NATIONAL FEDERATION
OF GROUP WATER SCHEMES

Framework for Climate Action on Group Water Schemes

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Contents

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Introduction

The climate is changing and it will continue to change, affecting societies and the environment. While there may be uncertainty about the timing and scale of the change, that should not be used as an excuse to deny the process of change nor to fail to prepare. We have already seen (and can expect further) changes in the hydrological systems that are affecting water availability, water quality and water demand. So the time for climate action is now and forever.

Science tells us that profound changes are likely in the course of this century and beyond, and science further informs us that, as human behaviour is largely responsible, an alteration in human behaviour is urgently required, both to slow down the process of global warming and to make us better prepared to meet the unprecedented challenges facing society.

So where do group water schemes fit into the unfolding scenario? Is the GWS sector contributing to the problem of carbon (CO_2) emissions? Yes it is and it will continue to do so for as long as schemes rely on fossil fuel energy to power pumping systems and the operation of treatment facilities and offices and to fuel our vehicles. As an energy-dependent sector, group water schemes need to implement strategies that will significantly reduce their energy requirements and replace fossil-fuelled energy sources with renewable energy.

Does a changing climate, including more frequent storm events, have a bearing on the delivery of consistent, safe and wholesome drinking water supplies to rural communities? Of course it does; there are few sectors that are likely to be more acutely impacted than drinking water supplies because climatic conditions directly affect both raw water quantity and quality and any change in these has a knock-on impact on treatment systems, storage systems and distribution networks, up to and including the internal plumbing systems of our members. The challenge will be to design and implement measures that will make schemes more resilient so that they are better prepared to cope with whatever nature throws at them.

This guidance document aims to encourage and assist group water schemes to become more climate active and climate resilient. In particular, it aims to encourage schemes to actively reduce or eliminate their dependence on fossil-fuel energy sources and suggests steps that may be taken to build resilience from catchment/source to tap. Clearly, a large surface water scheme with full treatment and an extensive distribution network will have much more to think about than a small, borehole-sourced scheme, but both have a contribution to make and both need to prepare.

If there is one single climate action that is applicable to all group water schemes, it is reducing daily water demand. Indeed, this is likely to be the single greatest climate action that any scheme can take. Ireland is currently abstracting, treating, distributing and disposing of far more water than is required. This reality and its environmental and cost implications needs to inform our strategic direction if we are to build resilience in the drinking water and wastewater sectors. Excessive water demand means excessive and preventable pumping, treatment, backwashing and sludge disposal, as well as preventable pressure on distribution systems and wastewater systems. For this reason, the framework reiterates NFGWS guidance on reducing daily water demand that has issued previously and strongly recommends that schemes address excessive water usage and UFW as a priority.

While certain measures and particular actions advocated in this framework will require capital investment, the evidence to date from schemes that are already climate active is that there is a quick payback on such investment. They result in financial savings to the scheme and to the public exchequer, which currently finances the provision of potable water to GWS domestic connections. As a further financial incentive, there are several funding avenues available to schemes wishing to pursue climate-friendly actions. While the Rural Water Programme already provides funding towards GWS infrastructure, organisations such as the Sustainable Energy Association of Ireland (SEAI) and LEADER have funds available towards initiatives that specifically address CO2 reductions.

As an earnest of its commitment to addressing the challenges posed by extreme weather events and to tackling the climate crisis, in 2019 the Board of the National Federation of Group Water Schemes appointed Róisín Dowd Smith as development officer with special responsibility for driving the climate actions included in the Federation's 6-year strategic plan. By 2025, the Board expects that schemes will have:

• considered their vulnerability to weather events from source/catchment to tap.

• developed plans to deal with incidents/emergencies.

• gained a better understanding of the impact that extreme weather events have on raw water quality.

• installed filtration systems that are automatically responsive to variations in raw water quality.

• installed back-up power systems in readiness (especially schemes relying on direct pump systems).

In developing this guidance document, the Federation has engaged with the National Plan on Climate Action and the Climate office established by government. We have also engaged with SEAI and other statutory and voluntary agencies, all of the time building on our understanding of how the GWS sector might contribute to climate action and build resilience. This document provides a synthesis of what we have learned to date, but the emerging issue of manganese exceedances in surface supplies (due to anoxic conditions generated by extreme heat) suggests that we will face further, as yet unforeseen, challenges as the climate crisis deepens.

