

# Scotland: The Hydro Nation Annual Report 2022

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### Further information on the issues raised in this report can be found at:

Scottish Government

[www.gov.scot](http://www.gov.scot)

Scottish Water

[www.scottishwater.co.uk](http://www.scottishwater.co.uk)

Water Industry Commission for Scotland

[www.watercommission.co.uk](http://www.watercommission.co.uk)

Drinking Water Quality Regulator

[www.dwqr.scot](http://www.dwqr.scot)

Consumer Scotland

<https://consumer.scot/>

Scottish Environment Protection Agency

[www.sepa.org.uk](http://www.sepa.org.uk)

Scottish Canals

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# Developing Scotland's Water Economy

## Introduction by Mairi McAllan MSP, Cabinet Secretary for Transport, Net Zero and Just Transition



I am very pleased to be able to introduce the ninth annual Hydro Nation report to the Scottish Parliament, highlighting Scotland's progress as a Hydro Nation. 2022 has seen our continued recovery from the challenges of the global Covid-19 pandemic but many challenges remain as we seek to build back better. Capital inflation and the cost of living crisis have had significant impacts right across society, and the water sector is not immune. However, it is clear to me that our water sector is incredibly resilient and there are many excellent examples in this report of how it has successfully adapted its practices to help keep customers and communities safe while offering excellent service.

In my introduction to last year's Report, I highlighted the role of the Hydro Nation Forum in reviewing the Hydro Nation agenda to help ensure it remains relevant. After a period of unprecedented turbulence during which the Forum has been on a hiatus we are now better placed to progress the review and will report on the outcomes in due course.

Having mentioned the Covid-19 pandemic I want to once again highlight the excellent collaborative work that has been done by a wide range of partners including Scottish Water, SEPA, the University of Edinburgh, Public Health Scotland, the James Hutton Institute and CREW – the Centre of Expertise for Waters. Their important work on wastewater monitoring has provided key information about the prevalence of the virus in our communities and has helped grow our understanding about how the monitoring techniques developed can help protect us now and in the future.

Since the pandemic we have seen an increased focus on sewage pollution in rivers across the UK. While Scotland has a solid track record of environmental improvement, which has delivered excellent results including 66% of Scotland's water bodies in good ecological condition or better, we are not complacent. In December 2022, Scottish Water published their first annual update on their Improving Urban Waters Routemap - backed by half a billion pounds worth of investment - which sets out the progress being made to develop solutions for high priority unsatisfactory Combined Sewer Overflows (CSOs) due to their impact on water quality or sewage-related debris. This Report contains further detail including on how Scottish Water is developing smart networks using the most up to date monitoring technology to make further significant improvements.

Climate change remains our biggest threat, with impacts ranging from water scarcity during prolonged dry weather, to severe storms overwhelming our sewage systems and flooding households and businesses. This report provides examples of how Scotland is working hard to mitigate the impacts.

Internationally too, Hydro Nation partners continue to deliver important work, perhaps most notably in Malawi where the tragedy of Storm Freddy caused such devastation earlier this year, highlighting the importance of our work with Government of Malawi colleagues to establish and grow capability in water and environmental regulation.

Finally, I offer my thanks to everyone involved in delivering the activities which are supporting our Hydro Nation agenda and I look forward to continuing to work together to promote and further grow our water economy.

## National: Supporting communities and Scotland's water economy

Scotland is a Hydro Nation, one that views and manages its water resources responsibly, and views our relationship, and the ways we work, with the water environment and industry as inextricably linked to our national identity.

Our water sector, including Scottish Water, is worth an estimated £3.7 billion to the Scottish Economy and provides almost 17,000 jobs<sup>1</sup>. We are committed to the sector's growing success and will work with our enterprise agencies and Scotland Development International to support our businesses into new markets. The examples below help to underline how the Hydro Nation agenda is delivering in Scotland, and for Scotland.

### Scottish Water: Delivering for you

Scottish Water continues to invest and deliver infrastructure that is fit for communities throughout the country now and for decades to come. 2022 marked the second year of the 2021-27 investment period, delivering improved services for customers despite increasingly challenging construction market conditions as a result of the cost of living crisis.

#### State of the art supply for Islay

Scottish Water's multi-million pound investment for Islay came on-stream in January 2022 after a marathon journey across land and sea and months of on-site testing. The Transportable Treatment Unit (TTU) is now connected to the network supplying nearly 2000 customers in the Bowmore and Port Ellen areas.

This £2.5 million investment is just part of Scottish Water's on-going programme of works for Islay to provide capacity for future housing developments but also resilience and improvements to the existing network. The new TTU was transported under police escort more than 200 miles from



Ross-shire Engineering's specialist factory in Muir of Ord where it was built and partially commissioned off-site. The unit provides capacity for an additional 70,000 litres, boosting the 81,000 litres already supplied from the existing Torra Water Treatment Works on the island.

As part of the installation of the TTU a new pipe bridge across the River Torra has been constructed to support a short section of the two kilometres of new raw water main that has also been installed north of the water treatment works.

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<sup>1</sup> Figures from [The water sector in Scotland: market size research](#) – turnover, jobs, exports and gross value added report.

## **Scottish Water intelligent assets helping to improve service and protect the environment**

Investment in Scottish Water's intelligent asset base on its wastewater infrastructure, including remote sensors and data-driven insight, is set to improve its service to customers, protect the environment, reduce costs and assist in its journey towards net zero carbon emissions.

