ALLIANCE FOR
WATER STEWARDSHIP

CASE STUDY

THE FIRST HOSPITAL IN THE WORLD TO ACHIEVE ALLIANCE FOR WATER STEWARDSHIP (AWS) CERTIFICATION

CAITHNESS GENERAL HOSPITAL

SCOTLAND, UK

APRIL 2021

NHS Highland

HIE
Highlands and Islands Enterprise
Iomairt na Gàidhealtachd 's nan Eilean

eri environmental research institute

INTRODUCTION TO AWS

The Alliance for Water Stewardship (AWS)[1] is a global membership collaboration comprising businesses, the public sector and NGOs. AWS members contribute to the sustainability of local water resources through their adoption and promotion of a universal framework for the sustainable use of water – the International Water Stewardship Standard, or 'AWS Standard', which drives, recognises and rewards good water stewardship performance. AWS defines water stewardship as 'the use of water that is socially and culturally equitable, environmentally sustainable and economically beneficial, achieved through a stakeholder-inclusive process that includes both site- and catchment-based actions'.

AWS works on three fundamental building blocks of water stewardship:

1. The AWS Standard is globally recognised and respected as defining best practice in catchment-focused, collaborative water use. The Standard is being widely used by major water users to help address water risks and bring stakeholders together to resolve shared water challenges. Water users' implementation of the Standard is verified by independent third-party audit, enabling those water users to make credible claims about improving their water use, thereby helping to build the trust needed to ensure the sustainability of water as a precious natural resource. **Figure 1** below illustrates the five steps of the AWS Standard 2.0 and the five intended outcomes of its implementation.

2. AWS Membership connects progressive organisations from all sectors in advancing water stewardship and enables precompetitive collaborations to flourish at different levels (technical, conceptual and practical). AWS members seek a more structured way to engage with water stewardship in their country and region.

3. The AWS Global Network is a multi-stakeholder platform to engage different interests in advancement of water stewardship. In Europe, AWS recently convened, with partners, the inaugural meeting of the European Water Stewardship Network, which will enable a direct link among and between European and global water stewardship good practices.

