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WATER NET GAIN: A WATER RESOURCE ECO-NETWORK

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Creating a distributive Smart Water Grid for the future

Water Net Gain is a new £1.1 million initiative led by South West Water and the Westcountry Rivers Trust. It is funded under the OFWAT Water Breakthrough Challenge, a pioneering £200 million programme to unleash a wave of innovation in the water sector and tackle some of the major challenges of our time – delivering transformative benefits for consumers, society and the environment.

The overarching objective of the Fund is for the sector to better meet the needs of, and create long-term value for, customers, society and the environment through innovation. To meet this objective, South West Water teamed up with the Westcountry Rivers Trust and other partners, building on the award-winning drinking water programme Upstream Thinking,[1] to encompass water resource management in future water company asset management plans.

Nationally, projections show that per capita future water resources are expected to reduce due to population growth, climate change-driven reductions of summer rainfall, and increased environmental stress. The Environment Agency's National Framework

for Water Resources[2] estimates that an additional 3,434 Megalitres per day nationally will be needed by 2050. Additionally, the National Infrastructure Commission report[3] highlights that under current plans, there is about a one-in-four chance over the next 30 years that large numbers of households will have water supplies cut off for extended periods because of drought, highlighting that an extra 1,300Ml/day supply will be needed.

With water resources across the country predicted to be in deficit by 2050 – albeit variable across the country – the ability to hold water efficiently through a distributed network of storage sites depends on rainfall, topography and soil or geology type in each region. The expectation is that water companies in the South will need to hold greater volumes to manage direct deficits, whereas water companies in the North West may wish to hold surplus water for shunting. This forecast requires urgent action. However, building new reservoirs is expensive and lengthy, and an urgent plan is needed to increase water storage across the landscape to ensure sufficient supply through these extreme droughts.

To help alleviate the above pressure, Water Net Gain was formed, and is a catchment-scale concept whereby farmers would be paid to store water on their land. Restoring natural sponges, like healthy soils, woodlands and wetlands, can passively contribute water to summer base flows, but the creation of additional ecologically connected smart ponds and lakes can be used for farm demand management or actively releasing flows during droughts. The impact of this distributive ecologically connected water bank, released to the river during droughts – especially when fish are in distress – adds much-needed flow to the system and dilutes residual pollution not managed through current agricultural water quality incentivisation schemes. Alongside water purification, water retention solutions are designed to provide additional flood protection and aquatic biodiversity benefits.

The scheme would form a Smart Water Grid (see **Figure 1**) where rainfall and surface water generation that would have been lost in the system is slowly transmitted using

