Scottish Water
Trusted to serve Scotland

# NET ZERO EMISSIONS ROUTEMAP

## ANNUAL UPDATE 2022 – YEAR TWO

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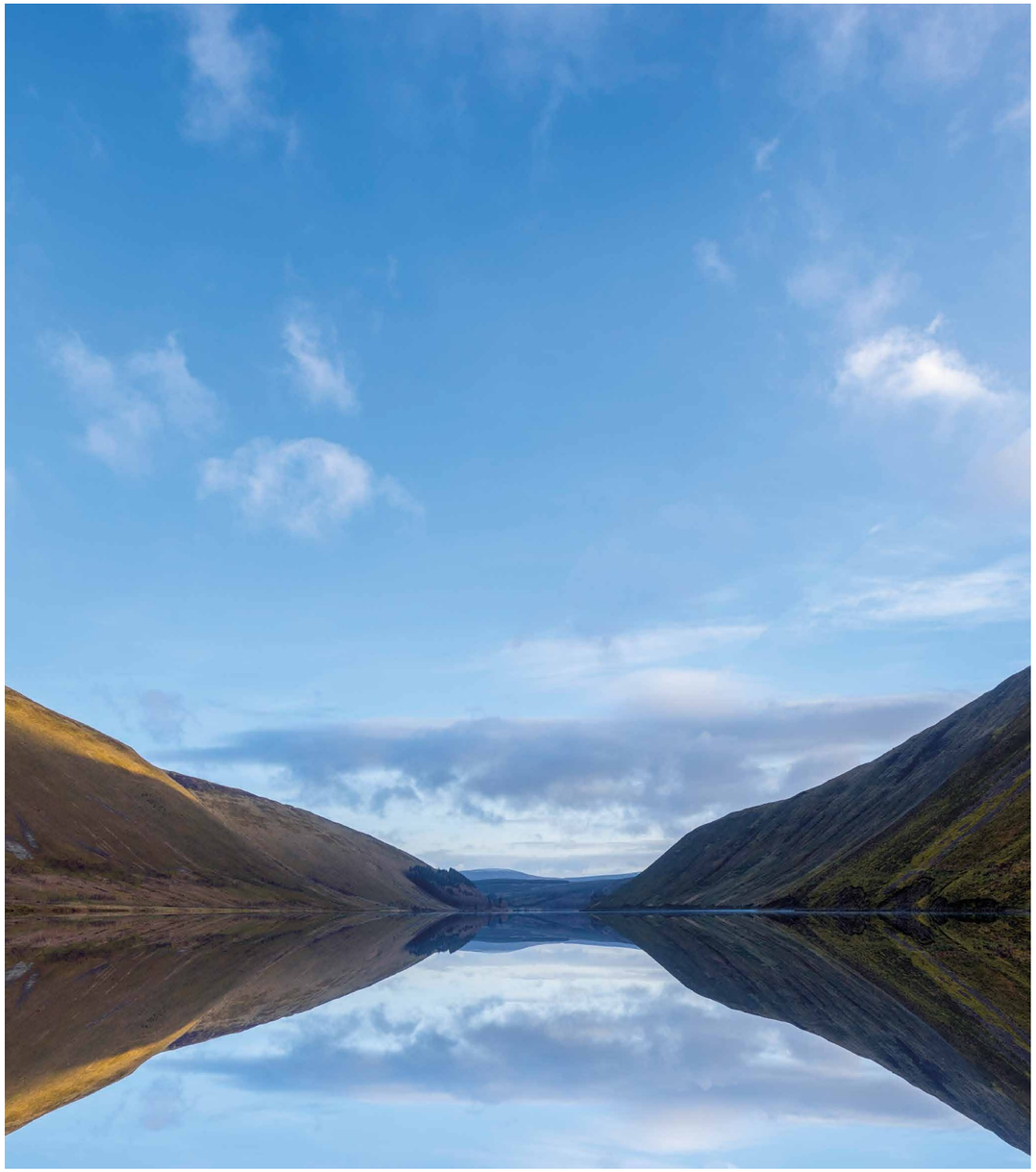
# YEAR TWO OVERVIEW

Our focus in the past year was to accelerate action to deliver our routemap and reduce our carbon emissions. Our annual operational greenhouse gas emissions fell by 18,000 tonnes to 231kt$CO_2$e, down over 7% from 2020/21. It is now exactly half the emissions of our baseline year of 2006/07.