Energy consumption in the GWS sector

Most costs in water supplies arise from the use of electricity to pump water from the source to the treatment plant, the operation of treatment processes and backwashing and, from there, pumping to a storage reservoir or directly to consumers. Besides the expense involved, energy use constitutes the single greatest contribution of the sector to CO2 emissions.

As part of Climate Change preparations:

- energy audits should be completed on all supplies and their recommendations implemented as quickly as possible.
- positive consideration should be given to installing alternative, zero carbon or carbon neutral, energy generating systems.

Energy auditing

What does an energy audit involve? Between 2018 and 2019, in response to a request from the NFGWS, six group water schemes in Leinster completed a professional audit with Tipperary Energy Agency CLG (TEA). The audits included:

Analysis of electricity billing data

Evaluation of pump characteristics and performance

Recommendations towards reducing energy use

Traditionally such audits focus primarily on potential **financial** savings and this study was no different. Following discussion with the NFGWS it was agreed that in addition to establishing cost savings, that future energy audits should focus on the potential benefits for a scheme of achieving its 'legitimate' or 'theoretical' water demand'[1] through improved water demand management and pressure control in the network as well as by encouraging water conservation on the consumer side of connections.

Apart from strongly recommending that *all* group water schemes go to the market annually to secure the lowest price possible for electricity, the studies found potential energy savings ranging from almost 7,000kWh on Clareen GWS to 77,606kWh on Killeigh GWS and totalling 147,754kWh per annum across six participating schemes.[2] These savings arose from what were termed simple 'low hanging fruit' measures, with little or no capital outlay required, as well as capital projects. The primary focus of the studies was on the efficiency of the pumps being used and the speed at which they were being operated. To quantify the energy performance of pumps, TEA utilised kWh/m^3, as this is the standard

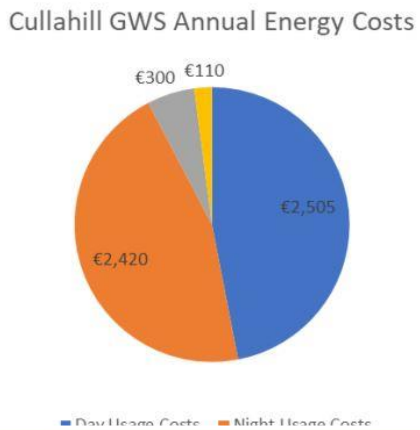
[1] Legitimate (theoretical) water demand is calculated by allowing a specific daily volume of water to all consumers (human, animal, industrial) within a supply area. The NFGWS provides a ready reckoner for assessing water demand across all uses.
[2] See Climate Action section on the NFGWS website for the completed reports.

Energy Performance Indicator (EnPI) of water pumping. In other words, it asked how much energy is being used to pump a cubic metre of water.

Recommending the installation of variable speed drive (VSD) pumps, the reports emphasised that a pump without a VSD will drive its motor at full output regardless of what speed the pump requires, leading to low overall efficiency. A VSD will also slowly ramp up or down to the setpoint speed, to drive the motor and will pump more gently, which reduces wear and tear.

Cullahill GWS, an 80-house scheme in Laois, participated in the TEA study. This scheme consists of a source pump as well as pumps delivering water from the treatment facility to a high reservoir (mostly overnight). Treatment includes nitrate removal as well as UV and chlorine disinfection. The distribution network is supplied via gravity, with annual electricity consumption totalling 40,797 kWh.