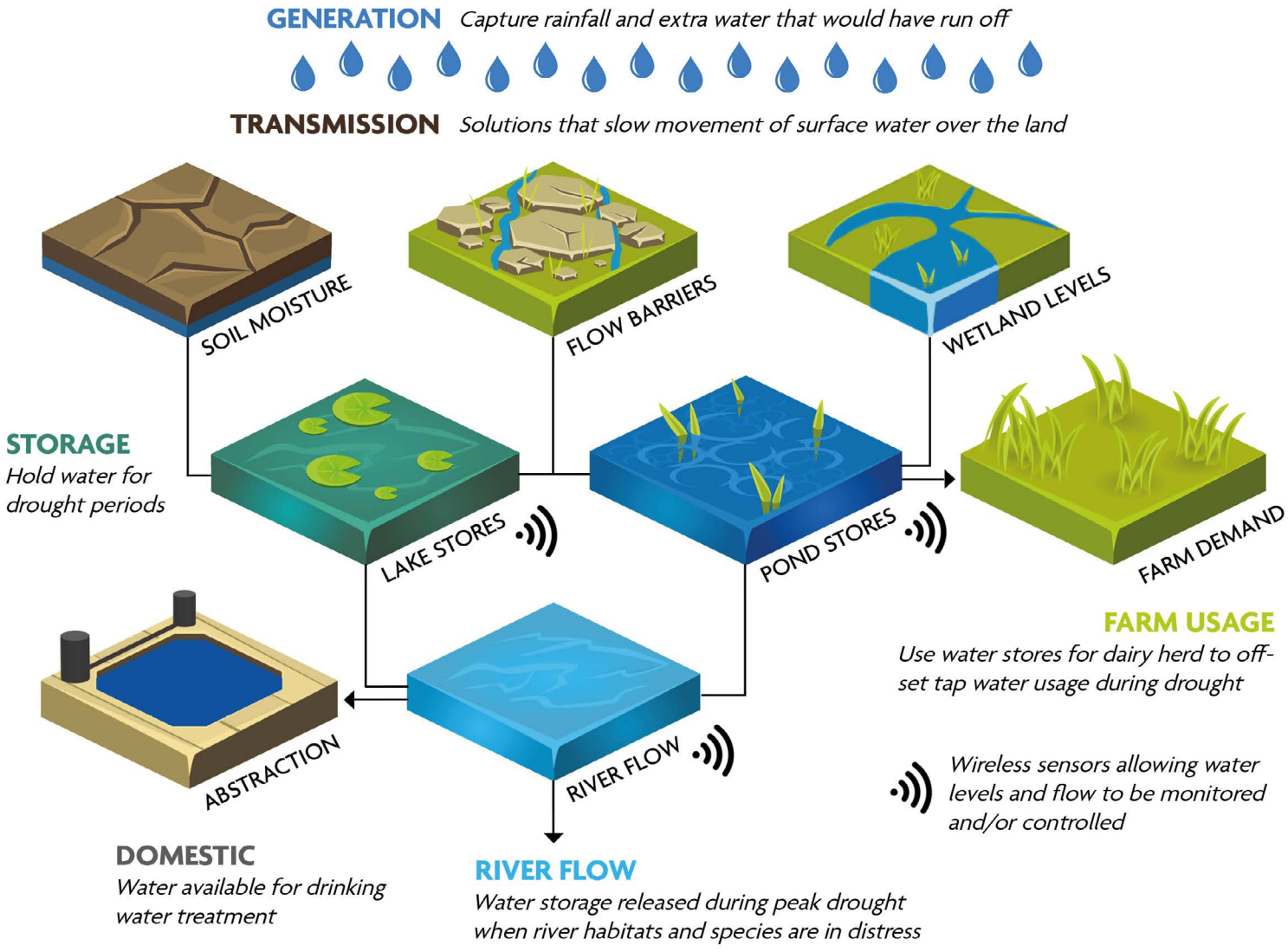

Figure 1. The Smart Water Grid: capturing surface water generation and transmitting it through nature-based solutions to storage ponds and lakes for offsetting demand or selling into the river during periods of drought. © Westcountry Rivers Trust

nature-based solutions to storage ponds and lakes. These features are telemetrically monitored and controlled to show the total capacity within a system and are recharged during the winter months and heavy rainfall events. They can then be used to offset farm demand, especially on high drinking water consumptive businesses such as dairy (e.g. for drinking, washing and cooling plates), or if not needed sold into the river to recharge flows at peak times. This Smart Water Grid is analogous to the Smart Energy System of transmitting solar energy through panels to charge batteries where electricity can either be consumed locally or sold into the grid.

Due to the way these nature-based solutions would be designed, the protection and enhancement of the environment would be felt not only during these low flow conditions, where the lack of dilution exacerbates summer pollution, but also during high rainfall events, as smart ponds can be drawn down before flood events are forecast. These solutions also deliver towards water quality and aquatic biodiversity goals and deliver an Integrated Catchment Management approach, rather than the siloed engineered technical solutions approach (see **Figure 2**). Additionally, this work adapts to climate change by building catchment resilience using nature-based solutions that also contribute to net-zero carbon. By creating this mix of a distributed network of passive and active water storage features across the landscape, this increases the long-term operational resilience within both surface water and ground water systems, and tests new ways of trading water storage and deployment at a drinking water catchment network level.

The benefit of supplying a Mega-litre of water during peak drought starts to address the National Infrastructure Committees' need for more deployable water, but at a fraction of the cost of reservoirs. However, there are considerable barriers to implementing this system in a similar way to the barriers for incentivising and installing solar and batteries within the Smart Energy Grid.

Water Net Gain will explore and break down these barriers through exploring governance issues, uniting technical

