to be 18.1 km^2 for this spring source. It also states that given the vulnerability of the spring to contamination, good agricultural practice relating to landspreading and slurry storage should be followed within the delineated ZOC. IW has not provided maps illustrating the ZOC to catchment users and actions to be taken in order to protect the water supply source. c. Meelick Spring is monitored quarterly under the EPA's National Groundwater Quality Network. The presence of Coliforms and *E. coli* during 2013 and 2014s' monitoring events indicates a surface water influence. The aforementioned SPZ report states that the spring's discharges are "strongly influenced by rainfall events" with "an approximate 36-hour time lag". Iron and manganese can also be elevated and exceed parametric values on occasion. d. There is an overflow from the spring chamber which is directed to a weir (water levels here have been monitored by the EPA since 2010). The quantity of water abstracted for drinking water treatment is relatively small compared to the total estimated discharge (7,530 m^3/d average) of the spring. e. There is a raw water turbidity monitor on the raw water intake however this is not set to alarm when the turbidity goes above an unacceptable level. Colour is also monitored on the intake and the plant shuts down automatically if the colour is > 20 Hazen for 30 minutes.
2.	**Coagulation, Flocculation and Clarification** a. Treatment using Poly Aluminium Chloride (PAC) initiated in 2013 and is manually introduced prior to filtration at times when the raw water turbidity approaches 1 NTU. The pre-mixed liquid PAC is set at a fixed concentration on the inlet to the filter and is flow-proportional. There are no jar tests carried out on site to determine the dose according to the raw water quality (see Photo 2). b. From January 2015 to date PAC was manually introduced at the plant on 7 occasions (4 of those were within the last month). The introduction of this treatment process is reliant on the caretaker observing that the raw water source has deteriorated. This is observed by checking

	the readout on the turbidity monitors at the plant on the raw water, post Filter No. 1 and No. 2 and on the final water and knowledge of the weather forecast for the coming days which could lead to deterioration in the raw water source. The caretaker does not have access to a system whereby trends in raw water, filtered water and treated water quality can be assessed. c. PAC was not being used on the day of the audit as turbidity levels were low (0.1 NTU in the raw water).
3.	**Filtration** a. The raw water is pre-chlorinated for iron and manganese removal and is then filtered via two rapid gravity sand filters. b. Backwash is based on time. Each filter is backwashed every second day. When PAC is being used the backwash is more frequent to prevent closing of the filter media and is based on headloss. c. Filter No. 1 was backwashed on the morning of the audit. During the 45 minute backwash cycle, the filter in operation takes the additional loading of the plant, however it was stated that the filters have the capacity to do this and turbidity has not been noted to increase during this period on post filtration. A backwash of Filter no. 2 was requested and observed and air scour was even. However a full backwash was not observed as the inlet to the plant was shut-off accidently preventing sufficient water flow to the filter to complete the full backwashing cycle. d. There is no run to waste facility built into the filters. Instead the filter media is allowed to settle for 30 minute prior to being put into production. e. The sand media was replaced in 2013 and levels are dipped to ensure adequate depth of sand media is in place. f. There is a turbidity monitor on each filter and the results from the filters on the date of the audit post observing the partial backwash on Filter No 2 were 0.09 NTU for Filter 2 and 0.1 NTU for Filter 1. The raw and final water monitors were both reading 0.1 NTU. This shows there little removal of turbidity by the rapid gravity filters. g. Turbidity for July ranged from 0.08 to 0.69 NTU in the treated water and was generally on average 0.2 NTU in the network. However, the raw water quality has spikes of turbidity close or in excess of 1 NTU (which was evident on 05-07/08/15) which can last several days and can impact on the final water quality if it is not adequately treated on-site (see reference to incident in Point 7 below). h. The caretaker is not alerted by text to a turbidity reading until it exceeds 1 NTU on the final water for 30 minutes and at this stage the plant automatically shuts down. This alarm set-up does not afford the caretaker time to react to deterioration in the raw water in an effort to prevent inadequately disinfected water being sent into the distribution network. i. It was highlighted at the audit that both filters needed to be cleaned (See Photo 3) and the channel in Filter No. 1 had a gap and was in need of repair.
4.	**Chlorination and Disinfection** a. A duty and standby UV disinfection treatment unit (which is validated to 73% UVT at flow volume of < 75 m^3/hr) provides disinfection at the site. A copy of the validation criteria was available on the audit. The flow at the inlet on 05/08/15 was 64.1 m^3/hr and 62.2 m^3/hr on 06/08/15. b. The duty and standby unit are frequently switched over manually to ensure both units are operating effectively. c. The plant is alarmed when the UVT goes below 73% for 30 minutes resulting in a plant shut down. The caretaker stated that the UV system has never alarmed as a result of it going outside the validation range. d. The UVT at the time of the audit was 91.8% and was last serviced on 14/07/15 by EPS. Internal calibration checks are also carried out and logged by GCC and this was last completed on 21/07/15. e. A review of the UVT results from the SCADA print out provided prior to the audit show there was a drop in UVT from an average of 90% to approx. 80% coinciding with the elevated levels of turbidity from 05-07 August 2015. f. 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 – *E. coli* in Drinking Water.

