CAMBRIDGE CITY COUNCIL

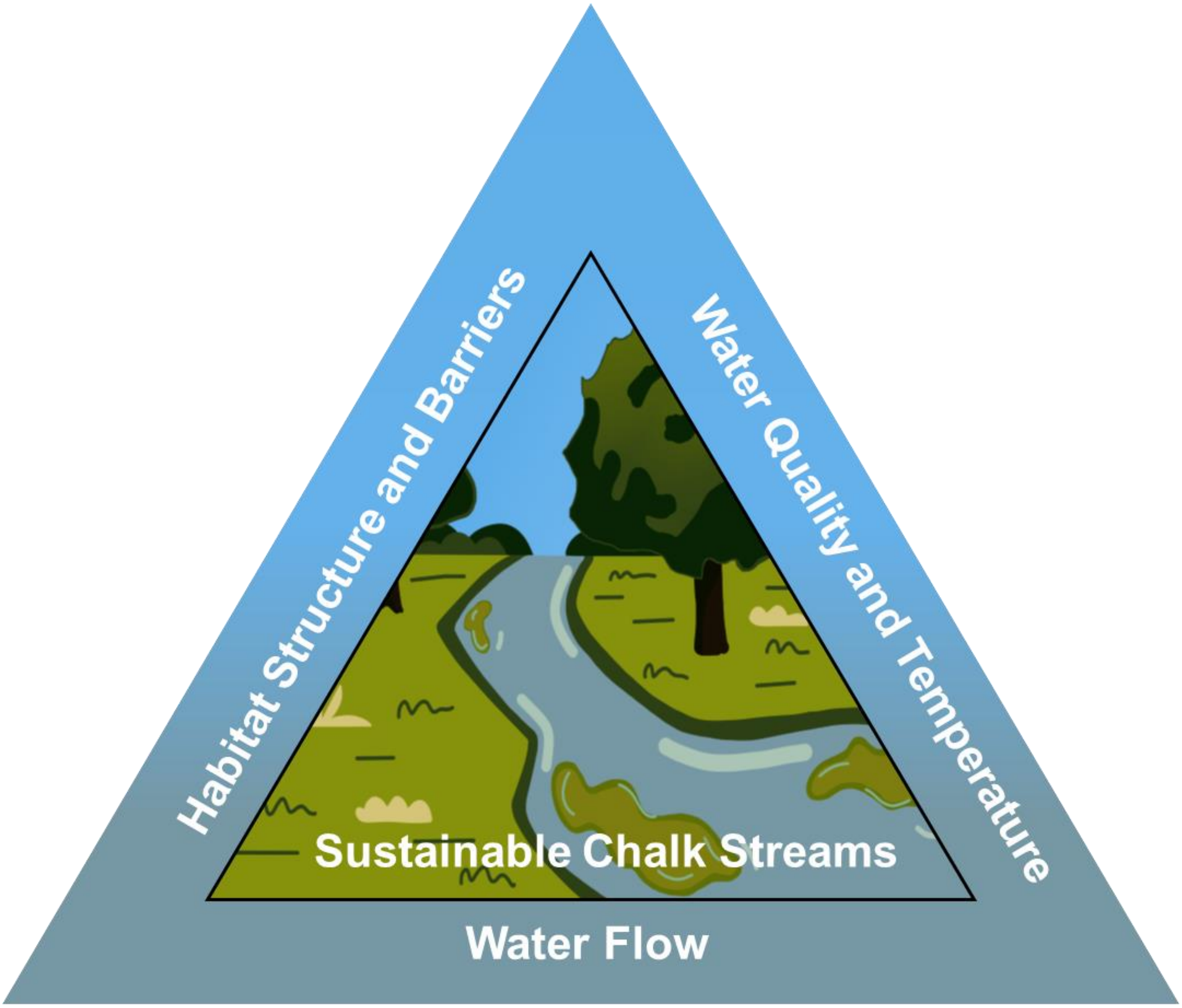
Greater Cambridge Chalk Stream Project

Contents

Foreword

The chalk streams of Greater Cambridge are treasures of extraordinary ecological and cultural value, once flowing in harmony with the crystal clear waters that shaped our landscapes and inspired generations. Today, these delicate ecosystems are severely degraded and face the threat of extinction, their vitality imperilled by centuries of human impact. The Greater Cambridge Chalk Stream Project is a case study, using specific sites to explore the holistic challenges affecting chalk stream flora and fauna within the channel. By examining these pressures in detail, the project seeks to build a deeper understanding of the issues driving habitat degradation and biodiversity loss. This initiative is more than a conservation effort; it is a commitment to learning, restoration, and long-term stewardship. Through collaboration, innovation, and a growing evidence base, we are equipping ourselves with the knowledge needed to inform meaningful action. By doing so, we not only work to restore these living freshwater mosaics but also ensure they remain vibrant sanctuaries for wildlife and a source of inspiration for the communities that cherish them. Together, we are shaping a future where chalk streams thrive once more, securing their place in the landscape for generations to come.

Threats to Chalk Streams



Habitat Structure and Barriers

- Sedimentation and siltation
- Bank erosion and destabilisation
- Loss of riparian vegetation
- Loss of aquatic plant diversity
- Loss of natural woody debris and refugia
- Lack of large woody debris affecting channel morphology
- Loss of undercut banks and refuge areas for fish
- Reduced spawning habitats for fish
- Habitat fragmentation (culverts, weirs, barriers)
- Channel straightening and simplification
- Floodplain disconnection
- Compacted riverbeds reducing habitat quality
- Invasive species (e.g. American signal crayfish, Himalayan balsam)
- Urban development reducing natural buffer zones
- Increased light penetration leading to excessive algal growth

Flow

- Over-abstraction reducing groundwater recharge
- Groundwater depletion affecting spring flow stability
- Urban runoff increasing peak flows and erosion
- Channelisation leading to unnatural flow patterns
- Loss of base flow (drying of springheads)
- Increased flood risk due to impermeable surfaces
- Climate change impacts on seasonal variability
- Increased sediment transport from extreme weather events
- Barriers preventing fish migration and sediment transport
- Disconnection from floodplains limiting natural flood storage