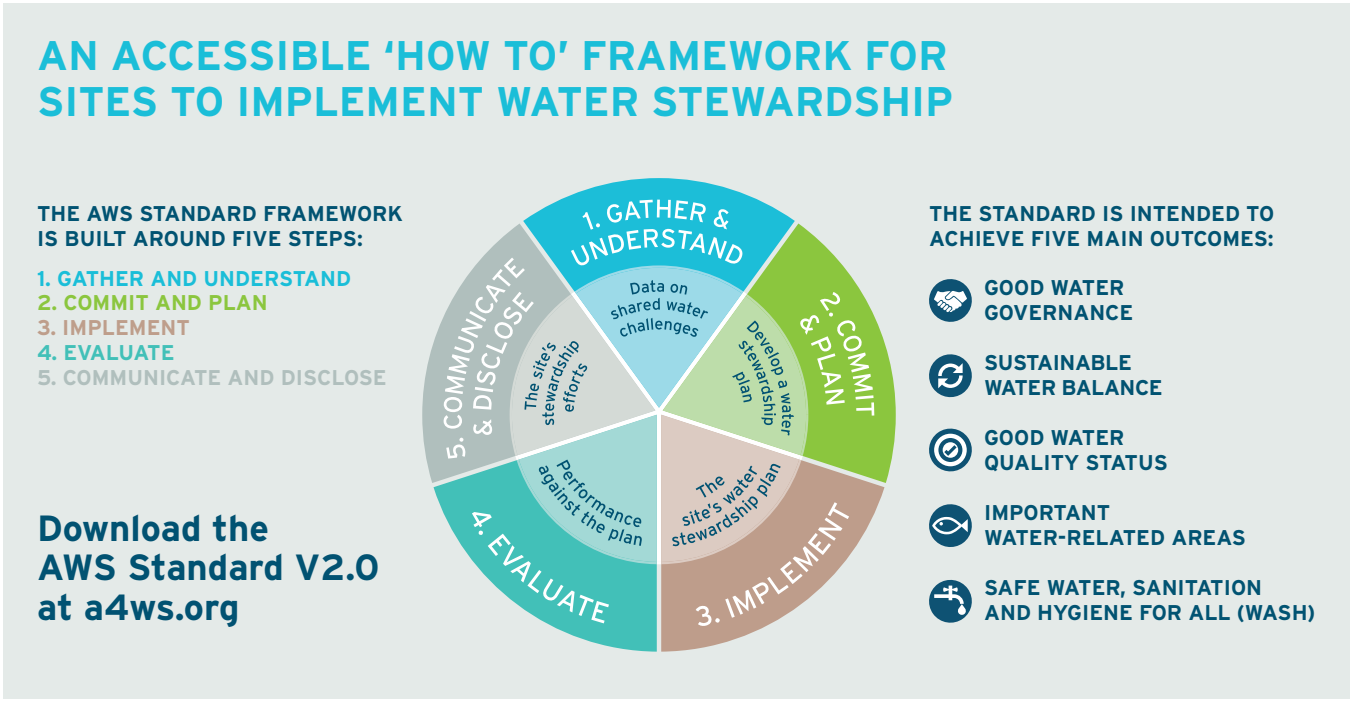

Figure 1. The AWS Standard V2.0: Five Steps and Five Outcomes

[1] a4ws.org

Cover Photo: Pexels/ Karolina-Grabowska.

OVERVIEW

Caithness General Hospital is owned and managed by the National Health Service (NHS Highland) in Scotland. The hospital provides health care to the local town, Wick (population of c.8,000), and the surrounding district (population of c.26,000). As 'General' in the title suggests, Caithness General responds to a broad range of medical conditions[2].

The Highland region of Scotland covers 41% of the land mass of Scotland. NHS Highland is, by geographical coverage, the largest Health Board in Scotland.

In November 2019, Caithness General was the first hospital in the world, and the first public sector organisation in the world, to achieve Alliance for Water Stewardship (AWS) certification.

The AWS Standard can be implemented by government and public agencies as well as private companies, thereby supporting public policy as well as business goals.

This case study demonstrates the relevance of water stewardship to public sector organisations - particularly hospitals and other health facilities.

The presence of pharmaceutical residues in water is recognised internationally as an important public health and environmental issue. The quality of the used water discharged from Caithness General into the sewerage system, and *from* there into the environment, was a key focus of the implementation of the AWS Standard at Caithness General, alongside improvement of efficiency of water use *within* the hospital.

WHY AWS?

The first interaction between Caithness General and AWS took place after a meeting in 2015 at Gorthleck Water Testing centre between the NHS Highland Estates Department, Highland and Islands Enterprise (HIE) and the Environmental Research Institute (ERI) to discuss techniques in water testing and treatment. NHS Highland was looking for new opportunities in environmental sustainability, including technical solutions.

An introduction was made to Adrian Sym, the CEO of AWS. Following an explanation of the AWS Standard and System, the NHS Highland Environment & Sustainability team presented to the then Chief Executive of NHS Highland the option of adopting the AWS Standard. The proposal was that implementation of the AWS Standard would be a means to lead reflection on the water management issues of hospitals in the Highlands and more widely in Scotland, including assessment of water use and risks associated with a district hospital. Elaine Mead, as CEO of NHS Highland, approved the proposal.

Implementation of the AWS Standard started in May 2017 as a means of exploring the issue of 'downstream' impacts on people and the environment of the water used and discharged by the hospital. As stated in the Introduction to the AWS Standard[3]: "Any responsible business or organisation should commit to causing no harm to the natural environment and communities…". Health organisations are a case in point. NHS Highland was looking to act on the principle of health provision that healthcare practitioners and facilities 'should do no harm' and should apply that principle as best as possible in relation to risks to the environment and public health.

As a natural function of their public health mission, hospitals are major users of medicines. As such they are key point-sources for pharmaceuticals that go into the public water supply through consumption/use of medicines. Patients consume 'active pharmaceutical ingredients' (APIs) and excrete them in urine into the sewerage system (between 30% and 100% of an oral dose)[4].