	g. The plant shuts down if the chlorine residual is less than 0.5 mg/l in the final water for more than 30 minutes. The hi hi chlorine set point was set at 2.5 mg/l and this was raised to 3 mg/l after the detection of microbiological failures at the Ballygar PWS early August as a consequence of increasing the chlorine dose at the Mountbellew water treatment plant. The chlorine residual target is 1.2 mg/l leaving the plant and was 1.83 mg/l on the day of the audit. The final water pH was 6.69. h. The chlorine dosing lines remain outdoors and have not been frost proofed (this was raised in the EPA's audit of 2012). GCC stated that this would be arranged with ease if the weather deteriorated. i. Post chlorination the water goes to an 18 m^3 clearwater tank and on to another of the same size before being pumped to the reservoir at Corgory. There is approximately 30 minutes storage between the two clearwater tanks. The Corgory reservoir has level sensors. j. There is a cascade system in place for the four alarms set (raw water colour, final water turbidity, UVT and chlorine residual) which are sent by text to staff personnel. The staff working at the plant noted that at times the signal is poor and a text may not arrive to a mobile phone for a number of hours later.
5.	**Treated Water Storage and Distribution Network** a. The Corgory Reservoir serving the Mountbellew was built in the late 1980's and has a 6-7 hour storage time. It has not been cleaned out since it was constructed. b. There is no chlorine monitor post the reservoir to determine the residual entering the network post storage.
6.	**Monitoring and Sampling Programme for treated water** a. Monitoring results for 14/08/15 were provided during the audit for the Mountbellew raw water, treated water, St Annes B&B Mountbellew, Siopa n Phobail, Newbridge and S. Connolly, Woodbrook, Newbridge. 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 < 0.2 NTU. b. 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.
7.	**Exceedances of the Parametric Values** a. On 05/08/15 the raw water showed elevated turbidity at 1.26 NTU due to heavy rain. The filtered water was 1.15 NTU post Filter No. 1 and Filter No. 2 and the final water was 0.94 NTU. PAC was manually introduced prior to the filters to reduce the final water turbidity. The UVT, while within its validated range of >70.3% dropped from 91% on 04/08/15 to 85.5% on 05/08/15. The chlorine residual readings taken in the network showed a 50% decrease in chlorine residual levels (0.32 mg/l at college road). The caretaker increased the chlorine dose at the plant in response. b. PAC was introduced again on 06/08/15. The final water turbidity was > 1NTU frequently for a number of minutes. The caretaker is not alerted to these turbidity spikes as they are displayed only under the alarm settings read-out on a screen at the plant. The plant shut-down at 15.23 due to the final water having a turbidity of > 1NTU for 30 minutes. The caretaker was alerted to this via an automated text and found upon investigating the cause that the PAC injection point had blocked. The caretaker released the injection point and re-started the plant. However turbidity continued to spike above 1 NTU at the plant from 16.11 onwards (all occurring for less than 30 minutes, which again were not alerted to the caretaker). c. On 07/08/15 the raw water continued to show high turbidity readings (0.91 NTU recorded in the daily log book) and final water at 0.85 NTU. PAC continued to be used at the plant. The UVT dropped further to 82% and chlorine residuals in the network fell further at College Road (to 0.2 mg/l – usually 0.5-0.6 0.6 mg/l) . The chlorine dose was increased further at the plant. The alarm history shows that there was a power-cut at the plant which shut the plant down. The caretaker stated that this can happen often. It was stated that there is a back-up generator on-site but it appears that it is not used. d. On 06/08/15 there was an Enterococci failure in the Ballygar PWS. Follow-up sampling on