- Drainage modifications increasing flash floods and peak flows
- Reduction in groundwater-fed base flows affecting flow stability
- Lack of meandering and pool-riffle sequences disrupting flow regimes
- Drought impacts reducing stream connectivity

Water Quality and Temperature

- Agricultural pollution (fertilisers, pesticides, livestock waste)
- Urban and road runoff (oils, heavy metals, microplastics)
- Sewage discharge and untreated wastewater overflow
- Nutrient enrichment (phosphates, nitrates) leading to eutrophication
- Rising water temperatures reducing oxygen levels
- Emerging contaminants (PFAS, pharmaceuticals, personal care products)
- Algal blooms and excessive plant growth
- Low dissolved oxygen
- Bacterial and pathogen contamination affecting biodiversity and human health
- Pesticide residues impacting aquatic insects and fish
- Turbidity from suspended sediments reducing light penetration
- Salinity changes from road salt runoff affecting freshwater species
- Heavy metals accumulating in sediments and food chains
- Endocrine disruptors affecting fish reproduction
- Decomposing organic matter consuming oxygen (e.g., leaf litter accumulation in low-flow areas)
- Emerging risks from nanoplastics and synthetic chemical

Project Report Statement

As catchment partnerships are re-established and new collaborations emerge, the need for an evidence-based approach to river restoration has never been greater. This evolving landscape has shaped our project objectives, ensuring that local interventions align with broader strategic frameworks. At the same time, nature conservation and habitat management in Cambridgeshire are shifting towards a data-driven model, where baseline assessments and monitoring are essential for informed, long-term decisions.

Despite no official government statement, uncertainty remains over the level of commitment to supporting the Chalk Stream Strategy and its Implementation Plan. This lack of clarity has heightened the urgency of this project for Greater Cambridge, reinforcing the need for local leadership in delivering evidence-based restoration. Without a coordinated national framework, local initiatives must take the lead in generating data that informs and drives effective conservation. This project will establish a robust evidence base to highlight the critical issues facing Greater Cambridge chalk streams, ensuring decision-makers have the necessary information to implement meaningful action. Without this foundation, restoration efforts risk remaining fragmented, failing to address root causes, and leaving these rare habitats vulnerable to pollution, over-abstraction, and habitat loss.

This document serves as a Pre-Project Report, outlining our approach, objectives, and intended outcomes. River restoration in Cambridgeshire is complex, involving multiple stakeholders competing for funding and influence. By providing a clear framework for our methodology and project scope before implementation, this report ensures transparency and a shared vision among all partners.

Currently, restoration efforts remain disjointed, with various groups operating independently and no coordinated pre- or post- project monitoring, including water quality assessments, to evaluate success. This report defines our approach, key challenges, and project rationale. Data collection will occur throughout the project, with findings presented in a Post-Project Report. Detailed timelines and finalised project specifics will be developed collaboratively with partners by April 2025.

Upon completion, the Post-Project Report will evaluate successes, challenges, and lessons learned, supported by comprehensive data. This will serve as a critical reference for future restoration efforts, reinforcing the importance of data-driven decision-making in chalk stream conservation.

To maintain accessibility and reduce length, references, figures, and tables have been omitted from this report but are available upon request.

Introduction

Chalk streams are exceptionally rare, with approximately 200 worldwide, and England is home to about 85% of them. These streams support extraordinary biodiversity, making them among the world's most valuable freshwater ecosystems. However, their rarity also makes them highly vulnerable. All our Greater Cambridge chalk streams are under threat, and without urgent action, we risk losing these vital ecosystems, not only for future generations but also for the many species that depend on them.

The Origins of the Greater Cambridge Chalk Stream Project (GCCSP)

Recognising the urgency of this issue, Cambridge City Council (CCC) declared a Biodiversity Emergency, identifying chalk stream degradation as a priority concern. To address this, CCC successfully applied for funding from the Cambridgeshire and Peterborough Combined Authority (CPCA) and secured additional support from Anglian Water and South Staffordshire Water. This funding enabled the establishment of the Greater Cambridge Chalk Stream Project (GCCSP), a strategic initiative focused on restoring and safeguarding chalk streams across Greater Cambridge.

The GCCSP brings together key stakeholders, including CCC, South Cambridgeshire District Council (SCDC), Cambridgeshire County Council, Greater Cambridge Shared Planning, the Environment Agency, and regional water companies. By pooling resources and expertise, the project aims to enhance green infrastructure, deliver measurable biodiversity net gain, and contribute to more sustainable water resource management, aligning with the duties set out in the Environment Act 2021 and the priorities outlined by the Cam Ely Ouse Catchment

Partnership (CaMEO). The GCCSP steering group brings together key stakeholders, including CCC, South Cambridgeshire District Council (SCDC), Cambridgeshire County Council, Greater Cambridge Shared Planning, the Environment Agency, Anglian Water, South Staffordshire Water, and The Rivers Trust. During its early development, the project has been supported by academic research from other regions, as well as contributions from local and national geologists and ecologists, and in consultation with Natural England.

The 2022 CCC Biodiversity Strategy set out key priorities for nature recovery, including:

- Developing a network of resilient and connected wildlife habitats as outlined in the Cambridge Nature Network Report, produced by the Bedfordshire, Cambridgeshire & Northamptonshire (WTBCN) and Cambridge Past, Present & Future (CPPF).
- Promoting sustainable land and water management practices to support the objectives of the Cambridge City Climate Change Strategy.

Chalk stream conservation was also identified as a key priority in both CCC's Biodiversity Strategy and SCDC's Doubling Nature Strategy.

Building an Evidence Base to Drive Action for Greater Cambridge Chalk Streams

The Greater Cambridge Chalk Stream Project (GCCSP) builds upon the findings of the Greater Cambridge Chalk Streams Audit Report (GCCSAR), expanding its scope to provide a more comprehensive, evidence-based approach to chalk stream restoration.

