

Assessment of demand and pathways for buyer engagement in water outcomes across the Forth water basin region



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Assessment of demand and pathways for buyer engagement in water outcomes across the Forth water basin region

Targeted evidence review

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Introduction

Achieving Scotland's targets for nature recovery, climate resilience, and sustainable water management will require a significant scaling up of investment, beyond what can be delivered through public funding alone (Scottish Government 2024). Blended finance approaches (i.e. mobilising both public and private capital) are therefore central to the development of natural capital markets in Scotland to realise these ambitions. Within this context, there is growing interest in the role of nature-based solutions (NbS) in delivering water-related outcomes, and in the mechanisms through which these outcomes can be translated into investable opportunities. Developing a clearer understanding of demand from potential buyers and investors is a critical step in enabling this transition from policy ambition to practical implementation.

Water is a fundamental natural asset: it sustains life, underpins ecosystems, and supports economic activity across diverse economic sectors (Science Based Targets Network 2024; Cole et al. 2026). Reliable water quality and sufficient quantity are essential for public health, business continuity, and human wellbeing, while also maintaining the ecological integrity of rivers, wetlands, and wider catchments. However, increasing pressures from climate change, land use, and pollution place these systems at risk. Nature-based solutions (NbS) offer the potential to address these challenges in a cost-effective and multifunctional way, but their development and funding at scale depends on the extent to which their benefits can be clearly defined, measured, and valued by those who stand to benefit and are willing to invest.

This rapid evidence review seeks to synthesise current knowledge in relation to three key questions:

1. What are the demand drivers for buyers (corporations, utilities, etc.) to be willing to pay for water outcomes? – See [Drivers of demand](#)
2. What are the metrics via which these water outcomes can be quantified and sold / agreed? – See [Outcomes and metrics](#)
3. What are the existing / available models for structuring transactions to deliver these outcomes? – See [Mechanisms](#) and [Case study: Leven LENS](#).

By addressing these questions, the rapid evidence review aims to provide a focused and practical evidence base to inform the development of water outcome markets in the Forth basin and Scotland more broadly. Given the breadth and complexity of this topic, this rapid evidence review is necessarily selective in scope and depth. It aims to cover the full diversity of drivers, metrics, and mechanisms being used around the world to support and inform investment in NbS for water, establishing a complete evidence base to inform the range of approaches we will explore with stakeholders in interviews. A deeper analysis and prioritisation of these will appear in the final report, based on the results of those interviews, including their applicability to the Scottish context, potential enabling conditions, and longer-term market development pathways. The stakeholder interviews will be critical in addressing these gaps, testing the practical relevance of the

findings, and grounding the analysis in the realities of buyer willingness to pay within the Forth basin.

Drivers of demand

Understanding the drivers of demand for water-related ecosystem services is critical to shaping the future of private investment in NbS. In Scotland, this demand is currently emerging but remains relatively immature, with limited regulatory and market mechanisms in place. However, a range of overlapping and reinforcing drivers can be identified from the literature, spanning voluntary environmental, social and governance (ESG) commitments, ratcheting increases for mandated disclosures, regulatory compliance, financial risk management, and longer-term investment opportunities. These drivers are often context-specific and vary by sector, but collectively they point to a growing recognition of water-related risks and dependencies, and the role that NbS can play in addressing them.

Discretionary ESG demand

A key early-stage driver is voluntary corporate interest in ESG outcomes. Many companies and asset managers are exploring natural capital investments as a means of strengthening their environmental credentials to respond to stakeholder expectations and to mitigate nature and climate-related risk. As noted, “many of the largest investment funds and companies are interested in including natural capital and NbS within their investment portfolios... positioning them in a ‘Buyer’ role” (Irving 2023). In addition, voluntary corporate water stewardship commitments are becoming more prevalent, with companies setting “water positive targets—aiming to return more water to nature and communities than they consume” (“water neutrality”) (Green Finance Institute 2025; Alliance for Water Stewardship 2026). Reputational considerations and competitive positioning play a role, as “companies seen as leaders in environmental stewardship can strengthen their reputation with consumers and improve their perceived competitiveness among investors.”

However, this demand is often discretionary and can be limited in scale or consistency. There is evidence that “asset managers are unlikely to be able to access funding for non-mandatory ESG initiatives” (Irving 2023). This suggests that while ESG interest is important, it may not be sufficient on its own to drive sustained market demand, particularly for water outcomes, which are often more difficult to strictly quantify than carbon mitigation, for example.

See for example:

- [Nestle water stewardship approach](#) – Nestlé is pursuing water-positive outcomes, including volumetric water benefits (VWBs)¹ and catchment restoration.

¹ Volumetric Water Benefit Accounting is a method to “identify and implement activities, measure progress, and make claims toward meeting a water replenishment target in ways that address current and future shared water challenges in local catchments” (Reig and Vionnet 2021).

Standards-based ESG demand (e.g. TNFD and disclosures)

A more structured form of demand is emerging through environmental disclosure frameworks such as the Taskforce on Nature-related Financial Disclosures (TNFD). These frameworks are increasing pressure on organisations to assess and disclose their dependencies and impacts on nature, including water. As highlighted, “businesses are under increasing pressure from investors, customers, and regulators to assess, report, and act on their environmental impacts,” with frameworks such as TNFD and CSRD² driving more proactive management of nature-related risks (Green Finance Institute 2025). TNFD also introduces a structured understanding of risk, including transition risks³ and systemic risks,⁴ which can have wide-reaching financial implications. These frameworks can create demand for measurable, verifiable water outcomes as companies seek credible actions to demonstrate risk mitigation and alignment with disclosure requirements.

Compliance-driven demand

Regulation remains one of the most powerful and reliable drivers of demand. In the UK context, mechanisms such as nutrient neutrality (England), Sustainable Drainage Systems (SuDS),⁵ and Biodiversity Net Gain (BNG, England) are creating compliance markets where environmental outcomes must be delivered to in order for development to proceed. The [Flood Risk Management \(Scotland\) Act 2009](#) places a duty on local authorities to assess water bodies regarding flood risks and carry out works to mitigate these, with consideration of natural flood management techniques. In England, Ofwat are pushing water companies to place increasing priority on NbS for water solutions (Environment Agency 2026), as is WICS in Scotland⁶ (Water Industry Commission for Scotland WICS 2024); ORR are driving at similar objectives for Network Rail (Taylor 2026). Similarly, BNG requirements are driving demand for habitat creation and restoration, with potential co-benefits for water. However, in Scotland, these drivers are currently limited in scope: “water-related ecosystem service markets in Scotland are relatively immature and few of the necessary regulatory or economic drivers are in

² The Corporate Sustainability Reporting Directive: “EU law requires companies above a certain size to disclose information on what they see as the risks and opportunities arising from social and environmental issues, and on the impact of their activities on people and the environment [...] Companies subject to the CSRD have to report according to European Sustainability Reporting Standards (ESRS)” (European Commission 2025).

³ “Nature-related transition risks are risks to an organisation that result from a misalignment of economic actors with actions aimed at protecting, restoring and/or reducing negative impacts on nature” (TNFD 2023).

⁴ “Nature-related systemic risks are risks to an organisation that arise from the breakdown of the entire system, rather than the failure of individual parts. These risks are characterised by modest tipping points combining indirectly to produce large failures, where one loss triggers a chain of others, and prevents the system from reverting to its prior equilibrium” (TNFD 2023).

⁵ “Mandating Sustainable Drainage Systems (SuDS) for new building developments will mean that novel methods for reducing urban surface water flooding, such as wetlands and rain gardens, will need to form part of the drainage plans before development can begin” (Green Finance Institute 2024). SuDS integration has been mandated in Wales as part of the Flood and Water Management Act 2010, but has been delayed in England (Unda 2025).

⁶ “We expect Scottish Water to provide a range of options for investment, including innovative and nature-based solutions to support a range of possible charge paths which demonstrate best value for customers over time” (WICS 2024, p.10).

place” (Irving 2023). Expanding or adapting such compliance mechanisms could play a critical role in stimulating demand for water outcomes.

See for example:

- [Wendling Beck nutrient neutrality scheme, Norfolk](#) – example of regulated demand creating a functioning ecosystem service market; Credits fund wetland restoration and water quality improvements.