[2] Caithness General offers general medicine/surgery services, diagnostics (X-ray, ultrasound and CT(special X-ray tests)), accident and emergency, and limited high dependency, renal and palliative care services. The hospital has 20 medical and 42 surgical beds, a limited obstetric/midwifery unit (six beds) and an on-site laboratory and pharmacy.

[3] a4ws.org

[4] Other sources of pharmaceutical residues are by improper disposal (medicines flushed down toilets and sinks or put into bins which go to landfill) or in the production processes of the pharmaceutical industry.

WHY AWS? (Continued)

The report of the Organisation for Economic Cooperation and Development (OECD) published in November 2019[5] noted that about 2,000 APIs are being produced and administered worldwide in medicines[6] and these APIs are found in surface waters, groundwater, drinking water as well as soil/sediment and the food chain[7]. Because pharmaceuticals are intentionally designed to have a biological effect on humans, animals and organisms at low doses, even low concentrations in the environment can have unintended, negative impacts on freshwater ecosystems (e.g. feminisation of fish and amphibians, and alteration of fish behaviour)[8]. Public health experts note that many doctors and clinicians are unaware of the environmental impact of the pharmaceuticals which they prescribe for their patients and, when they are told, they are often shocked - and then willing to switch, where possible, to more environmentally-friendly alternatives[9] - as discussed further below.

For humans in particular, the discharge of antibiotics to water bodies exacerbates the problem of antimicrobial resistance which the World Health Organisation has noted is an increasingly serious threat to global public health[10]. As noted in the OECD report, the presence of APIs in drinking water is a particular problem due to incapacity of wastewater treatment plants to remove the pharmaceutical residues.

A key part of implementation of the AWS Standard is identification of shared catchment water challenges to be addressed in the water stewardship plan. In the case of Caithness General, the deterioration of water quality due to pharmaceutical residues was identified as the principal water challenge.

At the same time, the Steps of the AWS Standard include the means to identify and implement opportunities to improve efficiencies in water use within the operations of the 'site' which implements the Standard – and this opportunity was also taken up in this case.

"Within established NHS rules and government regulations, my position as Chief Executive afforded me opportunities to innovate. Alongside our obligations to the communities we serve, as well as the well-being of our staff - the NHS is the biggest employer in the Highlands - I was also conscious of our responsibility to the environment. Before going down the pathway of water stewardship, I and my colleagues in the Estates team had already made changes to the heating system at Caithness General (the switch from heavy oils to wooden pellets) and we had improved the building's insulation. By adopting the AWS Standard, we anticipated that we could provide an example of leadership in water management. First, however, we had to find out where we stood as aspiring water stewards."

- Elaine Mead, Former CEO of NHS Highland.

[5] 'Pharmaceutical Residues in Freshwater - Hazards and Policy Responses', November 2019: www.oecd.org/environment/resources/Pharmaceuticals-residues-in-freshwater-policy-highlights-preliminary-version.pdf
[6] For veterinary purposes as well as in medicines for humans.
[7] From the Executive Summary of the OECD 2019 report.
[8] From the Executive Summary of the OECD 2019 report.
[9] Source: Sharon Pfleger, public health consultant to NHS Highland.
[10] Source: 'Antimicrobial resistance – Key Facts', World Health Organisation, 31 July 2020: www.who.int/news-room/fact-sheets/detail/antimicrobial-resistance ; see also: 'Antimicrobial Resistance: An Emerging Water, Sanitation and Hygiene Issue', Briefing Note, World Health Organisation, 2014: https://apps.who.int/iris/bitstream/handle/10665/204948/WHO_FWCWSH_14.7_eng.pdf?sequence=1

CONTEXT

Caithness General is located in Wick, which is a small coastal town in the north of Scotland, not far from the most northerly point of the UK mainland – see Figure 2.

Wick is situated in a rural area, the principal activities of which are agriculture, fishing and distilling of whisky, energy (renewables and nuclear) and tourism, alongside public services. Recreational activities in the area include fishing in the rivers and in the sea, as well as golf and surfing from local beaches. The marine fishing brings in sea food for local consumption as well as being sold across the North of Scotland and elsewhere in the UK and Europe.