Commissioned in 2019, the GCCSAR assessed human-induced pressures on local chalk streams. Led by BCNWT, CCC, South Staffordshire Water (Cambridge Water), and the Wild Trout Trust (WTT), the study primarily focused on in-channel physical restoration and proposed a series of enhancement measures. However, the observational surveys conducted as part of this audit did not generate sufficient evidence to justify funding for effective in-channel interventions aimed at improving chalk stream flora and fauna. Citizen science water quality monitoring, conducted by Hobson's Conduit Trust and Cam Valley Forum, highlighted the need for enhanced monitoring efforts to develop comprehensive solutions for understanding and restoring in-channel habitats. Without robust, long-term data, decision-makers lack the necessary insight to prioritise funding for chalk stream restoration. The GCCSP was developed to build upon the GCCSAR by gathering more comprehensive scientific data to support informed decision-making and ensure that restoration efforts are both effective and sustainable.

Following the publication of the GCCSAR, the Catchment-Based Approach (CaBA) Chalk Streams Restoration Strategy was launched in October 2021, followed by an Implementation Plan in 2022. These reports underscored the necessity of coordinated, multifaceted, and holistic solutions, recognising that in-channel interventions alone would not be sufficient to restore and sustain these fragile ecosystems.

However, in early 2024, uncertainty arose over the UK government's commitment to the Chalk Stream Restoration Strategy and its Implementation Plan. While no official statement has been issued, there has been no clear indication that the government intends to support or implement the strategy. This uncertainty is a significant concern for the future of these rare and vulnerable ecosystems. The strategy provided a comprehensive framework addressing water quantity, quality, and habitat restoration, and without a clear commitment to its delivery, efforts to achieve the necessary water quality parameters essential for sustaining chalk stream flora and fauna are at risk.

This is particularly concerning for the chalk streams in Greater Cambridge, which do not benefit from the additional legal protections afforded to Sites of Special Scientific Interest (SSSI) or Special Areas of Conservation (SAC). Without these designations, these streams remain highly vulnerable to pollution, habitat degradation, and excessive water abstraction, making the implementation of a robust restoration strategy critical to their long-term survival. Without active intervention, particularly in addressing pollution and improving water quality, these unique habitats will continue to decline, leading to biodiversity loss and ecological instability.

Restoring flow regimes and improving upstream water retention alone will not be sufficient to sustain healthy chalk stream ecosystems without concurrent measures to reduce nutrient loading, mitigate sedimentation, and improve overall water chemistry. Without a definitive government commitment to delivering the full scope of the strategy, it is uncertain whether chalk streams, especially those in Greater Cambridge, will meet the ecological standards necessary for their long-term resilience.

Neither the GCCSAR nor the GCCSP alone can resolve the complex challenges facing chalk streams in Greater Cambridge. However, the case study research generated through these initiatives provides a robust evidence base for catchment partnerships to develop comprehensive and holistic catchment plans, an approach that aligns with the priorities of local authorities.

In November 2022, the CPCA Board provisionally approved CCC's GCCSP proposal, allocating £400,000 in capital and revenue funding for a three-year programme to address the multiple threats facing chalk streams in the Greater Cambridge region. However, this funding was delayed until 2024.

The Challenges Facing Chalk Streams in Greater Cambridge

Despite restoration efforts, chalk streams remain under intense pressure from human activities, particularly urban development and water demand. In the Greater Cambridge area, water abstraction for public supply constitutes a significant portion of total licensed abstraction. Specifically, in the upper Cam area, public water supply accounts for approximately 56% of total licensed abstraction. While agricultural and industrial groundwater abstractions are relatively minimal, the combined pressures from domestic, agricultural, and industrial water use continue to pose significant challenges for sustainable water resource management.

The expanding population and growing demand for domestic water place increasing strain on groundwater resources, further impacting the health of chalk streams. Between 2022 and 2041, Cambridgeshire and Peterborough's population is forecast to grow by 17%, reaching almost 1.06 million. This growth is expected to result in the completion of almost 85,000 new dwellings, a 22% increase in total housing stock. This rapid expansion will further exacerbate water stress, increasing the need for sustainable water management strategies to protect chalk streams.

In 2021, an Environment Agency consultation on water stress determined that South Staffordshire Water (Cambridge Water) must reduce abstraction by 22 million litres per day. This presents a major challenge in ensuring sufficient water supply while protecting the fragile chalk stream ecosystems.

Extreme weather conditions have already intensified these pressures. Between May 2018 and May 2019, the River Cam catchment received only 70% of its long-term average rainfall. Low rainfall, combined with excessive groundwater abstraction, led to critically low aquifer levels, and sections of the River Granta ran dry. These factors highlight the urgent need for evidence-based interventions to restore and safeguard Greater Cambridge's chalk streams.

The GCCSP's Long-Term Vision

The Greater Cambridge Chalk Stream Project (GCCSP) is committed to developing a scientifically informed, long-term approach to chalk stream restoration. Unlike past efforts that focused primarily on physical modifications, this initiative takes a holistic, data-driven approach, addressing both in-channel enhancements and the broader environmental pressures that influence chalk stream health.