Resilience and risk mitigation (business continuity)

Water-related risks (particularly those linked to climate change) are a growing concern for businesses. These include risks to operations, supply chains, and asset integrity arising from water scarcity, flooding, and declining water quality. As noted, “water-related challenges are expected to increase in the coming years due to the destabilising impacts of climate change,” with significant financial implications already being observed (Green Finance Institute 2025). NbS offer a means of enhancing resilience: “investing in NbS for water can significantly enhance business resilience by mitigating the risks posed by water scarcity and poor water quality” (Green Finance Institute 2025). This framing positions water outcomes as a form of risk management, aligning with core business priorities such as continuity, reliability, and long-term viability.

Avoided costs and damages

Closely linked to resilience is the concept of avoided costs. Businesses with assets exposed to water-related risks can quantify potential damages and compare these against the cost of investment in NbS. For example, “if the reduction in peak flood flow generated by an NFM project can be quantified, this can then be given a monetary value” allowing companies to assess whether investment is cost-effective (Green Finance Institute 2024). NbS can reduce operational disruptions, maintenance costs, and regulatory penalties, particularly where they enhance the performance of existing infrastructure, for instance by reducing sedimentation and treatment costs. Avoided costs is a key avenue to explore further in this work, as it draws upon the profit motive for potential buyers. However, the efficacy of this demand driver hinges upon the ability to accurately and convincingly quantify and forecast these future costs against the counterfactual.

See for example:

- Severn Trent (2020) [Severn Trent Environmental Protection Scheme](#).

Additional drivers: Co-benefits

Co-benefits such as carbon sequestration, biodiversity enhancement, and community wellbeing can make NbS more attractive to buyers, particularly where multiple outcomes can be delivered from a single intervention (see [Outcomes and metrics](#)).

Crucially, these demand drivers vary significantly in both their reliability and their potential to mobilise capital at pace:

- Discretionary ESG demand and co-benefits can unlock early-stage investment and innovation but are typically less reliable and more sensitive to economic conditions.
- Standards-based ESG drivers (e.g. disclosures and reporting frameworks) are likely to become increasingly influential, particularly as expectations tighten, but currently tend to drive more reputational and risk-management behaviour than direct financial flows.
- Compliance-driven demand offers the greatest certainty and long-term stability, as it is underpinned by enforceable obligations and can generate predictable revenue streams; however, its scale in the Forth basin will depend on the evolution of policy frameworks and regulatory ambition.
- Resilience, risk mitigation, and avoided cost drivers, particularly for water-dependent sectors, represent a strong and pragmatic entry point, as they are closely aligned with core business interests and can justify investment on commercial grounds.

Building on this typology, our data collection for this project will prioritise engagement with actors and sectors where demand is likely to be both most material and reliable. As noted by Mackenzie, C⁷, demand drivers can be broadly ranked in terms of scale and reliability, with compliance-driven demand representing the strongest and most predictable source of finance, followed by resilience and risk mitigation, then standards-based drivers, and finally discretionary ESG motivations.

This suggests a clear rationale for focusing initial investigation on organisations facing direct regulatory pressures (e.g. local authorities and utilities), as well as water-dependent industries where business continuity risks are most acute. In the Forth basin, this points in particular to agrifood supply chains, where resilience, risk mitigation and avoided costs are likely to provide a compelling and immediate entry point for investment in NbS. At the same time, compliance-linked opportunities (e.g. offsetting or regulatory obligations) warrant targeted exploration with public bodies, given their potential to unlock larger and more durable funding streams. Standards-based and discretionary ESG drivers will also be considered, particularly where they can complement or leverage more robust demand signals, but are likely to play a secondary, enabling role in scaling investment.

⁷ Mackenzie, C. (2026) *Demand drivers in UK nature markets* presentation at Nature Finance CircHive Hib conference May 2026

Table 1: Typology of demand for UK nature-based water outcomes. From Craig Mackenzie (n.d.) Demand drivers in UK nature markets⁷.

Nature service supply	Discretionary ESG demand	Standards Based ESG demand	Compliance demand	Resilience demand	OVERALL demand
Natural flood management	Yes	No	Infrastructure regulators	Strong in some sectors	High? catchment specific
Water quality	Yes	No	Water regulator	Early signs, potentially strong	High? catchment specific
Nutrient Neutrality	No	No	Strong (England)	No	Moderate, catchment specific
Water availability	Yes	No	Water regulator	Emerging (e.g. Speyside)	High? catchment specific

Typology of demand-side actors

Table 2: Examples of potential buyers of water outcomes of water environment NbS. Adapted from Green Finance Institute (2024) Financing natural flood management.

Potential buyers of water outcomes	Relevant demand drivers
Real estate developers	Reducing flood risk in an area to allow for potential residential and commercial property development.
Commercial property owners	Increase in land value through reduced flood risk, lower insurance costs and/or exposure to potential damages, and green space amenity improvement.
Water companies	Increased biodiversity; carbon sequestration; access to green spaces; improved community amenity value. Avoided costs of damages caused by flooding to water treatment plants; Avoided financial and reputational costs associated with flooding of combined sewer overflows (CSOs); Water Industry National Environment Programme drivers; and CSR drivers. "There are examples of Scottish Water supporting multi-benefit peatland restoration for a range of water benefits as well as carbon and biodiversity but this is one of the few 'buyer' relationships that currently exist in Scotland" (Irving 2023).
Power companies	Reduced damages to energy infrastructure. Reduced compensation claims for power outages from customers.
Rail and road operators	Reduce damages to road and rail infrastructure, reduced impact on service levels and associated costs.

Mortgage providers	Reduce flood risk to their asset book, increased mortgage affordability.
Local businesses	Reduce risk of flooding, increase community resilience, reduce disruption to business and employees. "The National Parks are working on wide-ranging landscape scale interventions which include water benefits but are struggling to attract private investment – other than from key private landowners" (Irving 2023).
Agrifood sector	Increase supply chain resilience, reduce the frequency of flooding on supplier farms. "Water scarcity for agriculture is a relatively new concept for many in Scotland but is predicted to become more of an issue for the east of the country and for businesses relying on private water supplies elsewhere. SEPA and Scottish Water have used a One Planet Choices approach to develop partnership working around water availability in NE Fife" (Irving 2023). "The one exception is the interest in water security from distillers. Diageo are using the VWBA approach across their international business and Suntory Beam are using internal systems and measures to prioritise water stewardship. Other companies such as Chivas and Glenlivet are working with academic institutions to explore water issues and develop NbS to their issues of water availability and quality" (Irving 2023).
Tourism sector	Increased bathing water quality during summer rainfall events.
(Future) AI data centres	New sector with water requirements, primarily driven by cooling needs. High-density GPU servers generate large amounts of heat, requiring continuous cooling, often via water-based systems (Brading, n.d.). Location-specific hydrological assessments and a shift toward low-water or closed-loop cooling systems are becoming critical to securing social licence and planning approval (Taft 2026). Scottish Water assures that tap water comes first and that safeguards against negative outcomes are already in place (Lindsay 2026). See Data Centre Map from APRS.

Investment for financial return

While not a demand driver as such, it is important to also consider investment as a key enabler for scaling NbS. Upfront capital investment provides financing to do an NbS project to generate a financial return, which arises if there is sufficient demand.

Investors are essential to creating project supply to meet demand, however, they do not create demand.

Although rife with challenges and frustratingly slow to materialise, there is consistent and growing interest in NbS as an investable asset class capable of generating financial

returns. This is most likely where multiple revenue streams can be “stacked,” such as carbon, biodiversity, and water outcomes. However, the Green Finance Institute asserted in 2024 that “there is only one example within the UK of an NFM project that has attracted upfront private investment and is expected to generate revenue streams to repay the investment plus interest” (referring to the [Wyre Catchment Natural Flood Management Project](#)), highlighting the early-stage nature of this market. Unlocking this investment will depend on developing reliable revenue models, standardised metrics, and sufficient demand for outcomes.