There are no reported problems, currently, with water supply deficits (too little water) in the district. The climate change impact assessment commissioned by NHS Highland in 2015 pointed to future pressure on water resources due to drier summers, as contrasted with current problems of flooding (too much water) caused by heavy rains[11].

Caithness General receives its water supply in the same manner as the rest of Wick, namely as provided by Scottish Water which draws all the water it needs from Loch[12] Calder, some 30 kms away. This untreated ('raw') water source provides potable water for much of the county of Caithness[13]. The water retailer, Wave Utilities, is the immediate supplier to Caithness General. As measured by engineering consultants and reported to NHS Highland, the water consumption of Caithness General is currently 7,740 cubic metres per year[14].

Wastewater from Caithness General - from all parts of the hospital – is routed to one water outflow which then runs into the Wick sewage system. It is Scottish Water which also provides the sewerage services to the town, putting all the effluent from local households, businesses and public facilities through the wastewater treatment plant in Wick, which it operates.

The discharged water, after it has passed through the water treatment plant in Wick, was tested by the Environmental Research Institute (ERI) in a baseline study during implementation of the AWS Standard[15]. This test revealed the extent of pharmaceutical residues, discharged by the hospital (as well as from local households[16]), still present in the water after treatment[17]. That is the case for similar water treatment plants in the UK and elsewhere in Europe. Professor Stuart Gibb of ERI pointed out that[18]:

Figure 2. Map of Caithness, with Wick

"Conventional wastewater treatment plants generally remove only around 30-80% of pharmaceuticals. New approaches and technologies are needed to remove the active ingredients that arise from the use of many medicines. At present these other technologies are either prohibitively expensive or simply not available".

The ERI study in Wick supported previous studies in other locations showing that rural communities can produce wastewater with significant concentrations of pharmaceuticals, despite having relatively small populations and population densities compared with larger urban areas.

Wick water treatment plant releases effluent into the sea. Such pharmaceutical residues are also considered to be a problem in the marine environment, and that is a particular concern in Caithness General's case given Wick's location on the coast. There was a test for pharmaceutical residues in Wick Bay, but these were found to be below limits of quantification.[19]

[11] Source: Climate Change Impact Assessment report of JBA Consulting, October 2015.
[12] The term 'loch' as used in Scotland means a lake.
[13] In the baseline study by the Environmental Research Institute (ERI) referred to below, the water of Loch Calder was tested and found to be free of any pharmaceuticals.
[14] Source: report on Water Mapping and Efficiency Support by Mabbett & Associates, June 2020.
[15] The baseline study was jointly funded by NHS Highland, HIE and ERI.
[16] Residents who are taking medication prescribed by the hospital or their doctor.
[17] For the purposes of the ERI study at Caithness General, eight pharmaceutical compounds were monitored: paracetamol, diclofenac and ibuprofen (analgesics/anti-inflammatories), clarithromycin and trimethoprim (antibiotics), carbamazepine and fluoxetine (psychiatric drugs) and 17Ð-ethynylestradiol (synthetic hormone). These were chosen for the study because they represented four different pharmaceutical classes, they have a range of physicochemical properties, they have high usage in Scotland, and because they had been regularly detected by other studies elsewhere (in final effluent and surface waters). Additionally, several are of regulatory concern, i.e., they are present on European and/or UK water quality 'Watch' or 'Control' Lists under the EU Water Framework Directive. This is the system that the EU uses to further investigate 'priority substances'. (Source: Niemi, L. et al, 2020).
[18] Source: Presentation on 2 November 2017 on 'Public Heath in Scotland: Transcending Boundaries'. ERI is part of the North Highland College, University of the Highlands and Islands.
[19] Source: Niemi et al, 2020.

BENEFITS OF AWS CERTIFICATION

Managing water stewardship: the Environment & Sustainability team within NHS Highland's Estates Department reported that the AWS Standard was helpful in breaking down the learning work involved in becoming a water steward into a manageable series of steps.

Strengthening stakeholder involvement: the process of implementing the AWS Standard was also instrumental in establishing closer relationships with the key stakeholders. John Burnside, Environmental and Sustainability Manager at NHS Highland, summarised the experience of implementing the Standard thus: "It was interesting work and we learnt a great deal about the Caithness General site and its water use, with measures that can be taken to protect local people and the local environment in future".

