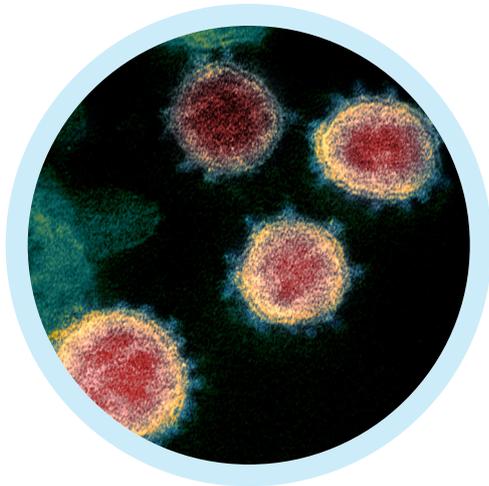


# How to collaborate in a crisis: lessons from Scottish wastewater testing

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Testing wastewater is a low cost and non-invasive means of tracking the prevalence of COVID-19 in populations. The development of the Scottish SARS-CoV-2 (Covid-19) wastewater testing programme was reviewed from initial laboratory research to a routine monitoring programme in order to learn lessons that can be used to improve future cross-sectoral collaborations in emergency situations. These findings highlight the need for improvements in cross-sectoral working across environment and health and the uptake of research by Scottish Government and its agencies.

## Background

This project reviewed the development of the Scottish programme for Covid-19 wastewater testing to learn key lessons to inform future urgent responses to health and environmental crises. Less than six months after Dutch researchers published the first test to detect the presence of the Covid-19 virus in wastewater, a collaboration between researchers from the Roslin Institute, the Scottish Environment Protection Agency (SEPA) and Scottish Water developed a pilot programme of wastewater testing in Scotland. By the end of 2020, this programme covered more than 80% of the Scottish population.

This research was commissioned by Scotland's Centre of Expertise for Waters (CREW) on behalf of Rural & Environment Science & Analytical Services (RESAS) to find out what could

## Overview

This research reviewed the development of the Scottish SARS-CoV-2 (Covid-19) wastewater testing programme from initial laboratory research to a routine monitoring programme. 41 key individuals from organisations including Public Health Scotland, Scottish Water, Scottish Government, SEPA and several universities were interviewed. Collaborations between researchers, industry and government were analysed to see what lessons could be learned to improve future crisis responses.

Summary recommendations to Scottish Government (SG) are:

- Stronger links across environment and health sectors within SG and its agencies.
- Public support for key research infrastructure and capacity.
- Better use of Chief Scientific Adviser (CSA) network as a contact point for researchers.
- A new SG post of Chief Scientist for Public Health.
- Knowledge brokerage units (on the RESAS model) for Scottish public health.
- Support to enable groups (e.g., CAMERAS) to meet and maintain professional networks.

be learned from this successful collaboration, as part of a larger project to detect SARS-CoV-2 variants in wastewater. A qualitative social science study was undertaken to analyse the challenges and enablers of interdisciplinary and cross-sectoral rapid responses to emerging situations, using the researchers' expertise in inter- and transdisciplinary research collaborations to provide recommendations ("lessons learned") to improve future responses. A major component of this research involved interviewing individuals working on wastewater research and the testing programme from organisations such as the Roslin Institute, SEPA, the Scottish Government and Scottish Water. The researchers are grateful to all the individuals for their participation in our research.

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### Box 1: Why test wastewater for COVID-19?

*Testing individuals for Covid-19 is expensive, invasive and, if certain groups are unwilling to come forward for testing, may not provide an accurate picture of who is infected.*

*Individuals who are infected with Covid-19 excrete the virus into the sewage system. At the beginning of the pandemic, researchers from the KWR Water Research Institute in the Netherlands published an article describing the first ever detection of SARS-CoV-2 in sewage (Medema et al., 2020).*

*Testing wastewater for Covid-19 was now possible, offering a cheaper and less invasive means of tracking infection rates in different populations.*

## The development of the Scottish Covid-19 wastewater testing programme

The Covid-19 wastewater testing programme began in April 2020 with research at the University of Edinburgh's Roslin Institute and the microbiology laboratory of SEPA using wastewater samples provided by Scottish Water. Scotland's Centre of Expertise for Waters (CREW) played a key role in bringing together these collaborators and funding the Roslin Institute research. In the summer of 2020, national wastewater monitoring was piloted testing samples covering approximately 40% of the Scottish population, and by September 2020 the programme had been expanded to cover 70% of the population. In December 2020, the Scottish Government's Health Directorate assumed responsibility for the programme, expanded it and committed funding for the next financial year (2021-22). A timeline of the key events is given in Box 2 (below).