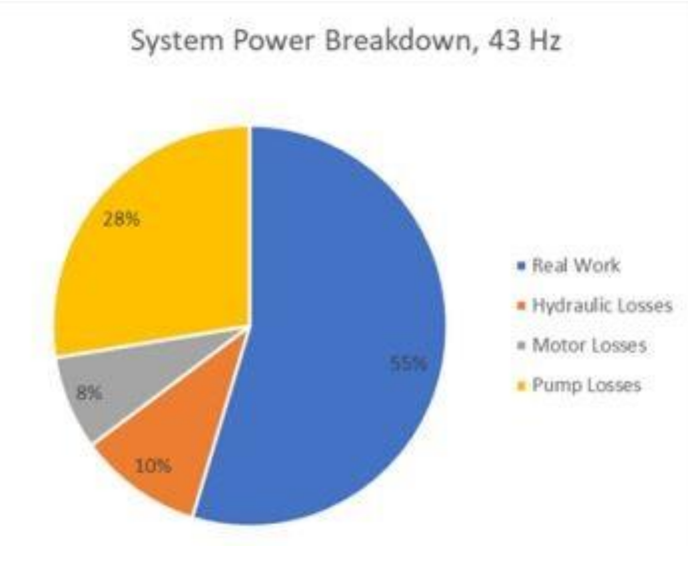
Four energy-saving opportunities were identified during the audit which, if executed, would generate energy savings of 11,264 kWh per annum, a 28% reduction on current fossil-fuel energy demand. The capital cost of each measure was included (where applicable), the annual saving that would accrue (energy and cost), and the projected payback period.



Measure	Annual Energy Savings (kWh)	Annual Cost Savings (€)	Capital Cost (€)	Payback Period (yrs)	Comment
Change energy suppliers	-	€1,290	-	-	Easy cost savings could be achieved my getting a better deal for electricity supply to the site.
Replace main pump with newer more efficient pump	7,558	€912	€15,000	16.4	Existing pump is approx. ten years old. Newer modern pumps could operate more efficiently than the existing pump.
Slow down pumps to reduce friction losses	1,297	€124	-	-	There are relatively high friction losses at the speed the pump is being ran at. Slowing down would lead to reasonable savings. The existing pump will not save energy by slowing down, but a newer pump would.
Install 2.6 kW roof mounted Solar PV array, along with a 5kWh battery	2,409	€478	€7,350	15.4	Roof mounted solar PV, with 5 kWh battery to store excess energy would offset daytime consumption, and reduce electricity bill.
TOTAL	11,264	€2,805	€22,350	8.0	

The Eglish, Rath & Drumcullen GWS study explains that the energy needed to pump water can be split into two components; **static head loss** and **dynamic head loss**. Static head loss is the potential energy input to the water working against gravity - to raise it up from point A to point B (e.g. from a well-site to a reservoir). As a function of the height water is lifted, static head loss can't and won't change. Indeed, a theoretically perfectly efficient pumping system would turn all input energy to static head losses. The second component, dynamic head losses comprises friction losses from transporting water in a pipe. Thinner pipes and higher velocities both result in higher dynamic head losses. Reducing dynamic head losses is the simplest way to improve energy efficiency at a water pumping facility. Further energy savings will accrue from ensuring the efficiency of the pump motor and optimising the pumping regime.

In the case of Eglish, Rath & Drumcullen GWS, duty and standby pumps at the treatment facility lift water 48 metres to a reservoir site 5.2 kilometres distant through a 150mm diameter pipe.[3] Using the EnPI to assess energy demand, pump no. 1 was found to demand 0.313 kWh/m^3 while pump no. 2 proved less efficient, demanding 0.328 kWh/m^3. While operating at its optimum frequency of 43 Hz, the overall pumping system was 55% efficient. The study found that *'11% of the energy is lost in motor inefficiency, 24% is lost in pump inefficiency and 10% is lost in hydraulic losses (i.e. dynamic head/friction losses in the pipe*)'. As 55% loss is deemed to be a reasonably good performance of a pump operating in the conditions pertaining at Rath, it was estimated that a 7% reduction could be achieved by upgrading the less efficient pump. However, given the projected costs of pump replacement and the length of the pay-back period, it was decided that this would not be a cost-effective means of reducing mains energy demand.[4]



Eglish, Rath & Drumcullen GWS pump system energy demand.