The early stages of investment of up to £100m over the next five years in its intelligent asset base – designed to use new technology to monitor sewage pipes rather than relying on customers reporting a problem – have indicated that Scottish Water will be able to better predict and prevent wastewater issues before they impact customers and the environment.

Trials of the new technology have shown that it will give the company real-time insights into how its network is operating and enable it to be more proactive in how it responds to issues and to solve problems before customers and the environment are affected. The technology is currently being trialled in four areas - Erskine, Inverness, Lossiemouth and East Calder – each of which have suffered from flooding and pollution events historically. Scottish Water has placed sensors that detect the presence of blockages and has already used this data to avert potential Environmental Pollution Incidents (EPIs) and flooding of customers' premises.

Using the learning from these four areas, Scottish Water intends to extend this intelligence into other areas which experience similar issues.

## **New era for two Highland wastewater treatment works**

Scottish Water has taken over the ownership and operation of two wastewater treatment works (WwTW) in the Highlands following the conclusion of a Private Finance Initiative (PFI) arrangement which has been in place since 1996. Veolia, who operate the plant on behalf of the Catchment consortium, handed over to Scottish Water on Sunday 29th May



2022 as planned, on the expiry of the existing contract. The Highland PFI includes Allanfearn WwTW to the east of Inverness and Fort William WwTW at Caol Point, as well as the two sites' associated infrastructure.

The change will enable opportunities for Scottish Water to optimise the running of both sites to provide better value for customers as well as harness their potential to contribute towards the target of net zero carbon emissions by 2040 across the organisation.

Allanfearn WwTW serves the city of Inverness and its surrounding area, treating the waste water for a population equivalent of around 90,000, while Fort William WwTW serves around 25,000.

## **Programme SWIFT - improving flooding investigations**

The Flooding Investigation Team (FIT) at Scottish Water are seeing the advantages of working with a new I.T. system and the improved data quality that it brings. The ease of sharing information across the business has improved greatly since the launch of Programme SWIFT and it is Scottish Water's customers who are benefiting from this. The information that is collected by Sewer Response when they attend a flooding incident is key for the Flooding Investigation Team. It enables and informs their investigations, ensuring the possible causes of flooding are fully understood and that measures to minimise a repeat incident are implemented. Thus, minimising the impact on customers and the environment.

The new I.T. system, Salesforce, gathers information for teams across Customer Service Delivery. It is able to take customer interviews and provide online detailed maps rather than using large print outs of the area affected. Other benefits being able to review stored photos and documents, as well as being able to check previous case history. Teams now feel equipped to take on this important role as they are armed with all this information before engaging with customers, which lends itself to having more constructive conversations.

## **Hydro Nation Chair launch**

The Hydro Nation Chair research and innovation programme, funded by Scottish Water and hosted by University of Stirling, was formally launched in March 2022. The programme brings together research, industry and communities to harness new technologies and build the infrastructure necessary to enable Scottish Water to deliver on their net zero ambitions.

Professor Andrew Tyler, the Hydro Nation Chair, will lead a team of six fellows who will find and lead collaborative opportunities throughout the water sector. Research Leader Fellows from Heriot-Watt University, the University of Strathclyde, Glasgow Caledonian University and the UK Centre for Ecology and Hydrology will build research programmes around four areas: eliminating emissions from infrastructure, driving down process emissions, enhancing the natural environment and embracing the circular economy.

Two innovation fellows, based at the University of Stirling, will link research and industry to develop commercially viable solutions to water challenges, and will work with communities on place-based innovation within water catchments.

## Improving urban waters

On 22 December 2021 the Minister for Environment and Land Reform gave a statement in the Scottish Parliament to highlight the latest River Basin Management Plan (RBMP3) which sets objectives and provides a programme of actions for delivering improvements to Scotland's water bodies. In tandem, Scottish Water published an Improving Urban Waters Routemap to explain how it will direct its own investment to help achieve improvements under RBMP3. The first annual update to the routemap was published in December 2022. Key indicators of progress include:

- 54 projects have been initiated to develop solutions and support delivery of all high priority CSO discharges by 2027
- the projects will be developed over the next two years, in line with Scottish Water's capital investment process
- priority locations have been identified for 1,000 spill monitors, with installation programmed over 2023 and 2024
- Wastewater Intelligent Network installed in 4 catchments and a plan is in place to extend to 12 further catchments by December 2023 covering 27.5% of Scotland's population
- a project has been developed in the River Almond catchment with representatives from Scottish Water, SEPA, Hydro Nation Chair, West Lothian Council, Forth Rivers Trust and community groups
- spill data which is reported to SEPA is now published on Scottish Water's website

## Delivering environmental savings to the Scottish public sector

As a responsible water retailer, Business Stream has an important role to play in supporting its customers to reduce their water use to help lower costs and deliver environmental savings. Since being awarded the Scottish Government Public Sector Water and Waste Water Framework contract in early 2020, Business Stream has been working with over 200 public sector bodies across the country to help generate water efficiencies. Through a combination of discounts and pro-active water efficiency and leak detection measures, in the past year Business Stream has saved the sector over £2.2 million in water costs and 1.4 billion litres of water – the equivalent of 558 Olympic sized swimming pools. Business Stream has delivered energy savings too, helping to save over 586,000 tonnes of carbon last year, which will contribute to the sector's efforts to meet the Scottish Government's net zero target.