Through intensive water quality and biological monitoring, the GCCSP aims to:

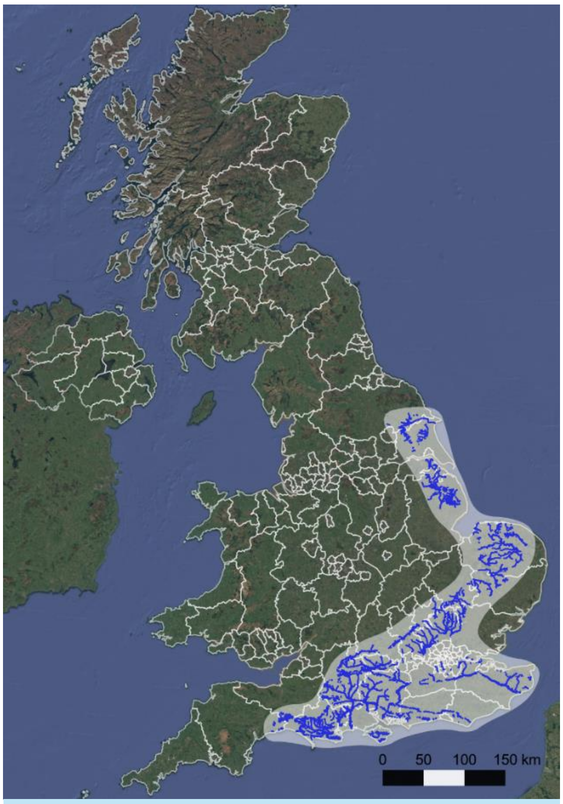
- Identify key factors driving ecological decline
- Develop targeted, sustainable restoration strategies
- Enhance resilience against climate change and human pressures

A key component of the project is the use of case study demonstration sites as hubs for research, education, and community and business engagement. By integrating scientific research with practical conservation efforts, the GCCSP ensures that restoration funding is used effectively, interventions are evidence-based, and Greater Cambridge's chalk streams are protected for the future.

It is hoped that the legacy of this work will continue long after the GCCSP, with ongoing restoration, monitoring, and stewardship at each case study site and beyond.

Where are our chalk streams located?

The distribution of chalk streams in England extends from the South to the East and further up along the Northeastern coast. Accurately determining the number of chalk streams in England remains challenging. Current estimates suggest there are over 200, but this figure is not definitive. This uncertainty arises partly because the full network of chalk streams, particularly in Greater Cambridge, has yet to be fully mapped. Additionally, many chalk streams have been altered, converted into agricultural drainage ditches, lost, or heavily modified by urban development. Furthermore, there is no standardised definition for classifying modified chalk streams, making it difficult for experts to develop a comprehensive assessment.



Map showing chalk stream distribution in England.

Why are chalk streams important?

Chalk streams are renowned for their cool, crystal-clear waters, gravel riffles, fine sediments, and stable flow. Their unique chemical composition and hydrological stability create an ideal habitat for delicate flora and fauna that have exclusively adapted to these conditions. Species that thrive in chalk streams include brown trout, water crowfoot, and water starwort.

Due to their exceptional biodiversity, chalk streams support a wealth of aquatic and terrestrial wildlife, earning them the nickname ‘England’s rainforests’. In addition to their ecological importance, chalk aquifers the underground water sources that feed chalk streams are a crucial supply of drinking water for people in the Southeast of England. These aquifers naturally filter and store water, playing a vital role in the region’s water security.

What is threatening chalk streams?

These fragile and vulnerable ecosystems are highly threatened by human activity. Agricultural pollution, both current and historic, is devastating watercourses, suffocating the life within them. Sewage and urban pollution further degrade water quality, introducing harmful contaminants that disrupt aquatic ecosystems.

Sedimentation, driven by agriculture, urban development, and channel modifications such as straightening and deepening, disrupts the delicate balance of the riverbed. The natural, essential sediments that support aquatic life become overwhelmed by excessive finer sediments, which smother gravels, clog vital spawning grounds, and degrade habitat quality. This process threatens species like the brown trout (Salmo trutta), whose eggs require clean, well-oxygenated gravels to survive. The decline of brown trout populations signals wider biodiversity loss within these already fragile chalk streams.

As towns and cities expand, so does the demand for drinking water, leading to over-abstraction from aquifers and, in some cases, streams drying up. Groundwater recharge decreases due to increasing impermeable surfaces, while polluted runoff, containing a cocktail of persistent contaminants, increases, further deteriorating water quality.

Chalk streams also face habitat degradation from the destruction of stream banks and the loss of vital riparian vegetation. This leads to increased soil erosion, disrupting intricate food webs and reducing the stream's ability to self-regulate. Without the stabilising presence of native plant communities, banks become vulnerable to collapse, allowing excessive fine sediments to wash into the channel. Instead of the well-sorted gravels essential for aquatic life, these unwanted fine particles cloud the water and smother spawning beds, further degrading the ecosystem. Increased turbidity alters the delicate ecological balance, while competition with invasive species further weakens these diverse and unique habitats, reducing their resilience and biodiversity.

Without urgent intervention, the cumulative impacts of pollution, abstraction, habitat loss, and climate change will continue to degrade chalk streams, threatening their future and the invaluable biodiversity they support.

What can we do to restore them?

The limitations of chalk stream restoration lie more in aesthetics than in hydrology. Many people associate healthy chalk streams with clear, fast-flowing water over clean gravels, teeming with aquatic plants and wildlife. However, true ecological restoration is not just about creating a picturesque scene it requires restoring natural processes that support biodiversity and long-term ecosystem health. Often, reprofiling a chalk stream will involve placing gravel beds and planting chalk stream plants, but these interventions alone may not be enough if they do not also address underlying issues such as sedimentation, nutrient pollution, and hydrological disruption. Without understanding the full range of pressures affecting a chalk stream, such as water abstraction, diffuse pollution, siltation, and climate impacts, how can effective in-channel restoration decisions be made? If these broader issues are not tackled, interventions may be superficial, leading to short-term aesthetic improvements rather than long-term ecological recovery.

The Water Framework Directive (WFD) is a European directive that establishes a framework for the protection of water bodies. Though its guidelines for nutrient concentrations in rivers are important, it does not consider the unique needs of chalk streams. The WFD recommends no more than 5-6 mg/l of Nitrate-N and 0.1 mg/l of Phosphate-P in rivers to achieve a ‘Good Ecological Status’. This surpasses the nutrient tolerance of chalk stream flora and fauna. Multiple studies have found that chalk stream species require only 2 mg/l of Nitrate-N and no more than 0.05 mg/l of Phosphate-P. These nutrient concentrations are challenging to achieve in environments near human activity. By following the umbrella recommendations of entities like the WFD, we do not consider the unique needs of this ecosystem.