Renewable Energy

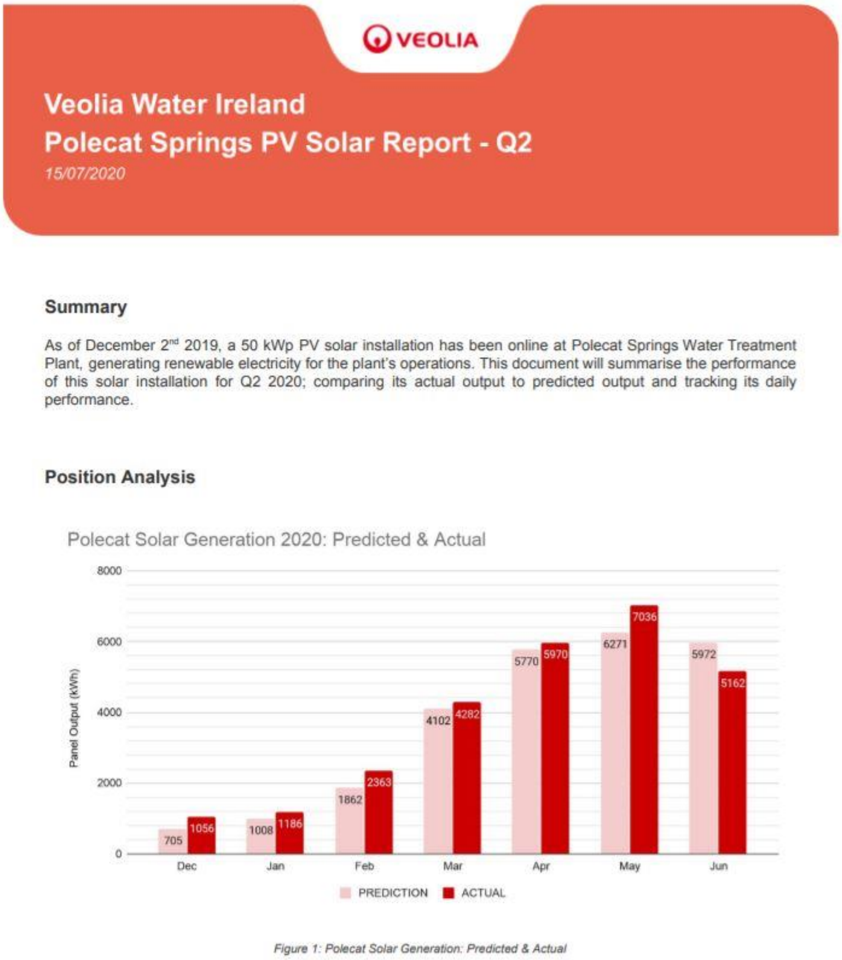
TEA determined that a preferable strategy for Eglish, Rath & Drumcullen would be to offset current energy usage by generating energy on site, reducing the energy imported from the grid. It estimated that

[3] The study references a leak somewhere in the rising main, 'losing approximately 100m^3 /day since October 2017'. However, the GWS has clarified that this water is not being leaked but is supplying a number of houses and a large mill that are connected off the rising main. There are plans to run a line from the distribution main to these premises, and this will result in further energy savings on the rising main.

[4] This was, in fact, the opinion of Grundfos Pumps which was consulted by TEA as part of the study and showed commendable objectivity in making their assessment. The cost of the replacement pump was €23,000, excluding VAT and labour, with an estimated payback period of over 20 years.

a 20-kW solar PV array, with an 8-kWh battery would reduce fossil-fuel energy consumption on site by 17,427-kWh per year. To fully assess the performance of these systems, they need to be connected to the internet at all times. In the case of Eglish, Rath & Drumcullen GWS, the scheme manager, Noel Lyons, is happy that the system is meeting its projected output. He cautions, however, that there is, as with all solar arrays, a major differential between summer and winter solar energy generation.

In 2019 Pollacat Springs GWS in Roscommon (with full co-operation from its DBO service provider, Veolia Water), completed the installation of 158 PV solar panels. These were projected to meet 75% of energy demand in the treatment plant at full production. In fact, energy production from this array has far exceeded projections.[5]



As in Eglish, Rath & Drumcullen, surplus energy [e.g. when storage batteries are full] is fed into the National grid. Although there is currently no tariff payable on this energy, it is anticipated that a tariff will be introduced as an incentive to individual householders to help the State meet its ambitious renewable energy targets.