See also: [Nature Prosperity](#)

Outcomes and metrics

With market-based mechanisms just emerging in Scotland, investment is risky, and to build buyers’ confidence it is crucial to demonstrate that investments in NbS are delivering real, measurable and quantifiable outcomes (Irving 2023). With desired outcomes varying between investors, metrics must align with both the project’s intended outcomes while also being meaningful to the buyer (e.g. reduction in impact, safeguarding of water resources). Projects need a monitoring framework with well-designed metrics that provide a scientifically robust and replicable way to measure project outcomes at an appropriate scale and timeframe.

Healthy water environments deliver a wide variety of ecosystem services and investment in NbS that protect, enhance and restore aquatic ecosystems typically delivering multiple benefits (Cole et al. 2026). NbS have the potential to meet several objectives simultaneously. For example, Scottish Water is exploring the impact of peatland restoration on water quality, regulating water flows, building resilience to drought and carbon capture (Irving 2023).

To make informed investment decisions, investors will often seek to quantify outcomes that align with their specific objectives. Broad indicators of ecosystem condition, such as the ecological status classifications used by SEPA to assess compliance with the Water Framework Directive integrates information on biological, chemical and physical attributes (European Parliament and Council, 2000). While these indicators provide valuable measures of overall ecosystem health, they are unlikely to be sufficiently refined to support all investment decisions.

While some investors may be interested in multiple outcomes, others may focus on a single benefit. For example, an insurance company is likely to be primarily interested in how peatland restoration reduces peak river flows to mitigate flood risk, whereas an airline company may be interested in the avoided carbon losses and the potential generation of carbon credits. Recognising, quantifying and monitoring these different outcomes could potentially unlock greater investment (e.g. for example through the stacking of different credits). Monitoring frameworks should, where possible, quantify a range of outcomes using metrics that are directly linked to the benefits sought by different investors.

Outcomes

McCarthy (2025) highlighted the importance of having clear milestones and outcomes throughout the planning, delivery and monitoring stages in addition to monitoring at the project level, and at the portfolio-level (i.e. across multiple projects that are implemented within a catchment). With this project primarily focussing on emerging natural-capital mechanisms, this review primarily focusses on monitoring stage outcomes. Specifically, changes in specific aspects of the water environment that are expected to occur as a result of the implementation of NbS to protect, enhance and restore the water environment. Across the literature, a variety of outcomes are cited, which can largely be grouped into five broad categories: water quality, water resources, ecological condition, physical condition and societal impacts (Table 3).

Table 3: Overview of outcomes

Broad outcome	Examples	Source
Water quality	Water quality	Irving et al. 2023, RBMP, Alliance for Water Stewardship Standard ⁸ ; The Water Resilience Coalition ⁹
	Cold, clean water	McCarthy (2025)
Water resources	Water resources	RBMP
	Water stewardship (supply); "Water neutrality"	Irving et al. 2023
	Natural flood management	Irving et al. 2023
	Water quantity	McCarthy (2025); The water resilience coalition
	Sustainable water balance	Alliance for Water Stewardship Standard
Ecological condition	Ecological condition	RBMP
	Biodiversity and ecosystems	McCarthy (2025)
	Health of important water-related areas	Alliance for Water Stewardship Standard
Physical condition	Physical condition	RBMP
Societal impacts	Social benefits	McCarthy (2025)
	Sanitation and hygiene for all	Alliance for Water Stewardship Standard
	Good water governance	Alliance for Water Stewardship Standard
	Access	The Water Resilience Coalition

⁸ AWS Standard | Alliance for Water Stewardship

⁹ Water Resilience Coalition

Metrics

Unlocking private investment in NbS depends on the ability to measure and monitor the outcomes they deliver, which requires robust, science-based metrics (McCarthy 2025). Fundamentally, metrics should be driven by, and responsive to, the intended project outcomes and informed by a sound understanding of the functional linkages between NbS and the water environment (McCarthy 2025; Cole et al. 2026). Metrics should be underpinned by robust, reproducible methodologies to allow progress to be tracked over time and for some investors, metrics may also have to be formally validated and verified.

The Stream Functions Pyramid is a conceptual framework demonstrating how ecosystem processes are typically organised hierarchically with hydrological and geomorphological processes underpinning water quality, habitat condition and biodiversity (Figure 1). Ecosystem service delivery is typically mediated through several interacting bio-physical processes rather than as a direct response to an intervention. Metrics should be selected to reflect both the outcomes of interest and the ecological processes through which those outcomes are delivered.

Through reducing pressures and restoring ecosystem functioning, NbS can enhance the delivery of ecosystem service generating benefits for investors (although potential trade-offs and unintended negative impacts should also be considered) (Cole et al. 2026). Broad outcomes are typically associated with one or more ecosystem service and can be quantified using a range of different metrics. For example, outcomes relating to water resources could be measures through metrics such as peak flows, groundwater levels or volume of water stored in a NbS. Metrics should be selected to capture the outcomes a NbS or suite of NbS are expected to deliver and informed by a sound understanding of the bio-physical processes that underpin those outcomes.

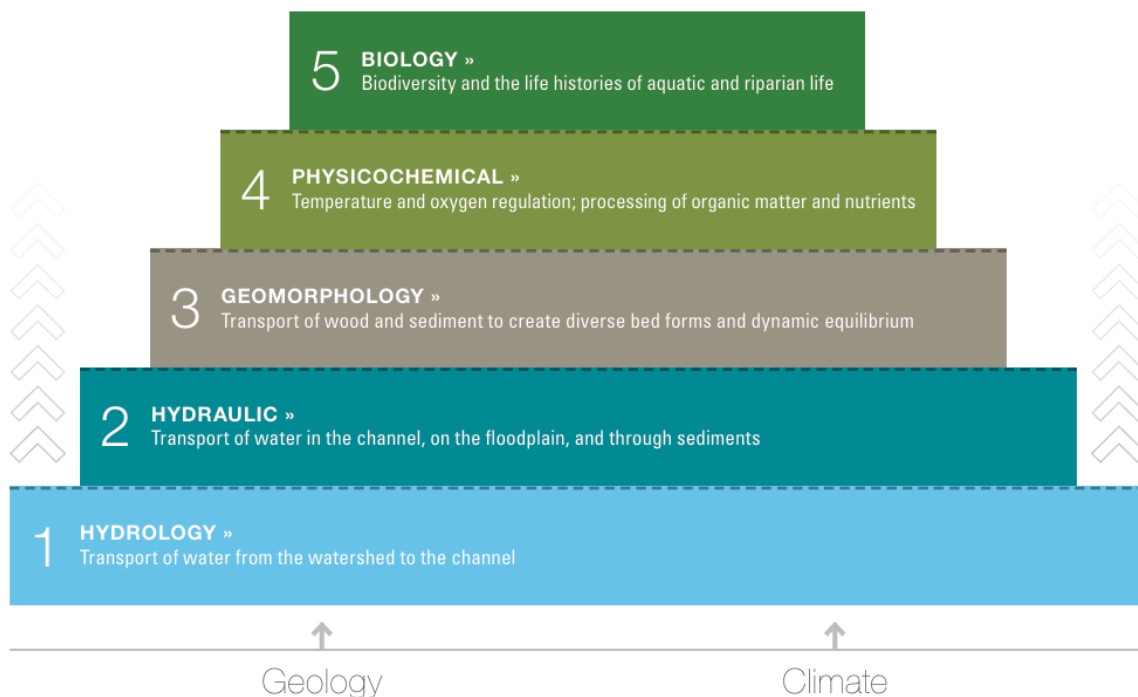


Figure 1: Stream functions pyramid demonstrating the hierarchical structure of ecosystem processes. Source StreamMechanics¹⁰

Metrics and indicators of water quality

Water quality is typically assessed through a combination of physical (e.g. turbidity, suspended solids), chemical (e.g. nitrogen, phosphorus, pH, salinity), biological (e.g. coliform bacteria) and contaminant indicators (e.g. pesticides, pharmaceuticals and microplastics) (Table 4). While some metrics measure concentrations of particular substances (i.e. the amount of a substance in a given volume of water) others measure loads (i.e. the total mass transported – combining concentration with water flow or discharge over a specific time period). While loads facilitate comparison between waterbodies (Chapman et al. 2024), aquatic biodiversity often responds to concentrations rather than loads (Defra, 2022). Metrics typically measures water quality directly, however, some metrics such as the Uptake of on-farm mitigating measures targeted to reduce inputs and protect waterbodies have the potential to provide cost-effective proxies. By directly engaging farmers, such metrics may be of particular interest to agricultural supply chains as a means of demonstrating actions to mitigate nature-related risks.

