



# Drinking Water Audit Report

<b>County:</b>	Donegal	<b>Date of Audit:</b>	20 <sup>th</sup> September 2016
<b>Plant(s) visited:</b>	Frosses-Inver Water Treatment Plant	<b>Date of issue of Audit Report:</b>	14 <sup>th</sup> October 2016
		<b>File Reference:</b>	DW2016/144
		<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>• <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> </ul>		

## MAIN FINDINGS

- i. **Pin-floc carry-over from the clarifiers to the filters and the cause of aluminium failures in the network requires further investigation.**
- ii. **The disinfection process is to be upgraded by year end which may incorporate enclosure of the coagulation, flocculation and clarification (CFC) stage to provide protection from the elements during the winter period.**
- iii. **There is no sludge handling facility at this treatment plant. Sludge generated from the treatment process is discharged to a stream which enters the River Inny.**

## 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 to assess the performance of Irish Water in providing clean and wholesome drinking water and to investigate the notification submitted by Irish Water on 19<sup>th</sup> August 2016 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 Frosses-Inver Public Water Supply (PWS).

The Frosses-Inver PWS serves 4,825 persons and during 2015 produced, on average, 1,876 m<sup>3</sup> /day of treated water. Information in EDEN states this supply serves 4,778 persons and produces 1760 m<sup>3</sup>/d. Demand increases during the tourist season due to the area serving a substantial number of holiday homes. An upgrade to the Frosses-Inver PWS resulted in the decommissioning of the Upper and Lower Mountcharles Water Treatment Works in December 2007. The upgrade included laying a new raw water pipeline from St Peter's Lough to the plant at Frosses Inver and the construction of a new rising main to a new reservoir on Glencoagh Hill during 2005/2006. During 2007 Phase II of the upgrade works commenced with the installation of a standalone 1,200 m<sup>3</sup>/d capacity water treatment plant (including contact tanks, a sedimentation tank, rapid gravity filters and a high-lift pumping station to transfer the treated water to the new reservoir at Glencoagh Hill). As a result there are two water treatment plants at Frosses-Inver; the new plant treating water from St. Peter's Lough (referred to as Stream 1) and the old plant (a sedimentation tank and rapid gravity filters) built in 1972 with a contact tank installed in 2008 as part of the upgrade which treats water from Glencoagh Lough (referred to as Stream 2). Treated water from both supplies is blended in the final water tank prior to delivery to the headworks reservoirs.

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 10 am at the Frosses-Inver 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:**

Martin Temple, Operations and Maintenance; Yvonne McMonagle, Compliance; Diarmuid Campbell, Process Operations; Pat O’Sullivan, Compliance.

Donegal County Council: Paul Lyons, Senior Executive Engineer; Martin Gallagher, Executive Engineer; Eddie McGrane, Supervisor; Patrick Haughy, Water Works Inspector; Martin Keeney, A/ Water Works Inspector; Eamonn Kelly; Electrician/Process; Hugh Kerr, Chief Technician.

**Representing the Environmental Protection Agency:**

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.	<p><b>Source Protection</b></p> <ol style="list-style-type: none"> <li>a. The average flow from St Peter’s Lough is 65m<sup>3</sup>/hr (max. 70 m<sup>3</sup>/hr) and 35m<sup>3</sup>/hr (max. 40 m<sup>3</sup>/hr) from Glencoagh Lough. The lake sources (St. Peter’s Lough and Glencoagh Lough) were not visited as part of this audit.</li> <li>b. The catchment area consists of 180 ha. St Peter’s Lough is manmade; it was a disused quarry site and is used mainly for fishing with no motorised boats allowed. Its source is mainly spring-fed. There are very few houses in the catchment and it is not intensively farmed with no slurry spreading being carried out. The catchment area around the intake is inspected on a monthly basis.</li> <li>c. The <i>Cryptosporidium</i> risk score is 60 (moderate risk), however it is stated on EDEN that it is low risk (score of 44). There is no monitoring for <i>Cryptosporidium</i> on the scheme unless the HSE requests it. <i>Cryptosporidium</i> monitoring was carried out on 02/05/13 at the request of the HSE at a household tap to investigate a <i>Cryptosporidiosis</i> case. The result was clear.</li> <li>d. Letters in relation to the requirements of the <i>European Union (Good Agricultural Practice for the Protection of Waters) Regulations 2014 (SI No.31 of 2014)</i> have been issued by Donegal Co. Co. to relevant farmers in the catchment area.</li> <li>e. Water is fed by gravity to the treatment plant. Raw water is monitored daily for colour and pH. There is also an online pH and turbidity monitor on both raw water sources. The online monitor for St Peter’s Lough source had a pH of 7.18 and turbidity of 2.93 NTU and at Glencoagh Lough a pH of 7.24 and turbidity of 5.95 NTU on the day of the audit. There is an online flow meter on the intake from these sources also.</li> <li>f. The raw water is monitored 10 times per year for microbiological parameters.</li> <li>g. St Peter’s Lough is subject to seasonal changes and algal blooms. An algal bloom affected that raw water source for 2-3 weeks 4 years ago, but this has not occurred since. Glencoagh Lough’s water quality is more stable.</li> <li>h. There are screens at both intake areas to remove any debris from the lake water.</li> </ol>
2.	<p><b>Coagulation, Flocculation and Clarification</b></p> <ol style="list-style-type: none"> <li>a. Raw water from each source is treated separately at the Rosses Regional Water Works site.</li> </ol>