Alternative energy is also being generated on Blackstairs GWS in County Wexford. In this case, a low-cost pump-as-turbine (PAT) was installed on the inflow pipe to the raw water tank as part of the Dwr/Uisce Project.[6] This generated 12,689kWh in 2020. This technology is particularly applicable to group water schemes with a reservoir, as this provides the pressure to drive the PAT.

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[5] Over the 9-month period the system was operational during 2019, it generated 44,584kWh. To date in 2021 the solar panels have generated 82,089kWh.

[6] For details of the Dwr Uisce project on Blackstairs GWS, see https://nfgws.ie/blackstiars-gws-reducing-its-carbon-footprint/.

Building climate resilience in the GWS sector

Adopting a risk-based approach will mean that actions and resources can be targeted to where they are most needed in building resilience to climate change in the GWS sector. Therefore, assessing the current level of risk on each supply from catchment to tap is strongly recommended as a starting point. Such assessments will include a review of historic data and the gathering of additional data where there are gaps. This assessment will consider:

- raw water variability (what is driving it and the measures actions needed to minimise it)
- capacity of treatment systems to deal with deteriorating quality
- vulnerability to extreme weather events (very heavy rainfall, flooding, extreme cold and heat, prolonged drought, high winds)
- water demand management (water loss and legitimate water usage)

Raw water variability

A reasonable assumption can be made that all surface water supplies are subject to variability. It can also be assumed that groundwater sources influenced by surface water flow (such as springs in karst areas and shallow wells) are likely to be subject to variability. Deeper, well-constructed boreholes, on the other hand, may or may not exhibit variability to short-term extreme weather events or activities at catchment level. However, they may be susceptible to long periods of drought in terms of both water quantity and water quality and to nitrate as a diffuse pressure.

There are some historic records that will help in building up data on vulnerability, including data collated as part of a Raw Water Monitoring Programme co-ordinated by the National Rural Water Monitoring Committee over a 2-year period at the turn of the Millennium. Raw water sampling was also completed in advance of design, build, operate projects and, more recently, as part of zone of contribution (ZOC)/catchment delineation reports completed on all group water scheme sources. Because of the limited treatment required on most GWS groundwater supplies, drinking water quality analysis (as part of compliance and operational monitoring) over several decades can also provide a rich historic database to help a scheme determine the extent of variability in its source. NFGWS development officers can assist schemes in accessing historic data on water quality.

Having established that there is variability, the risk assessment must determine what is driving it so that appropriate measures and actions can be implemented to minimise variability. The development of an Integrated Source Protection Plan (ISPP) for any GWS supply will necessitate a programme of monitoring over a 12-month period to establish a baseline, but schemes should already be monitoring several key parameters (including turbidity) as well as any parameters that are known to vary (e.g.

nitrate in some groundwaters and manganese in some surface waters). In addition to periodic monitoring, sampling should be completed during and after extreme weather events as most variability is weather related. Weather stations (preferably linked to raw water turbidity monitors) should be installed on all group water schemes. There should also be ongoing monitoring of activities in the delineated source catchment. Under the recast Drinking Water Directive, raw and treated water turbidity monitoring will be expected of water suppliers, so group water schemes should consider moving forward with this investment on those supplies that don't already have turbidity monitors and weather stations installed. For some surface water schemes with a high potential for THM formation, UV absorbance monitoring should also be considered.

In terms of judging the responsiveness of groundwater sources to extreme weather events, the initiative taken by in some local authority areas to place loggers in GWS boreholes should be replicated on all borehole schemes, as this will provide essential information on aquifer depletion during prolonged dry weather and will allow the scheme to determine the rate of recovery during precipitation. Similarly, loggers on the outflow from springs and staff gauges on lake sources would make an important contribution to better understanding how these sources respond to extreme weather events.

Capacity of treatment systems to deal with deteriorating quality

There are two principal treatment barriers that need to be considered: filtration and disinfection. Filtration barriers range from a simple cartridge filter on a good groundwater supply (i.e a supply that has consistently high clarity and has turbidity of <0.2 NTU), to full DAF treatment on impacted surface water supplies.[7] As the objective of filtration is to reduce turbidity below 0.2 NTU, this may be achieved using a single filter or two or more filtration systems, with turbidity levels being progressively reduced. Management of the filters and of the media within them will determine whether or not the objective is being achieved. The only way to verify that systems are performing optimally is to measure turbidity at the raw water intake and after each filtration process. On surface water supplies with high variability, there is a case to be made for linking raw water turbidity monitors to the GWS weather station and to coagulant dosing, to ensure speedy responsiveness to change. The raw water turbidity monitor should also trigger automatic shutdown of a supply where water quality deteriorates to a point that is outside the design capacity of the treatment facility.