Paired with existing gaps in data, there is no robust foundation on which to carry out any worthwhile, ecologically meaningful restoration initiative to these streams. The Greater Cambridge Chalk Stream Project aims to address both the gap in locally relevant data and the need for sustainable, long-term health of the Cambridge chalk stream network. With these streams among the most degraded in the country, the GCCSP is undertaking case study site research, developing long-term monitoring to assess their condition and implement the most holistic interventions possible.

Interventions used at case study sites will combine tried-and-tested traditional restoration methods with the trialling of new and innovative technologies. Through research at case study sites, the project is building a locally relevant evidence base to support local authorities in making informed decisions on future funding for chalk stream restoration. The project advocates that local authorities should only fund habitat restoration that is guided by an evidence-based approach. By further monitoring the success of case study interventions, these can be refined and confidently scaled across Cambridgeshire, ensuring a more effective, evidence-led approach to restoring these fragile ecosystems.

Understanding Chalk Streams

How are they formed?

Chalk streams are rare because they require very specific geological conditions to form. During the Cretaceous Period (between 66 and 145 million years ago), most of England was covered by a warm, tropical sea. Large populations of plankton lived in these surface waters. When they died, their calcium carbonate skeletons accumulated on the seabed as a chalky sludge. Over time, as more layers of sludge settled on top, this eventually solidified into chalk.

Later, between 65 and 2.5 million years ago, tectonic activity uplifted and folded this chalk bedrock beneath southeastern England and northern France. Due to natural weathering and erosion, the chalk eventually became exposed at the surface, forming ridges called escarpments. This chalk was further sculpted during the Ice Age by the Anglian Ice Sheet, between 478 and 424 thousand years ago. Typically, ice sheets erode the underlying rock, leaving behind thick ‘glacial till’ deposits consisting of clay, sand, and rock debris. However, in southern England, the ice sheets seem to have left some areas of bare chalk, with glacial till accumulating only on the lower slopes.

The fissured and porous nature of the chalk bedrock allowed it to form an aquifer, an underground layer of rock that is permeable enough to hold groundwater. Rainwater seeps down through the chalk, forming a water table, sometimes referred to as the chalk groundwater. When the groundwater level is high enough to reach the surface at the bottom of a valley, a chalk stream begins to flow. If the groundwater reaches the land surface at the foot of a chalk escarpment, it forms a chalk spring, which in turn feeds a chalk stream.

The chalk aquifer is replenished each year by winter rainfall, reaching its highest level in spring and its lowest in autumn. The soil around chalk streams is thin and highly permeable, allowing rainwater to soak directly into the chalk bedrock. The chalk aquifer sits between the ground surface and the underlying impermeable Gault Clay, which prevents groundwater from draining away. While chalk has relatively low permeability due to its fine-grained structure, it is highly effective at storing water, meaning that groundwater moves through it slowly. However, the chalk bedrock also contains a network of fissures and fractures that create areas of high permeability. As rainwater is slightly acidic, it slowly weathers the chalk, enlarging these fractures over time.

What's below our feet? Exposed chalk escarpment (Left) and a close-up of chalk fissures (Right).

What is the definition of a chalk stream?

The definition of what constitutes a chalk stream is a source of debate. As such, there is no precise universal definition. The GCCSP defines a river as a 'true' chalk stream if it is fed by chalk groundwater and flows over exposed chalk bedrock for part of its course, or if it is fed by chalk springs. A chalk stream should have clear, cool water that is nutrient-poor and oxygen-rich, with a stable, consistent base flow, fed by the chalk groundwater.

Chalk streams should typically flow over clean, well-sorted gravel beds (riffles) and support rich biodiversity, with lush vegetation providing habitat for insects, birds, and fish. Healthy chalk streams also rely on good sediments in transition zones, where fine gravels, sands, and organic matter stabilise plants and support aquatic life. Chalk streams usually have a meandering nature, with a fast-flowing channel interspersed with slower-flowing sections where crowfoot and starwort grow. The shallow, fast-flowing riffles of the stream aerate the water and provide spawning grounds for species like brown trout, while the slower water and deeper pools provide habitats for a wide variety of aquatic life. Brook lamprey, another key chalk stream species, rely on clean sands, gravels, and fine sediment for different stages of their life cycle. Their larvae, known as ammocoetes, burrow into fine sediments where they filter-feed on organic matter, while adults spawn in clean gravel beds.

A key feature of chalk streams is gravel riffles, which have mostly formed from flint eroded from the chalk bedrock. During the Cretaceous Period, some types of plankton had silica skeletons instead of calcium carbonate. This silica, under pressure, turned into flint. Over time, the softer chalk eroded, leaving behind durable flint, which weathered down to form gravel. Within the clear water channel, there can also be areas of fine sediments that provide habitat for macrophytes, which are aquatic plants visible to the naked eye, such as water crowfoot and starwort. Many important chalk stream species rely on these fine sediment areas, as they support a diverse range of aquatic organisms. Chalk stream plants such as crowfoot hold a significant proportion of the ecosystem's biomass, playing a crucial role in maintaining habitat complexity and supporting invertebrates and fish.

There are many different types of chalk stream, each hosting distinct chalk stream flora and fauna communities and requiring differing water quality parameters. Factors such as geology, flow regime, sediment composition, and nutrient levels shape these unique ecosystems. While some chalk streams may have low-nutrient, fast-flowing headwaters dominated by aquatic plants like crowfoot, others may be slower-flowing, with higher organic sediment content supporting different invertebrate and fish communities. The variation in habitat types means that conservation and restoration efforts must be tailored to the specific characteristics and ecological requirements of each chalk stream.