	<p>For ease of reference Donegal Co Co &amp; Irish Water refers to Glencoagh Lough as Stream 2 (the old plant) and St Peter's Lough as Stream 1 (the newer plant).</p> <ul style="list-style-type: none"> <li>b. The average flow into the plant from Stream 2 is 35 m<sup>3</sup>/hr (the design flow is 42 m<sup>3</sup>/hr) and the average flow from Stream 1 is 65 m<sup>3</sup>/hr (the design flow is 70 m<sup>3</sup>/hr).</li> <li>c. There is a flash mixer, a rapid mixer and a 3<sup>rd</sup> tank with a slower mixer to treat water from Stream 1. The same process is set up on-site to treat water from Stream 2. Both treatment systems were installed with the addition of the new plant in 2008.</li> <li>d. Soda ash (sodium bicarbonate) is added from a day tank at a concentration of approximately 18 mg/l to Stream 1 and 26 mg/l to Stream 2. The target pH post clarification is 6.5 – 6.6. There is approximately a 3 minute delay prior to the addition of liquid aluminium sulphate (approximately 130 mg/l to Stream 1 and 143 mg/l to Stream 2) to the flash mixer tank. There is a 3 minute contact time here prior to the addition of polyelectrolyte LT25 at a concentration of approximately 0.15 mg/l.</li> <li>e. There is jar testing equipment on-site and testing was carried out the day before the audit.</li> <li>f. Stream 1 and 2 enter separate clarifiers. Stream 2's hopper bottomed clarifier has an upflow rate of 1.27 m rise /hr and sludge bleeds of 5 m<sup>3</sup> every 30 seconds and a turnover of 7 bleeds per hour. Stream 1's flat bottomed hopper has an upflow rate of 1.02 m rise/hr. Pin-floc was observed entering the decanting troughs of both clarifiers for delivery to the filters.</li> <li>g. The clarifiers are cleaned twice per year. There are turbidity meters on the settled water of Streams 1 and 2 which read 0.71 NTU and 2.4 NTU respectively.</li> <li>h. On the day of the audit three online aluminium monitors were being installed at the plant on the filtered water of Stream 1 and Stream 2 and the final combined water to provide greater control and understanding of the coagulation process.</li> <li>i. Adverse weather conditions, particularly during the winter months have affected the coagulation process (e.g. pipes freezing and issues with floc formation due to freezing temperatures). The disinfection upgrade which is to house a new bulk storage tank may address this by also roofing the CFC process.</li> </ul>
<p><b>3.</b></p>	<p><b>Filtration</b></p> <ul style="list-style-type: none"> <li>a. Stream 1 and Stream 2 each have two rapid gravity sand filters (RGSFs). All four RGSFs were upgraded this year with the replacement of sand and gravel (and carbon in Stream 1 filters) and scour nozzles inspected.</li> <li>b. The filtration rate for Stream 1's RGSFs is 5.8 m<sup>3</sup>/m<sup>2</sup>/hr and for Stream 2's RGSFs is 4.22 m<sup>3</sup>/m<sup>2</sup>/hr.</li> <li>c. Backwash is automated based on time (300 seconds every 36 hours) but can be operated to backwash on turbidity (above 0.5 NTU) or head loss.</li> <li>d. A backwash was observed on Filter No. 2 of Stream 2's treatment process and deemed satisfactory with even air and water distribution noted. A run to waste facility is present on the filters based on time and observation of the turbidity meters readout.</li> <li>e. There are two No. Granulated Activated Carbon (GAC) filters post Stream 2' RGSFs with a filtration rate of 5.8 m<sup>3</sup>/m<sup>2</sup>/hr. The media was replaced in both GAC filters during in April 2016. These filters were installed to address taste and odour issues with this source, particularly during algal blooms. The GAC filters were operational during the audit and it was stated that its operation generally ceases for a period from the end of October/November to Mid-March the following year.</li> <li>f. There are turbidity meters on the outlet of each filter and on the combined final water. On the day of the audit the turbidity meter post Filter 1 and 2 of Stream 1 read 1 NTU and 0.148 NTU respectively and the outlet post the carbon filter read 0.4 NTU. Filter 1 and 2 of Stream 2 read 0.087 NTU and 0.71 NTU respectively. The combined final water turbidity meter read 0.352 NTU on the day of the audit.</li> </ul>
<p><b>4.</b></p>	<p><b>Disinfection</b></p> <ul style="list-style-type: none"> <li>a. Filtered water from Stream 1 and Stream 2 is blended in a final water and backwash tank. Prior to each stream entering this tank the water is corrected using soda ash to obtain a target pH of 7.25.</li> <li>b. Water flows from the final water tank into Cell 1 and Cell 2 reservoir. Both on-site reservoirs have 192 m<sup>3</sup> capacity and were cleaned and inspected in August 2016. Both reservoirs are roofed.</li> <li>c. Chlorine gas was used in the past at this plant but has been replaced by 14% sodium</li> </ul>