To help deliver further water efficiency savings, in 2021 Business Stream developed and launched its annual water efficiency fund, which enables public sector bodies in Scotland to apply for funding to help deliver water efficiency projects. Public bodies can apply for a proportion of the £50,000 annual fund with an external panel selecting the successful applications. To date, the fund has helped to fund a range of projects including a Glasgow City Council scheme aiming to help young children learn about the importance of saving water; an innovative water capture and recirculation project at the University of Glasgow; and the introduction of rainwater harvesting at NHS Tayside. This fund not only removes any financial barriers to investing in water efficiency, but helps the sector to reduce costs and lower its impact on the environment.



## **International – reaching out to the world**

The Hydro Nation Strategy outlines our intent to deploy the potential of Scotland’s knowledge and innovation in a global context. Hydro Nation International (HNI) describes our activity to co-ordinate and harness a range of international water-related activities across Scottish public bodies, universities and non-Governmental organisations that contribute not only to the Hydro Nation agenda but also to the United Nation’s Sustainable Development Goals; in particular Sustainable Development Goal 6 (Ensure availability and sustainable management of water and sanitation for all by 2030). Activities completed as part of this agenda in 2022 include:

### **Malawi Scotland Regulatory Partnership (MSRP)**

The MSRP is continuing to offer peer-to-peer support and capacity building to colleagues in Malawi’s two environmental regulators - the National Water Resources Authority (NWRA) and Malawi Environment Protection Agency (MEPA).

Supported by the Scottish Government through the Hydro Nation International Centre (HNIC), the partnership welcomes multi-sectoral collaboration from across the Hydro Nation family, and beyond, bringing additional expertise to match with the needs of the NWRA and MEPA as both take steps towards becoming fully operational.

In 2021-2022, the partnership included on-going collaboration with the James Hutton Institute (JHI), Hydro Nation Scholars and Water Witness International (WWI) in Scotland, and Malawi-based NGO BASEflow working closely with BAWI consultants. The ability to assemble a collaboration of this kind, enabled by Hydro Nation, continues to offer a valuable and effective vehicle for supporting fellow institutions from other countries.

During the year, the MSRP delivered corporate governance support to the NWRA and MEPA, but also supported the development of information and evidence relevant to the regulators through increased engagement with the Ministry of Water and Sanitation. This included a national assessment of Malawi’s groundwater monitoring network and forward planning to secure investment in improved national monitoring infrastructure. The model of delivery continued to be influenced by a post-covid and Net-Zero world, with a significant proportion of work being led by Malawi partners or through remote engagement. The MSRP will continually review this model of delivery to ensure it pursues innovative and effective ways to continue to support Malawi in the most carbon efficient manner.

### **Scotland’s Global Partnership for Knowledge and Expertise in Water and Climate (SPARKE)**

As part of a Scottish National Party 2021 Manifesto Scotland’s Future, Scotland’s Choices, a pledge was established to;

“...create new peer-to-peer partnerships between Scotland’s Centre of Expertise for Climate Change, Water & Flooding and organisations in the Global South, sharing experience and data towards tackling these shared challenges”

To support the fulfilment of this pledge, the HNIC was awarded a project which commenced in Autumn 2022. Scotland’s Global Partnership for Knowledge and

Expertise in Water and Climate, or 'SPARKE', will work in partnership with a wide range of global stakeholders in the water environment to share knowledge and experience of science-policy exchange. Throughout the evolution of the project, it will work with partners in Malawi and India to identify data as well as capacity and skills needs to co-construct a series of activities that make use of peer-to-peer approaches for addressing these needs. This aim is underpinned by Scotland's new international development principles of in-country led, demand-driven partnership working. The HNIC is an ideal partner to host SPARKE because of its strengths and experience in brokering science policy exchange.

## Supporting water reform in New Zealand

The Water Industry Commission for Scotland's (WICS) work within New Zealand started with a project for two water and sewerage companies; Wellington Water and Watercare (which provides services across Auckland). WICS analysed the performance of the two companies and helped them better understand their costs, the potential for efficiencies, and future investment needs.

The success of this initial project led to further work with Watercare, with WICS providing regulatory support and helping the company put in place the same processes that are used to regulate Scottish Water. These changes should help Watercare provide better value for its customers and be better prepared for [Three Waters Reform](#).

More recently WICS has supported New Zealand's Department of Internal Affairs (DIA) by undertaking a strategic analysis and estimation of the economic benefits from aggregating water service delivery entities in the country. New Zealanders were already experiencing the consequences of underinvestment in their water infrastructure, with several high-profile infrastructure failures in recent years. Part of the problem was a lack of good quality information on the state of that infrastructure and future investment requirements.

As part of the project, WICS helped 49 separate councils or other entities that are responsible for delivering water and sewerage services, to complete an extensive 'Request for Information'. Using the detailed data from these submissions WICS carried out complex economic modelling; benchmarked current operating costs and levels of service to those of the leading companies in Great Britain; and modelled the scope for improving the sector's efficiency.

As well as presenting its analysis to the DIA, WICS gave individual feedback to the councils it had worked with. WICS's final report was submitted to the DIA in May 2021, and the New Zealand government is now progressing the programme of reform, with WICS's CEO continuing to provide strategic advice to the reform programme's steering group.