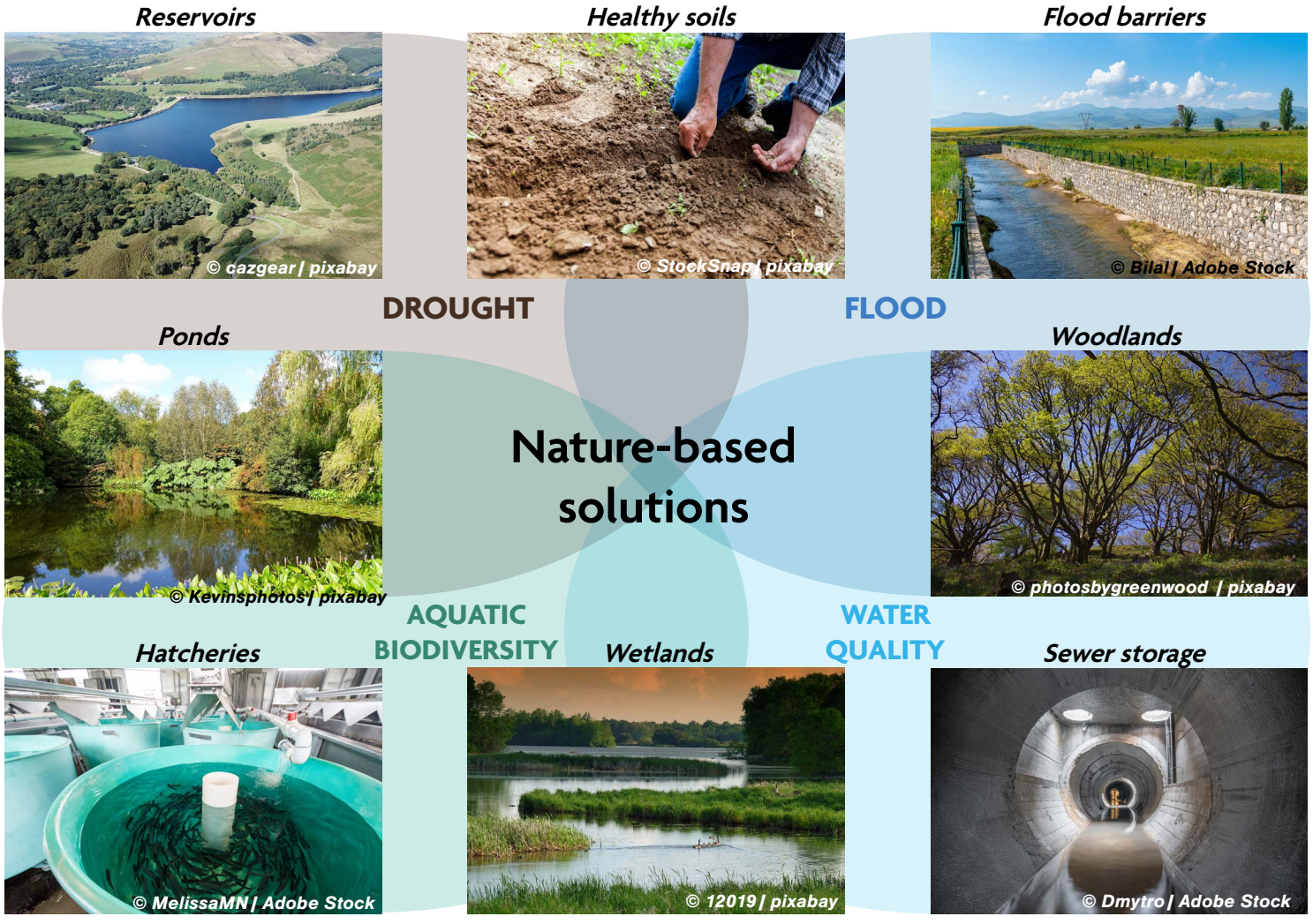

Figure 2. Nature-based solutions can deliver across all water sector silos, which historically worked through single-benefit technical engineered solutions. Multi-site solutions provide multiple benefits but are not as certain as single-site engineered solutions. © Westcountry Rivers Trust

components, understanding the willingness to accept by farmers, and embedding the approach in future Asset Management Plans. Therefore, the project's long-term outcomes are:

- To slow and store water at a catchment scale to ensure sufficient flows during the summer months for both drinking water abstraction but also maintenance of aquatic biodiversity (both water quantity and quality);
- To generate secondary benefits such as retention of flood waters, sequestration of carbon and creation of habitat connectivity; and
- To communicate the benefit of catchment-scale use of nature-based solutions to create a distributive deployable and tradable water bank.

These longer-term objectives will be broken down into seven short-term project outcomes that centre around how the Natural Water System overlaps with the Social Water System (see **Figure 3**). These shorter-term outcomes are:

1. To understand and manage the multi-sector, multi-stakeholder risks associated with creating a distributive network of ponds and lakes.
2. To create the components of a water trading system that allows the creation, monitoring and deployment of a distributive water bank based on both passive and actively releasable nature-based solutions.
3. To allow farmers and their buyers to deliver a Water Net Gain from their business by firstly reducing their own pollutant loading, but secondly diluting summer pollution loads by releasing water during droughts and low flow periods.
4. To create a living laboratory catchment that allows for the governance to be researched, tested and demonstrated.
5. To explore, elucidate and address any barriers and enablers needed to embed this approach across the wider water sector.
6. To embed the findings within water company 2030 business plans.
7. To help fill evidence/knowledge gaps in the use of nature-based solutions for water resource management.

By pulling together partners from across the country and the South West, the longer-term impacts of Water Net Gain can be realised – benefits to water companies and to wider society and bill payers.

The biggest impacts on water companies are:

- reducing demand for potable water through rainwater and effluent harvesting and reuse/water use reductions;
- supply-side benefits such as increasing the water available for use at key times, reducing reliance on other supply-side options (e.g., pumping); and
- increasing non-household customer resilience during periods of water shortage (e.g. agriculture).