	<p>hypochlorite. Drums containing sodium hypochlorite are being used as an interim measure until such time as the disinfection process is upgraded under Irish Water's Disinfection Programme. It is planned to install a chlorine bulk storage tank which is roofed on-site as part of such upgrade.</p> <p>d. Chlorine is flow proportionally injected by a duty (and standby) pump into the pipeline that delivers treated water from the final water tank to the on-site reservoirs. Approximately 2.6 mg/l of chlorine is dosed and mixed by an inline static mixer to achieve a chlorine residual target of 1.2 mg/l leaving the reservoir. The pumps switch over manually every 24 hours and it is planned to automate this as part of the disinfection upgrade.</p> <p>e. Fluoride is also dosed (approximately 0.6 mg/l) at the same location as the chlorine dosing point. The fluoridation process is due an upgrade and Irish Water is in contact with the HSE on this matter.</p> <p>f. A chlorine monitor is present on the mixed streams prior to entry to the reservoirs and post the reservoirs. The monitors were calibrated in September 2016. The caretaker also takes chlorine residual samples of the treated water to compare to the chlorine monitors and these are recorded in the plant's daily log book.</p> <p>g. The chlorine alarms on both chlorine monitors are set at 1 mg/l and a cascade system is in place to alert relevant persons of low chlorine levels in the treated water. The CL17 pre-reservoirs was reading 2.4 mg/l on the day of the audit, and 1.07 mg/l post the on-site reservoirs.</p>
<b>5.</b>	<p><b>Treated Water Storage and Distribution Network</b></p> <p>a. Treated water is pumped from the on-site reservoirs to Glencoagh Hill reservoir which was cleaned in August 2016. This reservoir is modern and roofed with a capacity of 1,363 m<sup>3</sup> and serves the Glencoagh area. It is planned as part of the Disinfection upgrade to install a chlorine monitor on the outlet to this reservoir. Water from the on-site reservoirs at the plant also flows east (i.e. does not enter the Glencoagh Hill Reservoir) to serve the Rosses Network.</p>
<b>6.</b>	<p><b>Monitoring and Sampling Programme for treated water</b></p> <p>a. There are 10 check and 2 audit compliance samples planned for 2016. Compliance sampling carried out during 2015 and 2016 was reviewed during the audit.</p>
<b>7.</b>	<p><b>Exceedances of the Parametric Values</b></p> <p>a. Aluminium exceeded the parametric value of 200 µg/l on 3 occasions in 2015 and on 4 occasions to date in 2016 with a maximum concentration of 801 µg/l. Compliance monitoring shows that aluminium results can vary greatly at the same location within a matter of weeks. There is an open file (DW2016/144) in relation to the notification of the aluminium failure of 801 µg/l on 02/08/16 in the network and information is due for submission to the EPA for assessment once this becomes available to Irish Water.</p>
<b>8.</b>	<p><b>Management and Control</b></p> <p>a. This plant is due upgrades under 2 Minor Programmes; the disinfection programme and flocculation programme. An initial review of the flocculation process was carried out by a consultant engineer a few months ago which will feed into the flocculation programme. The disinfection programme is expected to be complete by end of 2016 and the flocculation programme by the end of Q3, 2017.</p>
<b>9.</b>	<p><b>Sludge Management</b></p> <p>a. There is no sludge handling facility on-site. Since 1972, backwash water and material from sludge bleeds enters an open concrete tank (see Photo 1) and its contents are piped to a stream which flows into the Inny River.</p>