Progress across each can be viewed on the following pages.



## DELIVERY

We made progress across all areas of the routemap, delivering actions to eliminate, reduce or capture emissions.

Highlights include:

- Increasing the pace of energy efficiency delivery through improving control of waste water treatment as part of the long term 20% efficiency target.
- Upping the rate of renewables delivery, adopting new battery technology to maximise the benefits of solar power, and concluding studies that enable us to extend our renewable self-generation target to 120GWh by the end of the decade.
- Innovative partnerships to trial co-digestion of distillery material and waste water sludge to maximise biogas production.
- Piloting low carbon concrete, alternative materials and delivery approaches with capital investment partners to support development of a pathway to net zero capital investment.
- Commencing transition of our 800 small van fleet to electric vehicles.
- Planting over 240,000 trees as we begin our carbon capture journey.

We learned by doing, enabling us to shape future work and set ambitious goals for next year. This will see increased delivery of energy efficiency and generation, research and innovation to manage problematic methane and nitrous oxide emissions, and further adoption of low carbon methods in capital investment. Strengthened partnerships with Forestry and Land Scotland, NatureScot and others will help us increase our ambition to deliver more carbon capture and biodiversity projects at scale.

## LEARNING

We learned a great deal in the first 2 years of routemap delivery about the source and scale of emissions, and effectiveness of mitigation measures. This has endorsed our overall strategy to drive down energy, use lower carbon energy, address construction emissions and capture carbon. Decision tools to support energy efficiency, renewables and carbon capture have been implemented to enable cost effective projects to be projects to be promoted and delivered.

The tools, training and partnerships with the supply chain have enabled us to build capacity, identify and progress initiatives for low carbon construction. We have shared our approaches in learning seminars through the Sustainable Scotland Network and will continue to expand our online resources to enable us to share learning.

But we need to change some approaches. We did not achieve all we had hoped on our renewables programme in Year Two due to challenges of securing a grid connection at a major site and concerns relating to labour practices linked to materials used to manufacture solar panels. This led to a delay whilst we reviewed procurement processes to ensure we act responsibly. We have also scaled up our project resource, including a new hydro energy development team, and established closer engagement with energy network operators to secure connections and accelerate delivery.

We had planned an ambitious programme of peatland restoration to address water quality risks and capture carbon, working in partnership with third party landowners. This was delayed as landowners reviewed and reconsidered their approach to managing carbon capture on their land. Through work with the James Hutton Institute, we also learned that peatland on our land may contribute significantly to land based emissions. We will now focus on restoration of all peatland within our landholdings and projects are being prepared for delivery next restoration season.

We learned a lot around the technical challenges of adopting low carbon materials in capital investment, which can be problematic. Innovative materials and equipment must meet technical performance expectations and we have had to increase engagement with designers, technical assurance teams, operators and suppliers to build confidence in low carbon delivery.

This deeper knowledge of how we can transform our services and assets is shaping our approach to Year 3 as we seek to accelerate action.

## PARTNERSHIP

Partnership was a key theme in the year with strong links forged with Forestry and Land Scotland and NatureScot to develop and deliver practical improvements at landscape scale. A focus on our Loch Katrine estate could see up to 3,000 hectares (ha) of new woodland and extensive peatland restoration over the next few years.

Our "Demonstrably Different" partnership with SEPA is exploring practical measures to support sustainable environmental performance. One initiative engaged Chivas Bros whisky distillers to import their process co products for co-digestion with waste water sludge. This has significantly increased biogas production at Nigg Waste Water Treatment Works and provided a sustainable outlet for distillery co product.

We are partnering with Scottish Power and other hydrogen producers to enable water supply for new hydrogen facilities across the country.