As microbiological contaminants pose the greatest risk on drinking water supplies, it is essential that disinfection systems can effectively cope with raw water variations and that there is automatic cut-off of a supply where they cannot do so. Where UV disinfection is installed, it should always be preceded by appropriate filtration and must be validated so that it operates within pre-defined limits for both the

[7] See EPA Filtration Manual (December 2020) at EPA-Water-Filtration-Manual.pdf

transmissivity of the water (UVT) and the intensity of light from the UV bulbs (UVI).[8] Automatic shut-off of the supply is particularly important where UV is the only treatment barrier in a supply with a high risk of Cryptosporidium contamination.

For chlorination, duty and stand-by dosing pumps, with automatic changeover and alarms are essential. The chlorine dose required will be informed by the quality of the filtered water, including pH and ammonia levels, and by several other factors as outlined in the EPA Filtration Manual[9] and the NFGWS publication Chlorination information for group water schemes.[10]

Vulnerability to extreme weather events

Very heavy rainfall, flooding, gale force winds, extreme cold and heat and prolonged drought may all impact on group water schemes. Raw water changes follow torrential rain as contaminants are washed into a source, while flooding will pull contaminants into the source as the floodwaters recede. Gale force winds have the potential to disturb the bed of lake sources. Extreme heat can lead to algal blooms that put pressure on filtration systems and may contain Microcystin L-R (a parameter under the revised Drinking Water Directive), as well as creating anoxic conditions and the release of naturally-occurring manganese oxides. Combined with prolonged drought, extreme heat inevitably gives rise to increased water demand at a time when source levels are falling. Extreme cold can similarly result in increased demand as some consumers leave taps running to prevent pipes freezing and, as a consequence, there may be reduced water pressure (or no water) for homes and businesses in more elevated areas. Leakage is more common in conditions of extreme cold, arising partly from the fact that pipe services on the network or after consumer connections are not buried deeply enough. Meters burst where frost bungs are not in place and fittings on items such as drinking water troughs may also burst. There is also the issue of reduced access to the source, abstraction points, treatment plants, storage reservoirs and to burst pipework during and after extreme weather events. Power outages are also much more likely during such events.

All of the above weather conditions are likely to become much more severe in the years and decades ahead. It is incumbent on schemes to prepare mitigation measures from catchment source to tap based on an assessment of vulnerability to any or all of the above scenarios. The next section provides a listing of measures/actions that should be considered.

As power outages are a particular risk during periods of extreme climate conditions, schemes need to have an alternate power supply organised, sized to its requirements for treatment and pumping and capable of being brought into service immediately. In the case of smaller supplies with direct pump

[8] For further details on the management of UV systems, see NFGWS QA Implementation manual pp47-50.
[9] See https://www.epa.ie/publications/compliance--enforcement/drinking-water/advice--guidance/Disinfection2_web.pdf
[10] See https://nfgws.ie/wp-content/uploads/2018/10/GWS-chlorination-guidance-web-booklet.pdf

systems (i.e. without reservoir storage) their pumphouses need to have an appropriate fitting into which a hired generator can be plugged.

Water demand management

Drinking water demand is a key consideration at all times and especially during periods of drought, extreme heat and extreme cold. It impacts on raw water quality, on abstraction, on treatment systems, storage and distribution. It also impacts on a scheme's carbon footprint. Reducing excessive demand as part of water demand management must be a top priority for every drinking water supply now and in the future.

On any communal drinking water supply, it is important to answer two questions: firstly, how much water are we pumping into the supply network as a whole and into each branch of the network? In other words, what is the 'actual' water demand? Secondly, how much water *should* we be pumping in an ideal situation, in which there is no leakage and no excessive usage by individual consumers? This is referred to as 'theoretical' or 'legitimate' water demand.