## Knowledge sharing and capacity building activity

### Hydro Nation Scholars

In the reporting year 2021-2022, 26 Hydro Nation Scholars were underway at nine Scottish Universities: Dundee, St. Andrew's, Edinburgh, Stirling, Glasgow Caledonian, Aberdeen, Robert Gordon, Highlands and Islands, and Strathclyde. The current scholars come from 12 different countries, bringing to the programme a rich diversity of cultures and perspectives, skills, and research experiences. Of these active scholars, five successfully submitted their theses and defended their VIVA during this period, thus joining the Hydro Nation Alumni Association, bringing the total number of alumni to 19.

The most recent alumni include:

- Dr Kathleen Stosch (University of Stirling), with the project "Building Resilience to Respond to Future Environmental Change Across Scottish Catchments"
- Dr Jonathan Fletcher (University of Stirling), with the project "Optimising Multi-Pollutant Phytoremediation Strategies to Sustainably Improve Raw Water Quality"
- Dr Sughayshinie Samba Sibam (University of Aberdeen) with the project "Epidemiology of Private Drinking Water Supplies in Scotland"
- Dr Victoria Porley (University of Edinburgh) with the project "Water Purification in Rural India Using Sunlight and Low-Cost Materials"
- Dr Craig McDougall (University of Stirling) with the project "The Role of Scotland's Inland Waters in Promoting Blue-Health of Rural Communities"

Additionally, the Hydro Nation Scholars Programme welcomed six new scholars with the 2021 cohort, for a total of 40 awards granted since the start of the programme and by the end of this reporting period. Further details on the scholars are available at Annex B.

### World Water Day – 22 March 2022

On March 22<sup>nd</sup> 2022, the Hydro Nation International Centre hosted [Scotland's World Water Day 2022](#), funded by the Scottish Government. The event provided a forum for water professionals, researchers, policymakers, regulators, and the wider community, to share knowledge and learn from recent projects to reduce carbon emissions following COP26, build resilience to climate change and benefit from Scotland's water resources. Over 100 delegates attended in-person and over 400 joined the live stream.





The event was structured around key themes of:

- 1) health and wellbeing,
- 2) Scotland's water sector route map to net zero,
- 3) working with communities for better water infrastructure and
- 4) engaging with youth to promote water sustainability.

The themes were explored through [presentations](#), round table discussions and a [poster](#) exhibition and curated for accessibility on the [HNIC website](#).

Scotland's WWD 2022 galvanized the sector to share knowledge and tackle the challenges ahead towards net zero in

2040. A [short video](#) to celebrate the event was posted on social media and a [policy note](#) was prepared to highlight the key messages of the day.



## Alliance for Water Stewardship

The Scottish Government has supported the first six editions of the Alliance for Water Stewardship (AWS) Global Water Stewardship Forum in Edinburgh and online, from 2016 to 2022. The Forum is attended by a range of stakeholders, all of whom share a common goal of advancing water stewardship globally through local site- and catchment-based activity.

The Sixth AWS Global Water Stewardship Forum took place at Dynamic Earth in Edinburgh from 17-19 May 2022, including over 300 registered delegates, both in-person and online, representing over 130 organisations worldwide. Participants unite behind the shared definition of water stewardship and the International Water Stewardship Standard (AWS Standard) as the globally applicable framework for robust and verifiable water stewardship. The Forum is also an important space for water stewardship practitioners to come together to collaborate on new projects and opportunities globally. It provides a place where the private sector, development finance institutions, civil society organisations and public institutions can exchange ideas and collaborate on international projects.

The Global Water Stewardship Forum in Scotland supports the Hydro Nation agenda through demonstrating Scotland's continued commitment to leading global water management and governance expertise. Since the AWS Forum, [Diageo certified their Cameronbridge distillery](#), building on the [certification of 11 Speyside distilleries in 2021](#). These are the first distilleries in the world to achieve AWS certification. It is expected that this will leverage additional commitments to the AWS Standard in Scotland. The Scottish Government's ongoing support for the Forum sends a clear signal around the world that Scotland is not only increasing national expertise in water, but also strengthening global efforts to improve water management and governance.

## Centre of Expertise for Waters

The Centre of Expertise for Waters (CREW) continues to support the Scottish Government, and delivery partners, to inform and steer water policy, by delivering objective and robust research and expert opinion. The Centre has contributed to the development of a range of Scottish/UK/EU policies, and implementation strategies, and continues to serve Scotland's legislative Hydro Nation agenda.

In 2022 the Centre delivered a portfolio of projects to support the immediacy and magnitude of the challenges faced from climate change. Projects focused on:

- [mitigating the impacts of climate change on freshwater ecosystems in terms of habitat](#)
- [evidence to support water resource management](#)
- [deterioration in water quality](#)
- [climate risks to water resources](#)
- [how to effectively communicate flood risk](#)

The Centre also contributed to debates on how catchments and infrastructure should be managed for carbon reduction and ultimately net zero emissions.

Issues in connection with the management of wastewater in rural areas continues to be a top priority as recognised in the “Strategic Plans of Scottish Water and SEPA (Water Supply and Waste Water Sector Plan)”. CREW commissioned a number of projects that address research needs - notably an [International policy review on small sewage systems](#), and policy brief providing an [overview of the types of barriers which inhibit effective engagement with private sewerage users](#).

State of the art management measures to reduce diffuse pollution from agricultural sources were highlighted in two reports on a) [sustainable methods of slurry application and the implications for water quality](#) and b) [better buffer design, placement and management](#).