¹⁰ Final-Stream-Functions-Pyramid.pdf

Table 4: Example metrics/indicators for Water quality outcomes including source/s.

Outcome: Water Quality	
Metrics and indicators	Source/s
Volume of water discharged (m ³), split into: Total; Freshwater; and Other Including concentrations of key pollutants in the wastewater discharged, by type of pollutant, (e.g. nitrogen, phosphorus, pesticides, organic loading, pathogens, metals).	TNFD Global metrics ¹¹
Amount, or load, of each individual pollutant or parameter. Loads are calculated from concentrations and the volume of water over a specific time period at a given location.	TNFD Food & Agriculture ¹² Chapman et al. 2024 Defra 2022
Coastal and freshwater eutrophication; plastic debris density; Chlorophyll-A concentration; In-situ concentration of nitrogen, phosphate and silica.	TNFD Food & Agriculture
Freshwater/marine water/brackish water pollution potential (kg P-Eq/t of ingredient) of each original raw material used in the feed.	TNFD Aquaculture ¹³
Reduction in Nitrogen and Phosphorous – kgTP/yr removed.	Graham et al. 2023 Defra 2022
Groundwaters: pH, Electrical Conductivity, and concentrations of nitrogen. Results compared with target values or standards for good quality.	United Nations ¹⁴
Sedimentation in reservoirs, algal blooms, chlorophyll a, and turbidity.	Chapman et al. 2024
Uptake of on-farm mitigating measures targeted to reduce inputs and protect waterbodies from inputs.	Defra 2022
Colour, turbidity, Total Organic Carbon, Dissolved Organic Carbon, coliforms, iron and manganese.	Irving 2023
Ground water: levels of chemicals in the water, risk of pollutants in ground waters reaching surface waters.	SEPA ¹⁵

Metrics and indicators of water resources

When it comes to monitoring water resources, metrics broadly relate to the regulation of water flows and safeguarding of water supplies (Table 5). Flow regulation is typically

¹¹ [Recommendations-of-the-Taskforce-on-Nature-related-Financial-Disclosures.pdf](#)

¹² [Additional-Sector-Guidance-Food-and-Agri.pdf](#)

¹³ [Additional-Sector-Guidance-Aquaculture.pdf](#)

¹⁴ Indicator 6.3.2 “Proportion of bodies of water with good ambient water quality” | UN-Water

¹⁵ IED-TG-42 Soil and Groundwater Monitoring Technical Guidance for Part A Installations

assessed using metrics that measure flow rates and their variability, flood reduction and surface water runoff. Metrics relating to water supply include abstraction volumes, water use/use-efficiency, reuse, storage capacity and the availability of ground and surface water resources. Water abstraction is an important indicator of pressure on water resources, however, a significant proportion of the water is returned (although not always to the same catchment) typically in a degraded state. Consequently, metrics relating to water use/reuse are strongly linked to water quality and water accounting approaches that consider both water abstraction and return flows provide a more holistic assessment of water resource management (Chapman et al. 2024). Metrics, therefore, encompass information on the sustainability of water use, the resilience of water systems to droughts and floods, the effectiveness of water management interventions, and the security of water supplies.

Table 5: Example metrics/indicators for Water resource outcomes including source/s.

Outcome: Water Resources	
Metrics and indicators	Source/s
Total volume of water withdrawal and consumption (m ³).	TNFD Global metrics
Total volume (m ³) or percentage of water (total, freshwater, other) reduced, reused or recycled.	TNFD Global metrics
Percentage of agricultural products or animal feed produced or sourced from regions with high or extremely high baseline water stress.	TNFD Food & Agriculture
Water Use Efficiency (WUE) calculated as net value added per volume of water use (currency/m ³).	TNFD Food & Agriculture Alliance for Water Stewardship
Volumes and flow rates, hydrological lag time, flood peak reduction, volume and duration of runoff, volume of storage (m ³ of water per km ² of catchment)	Irving 2023
Water availability: reservoir area, elevation, storage capacity, evaporation rate, and evaporation volume for reservoirs and lakes	NASA ¹⁶
Change in water use efficiency over time	United Nations ¹⁷
Level of water used per person: distribution input per population (DI/pop).	Defra 2022
River flow, water levels and rainfall, Number of days river flows are below a predetermined level	SEPA
Ground water: amount of water and impact of abstraction	SEPA

¹⁶ NASA VIIRS Land Products

¹⁷ Indicator 6.3.2 "Proportion of bodies of water with good ambient water quality" | UN-Water

Metrics and indicators of ecological condition

There are a wide variety of metrics for ecological condition, from simple metrics that measure the type, area and extent of a habitat, to more complex metrics looking at key taxa (Table 6). Habitat condition (i.e. quality) strongly impacts on the level and diversity of ecosystem services delivered with habitats in good condition tending to offer higher deliver levels in addition to a wider array of different services (Cole et al. 2026). Metrics that simply consider habitat type and extent do not necessarily accurately reflect outcomes, and metrics that also consider condition provide a more robust measure.

TNFD State of Nature metrics consider both type, extent and condition of habitats outlining some proxy measures for condition (e.g. Extent of land/freshwater/ocean ecosystem that is sustainably managed (km²) (TNFD). However, additional metrics are highly dependent on biome, ecosystem and geographical location, making it difficult to identify standard metrics.

For water environments the literature highlighted a number of taxa-based metrics, which tend to focus on the abundance and type of indicator invertebrates such as stoneflies, mayflies and caddis flies, or fish type, size or movement patterns. Additional metrics include aspects relating to pressures such as the presence of invasive non-native species or enhancing habitat connectivity. Finally, metrics such as the area of the catchment under sustainable or improved land management can provide a cost-effective proxy, however, impacts may take time to materialise and may not be noticeable unless significant changes to land management occur.

Table 6: Example metrics/indicators for Ecological condition outcomes including source/s.

Outcome: Ecological condition	
Metrics and indicators	Source/s
Extent of land/freshwater/ocean ecosystem use change (km ²) by: Type of ecosystem and business activity.	TNFD Global metrics
Extent of land/freshwater/ocean ecosystem that is sustainably managed (km ²) by: Type of ecosystem and business activity.	TNFD Global metrics McCarthy 2025
Total number and percentage of escapes per species, including type of escape events (minor, major, catastrophic failure) by type of ecosystem affected (marine, freshwater, terrestrial), including in cases of extreme weather.	TNFD Aquaculture
Connectivity measures, extent of restored connectivity of natural riparian corridor/instream habitat, number of barriers to movement.	TNFD Global metrics McCarthy 2025 NARIA ¹⁸ , SEPA

¹⁸ NARIA Framework.pdf

Type, abundance and/or diversity of aquatic invertebrates.	Riverfly Partnership ¹⁹ Wildfish ²⁰ River Resource Centre ²¹ NARIA
Monitoring fish, abundance, size class, movement.	River Resource Centre
River quality: survey records sediments, physical habitats, vegetation structure and human pressures and interventions across the bank tops, bank faces and bed of short river lengths called modules.	Modular River Survey ²² River Habitat Survey McCarthy 2025
Habitat quality assessment targeted to salmonids. Instream characteristics (water depth, flow type, substrates and vegetation cover), bank and riparian features (types and extent of erosion, canopy cover, grazing pressure and land use), available spawning habitat, obstacles to migration, possible causes for unsuitable habitat or a lack of fish (such as pollution sources)	Scottish Fisheries Coordination Centre (SFCC)
Invasive non-native species – introduced plant or animal species which can result in a loss of natural wildlife.	SEPA

Metrics and indicators of physical condition

The physical condition of waterbodies is a key outcome of River Basin Management Planning. Metrics and indicators relate to river morphology, hydrological regime, longitudinal connectivity (e.g. barriers such as dams) and lateral connectivity (connection to the floodplains and wetlands). Many of these attributes overlap with metrics relating to water resources (i.e. water flows and levels) and ecological condition (i.e. connectivity and habitat quality/condition). Additional metrics include the River Anthropogenic Modification Index providing an indication of the extent to which natural river processes have been altered through human modifications such as canalisation, bank reinforcement, culverts and weirs.