The classification of chalk streams is often based on their geological history, but this raises the question of whether they should be defined solely by their origins or also by their ecological characteristics. Are chalk streams only those formed through historical geological processes, or can newly created channels and ditch networks that support chalk stream communities be considered part of the chalk stream network? If a newly constructed channel is fed by chalk groundwater, has the appropriate water chemistry, and develops the characteristic flow conditions, sediments, and biodiversity associated with chalk streams, it may function ecologically as a chalk stream. This has important implications for conservation and restoration efforts, particularly when considering how best to expand, reconnect, and enhance chalk stream habitats in degraded landscapes.

Without a universally accepted definition of the different types of chalk streams, including precise water quality parameters, restoration decision-making is difficult. Restoration efforts require a clear ecological baseline to determine what conditions should be restored and how interventions should be prioritised. If definitions remain ambiguous, funding and conservation efforts may be misdirected, leading to projects that fail to achieve meaningful ecological benefits. Standardised definitions, supported by robust scientific data, are essential for ensuring that restoration strategies are tailored to the specific needs of chalk streams and their associated biodiversity.

What properties make chalk streams stable ecosystems?

Chalk streams are unique ecosystems, supported by a combination of physical, chemical, and biological properties. These properties contribute to their stability and support the rich biodiversity that thrives within them.

Stable Base Flow

Chalk streams are primarily fed by groundwater, which ensures a stable and reliable flow throughout the year. This base flow reduces the impacts of surface runoff and seasonal fluctuations, maintaining a consistent water level and flow velocity that supports diverse aquatic life.

Consistent and Cool Water Temperature

The temperature of chalk streams typically ranges from 10°C to 11°C, as the water comes from underground sources, where it is insulated from the fluctuating air temperatures above. This stable temperature supports cold-water species and maintains a conducive environment for organisms like brook lamprey, brown trout, and aquatic invertebrates.

Crystal-Clear Water

The water in chalk streams is naturally filtered as it percolates through chalk bedrock, resulting in exceptionally clear water. This clarity allows sunlight to penetrate deeper into the water, supporting the growth of aquatic plants such as water crowfoot and starwort, which play a key role in stabilising sediment and providing habitat for invertebrates and fish.

Low Nutrient Concentrations

Chalk streams are characterised by low nutrient concentrations, which is a result of the natural filtration through chalk. Healthy chalk streams typically have the following nutrient thresholds:

- Nitrate-N: ≤ 2 mg/L
- Phosphate-P: ≤ 0.05 mg/L
- Ammonia (NH_3-N): ≤ 0.05 mg/L

Exceeding these thresholds can lead to nutrient enrichment, causing excessive algal growth, which depletes oxygen levels, degrades habitats, and threatens biodiversity. This is particularly harmful to species sensitive to changes in water quality, such as brook lamprey and brown trout.

High Dissolved Oxygen Concentrations

Chalk streams maintain high levels of dissolved oxygen, particularly in riffle sections where water is aerated as it flows over gravel. The oxygen levels in healthy chalk streams are typically above 85% saturation, which is crucial for the survival of oxygen-demanding species such as brook lamprey, brown trout, and various invertebrates.

Low Turbidity

Turbidity in chalk streams is typically very low, usually ≤ 5 NTU (Nephelometric Turbidity Units). This ensures clear water, allowing sunlight to reach aquatic plants and supporting photosynthesis. High turbidity caused by pollution, erosion, or sediment disturbances can smother aquatic vegetation, disrupt photosynthesis, and degrade habitat quality for many species.

Minimal Sedimentation

Healthy chalk streams rely on clean gravel beds that support fish spawning and provide habitat for aquatic invertebrates. Excessive fine sediment accumulation, often resulting from agricultural runoff, urban development, or poor land management, can clog the spaces between gravels. This reduces the quality of spawning habitats for species like brook lamprey and brown trout larvae. Ideally, sediment deposition should remain low, with gravels kept clear of silt to ensure healthy ecosystems.

Flow Rate

A stable and appropriate flow rate is vital for maintaining habitat diversity and ecological function. In chalk streams, the flow rate typically ranges from 0.05 m/s (minimum) to 0.5 m/s (maximum) in riffle sections. This flow rate provides sufficient oxygenation, keeps gravels clean, and supports the movement of species. Slower-moving sections, such as deeper pools, offer refuge for aquatic life during dry periods. Reductions in flow, caused by over-abstraction or drought, can lead to reduced water quality, higher temperatures, and lower dissolved oxygen levels, which can negatively impact the ecosystem.

Threats to Chalk Streams

Chalk streams are highly sensitive ecosystems that are under increasing threat from various human activities. These threats, which arise from both urban and rural settings, disrupt the delicate balance of these ecosystems, affecting water quality, biodiversity, and overall ecosystem health. The following sections provide an in-depth look at the key threats facing chalk streams today.

Agricultural Pollution

Agriculture plays a significant role in the degradation of chalk streams, especially through practices that introduce excess nutrients, sediments, and chemicals into watercourses.

Soil Erosion and Sediment Runoff

Intensive agricultural practices, such as excessive ploughing, monoculture farming, and overgrazing, lead to soil erosion. This erosion causes sediment runoff, which diminishes water clarity and smothers vital habitats like gravel riffles, crucial for species such as brown trout to spawn. Sediment also clogs the spaces between gravels, reducing oxygen levels and

Poorly managed agricultural field, displaying soil erosion.

disrupting spawning habitats for fish and invertebrates.

Nutrient Enrichment

Fertiliser runoff from agricultural land carries high concentrations of nitrates and phosphates into chalk streams. These elevated nutrient levels, commonly found in agricultural runoff, can trigger eutrophication, a process that promotes excessive algae growth. Algal blooms reduce water clarity by blocking sunlight from reaching aquatic plants, leading to their eventual death. When algae decompose, bacteria consume the oxygen in the water, creating hypoxic or anoxic conditions that suffocate aquatic life.

Elevated nutrients also encourage the growth of nutrient-tolerant plants that outcompete native species like crowfoot and starwort. These plants are critical to the health of chalk streams as they support a diverse range of organisms. Their loss would have severe consequences for the entire ecosystem.