Typical solutions to increasing water storage have centred on reservoirs (estimated at £3-5 million per Ml/d of deployable water – OFWAT 2020-25 minimum supply-demand balance unit costs £1.2 million per Ml/d) whereas the savings for smart ponds and lakes are expected to be around 10% of this figure to create deployable flow in times of peak drought.

On top of the above direct benefits, the impacts to bill payers and the wider society and environment are multiple, and include:

- improved catchment resilience;
- dilution of summer pollutants during extreme low flows;
- reduced flooding of homes due to attenuation capacity in the winter;
- reduced sediment loss due to reduced run off and soil protection;

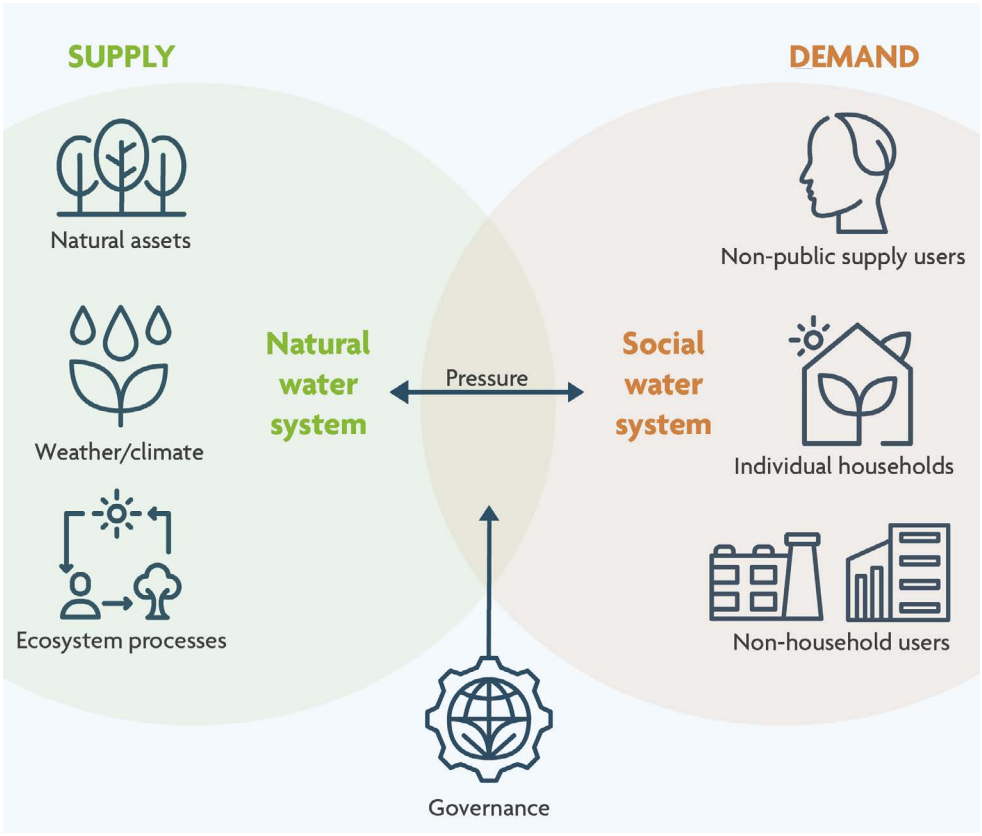

Figure 3. Water Net Gain will work on various issues of governance, technology and willingness to accept associated with uniting the Natural Water System and the Social Water System. © Westcountry Rivers Trust

Figure 4. Integrated Catchment Management balances the need for food whilst delivering slow and clean water into our rivers (right) rather than quick and dirty water (left). © Westcountry Rivers Trust

- improved river corridor habitat and connectivity; and
- increased aquatic species diversity.

These broad benefits deliver Integrated Catchment Management based on our need for food and energy, but delivered in a way where water is released slowly and cleanly rather than the release being quick and dirty (see **Figure 4**).

By investing in the governance and innovation needed to create a smart water grid, the partnership aims to not only build water resource resilience both within the water sector and the farming sector, but also reduce flooding and increase ecological connectivity in our rivers and wetlands. Additionally, these nature-based solutions improve water quality by buffering and reducing mobility of pollutants, but also diluting in river loading, especially during droughts, therefore having a Water Net Gain.