Drawing on networks and partnerships established in 2020-21, CREW continued efforts to coordinate research in support of the National surveillance programme for Covid-19 RNA in wastewater, acting as a foci for Scottish and UK partners to share updates on wastewater based epidemiology (WBE) as the pandemic evolved. CREW commissioned the University of Edinburgh to develop [methods for detecting new variants of SARS-COV-2 in wastewater](#), along with a dashboard to [capture analytical protocols and maximise access to project bioinformation data](#). Throughout the project, interviews with the community of practice and academics led to a review of the formation and operation of the SARS-CoV-2 wastewater testing programme and [key lessons to inform future urgent responses to health and environmental crises](#).

# Promoting growth and innovation in the water sector

## Scottish Water's route to net-zero

### Greenhouse Gas Emissions Halved as Net Zero Routemap Update Published

Exactly half of the greenhouse gas emissions associated with the delivery of Scotland's water and wastewater services have been cut. The second annual update of Scottish Water's Net Zero Emissions Routemap has been published and highlights the progress made.

Last year saw a reduction of 18,000 tonnes in operational greenhouse gas emissions – taking the total yearly figure to 231,000 CO<sub>2</sub>e. This was achieved through delivering a mixture of energy efficiency, generating renewable energy, transforming the fleet and planting more than 200,000 trees. In 2006/07, the baseline year for measurement, the figure was 462,000 CO<sub>2</sub>e. These are all emissions which stem from the processes of managing and delivering Scotland's daily water needs and wastewater treatment.

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

Highlights include:

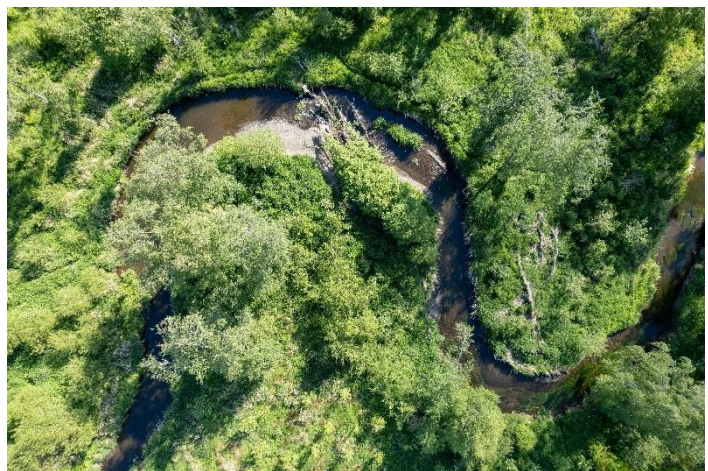
- increasing the pace of energy efficiency delivery through improving control of wastewater treatment as part of the long term 20% efficiency target
- upping the rate of renewables delivery, adopting new battery technology to maximise the benefits of solar power, and concluding studies that enable Scottish Water to extend its renewable self-generation target to 120GWh by the end of the decade
- innovative partnerships to trial co-digestion of distillery material and wastewater 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 800 small van fleet to electric vehicles
- planting over 240,000 trees to begin the carbon capture journey



## UNESCO Ecohydrology Demonstration

The Eddleston Water project, which is the Scottish Government's long-running empirical study on the effectiveness of natural flood management measures, has been designated a UNESCO Ecohydrology Demonstration site. As such it becomes the first UK study to be recognised and will now be included in the UNESCO Intergovernmental Hydrological Programme, part of the UN system dedicated to water research and management; enabling the creation of policies to achieve water quality improvement, biodiversity enhancement and sustainable development.

Managed by Tweed Forum and funded by Scottish Government, EU Interreg and SEPA, the project is delivered in collaboration with University of Dundee's UNESCO Centre for Water Law, Policy & Science, British Geological Services, local farmers and the surrounding community. Initiated in 2012, the project is collecting evidence of the costs and benefits of using Natural Flood Management techniques to reduce flood risk through the restoration of natural processes that slow water flow and increase the amount of water stored in the landscape. This helps reduce the risk of flooding to communities downstream and provides adaptation to climate change, while simultaneously improving the biodiversity of the river.



Measures implemented across the 69km<sup>2</sup> catchment include the creation of 38 new ponds to catch surface water flow and the re-meandering of 3.5km of once-straightened river channels. Over a hundred log structures have been placed in streams in the upper catchment, slowing excess water by directing it onto land either side of the river channel. Over 330,000 native trees have also been planted across the catchment which provide a positive impact for ecology and sequestering carbon, and also aid water infiltration in upstream areas where floods are generated, further helping slow overland water flows.

Results to date have shown reduced peak water levels downstream during heavy rain as well as a delay of up to 7 hours in the timing of river peaks, which gives people more time to prepare and take action. There has also been a rise in fish numbers due to increasing the channel length through re-meandering, and a recovery in the diversity and numbers of aquatic invertebrates in response to the range of new habitats created within the re-meandered channels. Other species including Kingfishers, Dippers, Lampreys and Otters will also benefit from improvements to these river habitats.

## Looking ahead – 2023 and beyond

### Hydro Nation Scholars

The Hydro Nation Scholars Programme hits an important milestone with its 10 years anniversary, during which it has seen a wealth of accomplishments and successes from its 40 scholars, of which 19 have joined the Alumni Association to date. This year also saw a fantastic response to the Call for Proposals 2023, drawing a total of 46 proposals across six key topics of water research, the highest number of applications received for a call so far. These achievements highlight the progressive growth and development of the programme, its increasing profile, its impact in deepening research to support the needs of the water sector, and its role in inspiring, educating, and mentoring future world water leaders.