Our commitment to partnership led to the signing of the Edinburgh Declaration, an international statement led by the Scottish Government to ensure action to protect global biodiversity. We also joined the board of the Clyde Climate Forest and will develop projects to contribute to their goal of 18 million trees planted in urban and rural areas of Glasgow City Region by 2031.

### CASE STUDY: INNOVATIVE PARTNERSHIP OFFERS ROUTE TO A GREENER DRAM

The successful trial involving Scottish Water, SEPA and major distiller Chivas Brothers saw distillery residue brought into Aberdeen's Nigg Waste Water Treatment Works for the first time, with promising results.

A process called 'co-digestion', means that the residues from distilleries and breweries in the area can be added to sewage sludge processed at Nigg, as part of a system which produces biogas – an alternative fuel used to run the site's boilers and Combined Heat and Power (CHP) engines.

The facility already has a process to turn sludge produced during waste water treatment into biogas – this is then used on site instead of oil or diesel.

Since October 2021 the sludge treatment centre has trialled co-digestion – in other words, processing residues brought in from Chivas Brothers' distilleries and breweries alongside the sludge – and this has noticeably increased the amount of biogas being produced.

Scottish Water's Chief Scientist Elise Cartmell said: "The team at Chivas Brothers approached us because the various residues created as part of the distillery process are often rich in energy, and they were keen to find alternative outlets to capture and use it. Fortunately this aligned very well with Scottish Water's existing ambitions to investigate co-digestion, extending work we had already begun with SEPA, so we decided this would be the perfect opportunity to try out this process.





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### CASE STUDY: INNOVATIVE PARTNERSHIP OFFERS ROUTE TO A GREENER DRAM (Cont.)

"It's turning out to be a win-win for both parties: the distilleries are provided with an outlet for treatment which helps this key regional industry become more sustainable, while we at Scottish Water benefit from a boost in production of green energy at our site, which reduces our reliance on fossil fuels and helps our journey to net zero."

With the addition of the distillery and brewery residues, the plant saw a saving of 58 tonnes of carbon over the 12-week trial period, which equates to 250 tonnes per year – the same as 250 passenger return flights from Paris to New York.

Chief Scientist Elise Cartmell said: "We're very pleased with the findings which show that the trial boosted biogas production and significantly reduced the site's need for oil to power its on-site boiler. Just as importantly, there was no adverse impact on the operation of the site or on the quality of the biosolids that are also produced for recycling to land.

"We believe there is excellent potential for this approach to be used at Nigg in the future and for it to be rolled out to other sites across Scottish Water."

The trial was made possible by close collaboration between the industry, the Scottish Environment Protection Agency (SEPA) and Scottish Water. It was led by the publicly owned water company's commercial subsidiary, Scottish Water Horizons.

Through collaborative working and close monitoring throughout the Nigg trial, the teams involved have laid the groundwork to explore further opportunities in the future to support businesses and green energy production across the country through co-digestion.

Chivas Brothers' Environmental Sustainability Manager Ronald Daalmans said: "The trial with Scottish Water has shown that residues from our effluent treatment process still have an energy value that can contribute to a more circular and sustainable economy and provide an alternative outlet for distillery residues when other routes are full.

"We hope the trial will open up further opportunities for collaboration between the Scotch Whisky sector and utility operators."

David Harley, SEPA's Interim Chief Officer, Circular Economy, stated: "Against a backdrop of climate and nature emergencies, there's a real environmental imperative for us all to act. But more than that, innovative partnerships like this between SEPA, Chivas Brothers and Scottish Water are real economic and social opportunities.

"The Nigg trial is an excellent example of that collaboration in action, driving sustainability in Scotland's food and drink sector, and making a tangible contribution to a circular economy and a Net Zero society."

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## COMMUNICATION AND ENGAGEMENT

The eyes of the world fell on Glasgow in November 2021 and the United Nation's 26th Annual Conference of the Parties – COP26.

We played an active part in events focused on energy and heat, carbon mitigation and climate change adaptation and sharing of low carbon best practice.

The role that nature-based solutions have in helping to mitigate carbon, support biodiversity and increase climate change resilience was highlighted for global leaders with Scottish Water and partners in the heart of the blue zone.