The first question is easily answered by monitoring flow through a bulk meter at the point of delivery into the pipe distribution network. Monitoring flow through district meters on sections of mains, referred to as District Metered Areas (DMA), lets a scheme see the volume of water flowing through on particular pipelines helping pinpoint areas that may have leakage or unauthorised connections.

Assessing 'legitimate' water demand is a simple matter of adding up what individual people and livestock units might reasonably be expected to use on a daily basis. This is not as straightforward as it seems, however, as there are times of the year when demand is higher than normal, such as during hot summer days when people and livestock require more water than they do in winter. Factoring in these variables, the NFGWS provides a ready reckoner that helps schemes calculate their legitimate demand.

The objective of the water supplier is to reduce 'actual' water demand to the 'legitimate' figure, or as close to it as is possible, bearing in mind that the savings from detecting and repairing small leaks might not always justify the cost involved, and remembering also that the GWS depends on its members to address water loss or excessive usage on their side of the metered connection (where excessive demand is identified on the consumer side of the meter).

While the GWS will always aim to encourage water conservation where excessive use is identified on individual connections, the first objective is to identify and eliminate Unaccounted for Water (UFW). Quantifying UFW requires the completion of a water audit by the GWS. This is generally conducted late at night as this limits disruption to consumers and because the scheme would reasonably expect to detect very little water demand compared to daytime flows.

Taking note of throughflow on the main bulk meter, the GWS compares this figure to the combined figures from district meters on its DMA lines. Using sluice valves, it can then isolate each DMA and compare the district meter reading to the combined demand recorded through individual meters. Armed with this information, the scheme will use various tools to pinpoint where the UFW is being lost. This can be painstaking work, but well worth it if a large leak or unauthorised connection is identified and dealt with. The more sluice valves the scheme has in place, the better, as these can be turned off in sequence, with flows recorded on the district meter after each individual valve and all individual meters have been closed. Once a significant drop in flow is recorded then you know that the leak is located after that sluice valve.

It is important to note that water demand management is a continuous process rather than a once-off activity. While zero water loss should be the objective, schemes should, at a minimum, aim for UFW of less than 20% and from there aim to achieve the European norm of less than 10%. Schems are reminded that if they require finance under the Rural Water Programme towards UFW and water conservation projects, they must complete a 3-phase process, beginning with a water audit.

Source catchment-to-tap guide to being climate change ready

[The NFGWS would welcome suggestions about climate actions that might be added to those included here.]

Source catchment

Climate action 1: Minimise the risk of contamination (especially during extreme weather events) by adopting the ISPP approach to catchment management, installing appropriate mitigation measures to slow the flow and capture pollutants through engagement with residents and with relevant statutory and voluntary bodies.

Objective: Improvements to water quality at source reduce the need for end-of-pipe treatment solutions. In the case of surface supplies, reduced coagulant dosing will mean less desludging also, so that energy savings are made. Adopting an ISPP approach will, therefore, help reduce a scheme's carbon footprint and will contribute to its resilience as treatment systems will have greater available capacity.

Climate action 2: Position a computer-linked weather station as close to the source abstraction point as possible and, where possible, connect this to a continuous turbidity monitor.

Objective: This measure will provide schemes with an understanding of how weather conditions impact of raw water quality so that they are better prepared to take timely action in periods of heightened contamination risk.

Climate action 3: Monitor for algal blooms on lake sources to determine the conditions that drive them and complete sampling and analysis of them to ascertain if and when the contaminant Microcystin L-R is most likely to be present in the raw water supply.

Objective: Eutrophic conditions that can, with temperature, lead to algal blooms has to be an objective for every surface water scheme, as these put enormous pressure on filtration systems, increase backwashing and, as a consequence, result in increased energy demand.

Climate action 4: [On borehole supplies] install an automated weather station in the ZOC that is linked to the raw water turbidity monitor at the intake.

Objective: This will contribute immeasurably to understanding what is driving variability in a raw water source.

Abstraction point

Climate action 1: Install a continuous raw water monitor at the intake to record variability in pH, conductivity, temperature and turbidity.