	the 11/08/15 in the Ballygar PWS showed gross levels of *E. coli* contamination (> 201 No./ml) at a number of locations in the town and inadequate chlorine residual levels in the failed samples. The Ballygar supply was supplemented by the Mountbellew PWS at this time. There were no chlorine residual readings taken in or around this time nor historically on the mains between Mountbellew and Ballygar prior to entering the water tower in Ballygar and mixing with the water from the Ballygar Water Treatment Plant. e. The low chlorine readings taken in the network near the Mountbellew water treatment plant between the 06/08/15 and 09/08/15 would suggest that there were inadequate chlorine residuals in the Mountbellew PWS network that feeds the tower at Ballygar. The UVT reading logged on 06/08/15 on the final water at Mountbellew was lower than normal at 86%. f. 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. g. Chlorine residuals taken at various points along the network between Mountbellew town and Ballygar from 13/08/15 were satisfactory and > 0.1 mg/l. h. 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. i. 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.
8.	**Chemical storage and bunds** a. A drum of Sodium Hypochlorite 14% was out of date (expiry date of 13/06/15 was on the drum's label - see Photo 4). It was stated post the audit that this was not used in the treatment process but for general cleaning on-site.
10.	**Management and Control** 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. b. There was no programme in place for maintenance of the supply's reservoirs, filters and the network (e.g. a network flushing programme).
11.	**Monitoring and Sampling Programmes for Treated Water** a. It was agreed to monitor for iron pre and post filtration to determine if pre-chlorination is actively reducing the iron / manganese in the raw water. b. GCC have arranged to undertake additional sampling of the network to confirm that disinfection is adequate and the water quality is safe.
12.	**Sludge Management** a. The backwash water is discharged to an underground tank. The supernatant flows to a percolation area on-site.

3. AUDITORS COMMENTS

The Mountbellew Water Treatment Plant was on the original Remedial Action List in 2008 under the heading "Poor turbidity removal" due to elevated levels of turbidity in excess of 1.0 NTU. The treatment plant was removed from the RAL in 2013 due to its upgrade to include the provision of two rapid gravity filters and intermittent PAC dosing for turbidity removal. The raw and treated water turbidity results at the Mountbellew water treatment plant indicate that the filters are not capable of removing sufficient levels of turbidity when the raw water turbidity level elevates. There is a heavy reliance on the caretaker to be aware of deterioration in raw water quality and to manually instigate PAC treatment in order to ensure adequate final water quality. The current set up of alarming the caretaker by text only when the plant goes to shut-down (e.g. after 30 minutes of turbidity being greater than 1 NTU in the final water) is not affording the caretaker time to ensure turbidity

levels in the final water are acceptable and it leaves the customers extremely vulnerable to consuming inadequately disinfected drinking water. Increases in turbidity due to raw water spikes or filter breakthrough as was seen on 06/08/15 at the Mountbellew water treatment plant can negatively impact delivery of the UV dose and may compromise disinfection if not properly accounted and adjusted for during operation as particles can provide protection to bacteria against UV inactivation and are capable of harbouring viruses.

Irish Water must review the treatment (turbidity removal) and disinfection controls at this plant and ensure that the caretaker is alerted of deterioration in raw water quality before it affects the final water leaving the plant.