The summit allowed us to contribute to national and international commitments to limit global warming.

The Scottish Government has placed increased focus and expectation on the public sector to achieve net zero. This reinforces the need for us all to play our part and to share our learning and Scottish Water was pleased to play a part in helping to draft guidance for the wider public sector to manage, report and reduce emissions.







# PROGRESS IN YEAR

### BECOMING MORE ENERGY EFFICIENT

Saved 7GWh of electricity through efficiency.

Delivered our first digital technology energy efficiency project.

### USING LOWER-CARBON ENERGY PRODUCTS

Installed 1.7GWh of solar renewable energy.

Commissioned our first solar-battery storage scheme at Perth Waste Water Treatment Works enabling 94% of electricity generated to be used on site.

Completed surveys of our assets and as a result of new knowledge, increased our target for renewable power to 120GWh by 2030.

Diverted up to 3,000t of waste water sludge from land reclamation to energy recovery.

Carried out a successful co-digestion trial of whisky and brewery waste products to generate more energy from sludge digestion units.

Took delivery of the first 20 of an expected 800 electric vehicles to transform our small van fleet, and expanded vehicle charging infrastructure.

### EMBRACING LOW CARBON CONSTRUCTION

Extended requirements to record the embodied and operational emissions generated to cover all projects in the investment programme.

Piloted refurbishment rather than replacing of assets, reducing overall carbon by c80% in these projects.

Our Carbon Academy developed with our supply chain was recognised as best practice in an **ICE report**.

Significant increase in intelligence gathered to fully understand and begin to address the materials driving emissions in our investment programme.

### STORING AWAY EMISSIONS THAT CANNOT BE AVOIDED

Created 95 ha of new woodland on our land at Lintrathen in Angus and piloted woodland creation on 3 small operational sites, with over 240,000 trees planted across the sites.

Restored 6 ha of peatland.

Developed a draft 10-year Land Management Plan with Forestry and Land Scotland for our Loch Katrine estate that could see up to 3,000 ha of natural woodland creation and significant peatland restoration.





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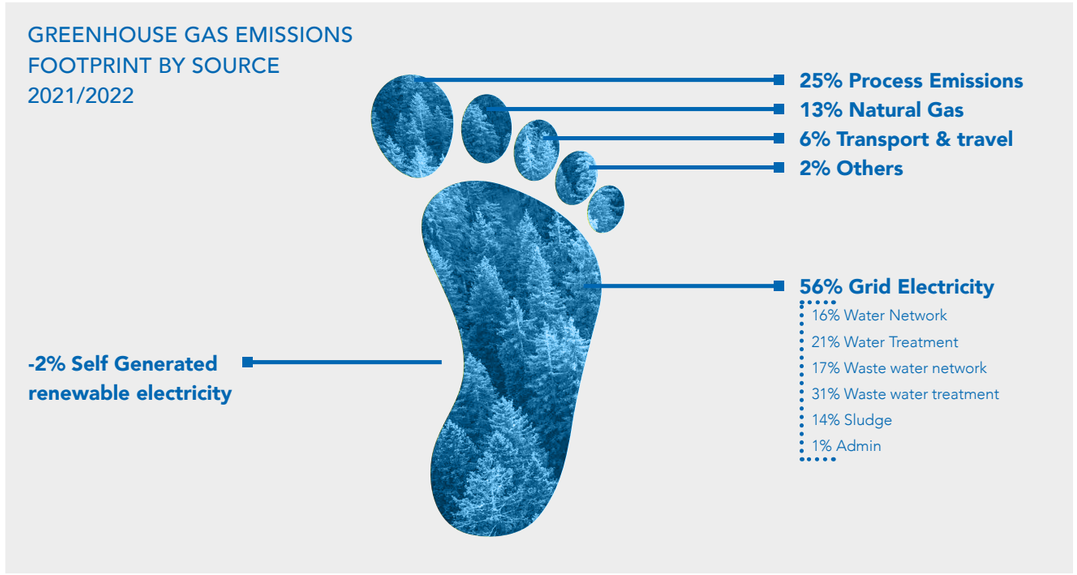
# KEY OBJECTIVES FOR 2022/23

Our plan for year 3 is to further increase our rate of delivery and deliver more carbon reduction than was achieved in 2021/22.