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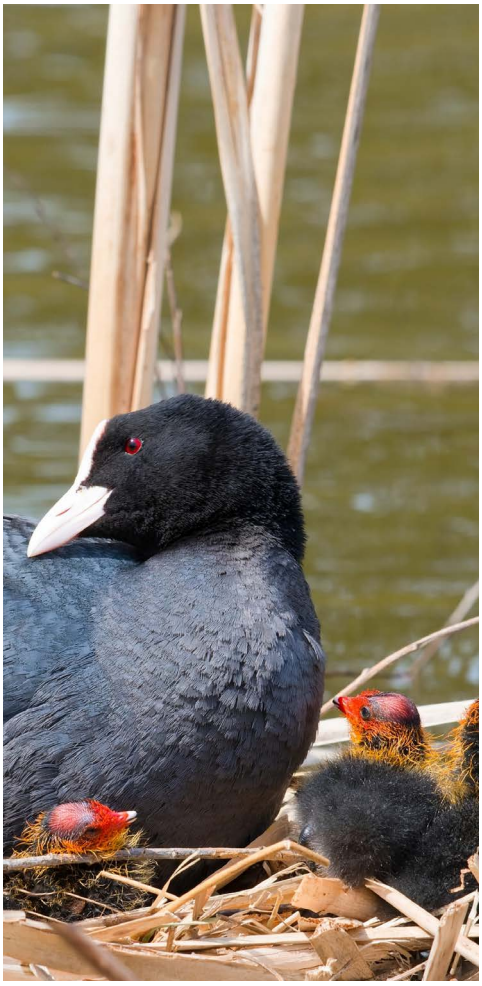

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“Sorry, we can’t use Sustainable Drainage Systems on this site because…”

Faye Redding
Director, Rennard Consulting Ltd.

If you have ever worked in drainage, you may have heard the above when developing the design on one of your projects. In the next few years, however, it looks like the drainage industry is in for a bit of a shake up, with a more onerous planning process, the implementation of new Biodiversity Net Gain legislation in November 2023, and Schedule 3[1] also being just around the corner.

As such, making sure that our projects are compliant and maximise the opportunities good Sustainable Drainage Systems (SuDS) design can bring has never been so important.

But what do you do if you don’t think your site is suitable? Surely you cannot use SuDS on every site.

While it is true that we need to make sure that the right systems are incorporated so that the needs of the site are being met, there are some common misconceptions when it comes to discounting SuDS from a development.

What are SuDS?

Before we begin myth-busting, it is first important to understand what SuDS are.

SuDS are the drainage engineers’ secret weapon when it comes to solving many of the future water related challenges our world faces.

Looking back at our previously undeveloped world, when the rain fell, before it made its way back to our rivers and seas, there was lots of opportunity for it to be lost along the way, whether it be through recharging ground water levels, being taken up by plants, or just lingering around at the surface long enough to evaporate back into the atmosphere. Water was doing a multitude of jobs to keep our planet alive and functioning.

As our population grew and we started to develop our world into what it has become today, we have managed to speed that process up, as well as to provide physical barriers through the creation of impermeable surfaces, meaning water just cannot get where it needs to be.

While traditionally the aim was to get water away from a site as quickly as possible, the issues it created such as flooding, pollution to watercourses and loss of habitat led to a different approach being required. This is where SuDS starts to come into play.

SuDS, in essence, aim to recreate that natural runoff profile of the undeveloped site, with the primary aim of any SuDS feature being to slow the flow (attenuate) surface water generated on a site.

In addition, some SuDS can also bring other benefits such as improving the quality of water leaving a site. For example, if we look at permeable paving, some of the filter materials used within the subbase have the capability of breaking down around 80 per cent of the hydrocarbons found in road runoff, providing massive benefits when it comes to the quality of water in our rivers and streams.

The best SuDS features, however, also provide an opportunity to improve spaces not only for the people living there, but also through the creation of new habitats.

There are many to choose from to fit any project, whether it be making the impermeable permeable through a permeable paving system, maintaining existing wildlife corridors using raingardens and vegetative swales, or adding a focal point to a development in the form of a pond.

Even a roof can get some SuDS treatment, with green and blue roofs becoming more popular (see **Figure 1**).