### 3. AUDITORS COMMENTS

The overall management of this supply is good with adequate records being maintained on the treatment process. The auditor notes the recent upgrade to the filters and cleaning of the clarifiers and

reservoirs and additional works that is proposed under Minor Programmes (i.e. under the Disinfection Programme and Flocculation Programme).

As an addendum to the audit, Irish Water submitted correspondence to the EPA on 07/10/16 stating Donegal County Council have identified the cause of the aluminium exceedence; the outlet valves on the filters were alarmed after the audit and found not to be holding 100% closed during run to waste and as a result run to waste water was entering the Clear Water Tank. Irish Water stated that replacement valves have been ordered and will be installed on receipt. The correspondence also stated that this plant has now been selected by Irish Water Asset Strategy regarding the automation of coagulation and will therefore get further attention over the coming weeks and months. This will include the collection of raw water data and asset data. It is hoped that the flocculation programme will bring about additional improvements to the CFC process and aluminium compliance.

Irish Water is requested to review the sludge handling practices on-site and determine if sludge discharge from the plant is having an impact on the receiving waters and the River Inny.

#### **4. RECOMMENDATIONS**

##### **Coagulation, Flocculation and Clarification**

1. Irish Water should carry out an investigation to identify the cause of floc carryover from the clarifier into the filters and complete works to improve the CFC process. As part of the investigation Irish Water should assess the efficiency of the sludge bleeds and should establish the optimum regime of sludge draw-off to ensure it is not affecting establishment of a proper blanket and contributing to floc carryover. In carrying out this investigation 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.
2. Irish Water should determine the feasibility of roofing the flocculation tanks as part of this upgrade to protect the CFC process from adverse weather.

##### **Disinfection**

3. Irish Water should, as part of the disinfection programme, ensure there is automatic switchover between the duty and standby chlorine dosing pump in the event of the failure of one of the pumps.

##### **Management and Control**

4. Irish Water should update information on this supply on EDEN to reflect current status (population served, volume of treated water supplies and its *Cryptosporidium* risk score).
5. Irish Water should submit the request for additional information under the aluminium file (DW2016/144) i.e. re-test results at the failed location post cleaning of reservoir and replacement of the filter outlet valves, the cause of the failure (if it is deemed that it is not a treatment plant issue as is now suspected) and 6 weeks of monitoring results from the newly installed 3 No. online aluminium monitors at the plant.

##### **Management and Control Sludge Management**

6. Irish Water should review current methods of handling and disposal of water treatment sludge to ensure that the practice is not in contravention of the *Waste Management Act, 1996-2003*. The discharge of water treatment sludge to receiving water, where practiced, should cease as soon as possible. Irish Water should submit a plan on how it is to handle sludge waste

generated at the plant. Irish Water should determine if sludge discharge to date has had any impact on the receiving waters. Leachate from stored drinking water sludge should not give rise to environmental pollution

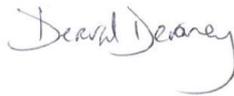
During the audit Irish Water representatives were advised of the audit findings and that action must be taken as a priority by Irish Water to address the issues raised. This report has been reviewed and approved by Ms Emer Cooney, Drinking Water Team Leader.

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 in any future correspondence in relation to this Report.

**Report prepared by:**



**Date:**

14<sup>th</sup> October 2016

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Derval Devaney

Inspector



**Photo 1 Holding tank for expended backwash water and sludge bleeds**