Looking ahead, with continued support from the Scottish Government and other stakeholders, CREW will continue to develop different levels of the Hydro Nation Scholars Programme, further building its scale and reputation, expanding its international reach, and continuing to support needs-based research conducted by talented scholars from across the globe. Through strategic scanning approaches, the programme will continue to identify priority areas for Scotland's waters and for international partners, selecting and funding projects that are novel and relevant to the core Hydro Nation strategy, promote innovative thinking in technologies and approach, and have the potential for wider application. The programme will also endeavour to enhance its impact and develop further learning and training opportunities for continuing the professional development journey of its scholars, through networking sessions, summer school and residential programmes, placements, and organisation of and participation in various conferences and events, including World Water Day 2023.

### Surface water management

For surface water management Scottish Water is developing an approach to transforming at three scales:

- Project - all new sewer flooding, unsatisfactory intermittent discharges (UIDs) & growth projects will now include development of sustainable options to manage surface water
- Neighbourhood - aim to develop a strategy and a programme of opportunities to be delivered in partnership with Local Authorities, SEPA and NatureScot
- City level - Working with Aberdeen City Council and SEPA to trial an approach to integrated surface water and sustainable infrastructure planning

### ETP Hydro Nation Energy Innovation Programme

2023 sees the launch of a new innovation support service for the water sector, building on the earlier successes of the Hydro Nation Water Innovation Service. Delivered by our partners at the University of Strathclyde's Energy Technology Partnership (ETP), a new water and energy theme is being established that will link businesses with academic experts to develop innovative collaborative projects that exploit the links between water and energy to drive down emissions. Broader innovation and business development support will continue to be available to eligible Scottish SME companies via Scottish Enterprise. Further details are available on the [ETP website](#).



## Malawi-Scotland Regulatory Partnership (MSRP)

As the MSRP looks forward into 2023 and beyond, it will continue to offer support to Malawi as it aims to reach key goals, such as the commitments of Vision 2063<sup>2</sup> and the UN's Sustainable Development Goals. Principally, the MSRP's approach will continue to support and evolve to the needs of the regulators in Malawi, with a greater focus on capacity building through practical regulatory training/support, enhancing the evidence and data used by the regulators, and investing in Malawian talent, driving home-grown environmental professionals for the future.

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<sup>2</sup> UN/Government of Malawi. (2020). Malawi Vision 2063: An Inclusively Wealthy and Self-reliant Nation. Lilongwe: Malawi National Planning Commission.

### Who does what?

**The Scottish Parliament** scrutinises the work of the Scottish Government and its public bodies, and holds them to account. Both the Scottish Government and the Scottish Parliament are accountable to the people of Scotland.

**The Scottish Government** – Scottish Ministers and their officials manage the relationship with Scottish Water and its regulators within the statutory framework established under the Water Industry (Scotland) Act 2002. Scottish Ministers set the objectives for the industry (as [set out in the Ministerial Directions](#)) and the principles that should underpin charges (as [set out in the Principles of Charging Statement](#)).

**The Water Industry Commission for Scotland (WICS)** has the statutory duty to set price limits for Scottish Water based on the lowest overall reasonable cost of achieving Ministers' Objectives for the water industry.

**Scottish Environment Protection Agency (SEPA)** is responsible for ensuring that Scottish Water meets strict environmental requirements. SEPA also advises Ministers on the delivery of and the need for future investment in environmental improvements

**The Drinking Water Quality Regulator (DWQR)** is responsible for monitoring and confirming that the drinking water supplied by Scottish Water through the public water mains system meets the requirements of the drinking water quality regulations and is safe to drink. DWQR also advises Ministers on the delivery of and the need for future investment in drinking water quality.

**The Scottish Public Services Ombudsman (SPSO)** is the final stage for complaints about Local Authorities, most licensed providers, the Scottish Government and its agencies and departments.

**Central Market Agency (CMA)** – On 1 April 2008, competition was introduced into the water industry in Scotland for retail (non-domestic) customers. The CMA is the organisation that administers the retail market for water and waste water services in Scotland. They are a company limited by guarantee and owned by its members.

## Key sector stakeholders

**Scottish Water** is a public corporation accountable to Scottish Ministers and through them to the Scottish Parliament. The service Scottish Water provides to 2.61 million households and more than 150,000 business premises is essential to daily life in Scotland. Every day, Scottish Water delivers 1.52 billion litres of clear, fresh drinking water and takes away 1.10 billion litres of waste water that it treats and returns safely to the environment. With more than 60,000 miles of pipes and 2,000 treatment works, Scottish Water supports communities the length and breadth of Scotland every day. In providing these essential services to customers, Scottish Water recognises these activities and operations can be visible in the communities it serves. That is why Scottish Water works very hard to ensure it is responsive and sensitive to the needs of its customers in every corner of Scotland and aims to put communities at the heart of the business.

**Scottish Water Horizons Ltd** is a commercial subsidiary wholly owned by Scottish Water. The company plays a key role in supporting the development of Scotland's sustainable and circular economy by making the most of the public utility's vast array of assets. Drawing on its experience of the remarkable transformation in the water industry in Scotland, it also offers international services to utilities, governments and other clients from around the world, including the Middle East, Canada, Ireland and Australia.