Water temperature is also commonly considered a physical condition with metrics relating mean, minimum and maximum temperatures, degree days, and the frequency with which ecological thresholds are exceeded. Temperature strongly influences the growth, survival, and distribution of aquatic organisms, particularly fish and invertebrates, and is expected to become increasingly important under climate change. However, because temperature is also a key determinant of chemical and biological processes in aquatic ecosystems, it may alternatively be considered alongside water quality indicators.

¹⁹ Recording Schemes — The Riverfly Partnership

²⁰ SmartRivers | Scientifically Robust Citizen Science | Wildfish

²¹ 14. Techniques A-Z – PRAGMO

²² Modular River Survey

Table 7: Example metrics/indicators for physical condition outcomes including source/s.

Outcome: Physical condition	
Metrics and indicators	Source/s
Extent of land/freshwater/ocean ecosystem that is sustainably managed (km ²) by: Type of ecosystem and business activity.	TNFD Global metrics McCarthy 2025
Temperature of water discharged	TNFD Global metrics
Connectivity measures, extent of restored connectivity of natural riparian corridor/instream habitat, number of barriers to movement.	TNFD Global metrics McCarthy 2025 NARIA, SEPA
River quality: survey records sediments, physical habitats, vegetation structure and human pressures and interventions across the bank tops, bank faces and bed of short river lengths called modules.	Modular River Survey River Habitat Survey McCarthy 2025
Habitat quality assessment targeted to salmonids. Instream characteristics (water depth, flow type, substrates and vegetation cover), bank and riparian features (types and extent of erosion, canopy cover, grazing pressure and land use), available spawning habitat, obstacles to migration, possible causes for unsuitable habitat or a lack of fish (such as pollution sources).	Scottish Fisheries Coordination Centre (SFCC)
River temperature metrics. Broad metrics: maximum, minimum, mean, degree days.	Jackson et al. (2026) Shilland et al. (2025)
Temperature growth, stress and/or lethal metrics for salmon, trout: e.g. number of days where mean daily river temperature is above optimal growth temperatures.	Scotland River Temperature Monitoring Network (SRTMN) Data App ²³
Stonefly metrics: Stonefly upper and lower limits – e.g. number of days where mean daily temperature is above 9.7 degrees.	Scotland River Temperature Monitoring Network (SRTMN) Data App
River Anthropogenic Modification Index: Index based on pressures that degrade channel form including bank protection, culverts, river straightening, bed reinforcement, embankments, weirs and more.	SEPA

Metrics and indicators of societal outcomes

Metrics relating to societal outcomes are less well represented in the literature and were often focussed on access to drinking water and sanitation services, making many of the globally adopted metrics less applicable to the Scottish context (Table 8). However, societal metrics remain important for assessing the extent to which NbS deliver benefits

²³ Scotland River Temperature Monitoring Network (SRTMN) Data App

to communities and engaged with these communities in decision-making. In addition to metrics relating to volunteer engagement McCarthy's (2025), indicators of community involvement in decision-making are highly relevant. For example, the United Nations metric relating to the proportion of local administrative units with established and operational procedures for community participation in water and sanitation management.

The Scottish Government outlines their commitment to societal benefits with their six principles for responsible investment outlining that investments should be ethical and values led, deliver community benefits and demonstrate engagement and collaboration²⁴. Community engagement and social outcomes are increasingly recognised within emerging natural-capital market codes and standards. For example, BSI Flex 701 v2.0:2025-03 (BSI 2025) indicates that suppliers need to provide accessible and transparent information on management plans, identify and manage material impacts on local communities, provide information on trading and ownership of credits, alongside detailing any benefit-sharing arrangements. Such arrangements should be informed by meaningful engagement and aligned with the needs and aspirations of local communities.

Benefits sharing is echoed in the Community Inclusion Standard (Nixseaman and Cook 2025) developed under FIRNS (Facility for Investment Ready Nature in Scotland). The standard has a strong emphasis in codesign, inclusive decision-making and promotes meaningful social and economic benefits that promote the sustainable development of communities. Consequently, social metrics are likely to become increasingly important to project designers and investors.

Table 8: Example metrics/indicators for societal outcomes including source/s.

Outcome: Societal outcomes	
Metrics and indicators	Source/s
Percentage of population with access to safe drinking water services.	Alliance for Water Stewardship United Nations ²⁵
Proportion of local administrative units with established and operational policies and procedures for participation of local communities in water and sanitation management.	United Nations
Proportion of population using (a) safely managed sanitation services and (b) a hand-washing facility with soap and water.	United Nations Alliance for Water Stewardship
Number of volunteers.	McCarthy (2025)
Proportion of transboundary basin area with an operational arrangement for water cooperation.	United Nations

²⁴ Principles for Responsible Investment in Natural Capital – gov.scot

²⁵ SDG 6 Data Portal | UN-Water

Metrics and indicators of risk and economic impacts

The metrics considered above provide a means of quantifying the impacts that implementing NbS can have on the condition of the water environment, capturing multiple aspects alongside broader societal outcomes. These metrics provide a useful framework to monitor how successful projects have been at delivering their intended outcomes, and can support businesses to identify priorities, set targets, and report against these targets, for sustainability and environmental disclosure purposes. While voluntary disclosure metrics may drive metric selection in some contexts, businesses seeking compliance obligations will require metrics that align with relevant statutory and regulatory requirements.

From a business perspective, translating metrics that capture biophysical changes into metrics that directly relate to risk reduction and/or avoided costs or damages can strengthen decision-making processes and help to justify investment in NbS (e.g. through cost-benefit analysis). The review identified metrics associated with both risk reduction (e.g. Annual Exceedance Probability, which describes the likelihood of an event occurring in a given year) and avoided damage or remediation costs (e.g. flood risk damage costs, avoided water treatment cost) (Table 9).

Such metrics can inform decision-making by comparing risk reductions and avoided damages or reduced costs across different intervention scenarios (e.g. grey infrastructure versus NbS, or comparing alternative NbS). For example, Expected Annual Damages provides an estimate of average annual flood losses, therefore, represents a key metric for quantifying the avoided costs and damages delivered by an intervention. Typically underpinned by depth-damage relationships (e.g. those set out in the Multi-Coloured Handbook: Penning-Rowse et al. 2014), expected Annual damages translations changes in flood probability/severity into estimated economic losses allowing us to compare different interventions.

Table 9: Example metrics/indicators for risk and economic impacts including source/s.

Outcome: Risk and economic indicators	
Metrics and indicators	Source/s
Average benefit to cost ratio of schemes delivering outcomes.	Penning-Rowse et al. 2014
Change in the number of properties at risk from flooding.	Penning-Rowse et al. 2014, Environment agency, 2021
Weighted Annual Average Damages/ Expected Annual Damages.	Penning-Rowse et al. 2014, Environment agency, 2021
Annual Exceedance Probability (AEP)/ return period (the 1-in-N event).	Penning-Rowse et al. 2014, The Flood Hub ²⁶
Estimates of the number of properties affected by different floods.	Penning-Rowse et al. 2014

²⁶ Understanding Flood Risk | The Flood Hub

The number of residents in the flood prone area (disaggregated by flood frequency if possible). This can be subdivided by social class.	Penning–Rowsell et al. 2014
Change in costs of disruption due to flooding (e.g. road and rail disruption, telecommunications, emergency services).	Penning–Rowsell et al. 2014
Economic and financial cost of damage due to flooding.	Penning–Rowsell et al. 2014
Drought risk indices integrate hazard (e.g. amount of rainfall), exposure (assets or people likely to be impacted) and vulnerability to damage.	Rahman et al. 2025
Avoided remediation cost (£/yr): reduction in treatment, restoration, or intervention expenditure attributable to water quality improvements.	Price and Heberling 2018
Water Quality Elasticity of Cost: % change in treatment cost resulting from a 1% change in source water quality	Price and Heberling 2018

Through quantifying risk reduction and avoided costs/damages such metrics provide a useful starting point to estimate the value of NbS, thus provide an economic case for investment. Cost–benefit analyses can, however, be oversimplistic if they focus on a restricted number of benefits, particularly benefits that are easily quantified and valued economically. NbS typically deliver multiple co-benefits to the environment and society in addition to providing economic benefits. More holistic assessments that capture and value these co-benefits could attract a broader range of investors.

