

# NATURE-BASED SOLUTIONS: HOW ARE THEY INNOVATING FOR A MORE RESILIENT AND SUSTAINABLE FUTURE?

Nature-based solutions, often known as NbS, are novel and environmentally friendly approaches to resolving environmental problems such as the effects of climate change, the loss of biodiversity, and the exhaustion of natural resources.

by Robert McTaggart  
**Technical Director, Stantec**  
 Gwen Rhodes  
**Senior Principal Engineer, Stantec**  
 & Amanda Ludlow  
**Principal, Stantec**

NbS can help mitigate environmental problems like climate change, the loss of biodiversity, and the loss of natural resources. They do this by using natural systems and processes to make solutions which are good for both people and nature. They are becoming more important in various sectors including the whole water cycle system (source to sink to source), and they are changing the way we think about our spaces. These solutions are pushing us to change the way we think, work, and live so we can have a stable and low-carbon future.

This article investigates the various innovations of NbS, such as the operational practises of managing stormwater runoff, reducing the risk of flooding, and enhancing water quality. It will also discuss behavioural innovations, such as how we are approaching projects differently by collaborating to develop industry-leading initiatives that promote more active lifestyles.

The International Union for Conservation of Nature (IUCN) defines NbS as “action to protect, sustainably manage and restore natural and modified ecosystems that address societal challenges effectively and adaptively, simultaneously benefiting people and nature.”

## NbS creating Green and Blue Urban Spaces

Rainwater runoff management is a significant problem in many urban areas, especially in the United Kingdom, where flooding and water pollution are becoming more common as the climate changes and rainfall becomes more frequent and intense. Traditional ways of dealing with rainwater, like building underground storage structures out of concrete - although effective - offer fewer wider benefits to people and nature. In recent years there has been a steady trend to move to more sustainable drainage.

NbS creates blue-green urban spaces through Sustainable Drainage Systems (SuDS) techniques to manage rainwater by either ‘slowing the flow’ or diverting flow away from existing ‘grey’ collection systems. These can change the rate and volume of stormwater that flows into streams and rivers, protecting the natural function of floodplains, and reducing the damage to infrastructure and property.

NbS techniques, such as rain gardens, green roofs, swales, basins, and wetlands reduce peak flows and extend the functional use of existing (sometimes Victorian) sewerage infrastructure. NbS provide innovative ways to improve water quality by trapping and intercepting pollutants within the stormwater while providing wider benefits such as amenity, biodiversity, habitat creation, and recreational opportunities.

## NbS in Urban Wastewater Treatment Infrastructure

Traditional ways of treating rainwater and wastewater can be expensive and use a lot of energy especially under high flows conditions. NbS can be designed to

provide biological treatment to a secondary treatment requirement for all or parts of the flows and can be used as a tertiary treatment process to ‘polish’ flows. NbS can be constructed, typically referred to as ‘free water surface’ or ‘floating’ wetlands or engineered such as a saturated subsurface vertical or horizontal flows systems which can be aerated.

The design of these systems has progressed over recent years as more wetlands are built. NbS uses the power of plants and earth to remove nutrients from urban/rain wastewater. Use of operating techniques agreements (OTAs) – which are granted by The Environment Agency in England have encouraged the industry to move in this direction. As we collect more long-term performance data, we envisage the mainstreaming of NbS for treating wastewater.

## NbS in Water Management

NbS constructed wetlands are the purifying kidneys of our landscape. Not only can they be used to treat wastewater but also to manage diffuse pollutants from nature and the built environment. Again, through using OTAs to manage investment, new ways of working are emerging around outcomes-based catchment partnerships. Wetlands and other measures provide new habitats and improve water quality, while also being able to store fluvial flood water and support aquatic life. Stantec aims to improve flood resilience to communities through the implementation of nature-based solutions.

The support of sustainable land use practices like agroforestry and sustainable forestry management, is another NbS innovation that helps clean up water and

carbon sequestration. Agroforestry is a way of using land that includes putting trees in agricultural systems to improve the health of the soil, increase biodiversity, and provide another stream of revenue for the farming communities. Sustainable forestry management is the practice of taking care of trees in a way that protects biodiversity and ecosystem services while promoting long-term forest health and production.

These land-use practises reduce erosion, sedimentation, and stream pollution from fertilisers and pesticides. They also aid carbon sequestration, which removes CO<sub>2</sub> from the air and stores it in trees and soil. Agroforestry and carbon-neutral forest management can store enormous amounts of carbon helping slow climate change.

## NbS in Protection and Restoration

NbS is needed more than ever because of rising global temperatures, drought intensity, water quality degradation, biodiversity loss, more severe and frequent storms, flooding, wildfires, sea level rise, and coastal erosion. NbS aids cost-effective climate mitigation and carbon sequestration.

NbS, such as the restoration or creation of coastal ecosystems (mangroves, tidal salt marshes, and seagrasses), deliver carbon reductions through a process called biological carbon sequestration—the capture and storage of CO<sub>2</sub> in vegetation and soils. A growing body of evidence suggests that restoring or creating natural environments helps mitigate climate change more effectively than other types of credits. This makes them a better investment for companies, people, and the planet that supports them.

In addition to capturing carbon, NbS can also build community resilience. For example, the restoration of shorelines, coastal environments, marshes, and wetlands has shown reduced risks of flooding from severe weather in coastal communities. These improvements also increase the natural capital and ecosystem services. This includes enhanced surface water filtration to improve water quality, new habitats for avian, aquatic, and terrestrial species, and increased natural areas to enhance aesthetics and recreation. In turn, this can increase real estate value and human well-being. Through the natural capital valuation process, we can quantify these ancillary benefits to water and air



Southwaite WwTW ICW.  
Image Courtesy of Advance-plus

quality, biodiversity, increased carbon sequestration, human well-being, and economic well-being. Tools such as CIRIA's Benefit Estimation Tool help create business cases.

## Why NbS?

NbS help combat global climate change and achieve environmental, social, and governance goals. NbS is good for the environment and good for people. It can change habits, allow communities to contribute and build better together. NbS has already shown that it can significantly support a Net Zero agenda. Projects such as Yorkshire Water's Clifton Wastewater Treatment Works (WwTW) Integrated Constructed Wetland (ICW) and United Utilities Southwaite WwTW ICW are paving the way.

IUCN research highlights that NbS could provide around 30% of the cost-effective mitigation needed by 2030 to stabilise warming to below 2°C.

NbS play a vital role in helping our communities and natural systems adapt to future climate conditions.

Collaboration means bringing together different groups, like community groups, businesses, and government agencies, to solve hard environmental and social issues. NbS can help this kind of teamwork happen

by giving stakeholders a shared vision for a more sustainable future and a place to work together towards a common goal.

Green spaces and designs with built-in recreation areas encourage exercise, nature connection, and learning and wellbeing. Nature exercise reduces stress, boosts happiness, and energises you, making it more fun.

Also, NbS let people get involved with their local surroundings, which creates a sense of community and caretaking. NbS can improve the health and happiness of both individuals and groups by promoting physical exercise and respect for the natural world.

Using techniques such as the PAS2080 carbon reduction hierarchy are just some of the steps that will support the move away from grey only. To sum up, nature-based solutions have become a powerful and new way to deal with environmental problems, lower carbon emissions, and get people to adopt positive habits. By using natural systems and processes to control and protect the environment, we can also obtain other benefits, such as better air and water quality, more biodiversity, reduced risk of natural disasters, and opportunities for recreation and tourism.

References  
 1 The Urban Waste Water Treatment (England and Wales) Regulations 1994