Identification of data gaps: the availability of reliable data is a key part of water management. In line with the intended outcome of the AWS Standard of 'Good Water Governance', local water governance in Wick has benefitted from the information the process of implementing the AWS Standard brought together. John Burnside noted: "The results from the ERI baseline study provided us with data regarding the water quality of which we would never have been aware had this project not gone ahead". The results of the study were shared with NHS Highland and Highland and Islands Enterprise and more recently, to reach a broad audience of scientists and practitioners, were published in an international journal[20].

Water stewardship plan: in line with the intended outcome of the AWS Standard entitled 'Sustainable Water Balance' (as noted in Figure 1), application of the Standard by Caithness General means that the hospital now has a quantified water balance for the hospital site. Based on that, the NHS Highland team drew up a water improvement plan, an aspect of the water stewardship plan. The report provided to Caithness General by Mabbett & Associates (referred to above) set out recommendations[21] for improving water efficiency at the hospital including upgrading of taps and toilets and water-related medical equipment (e.g. the endoscopy unit), with monitoring of water use. The recommendations were made following a detailed inspection of the water infrastructure at Caithness General in the different parts of the hospital, including the laundry, kitchen, wards, laboratory and discharge to sewer. The changes could - the consulting engineers advised[22] - bring an economic benefit in terms of a substantially reduced water and sewerage bill – see Figure 3.

Figure 3. Economic benefit of proposed water improvement plan at Caithness General

Out of a total annual water and sewerage bill of £10,579, the water improvement plan could return a saving of £3,447 in water-related costs per year (a potential cost reduction of 33%).

[20] Niemi et al, 2020.
[21] Source: report on Water Mapping and Efficiency Support by Mabbett & Associates, June 2020.
[22] Ibid, page 11.

The NHS Highland Environment & Sustainability team emphasised: "No longer is the water used by the hospital taken for granted, but instead as a precious asset"[23].

The interaction by Caithness General with Scottish Water is on-going, as is that with NHS Highland as the public health authority. Each of them continues to increase their understanding of the challenge of pharmaceutical residues in water, in accordance with the principle of 'continual improvement' as outlined in the Standard.

In accordance with the intended outcome of the AWS Standard of 'Good Water Quality Status', NHS Highland is exploring for Caithness General an end-of-pipe measure[24], namely installation of a prototype unit that they hope will remove most, if not all, of the pharmaceutical residues - more than a typical waste water treatment plant, i.e. the beginnings of an engineering solution. If that could be found, it would have both commercial and public health benefits. Filtration units could in the future be incorporated into the design of every new hospital as part of environmental standards for the National Health Service.

The public health expert advising the Environment & Sustainability team, Sharon Pfleger, Consultant in Pharmaceutical Public Health, is also exploring upstream approaches to tackle the source of the problem. These include public education campaigns to reduce the amount of medicines that are inappropriately flushed down toilets and sinks, an education video on antimicrobial resistance and the environment, a waste campaign to quantify the amount of medicines that are wasted and how this can be avoided, greening the medicine formulary (a list of medicines for prescribers to choose) so that prescribed medicines have a reduced impact on the environment but are still safe and effective for patients, researching the use of blue green resources in nature to benefit health[25].

"This is a classic public health approach that is preventative, tackling the cause of the problem rather than trying to fix it downstream, including educating and persuading doctors to prescribe medicines that have fewer environmental risks. Where a patient can be given a greener medicine, without detriment to that patient's health, the message to doctors will be to switch to that. The changes will not be immediate because altering prescribing behaviour often takes some time. That is why we have a "basket" of interventions that we will use to ensure that patients, the general public, healthcare professionals and industry partners all learn about the issue and how they can play a part in reducing the impact of pharmaceuticals on our environment."

- Sharon Pfleger, Consultant in Pharmaceutical Public Health.