Objective: Understanding the extent of raw water variability and its relationship to climate conditions/weather events is key to building resilience at this critical control and particularly to preparing for drought conditions.

Climate action 2: Ensure that abstraction pumps are performing optimally to reduce agitation of the raw water source and energy loss.

Objective: Gentle operation of abstraction is recommended in reducing potential contaminant levels in the raw water and to reduce avoidable energy loss in the intake pipe.

Climate action 3: [On surface water and spring supplies] install an automated weather station that is linked to the raw water turbidity monitor at the intake.

Objective: This will contribute immeasurably to understanding what is driving variability in a raw water source.

Treatment plant

Climate action 1: Assess electricity demand by commissioning an energy audit [this will include demand from all pumps used by the scheme as well as the treatment processes themselves].

Objective: This action will provide invaluable data on overall energy demand and will propose further actions aimed at reducing that demand. It will also form the basis about making a decision on installing alternative energy.

Climate action 2: Install electricity fittings with a low energy demand, including lights and space heaters.

Objective: Even in advance of an energy audit, the introduction of basic energy-efficient systems (and ensuring that lights are only switched on when necessary) will have a cumulative environmental benefit over time.

Climate action 3: Upgrade pumps to include variable speed drive.

Objective: This will undoubtedly be a recommendation in any energy audit, so schemes with older pumps that don't have VSD should consider installing them without delay to significantly reduce energy demand.

Climate action 4: Ensure that filtration systems are capable of removing target contaminant loadings.

Objective: While this is extremely important in terms of protecting human health, it is also important that systems are designed to cope with the worst that the raw water can get in terms of organic loading following an extreme weather event.

Climate action 5: Install online turbidity monitors before filtration systems to regulate coagulant dosing and with the capacity to shut down the plant where the organic content of the raw water exceeds the capacity of the filtration process.

Objective: This measure will provide reassurance that the filtration system is not overwhelmed in an extreme weather event.

Climate action 6: Ensure that there are duty and standby disinfection systems and that there is automatic shutdown of the plant where these are non-performing.

Objective: There should never be carry over of water into the distribution system that has not first been disinfected. This safeguard is particularly relevant in the context of a contamination surge that may be experienced during or following an extreme weather event.

Climate action 7: Purchase a back-up generator or, for smaller supplies, install a powerpoint that can accommodate a back-up generator.

Objective: This will assist the scheme in coping during power outages where purchased or hired generators are appropriately sized and in good working order.

Treated water reservoir

Climate action 1: Ensure that there is adequate water storage to provide continued supply in an emergency.

Objective: To provide water to GWS members while any problems (such as a power outage) are addressed. In normal conditions it is not recommended to have more than 24-hours back-up supply, but where a major weather event is forecast, it might be appropriate to have the reservoir full, even if that means having more than a day's supply. This should only be done where there is adequate chlorine residual in the stored water or where there is secondary chlorination available post reservoir.

Distribution network

Climate action 1: Manage water demand [as outlined in pages 14 and 15].

Objective: This will reduce energy demand, while also making a GWS more resilient in coping with weather events and extreme conditions.

Climate action 2: Make sure that there are sufficient meters and valves in the network and that these are in good working order.

Objective: To assist in water demand management.

Climate action 3: Consider providing an incentive to encourage the installation in new build properties of rainwater-harvesting/greywater re-use systems, dual flush toilets and low-flow plumbing systems.

Objective: To ensure that new-build properties on the GWS use minimal volumes of mains water.

Emergencies

Climate action 1: Prepare a Drinking Water Incident Response Plan (DWIRP).

Objective: To have a plan to hand that will guide the committee and staff in coping with the aftermath of storm damage and any other emergency.

Climate action 2: Develop a back-up raw water or treated water supply.

Objective: An interconnection with a neighbouring scheme or an Irish Water supply, or having a back-up raw water source will prove beneficial in the event that the source does dry or storm damage puts a supply out of action.

As a general point, schemes should develop and implement the NFGWS Quality Assurance System, so that identified protection measures from source to tap can be checked and verified on a regular basis. The preparation of Water Safety Planning reports on schemes, as required under the recast Drinking Water Directive, will provide a further opportunity to complete a detailed risk assessment on supplies.