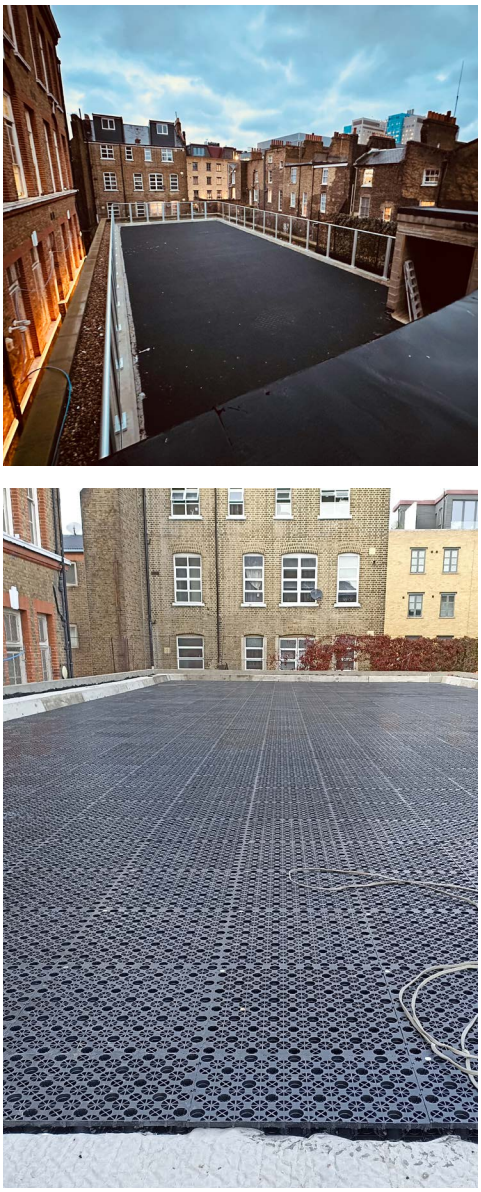

Figure 1. Example of RoofBlox Blue Roof on a School in London. © Aco Building Drainage

So, with the known benefits, why is there still some hesitancy and a desire to revert to the tried-and-tested methods of pipes for conveyance and tanks at the low spot?

Sometimes it is just that people think that their site is just not suitable. However, due to the flexible nature of SuDS, this is often not the case. Let us examine some common misconceptions.

We can't use SuDS on this site...because it is sloped.

It is easy to understand why people believe you can only construct SuDS on a flat site. After all, water (like all things) is heavily influenced by gravity and will always make its way to the lowest point of a site as quickly as possible; trying to slow the flow on a hill can seem like an almost impossible challenge.

It is rare, however, to have a completely flat site, and just because there is a gradient it does not necessarily mean SuDS have to be completely discounted.

One of the key challenges to overcome is an increase in the velocity of the runoff. Measures must be taken to try and slow this flow down, with one potential solution being the incorporation of things such as check dams or smaller staged storage.

Check dams act as a physical barrier to hold back the water at certain points, thus slowing it down. While attenuation potential is lower than if the site was flat, incorporating a couple of these features into a design can help reduce the volume of storage required at a low spot.

A great example of check dams having been executed well is in the Sheffield Grey to Green project (see **Figure 2**). The project – designed using a collaborative approach by Sheffield City Council, Amey, Robert Bray Associates and the University of Sheffield – transformed what was once a heavily tarmacked urban business district into an environmental haven. The scheme used raingardens to capture road runoff, attenuating and treating it before it was discharged into the River Don. As the site was sloped, the scheme used several check dams which allowed water to temporarily build up behind them during extreme events and provided opportunity for more to be lost through evapotranspiration in the vegetation.

Figure 2. Sheffield Grey to Green Project showing concrete check dams. © Faye Gennard

The project not only had drainage benefits, but by bringing more greenery into the area it additionally encouraged new businesses and more people to visit, giving what was once an abandoned area of the city a new lease of life.

We can't use SuDS on this site...because it is contaminated.

Contamination can be a tricky and time-consuming subject, with plenty of legislation and a general understanding that it is bad and can lead to a challenging development. Hence, on contaminated sites, many will shy away from using SuDS through fear that they may implement it wrong and make a bad situation worse.

With some careful design, however, SuDS can be effectively used on contaminated sites without any contaminates being transferred to deeper soils or more sensitive aquifers.

The priority is to isolate the drainage system from the contamination by lining it with an impermeable membrane, ensuring that any attenuation is kept near the surface.

In addition, the use of SuDS – particularly ones with good treatment properties such as permeable paving systems (see **Figure 3**) – on this type of site will have the added benefit of not contributing further to any pollution issues, by ensuring any generated surface water is captured and treated effectively.

We can't use SuDS on this project... because it has already been built

It is not just new projects that can benefit from SuDS. There are many reasons why we might want to revisit a drainage design. There could be an ongoing issue with maintenance, taking additional flows from a neighbouring development might be required, or it could be nearing over-capacity due to increased rainfall as a result of climate change.

When trying to create extra storage it can be tempting to simply add large tanks or crates into the ground; while this can provide a viable solution, there is a risk that it could result in extensive excavations, additional water treatment components and a potential increase in carbon.

To combat these possible complications, there are now many brilliant 'plug and play' SuDS components which have been developed for the retrofit market. These include GreenBlue Urbans HydroPlanter Flex (see **Figure 4**), SuDS Planters Raised Planters and Polypipes TreeBox HP systems, all of which are designed to intercept water at different stages and can help reduce if not completely remove the need for large underground tanks.

Not only that, but by bringing water to the surface, any maintenance issues can be identified and dealt with early, helping drainage systems stay operational for longer.