This review of processes developed a detailed understanding of the ways in which individuals and organisations, from the research and policy communities collaborated in developing the Scottish Covid-19 wastewater testing programme. The research used qualitative methods (interviews supplemented by desk research) to derive a series of "Lessons Learned" for future collaborations that demand rapid research and policy responses. These in turn led to the set of six actionable recommendations for improving emergency preparedness outlined below.

The Scottish Covid-19 wastewater testing programme was an impressive achievement: a nationwide surveillance programme for a novel organism was developed collaboratively from a "standing start" in less than six months. This success was due to a combination of high-level support from key individuals

within relevant organisations and the hard work and motivation of those working on the project. However, after this impressive start the programme encountered some organisational issues that made the transition from innovative research to a routine testing programme challenging (even taking account of the accelerated timescales involved).

### Successful elements of the collaboration

- The important role played by CREW in establishing and funding the pilot research projects.
- The flexibility of initial institutional responses.
- The sharing of specialist knowledge and research data among collaborators.
- The use of existing capacities and internal resources to develop the testing protocol, share it between collaborating organisations and set up the initial sampling and testing programme.
- The public availability of project data and its accessibility via the SEPA dashboard.
- The further collaborative work done to link the wastewater testing data to the individual case data.

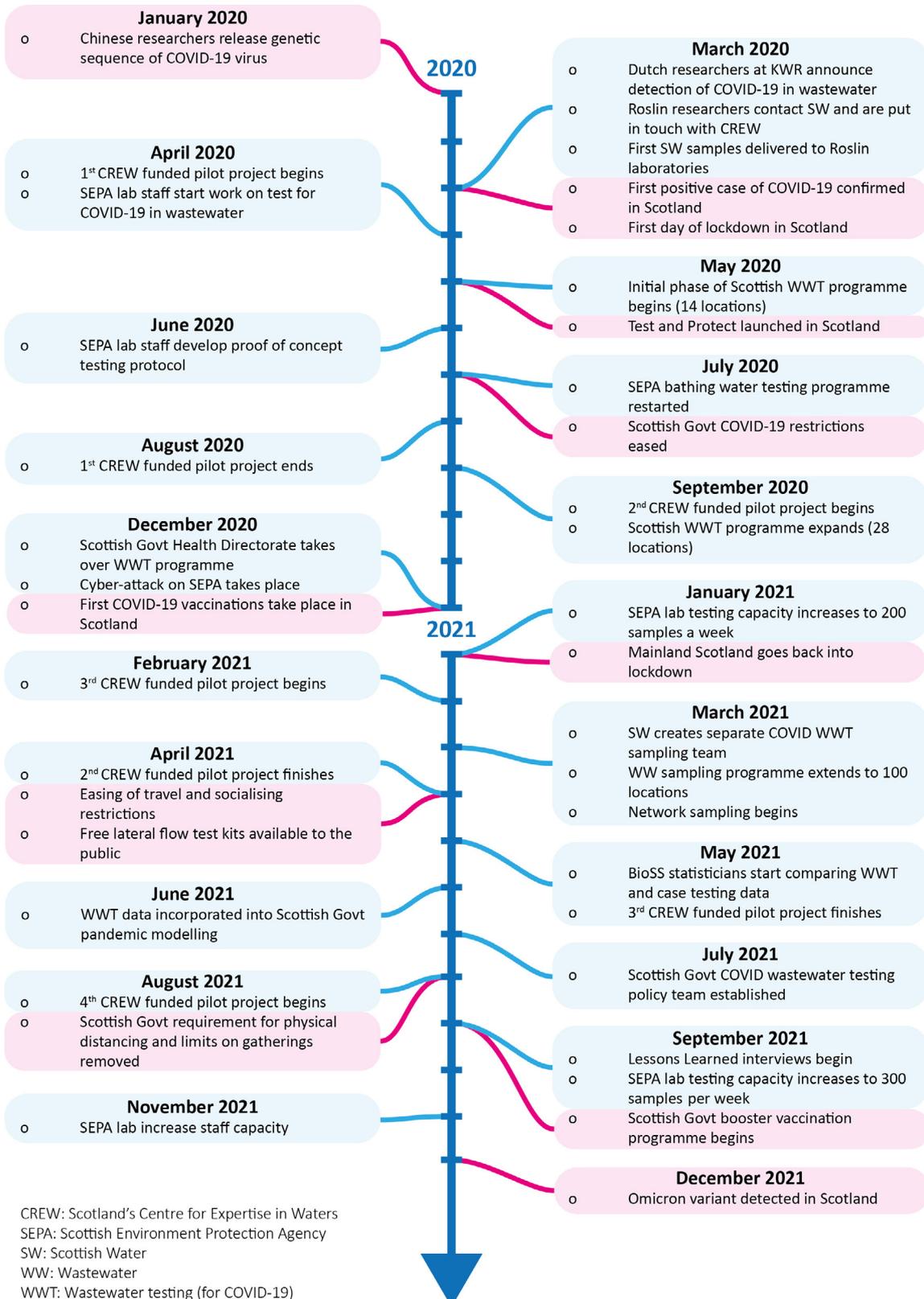
### Less successful elements of the collaboration

- Hesitant take up by Scottish Government leading to a lack of policy "ownership".
- The limited involvement of Public Health Scotland, and therefore weak public health rationale behind the development of the sampling programme.
- Ongoing use of ad-hoc approaches to organising the programme, some of which relied on extended periods of heavy workloads for particular individuals.
- The lack of strategic leadership as both research and testing programmes expanded well beyond the scope of the initial pilot projects.