Historic Nutrient Pollution

The contamination of aquifers by water-soluble nitrates is another legacy of past agricultural practices. These nitrates have leached into the soil over decades and accumulated in groundwater. When this contaminated groundwater feeds into chalk streams, it contributes to ongoing nutrient pollution. Phosphate concentrations in aquifers also contribute to this nutrient load, further disrupting the water chemistry and ecosystem health. This cumulative contamination leads to long-term issues, including the promotion of algal blooms and oxygen depletion, which harms aquatic organisms.

Over-Abstraction

Over-abstraction occurs when water is removed from chalk streams or groundwater faster than it can naturally recharge. This has serious consequences for stream health, as it reduces base flows and diminishes the availability of water for both wildlife and plants.

Diminished Base Flow

Over-abstraction leads to reduced stream flows, especially during dry periods. This lowers the water volume in the stream, directly impacting the habitats of aquatic species. Essential habitats such as gravel riffles, which are used by brown trout and brook lamprey for spawning, are particularly vulnerable to low flows. Reduced flow also leads to a decrease in water quality, as pollutants become more concentrated.

Increased Water Temperature

When water levels drop, the temperature of the stream increases. Water temperatures above **11°C** reduce dissolved oxygen levels, creating conditions that favour the growth of bacteria and fungi over aquatic species like brook lamprey, brown trout, and invertebrates. Higher water temperatures also increase stress on aquatic organisms and alter species distributions.

Pollution Concentration

As water volume decreases, the concentration of pollutants in the stream increases. This makes it harder for aquatic life to thrive, as both nutrients and toxic substances such as heavy metals become more concentrated. This situation leads to further degradation of the ecosystem, exacerbating the challenges posed by agricultural and wastewater pollution.

Habitat Degradation

Riparian zones, the areas of land adjacent to the stream, play a critical role in protecting water quality and providing habitats for wildlife. However, human activities such as agricultural expansion, urbanisation, and flood management efforts often lead to the degradation of these important habitats.

Channel Modifications

Modifying stream channels for flood control or agricultural purposes—such as straightening, deepening, or reinforcing the banks—disrupts the natural flow of water and increases soil erosion. This can lead to increased sedimentation, which affects species that rely on clean gravel riffles, such as invertebrates and fish. When riparian vegetation is removed, the ability of the land to filter pollutants and stabilise the banks is diminished. This increases sediment runoff into the water, further degrading water quality and the ecological health of chalk streams.

Invasive Species

Non-native plant species such as Himalayan balsam are rapidly spreading along chalk stream riparian zones, outcompeting native vegetation. The dense growth of this plant reduces biodiversity and destabilises the bank structure. Invasive aquatic species like the American signal crayfish also threaten chalk streams. These crayfish prey on native species like the white-clawed crayfish and cause physical damage to stream banks through their burrowing. This leads to increased sedimentation and turbidity in the water, further degrading stream health.

Himalayan Balsam growing beside a chalk stream

American signal crayfish burrowing increasing turbidity

Sewage and Wastewater Management

Sewage and wastewater mismanagement pose significant risks to chalk streams. Urban development and population growth place pressure on sewer systems, and improper connections or overflows can lead to untreated sewage being discharged directly into watercourses.

Sewage Misconnections

Sewage misconnections, where wastewater is wrongly directed into storm drains, can lead to untreated sewage entering chalk streams. This results in the introduction of harmful pathogens, excess nutrients, and chemicals, further degrading water quality. Sewage systems that cannot handle peak flows may discharge raw sewage directly into streams during heavy rainfall, exacerbating the pollution load and disrupting stream ecosystems.

Urban Runoff

In urban areas, water runs off impermeable surfaces such as roads, buildings, and pavements, carrying pollutants such as oils, heavy metals, and debris into chalk streams. This polluted runoff increases the concentration of contaminants in watercourses, leading to water quality degradation, higher turbidity, and harm to aquatic life.

Chalk streams face numerous threats, many of which result from human activity across rural and urban landscapes. Agricultural pollution, over-abstraction, habitat degradation, invasive species, and wastewater mismanagement all contribute to the ongoing decline of these unique ecosystems. Effective conservation and restoration efforts must address these diverse threats through sustainable land and water management practices, improved infrastructure, and ongoing monitoring. By tackling these challenges, we can help protect the future of chalk streams and ensure that they continue to support a wide variety of wildlife for generations to come.

Our approach

Why are we taking a Case Study Site approach?

Chalk stream flora and fauna are so fragile that it would take no more than a temporary disruption in the water's chemical balance to wipe out the entire bottom level of the food web. The knock-on effect of losing this trophic level is devastating to the health of chalk streams and their biodiversity. It is not enough to simply make a chalk stream look like a chalk stream by adding gravels and reprofiling. If the conditions are intolerable for the species that have adapted to live there, they will simply not reappear.

To assess the long-term success of chalk stream restoration efforts, there needs to be both systematic baseline and post-project monitoring. This means that data needs to be gathered before, during and after restoration efforts. By gathering robust data throughout the process, it ensures that the project's interventions are tailored, measurable and sustainable. It is challenging to determine the full ecological impact of past interventions or devise future restoration strategies without a robust and scientific evidence base. The Greater Cambridge Chalk Streams Project (GCCSP) seeks to address the gaps in data and long-term monitoring by adopting a case study site approach. This method focuses on gathering robust scientific data before, during and after restoration to ensure that interventions are tailored, measurable and sustainable. By integrating pre- and post-restoration monitoring into every project, the GCCSP aims to create a comprehensive database that not only informs local restoration efforts but also serves as a model for broader catchment management.

What does a Case Study Site approach allow us to achieve?

The methods identified below are evidence-based and aim to transform restoration into a systematic, measurable, results-oriented process, crucial for informed decision making.

- Identifying pollution sources, to understand the extent that nutrient pollution impacts water quality.
- Tailoring interventions holistically to every site, as not every site has the same needs or faces the same threats.
- Assessing long-term impacts by using systematic monitoring, to evaluate changes in water quality, biodiversity, and sedimentation over time.