**Licensed Providers (LPs)** – Retail (non-domestic) customers are able to choose who supplies their water and sewerage services. All water and sewerage service providers must be licensed by the Water Industry Commission for Scotland (WICS). WICS publishes [a list of licensed providers and information on the retail market](#).

**Consumer Scotland** represents water consumers, and is a key partner in many areas of policy development.

**The Convention of Scottish Local Authorities (COSLA)** is the representative voice of Scottish local government. Local Authorities provide the collection and billing for water and sewerage services on behalf of Scottish Water for all domestic (and non-metered) customers.

Scholar	Cohort	Project	University
Carolin Vorstius	2015-21	<p><b>Title:</b> Safeguarding and Improving Raw Water Quality by Increasing Catchment Resilience</p> <p><b>Community Impact:</b> Better integrated catchment resilience enhances environmental protection and reduces treatment costs resulting from compromised catchments.</p>	Dundee and James Hutton Institute
Kirsty Holstead (p/t)	2016-20	<p><b>Title:</b> Governing Water One Drop at a Time: Responses to, and Implications of, Community Water Management in Scotland &amp; Beyond.</p> <p><b>Community Impact:</b> will help optimise community engagement to protect and maintain raw water quality, improving quality of supply and reduce treatment in remote rural communities.</p>	St Andrews and James Hutton Institute
Lucille Grout (p/t)	2017-21	<p><b>Title:</b> Socio-Legal Responses to the Challenges of Contaminants of Emerging Concern.</p> <p><b>Community Impact:</b> The objective is to improve availability of "safer" products and assess feasibility of potential legal improvements. Furthermore, the project will look for ways to support consumers to make informed choices.</p>	Dundee
Kerr Adams	2018-22	<p><b>Title:</b> The Scottish Water Landscape and Its Resilience to Change: An Assessment to Support Future Policy.</p> <p><b>Community Impact:</b> The objective is to provide a systematic insight into the future of Scottish land use/management/industry and its relationship with water quality and quantity, and provide the necessary evidence (for national strategy, planning and policy) of the resilience of policy and management options to uncertain drivers of change.</p>	Edinburgh
Elliot Hurst	2018-22	<p><b>Title:</b> Adaptive Engineering Solutions to Water Abstraction and Control for Developing Countries.</p> <p><b>Community Impact:</b> The objective is to provide solid evidence to support best practice guidance for rural communities on the application and adaptive needs of wetland treatment systems utilising</p>	Stirling

Scholar	Cohort	Project	University
		different vegetation types, and how effectiveness may vary across wet and dry seasons.	
Hanna Peach	2018-22	<p><b>Title:</b> Optimising Microbial Communities for Removal of Priority Chemical from Water.</p> <p><b>Community Impact:</b> The objective is to characterise in detail the degradation of the OMPs diclofenac and triclosan by microbial biofilter communities formed in a range of Scottish source waters. This information is an essential prerequisite for targeted design of biofilter microbial communities for OMP degradation.</p>	Edinburgh and James Hutton Institute
Sydney Byrns	2019-23	<p><b>Title:</b> Co-developing strategies to promote inclusive water governance in Malawi</p> <p><b>Community Impact:</b> Through cross-scale analysis of social network structure, dynamics, and beliefs, this project aims to strengthen national and institutional water policies together with the methods of providing feedback between water sector stakeholders, with the objective of this leading to more adaptive water governance in Malawi.</p>	Stirling
Julius Cesar	2019-23	<p><b>Title:</b> Blue-green prescribing for a healthier population and a healthier water environment</p> <p><b>Community Impact:</b> The study aims to investigate the feasibility of adopting a blue green prescribing strategy in local health boards by examining the components of existing models of prescribing green pharmaceuticals and blue space interventions; mapping out key stakeholders and policies that influence the uptake of pharmacological and non-pharmacological prescribing; and analysing viewpoints of stakeholders about blue green prescribing. This information is useful in the development of a bespoke blue green prescribing strategy that fits in the context of Scottish healthcare system and considers behavioural, environmental, social, and systemic facets of intervention adoption.</p>	Glasgow Caledonian

Scholar	Cohort	Project	University
Rita Noelle Moussa	2019-23	<p><b>Title:</b> Conversion of wastewaters and organic waste into chemicals, energy, and organic fertiliser</p> <p><b>Community Impact:</b> The objective is to establish an anaerobic digestion process for the bio-decomposition of wastewaters and organic waste to be able to provide cleaner and healthier water before being discharged into the environment. Moreover, the process will produce valuable chemicals such as ethanol, short chain organic acid for industrial use and hydrogen, methane for energy production (biofuel and electricity).</p>	Aberdeen
Diana Souza Moura	2019-23	<p><b>Title:</b> Microplastics as a vector for micropollutants in aquatic environments.</p> <p><b>Community Impact:</b> Affect societal attitudes in respect of the use of plastics and provide tools to influence policies by understanding the mechanism of interaction between microplastics and natural toxins, such as microcystins, and pharmaceuticals, as well as the effect of microplastics loaded with micropollutants on aquatic biota in freshwater, and the potential dangers of underestimating these pollutants in drinking water as current water sampling protocols do not account for adsorbed pollutants.</p>	Robert Gordon
Indira De Menezes Castro	2020-24	<p><b>Title:</b> Elimination at source of biocidal agents from freshwater environments by TiO<sub>2</sub> photocatalysis</p> <p><b>Community Impact:</b> To research developing a pilot scale modular photocatalytic treatment unit that can be deployed for source management of biocide discharge, i.e. in drainage channels, waste gutters, rural SuDS, or waste water ponds.</p>	Robert Gordon
Manuel Valdivia Moya	2020-24	<p><b>Title:</b> Nanomaterials and photonic solutions: Novel 'at source' approaches to stop hospital-derived priority substances reaching the sewer network</p> <p><b>Community Impact:</b> To study the nature and extent of the emerging problem of pharmaceuticals in wastewater prior to developing novel at-source solutions to eliminate the risk,</p>	Highlands and Islands