We will act across all key strategic goals in our routemap to:

- Increase the rate of energy efficiency delivery and extend the programme across more asset systems with a long term goal of 90GWh efficiency.
- Deliver a further 6-10GWh of renewable energy capacity on operational sites.
- Deploy innovative methane recovery technology at sludge assets and understand how this can be scaled to minimise emissions and maximise energy value.
- Deploy process emissions monitors within a challenging research programme to build knowledge and develop innovation strategies to minimise emissions.
- Pilot the use of alternatives to diesel fuel in our heavy transport fleet.
- Deliver 300-500 ha of peatland restoration and 50-100 ha of woodland creation.
- Develop a costed pathway to achieve net zero investment emissions to support investment decisions.
- Continue to pilot and adopt innovative designs and construction materials to reduce emissions in current projects.

# 2021/2022 OPERATIONAL EMISSIONS FOOTPRINT




Our operational greenhouse gas emissions fell to 231,000t$CO_2$e, a 7.2% reduction from 2020/21.

A key milestone was achieved – 231,000 is half the amount reported in our baseline year 2006/07 (462,000 tonnes $CO_2$e), and we are on course to exceed the original goal in our routemap of a 60% reduction by 2025.

There were increases and decreases across the different carbon footprint categories this year.

The continued greening of the grid coupled with increased energy efficiency and renewables delivery has made a significant contribution to this progress, but at 56% of emissions, electricity remains our biggest source.

Overall electricity consumption fell by around 7GWh with the biggest fall in waste water pumping as a consequence of dry weather. Conversely there was a small increase in water pumping as more sources were used during the summer dry spell.

At 58,0000 tonnes $CO_2$e process emissions from waste water treatment are the next biggest source, which is driving much of the focus on innovation and research to minimise these emissions in the future.

We continue to see a reduced business travel as a legacy of the pandemic and a shift to more remote and virtual working and we expect this to continue as we operate a hybrid working approach for office based workers.

The footprint report continues to support the focus set in the routemap for the key emissions we need to eliminate. As in previous years the footprint was verified externally to ISO 14064-1.



# PROGRESS UPDATE

Our routemap highlighted a number of key milestones on the way to net zero, covering all aspects of our emissions. These are supported by commitments to a range of actions and activities to build capacity and capability, and to deliver specific goals we would undertake over defined timescales to reach net zero.

Progress across each can be viewed on following pages.

## ELECTRICITY

Electricity consumption is still our largest single source of emissions (56%). We must reduce our consumption to reduce emissions and increase financial benefits, while enabling us to support other goals such as generating all the electricity we consume.

### 1) Reducing our consumption of electricity

GOAL: 20% by 2040

- 7GWh of energy efficiency projects delivered with a further 5-7GWh targeted for 2022/23 as part of our transformation programme.
- We will dimension energy efficiency impact of asset replacement programme to inform asset replacement strategies for key mechanical and electrical equipment across our asset base.

### 2) Maximising the energy we recover from bio resource

- Diverted up to 3,000 tonnes of waste water sludge that was used for land reclamation to be used in energy generation, equivalent to 3GWh of renewable energy.
- Completed a successful co-digestion trial of whisky and brewery coproducts to generate more energy.
- We will seek further opportunities to maximise the amount of material we process through our digestion sites, including from third party sources through co-digestion.

### 3) Generating or hosting all the energy we use

- Delivered 1.9GWh of additional renewable capacity through solar generation. An additional 6-10GWh of additional renewable capacity is planned for delivery in delivery in 2022/23.
- Increased target for renewables from 90GWh to 120GWh by 2030.
- Progression of new 260GWh windfarm agreed with RWE on our land through the planning process, to be commissioned in 2027.
- Identified potential for several new hosted windfarms.

## CASE STUDY: BATTERY STORAGE FIRST FOR SCOTTISH WATER IN NET ZERO DRIVE

Scottish Water has completed work on its first large-scale battery storage project to accelerate its drive towards net zero emissions by 2040.