[23] The importance of a secure public water supply has been underlined by the Covid19 epidemic with the emphasis on hand-washing.
[24] 'End-of-pipe' as described in the 2019 OECD report refers to better processing of waste and purification of water including by upgrading waste water treatment.
[25] Source: presentation of Sharon Pfleger at the AWS Forum in November 2019.

COLLABORATION

Together with Highland and Islands Enterprise (HIE) and the Environmental Research Institute (ERI), implementation of the AWS Standard at Caithness General was supported by the Scottish Environment Protection Agency (SEPA) and Scottish Water. Additionally, Aurora Sustainability Group was engaged as the consultancy to assemble the evidence portfolio.

The implementation of the AWS Standard was seen as a means of raising the profile of Caithness General and underlying its good work for the local community. NHS Highland held several meetings of local stakeholders in Wick for communication and exchange, including question and answer sessions. The series of meetings began with an introduction to the concept of water stewardship and a description of the process of implementation of the AWS Standard. Subsequently, the meetings reported on progress. The NHS Highland team included a communications specialist, whilst Aurora Sustainability Group also supported the process (placing advertising). Those who attended the stakeholder meetings included the Caithness Chamber of Commerce, the Young Farmers, the Forestry Commission, the Royal Society for the Protection of Birds (RSPB), with interest also from suppliers of renewable energy (wind power). A town councillor and other council officers were also very supportive of the process. Some stakeholders expressed their support straight away, while others took longer to understand its value. The NHS Highland team noted that the benefits have included publicity for the area. NHS Highland has been seen to be committed to providing sustainable services and looking how to develop these further.

CHALLENGES AND LESSONS

Following the start of implementation of the AWS Standard, the attention of the NHS Highland Environment & Sustainability team was diverted to other tasks, for a period of many months. This caused substantial delay to implementing the first step of the AWS Standard. It became evident that additional external capacity was needed and a local environmental consultancy was engaged.

This experience at Caithness General suggests that other hospitals implementing the AWS Standard are advised to designate a member of their internal environmental management team to act as the dedicated manager of the AWS process, with a substantial part of her/his time spent on maintaining progress through the Steps of the AWS Standard. With the benefit of hindsight, planning the project in this way would have substantially reduced the time and cost it took to complete the five Steps of the AWS Standard at Caithness General.

CONCLUSION

Environmental managers in other hospitals in Scotland have shown interest in the experience of implementing the AWS Standard at Caithness General. The Head of Environment & Sustainability for NHS Highland is aware of the responsibility to reduce the environmental impacts of NHS activities. The agency's public mission does not just involve ensuring the best possible health outcomes for members of the public who are admitted to the hospital, but also the best possible health of the residents of the local community. That includes tackling pollutants to water - part of a responsibility to provide sustainable health services in the sense of not harming the environment.

The motivation to implement the AWS Standard could - the NHS Highland Environment & Sustainability team has said - be particularly strong in locations in Scotland where issues of water quality (and water availability, or both) are pronounced, for example in larger towns or cities.

The advice to others contemplating implementation of the AWS Standard at other NHS hospitals, and indeed other hospitals around the world, would be to put in place the enabling conditions for water stewardship. As described above, key to those are: (i) designation of a dedicated member of the internal environmental management team to act as day-to-day manager of the AWS process; (Ii) securing the support of senior management; and (iii) a clear plan as to the time and cost involved in AWS Standard implementation.

"By adopting the AWS Standard and participating in the broad-based alliance that is part of the Alliance for Water Stewardship, we broke new ground. NHS Highland established itself as a leader in the debate and practice of water management as an essential part of public health - a step ahead of the rest - in line with the evolving standards expected by regulators and the public".

- Elaine Mead, Former CEO of NHS Highland.

To find out more information on AWS in Europe and to learn more about AWS Standard implementation, please email: Peter Newborne at peter@a4ws.org or visit the AWS website a4ws.org

This case study has been written by Peter Newborne and the AWS team in collaboration with NHS Highland and its partners. It is part of a set of water stewardship case studies that can be found on the Alliance for Water Stewardship website: a4ws.org/resources

Many thanks are due to Elaine Mead, John Burnside, Ruth Innes, Stuart Gibb and Sharon Pfleger for all the information and inputs supplied.