Scholar	Cohort	Project	University
		particularly with respect to healthcare facilities (e.g. at hospitals).	
Ilgaz Cakin	2020-24	<b>Title:</b> Reed Bed Use Within Scotch Whisky Distilleries to Treat Wastewater: A New Toolkit to Help Maximise Performance <b>Community Impact:</b> To research sustainable, high-performance green wastewater treatment technologies for the Scottish whisky sector.	Highlands and Islands
Sayali Pawar	2020-24	<b>Title:</b> Future proofing Scotland's water security: delivering safe and resilient water supplies <b>Community Impact:</b> To relate past drought periods to observed water quality in drinking water supply catchments (chemical and biological status) to examine empirical evidence of drought impacts in Scotland in terms of water quantity, quality and ecosystem resilience, with a special focus on private water supplies and users.	Dundee and James Hutton Institute
Martyn Roberts	2020-24	<b>Title:</b> The role of place and scale on effectiveness of temporary storage areas for surface runoff attenuation <b>Community Impact:</b> To provide a decision support framework for policy and practitioners. This will communicate the functioning of temporary storage areas (TSAs) in various scenarios and provide a useful tool for effectively targeting and managing future TSAs.	Aberdeen and James Hutton Institute
Anna McWilliam	2021-25	<b>Title:</b> Innovative brush management to enhance water quality following peatland restoration and forestry operations <b>Community Impact:</b> By investigating physical and chemical properties of brush, this research will explore its potential use for mitigating water quality perturbations post-felling and for nutrient removal during water treatment, and produce guidance to help the forestry industry enhance water quality following peatland restoration and forestry operations.	Highlands and Islands

Scholar	Cohort	Project	University
Daniel Atton Beckmann	2021-25	<p><b>Title:</b> Using satellite remote sensing and automated in situ sensors to monitor and predict cyanobacterial blooms in multiple lakes</p> <p><b>Community Impact:</b> To find practical and innovative ways to monitor and forecast cyanobacterial blooms in inland waters by combining ongoing data acquisition (satellite and meteorological data) and automated in situ sensors for real-time assessment and short-term forecasting of crucial water quality and health parameters for multiple Scottish lakes. This project would benefit the general public in terms of lowering health risks owing to cyanobacterial blooms and benefit water managers who would be able to utilise the up-to-date information about their lakes.</p>	Stirling
David Bryan	2021-25	<p><b>Title:</b> Integrated management of Scotland's agricultural wetlands to deliver multiple benefits and minimise pollution swapping</p> <p><b>Community Impact:</b> To advance understanding on how constructed wetlands can be optimised within agricultural landscapes for ecosystem services whilst minimizing trade-offs, by means of a holistic assessment approach to study these systems. Furthermore, it will involve a significant degree of stakeholder engagement to understand the barriers to implementation across rural communities, aiming to provide tools to investigate how upscaling options will affect catchments within a changing climate.</p>	Stirling
Donald Robertson	2021-25	<p><b>Title:</b> Citizen-derived digital data for water resources management in Malawi</p> <p><b>Community Impact:</b> Through a multidisciplinary approach, this research will establish the scientific knowledge and data gaps that exist within the water sector in Malawi and develop an understanding of how decision makers interact with and utilise data. From this grounding, it will incorporate the use of use of citizen-generated, technology-enabled data in support of evidence-based decision making to create</p>	Strathclyde



Scholar	Cohort	Project	University
		stronger, proactive water management approaches and inform current Scottish Government efforts to enhance the capacity for sustainable water resources management in Malawi.	
Sarah Crowe	2021-25	<p><b>Title:</b> Water smart cities: towards a place-based approach for waterfront management and flood protection</p> <p><b>Community Impact:</b> Drawing upon a multi-disciplinary approach, with input from engineering, geoscience, urban planning, policy and community-based approaches to resilience, this research will further understanding of how integrated 'place-based waterfront approaches' for innovative flood protection and vulnerability risk assessments can develop 'waterfront smart cities', creating places that encompass a range of uses with social, environmental and economic benefits to promote better quality of life, well-being, resilience and protection against extreme climate change.</p>	Dundee
Oludare Durodola	2021-25	<p><b>Title:</b> Optimising water use and soil carbon sequestration - can agricultural co-cropping systems provide multiple benefits to address climate change?</p> <p><b>Community Impact:</b> To further understanding of the processes underlying optimal co-cropping systems for multiple benefits, aiming to develop a decision support framework for selecting appropriate crop combinations for sustainable water management and carbon sequestration while putting Scotland at the forefront of innovation for novel agricultural systems in mitigating and adapting to climate change.</p>	Aberdeen



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