The flagship scheme, delivered by framework contractor Absolute Solar & Wind Ltd, is part of a £2 million renewables project which includes the company's largest single solar energy array to date.

Four vanadium flow batteries, manufactured by Invinity Energy Systems, have recently been installed at the waste water treatment works that serve the city of Perth. The batteries are capable of storing up to 0.8 megawatt hours (MWh) of energy and will be used to store power generated from more than 2,520 solar panels, with a combined output of over 1 megawatt (MW).

By enabling solar energy to be used at any time of the day or night, the battery system will allow around 94% of the renewable power generated to be used on site – a significant step forward in the company's decarbonisation ambitions.

By combining battery storage and solar power, the carbon footprint of the treatment works will be cut by around 160 tonnes of $CO_2$ per annum – the equivalent of offsetting 580,000 miles from the average passenger car. The scheme will also help to power the utility's first rapid electric vehicle charging points which have been installed at the site; and will reduce energy costs of the treatment works by approximately 40%.

This installation is the latest investment by Scottish Water Horizons, the public utility's commercial subsidiary, who are developing a programme of opportunities for battery storage across Scottish Water's asset portfolio.

Scottish Water has committed to reach net zero carbon emissions by 2040 with an interim target to host or self-generate three times its annual electricity consumption by 2030. Almost 80 of the company's water and waste water treatment works are now either self-sufficient or partly sufficient in their power requirements.





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## PROCESS EMISSIONS

Process emissions, particularly nitrous oxide ($N_2O$) remain the most challenging area for the water sector to address, requiring a focus on the science, measurement and management of emissions, as well as on technologies to reduce or eliminate the production of emissions.

### 1) Reducing our production of process emissions

GOAL: 20% reduction

- Pilot of innovative methane recovery technology at Nigg Waste Water Treatment Works which we are now looking to deploy at scale.
- Identification of methane and $N_2O$ monitors to understand our emissions better which will deployed 2022/23.
- Trial of Artificial Intelligence technology at 2 waste water treatment works to reduce $N_2O$ emissions.
- Undertaken risk assessment of all waste water treatment works for $N_2O$ production.

## GAS AND FUEL OIL

Reducing our reliance on fossil fuels across all our sites is a key part of getting to net zero.

### 1) Maximising the energy we recover from bioresource

### 2) Eliminating consumption of gas and fuel oil

GOAL: 100% reduction in gas and fuel oil consumption

- We have worked with our supply chain and delivery partners to identify a route for sustainable hydrotreated vegetable oil – HVO – to replace diesel in our fleet and standby generators. We are developing a procurement framework that will allow us to roll out this product for use by both Scottish Water and its supply chain partners.
- Installed our first air source heat pump at our office in Dumfries.








## TRANSPORT AND TRAVEL

Pre pandemic our fleet travelled around 19 million miles for business reasons. Our strategy aims to minimise the miles we travel and find zero emissions ways to travel.

### 1) Reducing fleet mileage and business travel

GOAL: 50% reduction in the distance we travel

- 4.9 million fewer business miles driven during 2021/22 saving 81% of emissions, mainly due to Covid 19 changing how we work. We have sustained this reduction in the second year of covid restrictions and are reviewing how we might sustain these reductions longer term.
- 12% reduction in fleet emissions from reduced fleet mileage.

### 2) Transitioning our fleet to zero emissions vehicles

GOAL: 100% Zero Emissions Fleet

- Taken delivery of the first 20 of 800 electric vans as part of wider programme to replace diesel vehicles.
- Delivered 49 EV charging stations across our assets and offices.
- Agreed a salary sacrifice scheme for our staff to support them in EV purchase.
- Completed a study that has looked at how we might deploy alternative fuels and vehicle technology to accelerate transition of our large vans and HGV fleet.

## INVESTMENT

We were the first UK water company to include investment emissions as part of our net zero goal. Investment emissions are projected to overtake operational emissions over the next two years as the biggest source of emissions each year.