Additionally, by restoring ecosystem health and functioning, NbS can build resilience to environmental change (including climate change, and changes to land use and management). Consequently, risk assessments and cost–benefit analyses should consider longer-term impacts and build in scenarios to account for future changes in pressures (e.g. land use change or climate change). This will help to ensure that NbS are recognised and valued for their greater adaptive capacity and sustained performance over time when compared to approaches designed to address current conditions (Rahman et al. 2025).

Monitoring: Design, costs and scale

NbS can deliver a wide range of water-related outcomes, and identifying these multiple expected benefits may help attract investment (e.g. through bundling or stacking). However, monitoring the water environment can require substantial technical, labour, and financial resources, particularly as many metrics exhibit considerable seasonal and interannual variability (e.g. pollutant loads, water levels, and river flows), thus requiring repeated sampling (Chapman et al., 2024). Attribution of outcomes can also be challenging because catchments are complex systems influenced by multiple natural and anthropogenic pressures, meaning that demonstrating the effects of a specific intervention may require a high density of monitoring points (Defra, 2022). In addition, ecological and hydrological responses often occur over extended timescales, resulting in a lag between project implementation and the realisation of measurable outcomes. Consequently, long-term monitoring, potentially spanning decades (e.g. 10–50 years),

may be required to fully capture the benefits that NbS provide (Defra, 2022; McCarthy, 2025).

Monitoring, reporting and verification requirements will vary depending on whether investors are seeking verified credits to meet regulatory requirements, or simply to demonstrate corporate movement in environmental and social governance documents. It is crucial that we get the balance right to ensure that sufficient investment flows into nature restoration, rather than primarily funding costly monitoring (and indeed reporting and verification where required) processes. Metric selection should reflect the intended demand pathway (voluntary disclosure, regulatory compliance or resilience investment) to ensure that evidence requirements are proportionate and provide evidence that is sufficient to meet the intended purpose.

Advances in monitoring technologies such as remote sensing and automated monitoring can provide an auditable trail and decrease the costs associated with monitoring (and where required reporting and verification) (Chapman et al. 2024). Additionally, Environmental DNA can provide a rapid assessment across multiple taxa providing a more holistic view of ecosystem health. Environmental DNA provides a quick and cost-effective way to detect invasive non-native species (INNS), increasing the likelihood of eradication (Scottish Environment LINK 2026).

Monitoring costs could also be reduced through tapping into existing monitoring frameworks (e.g. SEPA, Scottish Water, citizen science initiatives) or establishing participatory monitoring schemes (e.g. farmer led monitoring). However, the experimental design must be robust and measure outcomes at the appropriate spatial scale, extent, frequency and longevity.

The scale of a project will strongly influence the metrics selected, monitoring methodology, and sampling design. Monitoring approaches should be proportionate to the scale at which outcomes are expected to occur and the level of evidence required by investors or other stakeholders. For example, where a project is designed to deliver a specific local outcome, such as nutrient removal through the creation of a constructed wetland, monitoring may focus on comparing nitrogen and phosphorus concentrations or loads between the inlet and outlet. In contrast, larger-scale interventions implemented across multiple farms or an entire catchment may require monitoring of broader indicators such as water quality, water flows, sediment loads, or ecological condition to capture cumulative impacts. McCarthy (2025) distinguishes between project-level metrics, which assess the performance of individual interventions, and portfolio-level metrics, which evaluate outcomes across multiple interventions and larger spatial scales. Selecting metrics that align with the scale of intervention is critical to ensuring that monitoring provides meaningful and credible evidence of environmental outcomes.

Catchment scale metrics (e.g. SEPA water flow, water quality metrics) could provide appropriate means of quantifying the impact of landscape scale interventions (providing they are delivered at a sufficient scale). However, more targeted monitoring would be required to quantify outcomes of more localised projects.

Wider benefits of monitoring multiple outcomes should also be considered. Scientifically robust and reproducible monitoring frameworks with appropriate metrics help identify if projects are meeting their intended outcomes and indeed quantify the extent of these outcomes (feeding into the evidence base) (McCarthy 2025). Additionally, they can identify projects that are not performing, or unintended consequences, reducing the risk of failure and identifying where management may need to be adapted to ensure outcomes are delivered. Ultimately monitoring ensures that projects are delivering the environmental outcomes in line with expectations providing reassurance for project managers, investors and local communities.

Predicting outcomes

While monitoring can help quantify outcomes post project delivery, estimating the proposed outcomes that NbS may deliver can help investors make informed decisions. Modelling has a clear role to play in enabling us to predict these outcomes, allowing investors to determine potential returns of investing NbS. Modelling can also help determine the viability of targets and the scale of delivery needed to meet targets (Defra 2022).

The Interim Nutrient Reduction Standard for Interceptor Wetland and Interceptor Woodland Projects estimates the reduction in Nitrogen and Phosphorus (i.e. kgTN/yr removed) associated with the creation of interceptor wetlands and woodlands (Graham et al. 2023). The standardised framework integrates datasets (e.g. on soils, rainfall, topography, land use and fertiliser use) to calculate catchment specific nutrient loadings. The nutrient load reduction on proposed wetlands and woodlands is then estimated taking into account factors such as woodland width, land use change, and existing NbS in the catchment.

Similarly, Farmscoper²⁷ is a decision support tool that models the impact of a variety of farm mitigation measures on diffuse pollution (nitrate, phosphorus, sediment, ammonia, methane, nitrous oxide, plant protection products, faecal indicator organisms). The tool developed for use in England and Wales integrates a number of datasets including climate, land use and farm management data to estimate load reductions (Gooday et al. 2015). The tool can estimate the impact of over 100 mitigation measures including infield management practices (e.g. cover crops, clover leys, regular movement of feeders) alongside habitat restoration actions (e.g. creation of buffer strips, establishment of hedgerows). The tool can model outcomes from catchment to farm level and in addition to estimating impacts on diffuse pollution, the tool also estimates the costs associated with implementing a specific measure.

In addition to estimating biophysical outcomes, modelling can also help to estimate the economic implications of NbS. For example, *The Weighted Annual Average Damage (WAAD) Estimation Tool*²⁸ can estimate avoided annual flood losses provided by flood defence schemes while the *Simplified benefit: cost appraisal tool for flood risk*

²⁷ [Download Farmscoper with ADAS](#)

²⁸ [Level2-Step3 – MCM-Online](#)

management ²⁹ provide insights into the economic costs and benefits of flood mitigation measures. Such tools can help investors compare alternative scenarios and estimate the potential investment from investing in NbS.

While modelling provides a useful estimate, models and underpinning data is lacking for many NbS and water-related outcomes in Scotland. It is important that lack of data does not hinder progress and Irving (2023) proposed to develop a suite of generic NbS interventions and predicted outcomes to reduce (but not eliminate) the need for detailed catchment/intervention specific modelling.

Considerations: metric selection and market development

The review demonstrated the wide range of different metrics available to monitor the impact of implementing NbS on a range of water-related outcomes, alongside capturing associated risks and economic outcomes. The primary challenge is not necessarily a lack of suitable metrics, but instead when it comes to selecting a suite of metrics that accurately quantify project outcomes, are designed to work at the intended spatial scale of impact and align with investor requirements. While metrics for water-related outcomes are typically comprehensive, metrics relating to social and community outcomes were less well represented indicating the need for further development.