4. RECOMMENDATIONS

1. Irish Water should investigate the Mountbellew PWS treatment process and network to determine if either was the source of the microbiological contamination on 06/08/15 and 11/08/15 in Ballygar town. This investigation should include reviewing the raw water quality, PAC system, UV and chlorination disinfection process, chlorine demands, water pressure, any ingress of contamination along the line, inadequately sized mains, the reservoirs, etc. which could have contributed to the failures. Irish Water should ensure that in future all possible avenues of contamination are investigated in the event of an incident (i.e. not just look at the sample point and surrounding locations, as was the case in response to the Enterococci failure on 06/08/15 in the Ballygar PWS).

2. Irish Water should ensure that the levels of turbidity in the filtered water are as low as possible and no greater than 0.25 NTU post filtration. Irish Water should undertake a review of the coagulation process at the water treatment works to include automation of the PAC treatment when the raw water quality deteriorates. Aluminium levels in the final water should also be monitored and recorded with the PAC treatment is in operation. Irish Water should take account of the recently published EPA Advice Note 15: Optimisation of Chemical Coagulation Dosing at Water Treatment Works available online at http://www.epa.ie/pubs/advice/drinkingwater/dwadvicenote15.html.

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 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 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 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.

6. Irish Water should arrange to have Filters No. 1 and 2 cleaned and carry out maintenance works on the channel in Filter No 1. Irish Water should ensure that the filters are cleaned on a regular basis to prevent build-up of algae on the channels and on the walls of the filters. Irish Water should have a maintenance programme in place for cleaning filters and other equipment used in the treatment and provision of drinking water.

7. 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.

8. Irish Water should ensure that the service reservoir 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.

9. Irish Water should instigate a regular programme of flushing and scouring of the mains.

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: Derval Devaney **Date:** 27th August 2015

Derval Devaney

Inspector

Photo 1 Spring source covered - note thin layer of fine silt on inlet

Photo 2 Liquid Poly Aluminium Chloride (PAC) dosed imtermittently pre-filtration

Photo 3 Filter No. 1 showing algae on filter walls and channel and gap in channel (circled in red)

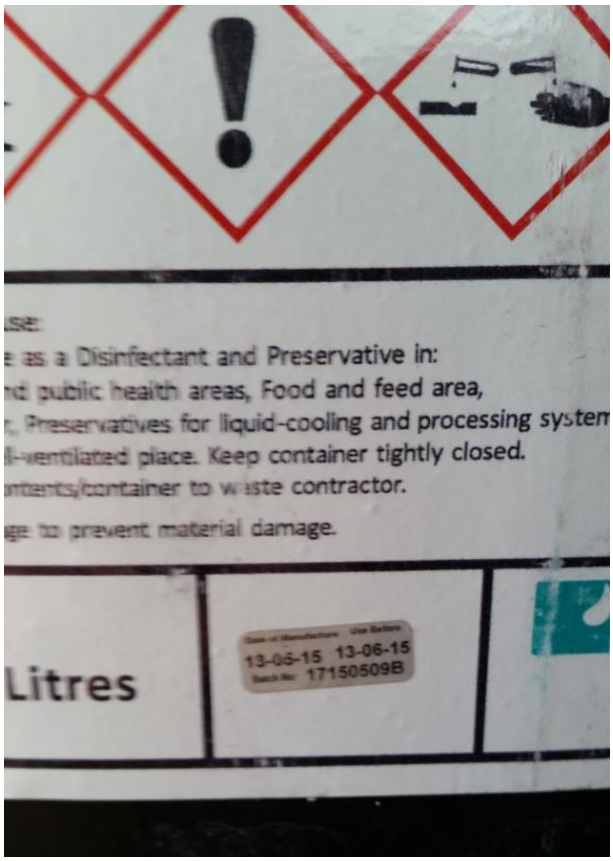

Photo 4 A Drum of Sodium Hypochlorite 14% gone past its "Use Before" date