### 1) We enable zero emission construction

GOAL: 75% reduction in carbon intensity of investment

- From 2021/22, all new projects are required to report their emissions, regardless of value, bringing hundreds more projects into the scope of carbon management.
- Our Carbon Academy developed in 2020/21 has developed further in partnership with our supply chains and was recognised as best practice in an **ICE Report.**

### 2) Delivering zero emission investment with supply chain

GOAL: 75% reduction in carbon intensity

- We have significantly increased the carbon intelligence around projects delivered and have a clear understanding of the Top 10 materials driving emissions in our investment programme.
- We piloted refurbishment rather than replacement of assets, reducing emissions by c80% in some projects.
- We are exploring options to replace steel reinforcement in concrete with alternative materials to reduce emissions.
- Developing designs with composite wooden laminates to replace steel and Glass Reinforced Plastic in our designs.
- We have piloted cemfree/low carbon concrete at one of our suites and are working with specification and supply chain teams to increase its availability in more projects.





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## SUPPORTING A FLOURISHING SCOTLAND

Across the 22,500 ha of our land, we can contribute to the natural, social and economic sustainability of Scotland's landscape by working to increase both carbon storage and the biodiversity of our landholdings.

### 1) We will capture and store more carbon dioxide than we produce

OUTCOME: Improve carbon dioxide storage on our land to support net zero emissions

- Completed ground breaking work with the James Hutton Institute to understand how much carbon is currently stored across our landholdings, how much it captures annually, what opportunities exist to improve this, and to set out a credible and transparent mechanism to report carbon capture.
- This shows that the trees on our land are capturing carbon but the peatland is emitting carbon and needs restoration. We are now progressing surveys to understand how we might restore it.
- Working with Forestry and Land Scotland to support the development of a 10-year land management plan covering over 5,000 ha of land in the Loch Katrine Estate, focusing on increasing woodland cover, peatland restoration, improving biodiversity and amenity value.
- Completed a biodiversity and natural capital audit of our landholdings.
- Adopting "nature based solutions", engaged with supply chains to explore approaches and working on a number of blue green solutions with Local Authorities across the country.

### Case Study

#### Lintrathen forest video

# ENABLERS

We know that we cannot achieve our ambitious goals alone. On our journey to net zero there are some key enabling activity areas which we have progressed in the last year.

## PEOPLE

- Growing use of Carbon Academy to share best practice and be a focal point for learning activities both within Scottish Water and across our supply chain.
- All of our leaders are being encouraged to complete the Scottish Governments Climate Solutions course.
- Engaging leadership in our delivery partners to focus on driving behaviour change to deliver net zero.

## CUSTOMERS AND COMMUNITIES

- Engaged communities on how we might improve access at 6 reservoirs.
- Carried out customer research to understand key priorities.
- Encouraged the correct disposal of wet wipes and launched our Nature Calls campaign.
- Increased the number of our Top Up Taps to 74 across the country.

## PROCUREMENT

- We are working with our 400 framework suppliers to understand their emissions and to develop emissions reduction plans.