Summary

While it is true that we need to ensure that the right SuDS are used in the right place, due to their flexible nature and the number of options available to the drainage engineer, there is an opportunity to include them in some form on almost every project. Ensuring they are considered early enough in the design process, however, is key to maximising the benefits they can bring and making sure each project gets off to the best possible start.

Faye Redding
Director, Rennard Consulting Ltd.

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Figure 3. Example of lined permeable paving system. © Marshalls

Figure 4. Recently installed Hydroplanter Flex System and Green Blue Urban Head Office. © Blue Green Urban

River Restoration Centre: Scientific Advancements in River Restoration Conference

6 - 8 September 2023
University of Liverpool

Members of the IES and FWR will be interested in the forthcoming Scientific Advances in River Restoration (SARR), taking place from 6th to 8th September 2023 at the University of Liverpool. The SARR conference, organised by The River Restoration Centre, is international in scope, synthesising multi-disciplinary global research advances on river restoration and identifying critical knowledge gaps.

Scientists as well as some practitioners involved in aspects of river restoration from around the world will present their work, discuss ideas, create new collaborations and help advance river restoration science to better inform real world solutions.

Keynote speakers include experts from Australia, the UK and the USA, with a wide programme of live sessions or poster presentations. The SARR conference has an exciting line up of speakers from 20 countries. Sessions span geomorphology, social policy, social partnerships, the role of large wood material, flooding, planning for river restoration, conditions assessment, climate change, soil/carbon, ecology, lessons learned, restoration benefits, tools, monitoring, ecology, and multiple plenary sessions.

At the time of writing, the SARR conference is still accepting poster submissions.

The SARR conference also enables sponsors to: showcase the latest products and services to academics and practitioners; network with the river restoration science community; and advertise company capabilities.

For full details about the SARR conference, including the programme and booking details, please go to *https://www.therrc.co.uk/sarr.*

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Bridging the Skills Gap in the Water Sector: Challenges, Solutions, and Future Transformations

Donna Davies – Digital Skills & Education Lead (Industry), Skewb

The water sector plays a vital role in providing clean and accessible water to communities, safeguarding public health, and ensuring sustainable water resource management.

While various sectors are facing skills shortages, the water industry is particularly affected. It struggles to fill 35% of job openings, exceeding the national average of 23%. Over the next five years, approximately 63,000 positions will need to be filled within the industry.[1]

To attract a new generation of skilled professionals, the water industry must undergo a transformation centred around data and digital technologies. Currently, only 8% of the industry's workforce is under 24 years old, and more than a fifth are nearing retirement within the next ten years.[2]

This article will explore the reasons behind the skills gap, the challenges it presents, and potential solutions and transformations that lie ahead.

Ageing workforce

There are several reasons for the skills gap in the water sector, with one of the primary reasons being an ageing workforce. Many experienced professionals in the industry are approaching retirement age, creating a gap in institutional knowledge and specialised skills. As they retire, their expertise and years of experience leave with them, hindering problem-solving capabilities and decision-making processes within organisations. It is crucial that the sector finds effective ways to transfer knowledge from the experienced workforce to the next generation, in part by filling these positions with adequately trained individuals.

Technological change

Across the whole sector there is a need for technical competence – which changes as new technical processes emerge. Technological advancements, including smart water networks, real-time monitoring systems, and data analytics, have evolved rapidly. However, education and training programs have struggled to keep pace with these developments. Consequently, there is a shortage of professionals with the necessary skills to leverage and manage these technologies effectively.

Reputation

At times, the sector faces challenges due to a negative reputation, resulting in many young individuals being unaware of the wide range of career opportunities it provides. Water-related careers are sometimes perceived as less glamorous or less lucrative than other industries, leading to a lack of interest and fewer individuals pursuing education and training in this field.

Key competencies

The skills gap in the water sector can lead to workforce shortages, making it difficult for water utilities and organisations to adequately staff their operations. The shortage of skilled workers can hamper the maintenance and operation of water treatment plants, distribution systems, and wastewater facilities, potentially impacting service delivery and infrastructure reliability. To avoid these effects, the sector particularly requires the following expertise:

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- Data analytics, IoT integration, and network management to provide real-time data on consumption and leakage;
- Skills in reverse osmosis, desalination processes, energy management, and infrastructure planning (vital for addressing freshwater scarcity);
- Advanced data analytics to optimise distribution, predict demand, and identify issues (requires skills in data analysis, machine learning, and AI);
- GIS software, data interpretation, and spatial analysis to enable the monitoring of water resources, identifying stress areas, and managing watersheds;
- Cybersecurity, network monitoring and risk assessment – crucial for the protection of critical infrastructure; and
- Regulatory and policy expertise, with knowledge of water regulations, policies, and governance frameworks.