There is also a need for proportionate monitoring and evaluation processes that operate at an appropriate scale and frequency, balancing monitoring costs against the level of monitoring, reporting and verification required. To build buyer confidence and increase transparency, Cole et al. (2026) recommended the development of an integrated monitoring and evaluation framework to standardise metric selection and monitoring approaches to evidence water-related outcomes. Such a framework could increase transparency and comparability across projects, whilst maintaining sufficient flexibility to ensure metrics and monitoring are tailored to the scale and intended outcomes of individual projects. To ensure that metrics are selected to capture the mechanisms through which the outcomes are delivered, the framework should be underpinned by an understanding of the biophysical processes and functional pathways that link NbS to water-related outcomes. Aligning such approaches with existing monitoring programmes could reduce monitoring costs and provide greater consistency across projects.

NbS versus grey infrastructure

The capital costs in implementing and managing NbS are often substantially lower than associated with traditional grey infrastructure. For example, a US study estimated that upfront costs for NbS designed to mitigate storm waters were 15–80% lower than equivalent grey infrastructure solutions (United States Environmental Protection Agency 2007). However, while capital investment may be lower, NbS rely on the restoration and enhancement of natural processes that can take years or decades to respond to interventions. Consequently, benefits take time materialise while whereas outcomes of

²⁹ Level3-Step3 – MCM-Online

grey infrastructure are often realised immediately and are more readily quantified (McCarthy 2025, Allan 2025).

Furthermore, the performance of grey infrastructure is typically predictable, whereas the outcomes of NbS are influenced by a wide range of factors including local environmental conditions, catchment characteristics, where and how they are implemented, their management and scale of implementation (Ogilvy et al. 2022; Williams et al. 2024). This can make it challenging to predict and quantify the impact of implementing NbS on specific metrics and may increase perceived investment risk. Robust monitoring frameworks can help address this uncertainty by identifying where expected outcomes are not being realised and identifying where adaptive management may be required. Such approaches can reduce risk and improve confidence amount investors.

Despite these challenges, NbS can protect, enhance and restore multiple hydrological, biological and biochemical processes generating a broad range of ecosystem services. For example, riparian woodlands can increase water infiltration and retention during heavy rainfall mitigating flooding, it can intercept sediments and sediment-bound pollutants enhancing water quality, it can buffer temperature extremes and increase instream diversity enhancing the ecological condition of the water environment (Ogilvy et al. 2022). In addition to these water-related benefits, riparian woodlands also capture and store carbon, provide recreational opportunities, support terrestrial biodiversity and can provide shade and shelter to livestock (Cole et al. 2026). In contrast to grey infrastructure, which is often designed to deliver a specific outcome, the multi-functional nature of NbS creates a broader portfolio of benefits and may attract a wider range of investors and buyers.

However, attributing observed changes in water-related outcomes to specific NbS interventions remains challenging. The water environment is influenced by a wide range of interacting factors including hydrology, asset quality and quantity, soils, land management and local climatic conditions. As a result detecting and quantifying the contribution of specific NbS on water-related outcomes can be difficult. For example, Scottish Water has struggled to link peatland restoration to the regulation of water flows (Irving 2023). Furthermore, the scale of implementation is critical. A recent review of NbS found that interventions such as improved grazing management, peatland restoration and hedgerow establishment typically resulted in positive outcomes at the site scale, evidence of their impact at the catchment scale was weaker (Cole et al. 2026). The highlights the importance of implementing NbS at sufficient scale to detect impacts across a catchment.

NbS can also complement and enhance the performance of grey infrastructure. For example, interventions targeted to reduce diffuse pollution (e.g. buffer strips, cover crops) can improve the efficiency of downstream water treatment processes and reduce operational costs (Allan 2025). Additionally, by restoring ecosystem condition and function, NbS can increase resilience to environmental change, including climate change and maybe better to adapt to future pressures when compared to engineering solutions (Allen 2025). NbS and grey infrastructure should be viewed as complementary components of resilient catchment management rather than as competing alternatives.

Mechanisms

A range of financial and market-based mechanisms are emerging to enable the transfer of funding from buyers and/or beneficiaries to providers of water-related ecosystem services delivered through NbS. These mechanisms define how value is recognised, structured and transacted, translating environmental outcomes into revenue streams that can support land managers and project developers. They span both regulatory and voluntary approaches, including compliance-driven models, water funds, Payments for Ecosystem Services (PES), voluntary credit mechanisms, and direct corporate investment. Each mechanism differs in terms of its scale, drivers, governance, level of standardisation and risk profile, but all play a role in mobilising finance and aligning incentives across stakeholders. Together, they represent a suite of pathways through which private and blended finance can be channelled into catchment-scale interventions, supporting more resilient and sustainable water systems. For more detail and associated case studies for each of these mechanisms, see Green Finance Institute (2025) [Revenues for Nature – Unlocking Private Investment into Freshwater](#).

Compliance models

Compliance-based models establish enforceable legal or regulatory obligations that generate financial flows for nature-based interventions targeting freshwater quality and availability. Unlike voluntary or incentive-based approaches, these mechanisms are embedded within legal frameworks, creating predictable and often long-term revenue streams. They can take several forms. Water tariffs, for example, can provide stable funding for NbS where utilities (despite often being publicly owned) leverage consistent revenue streams to attract private investment, though regulatory reform may be required to enable or mandate such use. Compensatory offsetting schemes require developers or polluters to balance environmental damage by restoring or protecting ecosystems elsewhere, either directly or through payments into credit markets or third-party projects, thereby supporting government environmental objectives. Polluter Pays mechanisms further reinforce this approach by assigning the cost of remediation directly to those responsible for pollution, as seen in policies such as the EU's extended producer responsibility under the Urban Wastewater Treatment Directive, which requires certain industries to contribute to treatment costs (Green Finance Institute 2025).

Our final report will include a more detailed analysis of which organisations are being incentivised or required to take action on water, whether through regulation or public payments. We will aim to set out what specific actions are currently expected in terms of adhering to good water management.

Water funds

Originally developed by The Nature Conservancy, water funds are an innovative mechanism designed to structure and facilitate the flow of capital from multiple stakeholders to support long-term upstream water management. These funds typically attract investment from major water users such as utilities, hydropower operators, beverage companies, and agricultural businesses, pooling resources that are then invested in financial markets to generate sustainable returns. These returns are

subsequently reinvested into targeted conservation interventions that address key drivers of water pollution and overuse within a watershed. Such interventions commonly include promoting sustainable agricultural practices to reduce upstream water consumption, incentivising erosion control measures such as terracing and riparian planting, removing invasive species that place pressure on water resources, funding conservation easements to enable ecosystem restoration, and supporting community engagement initiatives to encourage sustainable water use. The Nature Conservancy has supported the creation of over 40 water funds across multiple regions including Latin America, North America, Europe, Africa and East Asia (Green Finance Institute 2025; The Nature Conservancy 2012).

Payments for Ecosystem Services

Payments for Ecosystem Services (PES) are a widely used market-based instrument for financing nature conservation, based on the principle of providing financial incentives to those who manage or steward natural resources. PES schemes seek to translate the often-unpriced benefits that ecosystems provide into tangible economic value, creating a direct link between beneficiaries and providers of these services. In practice, this typically involves downstream users (such as utilities, businesses, or governments) making payments to upstream land managers or communities in return for adopting practices that protect or enhance ecosystem functions (see Case study: Leven LENSs). These may include changes in land use, restoration activities, or the implementation of more sustainable agricultural practices. By aligning economic incentives with environmental outcomes, PES mechanisms can support long-term behaviour change, improve ecosystem resilience, and provide a structured and scalable approach to funding nature-based solutions for water management (Green Finance Institute 2025).

Voluntary credit mechanisms

Voluntary credit mechanisms involve companies, investors, and other stakeholders choosing to address their water impacts through the purchase or generation of water-related credits, without a legal obligation to do so. These approaches are typically driven by corporate sustainability commitments, stakeholder expectations, and a desire to demonstrate leadership in water stewardship. In practice, they can take several forms, including directly funding watershed restoration projects that generate credits, purchasing credits based on established metrics, or investing in collective action initiatives that enhance water quality, availability, and ecosystem health. Water replenishment strategies can underpin these mechanisms by creating quantifiable and verifiable credits, either developed internally by companies or supplied by third-party project developers. As a result, voluntary crediting is contributing to the emergence of broader nature markets, where organisations seek to evidence positive environmental impact through measurable water outcomes. While voluntary, these mechanisms are increasingly important for organisations seeking to manage water-related risks, strengthen stakeholder trust, align with evolving disclosure requirements such as the Corporate Sustainability Reporting Directive, and deliver against water targets informed by frameworks like the Science Based Targets Network³⁰ (Green Finance Institute 2025).