## GOVERNANCE

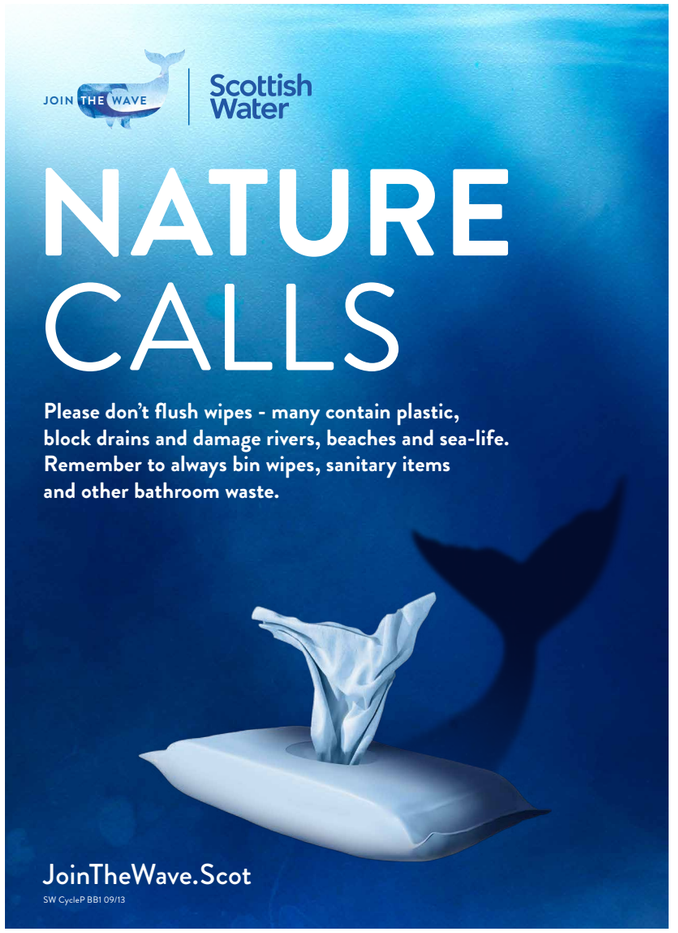
- We have appointed new auditors to verify our carbon footprint reports and will work towards full accreditation to ISO14064-1.
- We are progressing work to evaluate our capital investment emissions management processes against PAS 2080, building on earlier work to validate our assessment tools against this standard.
- Carbon is now fully integrated into Scottish Water's Investment Planning and decision making process, with a new "Net Present Cost and Carbon" model required for projects.

## POLICY AND REGULATION

- We worked with the Sustainable Scotland Network and the Scottish Government to draft Scottish Government guidance on Public Sector Leadership on climate change ahead of COP26 and are continuing to work on technical carbon reporting guidance for the Scottish Public Sector.

## INNOVATION

- Successfully trialed new technology to capture and reuse methane emissions.
- Identified new partners to work on $N_2O$ monitoring, risk assessment and reduction.
- Identified an ammonia recovery technology and are developing pilot installation.
- Hydro Nation Research Fellows have been appointed and carried out horizon scans in key areas for emerging technologies to support net zero.



# STRATEGIC INNOVATION FOCUS AREAS

We have progressed a number of activities across these areas.

**LOW ENERGY WATER AND WASTE WATER TREATMENT, AMMONIA AND METHANE RECOVERY**

**DIGITAL AND ANALYTIC TOOLS**

**MATERIALS RESEARCH**

**WATER FOR HYDROGEN PRODUCTION**

## CASE STUDY: RENEWABLE GENERATION AND BATTERY INNOVATION

In early 2022 the solar-battery scheme at Perth Waste Water Treatment Works was commissioned. Four 'vanadium flow' batteries, manufactured in Scotland and capable of storing up to 0.8 megawatt hours (MWh) of energy, store energy generated from more than 2,520 solar panels with a combined output of over 1 megawatt (MW).

By combining battery storage and solar power, the carbon footprint of the treatment works will be cut by around 160 tonnes of $CO_2$ per annum – that's the same as offsetting 580,000 miles from the average passenger car! The scheme will also help to power our first rapid electric vehicle charging points which have been installed at the site; and will reduce energy costs of the treatment works by around 40%.

## CASE STUDY: $N_2O$ REDUCTION TRIALS

We have partnered with Cobalt Water to deploy an innovative Artificial Intelligence approach that has the potential to reduce process emissions at two of our largest waste water treatment works in Glasgow.

The system analyses sensor reading from across the treatment works and uses analytics and machine learning to adjust the control setting of the works. In trials elsewhere this has led to significant reductions in $N_2O$ which we hope to deliver in Glasgow.

## CASE STUDY: LOW EMISSION PLANT & TRAVEL

We have been testing zero emissions plant and equipment such as mini diggers on our construction sites. These are generally proving effective and have the added bonus of reducing noise impact to customers in streetworks.

We have also been exploring the availability of alternative fuels such as biomethane and sustainable HVO to deploy in our heavy fleet to reduce emissions.


## CASE STUDY: SUPPLYING WATER FOR HYDROGEN

We are partnering with Scottish Power and other hydrogen producers to enable water supply for new hydrogen facilities.

The first project is with Scottish Power at the Whitelees windfarm south of Glasgow.

Scottish Water

Trusted to serve Scotland

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