Digital tools have become systemised to ties all professional functions together. As such, some level of digital literacy should be defined as a requirement for all industry jobs. Without these skills, serious threat is posed to the resilience of water infrastructure. Without enough skilled workers, infrastructure maintenance, repair, and upgrades may be delayed or not conducted to the

required standards. This can increase the vulnerability of water systems to failures, disruptions, and even potential health risks.

Potential Solutions and Water Sector Transformations

One action that the sector can take to address the gap is enhancing educational initiatives in collaboration with educational institutions, to develop curricula that align with industry needs. This includes incorporating emerging technologies, emphasising practical training, and providing opportunities for first-hand experiences. Increased awareness campaigns can also help promote water-related careers and attract new talent.

The water sector must assess its ability to provide the necessary training and development through a network of training providers. Skewb Climate (Part of Skewb Group[3]) acknowledges the importance of designing customised training that caters to the specific needs of organisations and individual learners, while also acknowledging the challenges faced by the sector. Embracing immersive learning experiences leads to more effective outcomes, better retention of knowledge, and enhanced skills development. In light of this, digital training delivery emerges as an inclusive method that accommodates various learning styles, offers cost savings, and saves time.

Apprenticeship programs and vocational training can also play a pivotal role in bridging the skills gap. By combining classroom instruction with on-the-job training, apprenticeships provide individuals with practical experience and specialised skills specific to the water sector. These programs can be tailored to different roles, such as water treatment operators, distribution system technicians, or wastewater engineers.

Collaboration and knowledge sharing are key. Water utilities, industry associations, and educational institutions should foster collaboration and knowledge sharing to address the skills gap collectively. This can include partnerships for research and development, sharing best practices, and creating platforms for professionals to exchange ideas and experiences.

© Blue Planet Studio / Adobe Stock

Promoting diversity and inclusion within the water sector can bring fresh perspectives and ideas. Efforts should be made to encourage underrepresented groups, such as women and minorities, to pursue careers in the water sector. By creating a diverse workforce, the sector can enhance problem-solving abilities and better serve the needs of diverse communities.

To attract young people and promote diversity in the water sector, it is crucial to create a value-led employee proposition that aligns with their aspirations and values. This can be achieved by emphasising long-term career progression, the sector's commitment to environmental values and sustainability, stability and employment benefits, competitive salaries, commitment to investing in employee training and development programs, and the meaningful work and social impact of the sector.

By highlighting the sector's technological advancements and innovation, it becomes more appealing to the younger generation and fosters interest in water-related careers. Salary disparity can be addressed by offering competitive compensation packages that align with industry standards and reflect the value of the work done in the water sector. This can help attract talent that might otherwise gravitate towards higher-paying industries.

Emphasising the meaningfulness of the work done in the water sector and the positive impact it has on communities and the environment is highly significant when considering a young cohort who are largely very concerned about environmental matters. By showcasing real-life examples of how water professionals can contribute to addressing the impacts of climate change and promoting social equity, we can develop a compelling case for their engagement and involvement. We see a younger generation faced with many

challenges unthinkable to previous generations, and yet the opportunities are available for them to leverage radically different approaches to data analysis and its application. These possibilities can be used in conjunction with tried-and-tested approaches to water governance, including those that use nature-based solutions. One example of this approach can be seen in the drive to develop sustainable new communities in water-stressed regions of the UK. These water-neutral developments are demonstrating that zero water footprint installation can be delivered through a collaborative and innovative approach.

Lastly, it is important to look at other talent pools in order to remove barriers faced by potential water professionals. This can be achieved by:

- Partnering with educational institutions, vocational training centres, and youth organisations to offer internships, apprenticeships, and mentorship programs for young people;
- Implementing inclusive hiring practices to actively recruit and accommodate individuals with disabilities. Provide accessibility in job postings, workplace adjustments, and disability awareness training;
- Recognising the skills of ex-military personnel and developing transition programs and partnerships with veterans' organizations;
- Collaborating with social services and foster care organisations to create programs for care leavers and individuals in care, offering mentorship and skills development initiatives;
- Fostering inclusive and supportive work environments, implementing diversity and inclusion policies and raising awareness among employees; and
- Establishing partnerships with community organisations, non-profits, and government agencies to leverage their expertise and networks in identifying and connecting with underrepresented talent pools.

Many believe these skills are not "teachable" but rather gained through experience and work history. It does not make sense that the same skills that keep applicants from gaining a job are primarily learned on the job. The recruitment process needs changing.

Conclusion

Bridging the skills gap in the water sector is crucial to ensure the provision of safe and sustainable water resources for communities worldwide. By addressing the reasons behind the skills gap, tackling challenges head-on, and implementing potential solutions, the sector can transform itself into an attractive and dynamic industry. With collaboration, technological advancements, and a focus on education and training, the water sector can overcome the skills gap and build a resilient and skilled workforce for the future.

Donna Davies
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