³⁰ Science Based Targets Network: Freshwater targets

Note: Currently in Scotland, outcomes for nature and water are primarily delivered as co-benefits from investment in voluntary carbon markets (i.e. Woodland Carbon Code and Peatland Code). The forthcoming Ecosystem Restoration Code should provide a mechanism to diversify investment opportunities in NbS, shifting this balance towards the development of markets for biodiversity, water quality, flood resilience and wider ecosystem services.

Corporate direct investment in supply chains (insetting)

In response to growing investor scrutiny and the need to safeguard business continuity, some companies are turning to direct investment in NbS within their supply chains to reduce exposure to these risks. Unlike traditional Corporate Social Responsibility activities, these investments (often referred to as “insetting”) are strategically motivated and closely aligned with core business interests rather than being purely philanthropic. For example, a hydropower operator dependent on stable flow regimes and low sediment loads may invest in upstream erosion control and catchment management, while consumer goods companies reliant on water-intensive production processes may invest both in on-site efficiency measures and in wider watershed restoration initiatives. Such investments help to secure long-term water availability and quality, strengthening operational resilience while also delivering wider benefits for ecosystems and local communities that depend on the same water resources (Green Finance Institute 2025).

Application to Forth basin and next steps for this research

While this section gives an overview of some of the range of mechanisms being used to fund water environment interventions around the world, a more critical assessment is needed to understand their relevance and applicability to Scotland and the Forth basin. For example, compliance-driven mechanisms such as England's nutrient neutrality rely on strong regulatory drivers to consistent demand, therefore their applicability to Scotland may be constrained by differences in planning policy, regulatory frameworks, and institutional capacity. Conversely, voluntary or hybrid models may be easier to initiate, but face challenges around demand certainty and market maturity.

Drawing on this evidence review and the results of our stakeholder interviews, our final report will critically assess which mechanisms may be most promising to introduce within the Forth basin. It will identify key policy gaps or enabling conditions (e.g. clearer regulatory drivers, aggregation mechanisms, or public sector market-making roles) that may be required as a precondition for scaling these approaches.

Case study: Leven LENS

Investing in nature can present a compelling business case for addressing water quality and availability challenges. NbS can offer opportunities and developments, which last long term, offer an array of benefits and involve a cooperation between different stakeholders to build success and longevity. As water related risks continue to grow due to climate change, population growth, and industrial demand, NbS can provide an innovative, cost-effective, and scalable alternative to traditional water management approaches, such as gray infrastructure. Gray infrastructure options have their place but generating a market and sustainable solutions, which aim to aid and enhance multiple services to improve more than one attribute can make financial and business sense. However, this is an evolving market space.

Collaborative mechanisms work by a facilitator recruiting investment stakeholders who wish to improve ecosystem services and 'match' them with land managers to implement NbS on their land. Such schemes include Landscape Enterprise Networks (LENs) and Natural Infrastructure Schemes in the UK. Collaboration mechanisms provide key access to funding and advice for land managers to implement NbS on the ground. Historically, land managers were faced with the financial burden and time commitment to implement these schemes, which prevented participation. Having this market available, being able to discuss terms and plan together is beneficial to the land manager, stakeholders, and the local community. However, investing in NbS has its challenges, as discussed within this report. How metrics, goals and success is monitored and reported can take time, and success is not always guaranteed or readily visible.

There are numerous case studies provided as links and signposts throughout this document. However, we wanted to highlight the LENs model as a unique and relevant initiative already active within the Forth Basin. LENs are schemes that organise the buying and selling of ecosystem service to increase the uptake of NbS, bridging the financial gap from public funding to help improve the natural environment. Public funding streams can help initiate and begin projects, however, for impactful and long-term backing, additional support is required. LENs brings together stakeholders, such as local public bodies, business, landowners and farmers to discuss and broker options, allowing for meaningful investment to suit all parties. The projects, following investment models, allow co-funding of regenerative agricultural practices to improve and deliver NbS within the catchment.

In aggregating investors allowing co-funding, LENs reduces both the required investment and the level of risk involved. Furthermore, when it comes to water-related outcomes, NbS need to be implemented at a sufficient scale for impacts to be realised and measured (Cole et al. 2026). Aggregating investors allows for more ambitious and innovative projects to gain traction and buy-in. The projects are measured and verified, allowing for metrics to be included in business planning and reporting. Through these investments it allows for training and upskilling in the catchment area, which allows for growth and the ability to expand and develop projects further in the future. This gains traction, incentivising further investment and development with other stakeholders and land managers within the area, which increases the benefits of ecosystem services and the subsequent benefits they provide to all.

The Leven LENS project is facilitated by the Forth Rivers Trust and is the first LENS project in Scotland. With success in England, the Leven LENS project was piloted in to highlight and demonstrate how multiple stakeholders can come together to fund, implement and improve the ecosystem services, which businesses, companies and local communities depend. This collaborative project, brings various stakeholders, including Diageo, Forth Rivers Trust, NatureScot, Heritage Lottery Fund, Lockett Agri-Environmental, Perth & Kinross Council, SRUC and Scottish Enterprise to work together to create long-term positive impact to the local environment.

Stakeholders came together in 2024 to discuss the catchment priorities and potential solutions, resulting in a shared vision to develop and deliver collaboratively. The project currently focuses on supporting regenerative agricultural practices to improve water quality, flood protection, carbon sequestration and biodiversity outputs. The broad range of stakeholders within this working group allows for cohesive, practical conversations and plans to be made that seek to provide benefits for all participants. Taking the pressure of an individual and working cohesively together for an end goal. In this the facilitator is key to ensure that all participants are represented fairly, given appropriate information about project involvement, term length and what is expected to be delivered is explained and documented. Depending on the investors involved, there could be bias to skew the focus of the projects towards investors goals, however, LENS utilises the facilitator and communication with all stakeholders to minimise risk and allow for cohesive planning and participation.

By spreading the investment between different buyers, and delivery across different farms and estates, risks associated with NbS are reduced. With currently policy change, extreme weather and financial restrictions, land managers can be hesitant to commit to implementing NbS. However, LENS provides flexibility allowing land managers to select NbS allowing actions to be tailored to individual business models and operational needs. LENS can provide farmers with access to fundings, training, and flexible contracts to suit their business needs, while investors can build business resilience, reduce their impacts on climate, water and nature and help deliver on biodiversity and Net Zero goals and reduce costs as projects can be co-funded. To date the enterprise is working with 10 farms across the catchment, with the first trade occurring in 2025. With ambitions to more than double the farmer intake in 2026, the Leven LENS project is planning to build and diversify to increase investment and expand capacity. However, for all schemes to be successful they need to grow and encourage stakeholders to join.

Conclusions and next steps for this research

This rapid evidence review synthesises the current evidence base across three key areas: demand drivers for water outcomes, the metrics used to quantify and transact these outcomes, and the mechanisms available to structure delivery. Taken together, these findings provide a structured understanding of how water-related NbS are currently valued and financed in the UK and internationally. The review highlights that while a wide range of potential demand drivers and mechanisms exist, their applicability varies significantly depending on regulatory context, market maturity, and the presence of clearly defined buyers. In particular, the strongest and most scalable forms of demand tend to be those linked to compliance requirements and operational resilience, where willingness to pay is clearer and more immediate.

The next phase of the project will build on this evidence through targeted interviews with demand-side actors in the Forth basin, with the aim of grounding these insights in local reality. This will prioritise exploration of those demand drivers and buyer types associated with larger-scale, more reliable funding flows (particularly compliance and resilience) alongside mechanisms that represent the most immediate and practical opportunities for implementation. A key focus will be to understand current willingness to pay, ensuring the work remains focused on the most immediate opportunities, rather than hypothetical best-case scenarios. However, interviews will also explore where there may be scope to unlock additional demand in the future, and what enabling conditions (e.g. policy, regulatory, or market-based) would be required to support this.

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