### Future perspectives

This review further demonstrates that, in future, the Scottish Government should be able to fully adopt the validated 'One Health' approaches that many have argued will be necessary to manage the future impacts of the climate crisis. However, this study also reveals some weaknesses in cross-sectoral working across health and environment, and in the take up of research by Scottish Government, and recommendations are targeted towards these areas.

**Box 2: Timeline of key events in the development of the Scottish Covid-19 wastewater testing programme (in blue) and selected external events from the SPICe COVID-19 timeline (in red)**



## Policy recommendations

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These six recommendations, which have been road-tested in discussion with key stakeholders, focus on the ways in which Scottish Government and its agencies can improve their communication and co-ordination with each other and with the wider Scottish research community, thereby ensuring the effectiveness of collaborative responses across the broad 'One Health' science policy landscape to achieve optimal outcomes in emergency situations.

**1. Stronger cross-government and inter-agency links among those working in the environment and health sectors are needed to tackle future crises.**

For example, the climate crisis will result in increasing threats to human health (including future pandemics) demanding responses that span public health, animal health and environment. This, in turn, will require more joined-up approaches with effective day-to-day working relationships among Scottish Government directorates and its agencies such as PHS and SEPA.

**2. A well-founded and responsive national research capacity requires an appropriate balance of public support for project and core funding to ensure the availability of key research infrastructure and capacity.**

Small-scale and responsive funding schemes worked well in this case, but their success was contingent on standing research capacity such as cat-3 laboratories, specialist equipment and the availability of appropriately trained researchers. Continuity of funding is especially important in cross-sectoral research where it takes longer to build and maintain relationships of trust.

**3. The Scottish Government could make better use of its network of Chief Scientific Advisors as a conduit for information exchange among the research and policy communities.**

Researchers and other government outsiders find it difficult to identify the right person within Scottish Government to contact, partly because they find its structure hard to understand and therefore navigate. This could be part of the expanded scientific advisory mechanism recommended by the recent SSAC report Building on the Science Legacy of Covid-19 in Scotland.

**4. The Scottish Government should establish a new post of Chief Scientist for Public Health to better represent the Scottish Public Health community.**

The review findings indicate that neither the Chief Scientist (Health) nor the Chief Medical Officer currently represent or provide sufficiently high-profile leadership for the Scottish Public Health community. This gap has implications for both the public standing of the sector and the possibilities for strategic co-ordination with other sectors and with the Chief Scientific Advisors.

**5. The Scottish Government should consider adopting the good practice of the RESAS-funded knowledge brokerage units such as CREW, and establish similar bodies for the Scottish public health community that bring researchers and stakeholders together to co-create research on policy-related topics.**

CREW played a crucial role in the rapid development of the Covid-19 wastewater testing pilot programme. CREW's existing relationships with a range of key stakeholders were an important asset in the Scottish case. However, it has not been possible to identify similar knowledge-brokerage organisations within Public Health.

**6. Ensure ongoing support to enable groups (such as CAMERAS) to meet and maintain professional networks. These are a cost-effective way of future-proofing crisis responses and funding for such activities should be protected.**

In crisis situations, people initially turn to their existing networks for assistance with unexpected and urgent tasks. This is an example of the importance of 'weak ties' where initiating a rapid response does not always require a well-developed relationship with the individual.

## References

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Medema et al. (2020). Presence of SARS-Coronavirus-2 RNA in Sewage and Correlation with Reported COVID-19 Prevalence in the Early Stage of the Epidemic in The Netherlands. *Environmental Science & Technology Letters*, 7 (7), 511-516. DOI: 10.1021/acs.estlett.0c00357

SPICe, (2022). Scottish Parliamentary Information Centre Timeline of Coronavirus (COVID-19) in Scotland. Available at: <https://spice-spotlight.scot/2022/06/10/timeline-of-coronavirus-covid-19-in-scotland/> [last accessed 16.6.22].

The SEPA Dashboard displays the data collected by the Scottish wastewater testing programme: <https://informatics.sepa.org.uk/RNAmonitoring/> [last accessed 16.6.22].

The COVID-19 Poops Dashboard summarises global wastewater testing research: <https://ucmerced.maps.arcgis.com/apps/dashboards/c778145ea5bb4daeb58d31afee389082> [last accessed 16.6.22].



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