A case study approach offers long-term value for money as it ensures that restoration interventions are evidence based. Meaning that the ‘root cause’ is being addressed, as opposed to the ‘symptoms’. Addressing sites this way allows for a greater long-term improvement of site health. By monitoring small scale tests on case study sites, it allows for informed decision making to be implemented for similar but larger sites. This reduces the risk of costly and under researched large-scale restoration from being unsuccessful.

Understanding New Technologies in chalk stream restoration

The GCCSP will be trialling new and innovative technologies to address the unique challenges faced by urban chalk streams. In urban areas specifically, these challenges include low water quality and poor habitat conditions, constrained by space and infrastructure. These trials will address nutrient pollution, habitat fragmentation and low dissolved oxygen concentrations. Monitoring these new methods and their outcomes will provide scalable solutions for similar challenges in other urban environments.

Using GCCSP Case Study Research to Develop a Step-by-Step Guide for Local Authorities in Chalk Stream Restoration

The Greater Cambridge Chalk Streams Project (GCCSP) is the first chalk stream project in Greater Cambridge to prioritise the need for robust data in selecting restoration sites. Chalk stream restoration efforts without a solid evidence base should not be supported or funded, as this increases the risk of ineffective interventions that fail to deliver long-term ecological benefits. Local authorities should only support chalk stream restoration outlined within robust, evidence-based catchment plans and will only support evidence-based catchment planning on their watercourses, especially awarded watercourses. The lack of an evidence-based approach also poses a significant risk in the use of public funds, as it can result in wasted resources and unsustainable restoration outcomes.

To ensure that restoration projects are impactful and sustainable, GCCSP will aid in the development of a tool that enables local authorities to make data-driven, informed decisions about suitable chalk stream restoration sites. This approach ensures that restoration interventions are targeted, sustainable, and grounded in comprehensive data and research. As a result of the GCCSP case study work, the following will happen:

Comprehensive Data Collection

Moving forward, local authorities will gather baseline data on water quality, habitat conditions, and species presence before initiating restoration projects. This data will ensure that all restoration efforts are rooted in a solid understanding of the site’s ecological status, enabling authorities to make informed decisions on the most effective interventions and areas of focus for restoration.

Multidisciplinary Research

The future of chalk stream restoration will integrate geographical, geomorphological, and hydrological research, providing a detailed assessment of both natural and anthropogenic factors influencing the site.

- Geographical research will identify areas under environmental pressure, allowing authorities to target the most critical sites in need of restoration.
- Geomorphological studies will assess the stream's physical characteristics, such as sediment composition and erosion, determining the most appropriate restoration techniques.
- Hydrological analysis will examine flow patterns, water quality, and catchment characteristics, ensuring that restoration efforts will have a lasting positive effect on water conditions and stream ecology.

Urban and Rural Considerations

The approach will continue to consider both urban and rural sites, addressing the unique challenges that each environment presents. For example:

- Urban chalk streams may face challenges such as poor water quality and habitat fragmentation, requiring tailored restoration methods.
- Rural chalk streams may need restoration strategies focused on land use, hydrological conditions, and stream physical features. This dual approach will ensure that local authorities can address the wide range of challenges presented by both types of environments.

Innovative Trialling of New Technologies

Through the GCCSP case studies, local authorities will begin trialling innovative technologies, such as floating wetlands and aeration systems, to address common challenges like nutrient

Left: A floating wetland mat

Right: A solar-powered aeration and diffuser pollution and low dissolved oxygen. These technologies will be scalable and applicable to a wide range of chalk stream environments, offering proven, evidence-based solutions to improve water quality and habitat conditions.

Adaptive Monitoring

The future of chalk stream restoration will rely on before, during, and after monitoring to ensure that all restoration efforts are flexible and responsive. This system will allow for continuous, real-time data collection, enabling mid-project adjustments and long-term post-restoration monitoring. This adaptive approach ensures that restoration efforts can be constantly refined and optimised for maximum effectiveness and sustainability.

Long-Term Decision Making

As a result of the data gathered, local authorities will adopt a data-driven approach to decision-making. This long-term strategy will allow for continuous refinement of restoration techniques, ensuring that authorities can optimise interventions for better outcomes and more efficient use of public funds. Authorities will be able to use the collected data to guide future restoration projects, ensuring their sustainability and cost-effectiveness.

Community Engagement

Local authorities will continue to prioritise collaboration and stakeholder engagement, ensuring that local communities, stakeholders, and environmental organisations are involved throughout the restoration process. This collaborative approach will foster public support, align restoration efforts with local goals, and maximise the chance of successful long-term outcomes. By engaging communities in the process, authorities will ensure that restoration efforts reflect the values and priorities of the people who live and work in these areas.

As a result of the GCCSP case study work, the future of chalk stream restoration will be evidence-based, data-driven, and responsive. Local authorities will be equipped with the tools, research, and data needed to make informed decisions on restoration projects, ensuring they are both effective and sustainable. Local authorities will only support restoration outlined in robust, evidence-based catchment plans, ensuring that public funds are used efficiently and that chalk streams are restored in a sustainable, scientifically backed manner.

Case Studies of Citizen Science and Monitoring influencing River Restoration

The CaSTCo Project, Norfolk Rivers Trust (UK)

The CaSTCo (Catchment Systems Thinking Cooperative) project, led by the Norfolk Rivers Trust, focuses on improving the ecological health of the River Wensum and its tributaries in Norfolk. Building on a successful citizen science pilot in 2022, the project engages local communities in monitoring water quality across the catchment area. Volunteers receive standardised training to ensure accurate data, and special 'waterblitz' days are organised to pinpoint nutrient sources. The collected data informs restoration strategies and is utilised by the Wensum Catchment Partnership to develop targeted water quality solutions, empowering locals to actively contribute to river restoration and conservation.

River Guardians Program, Mersey Rivers Trust (UK)

The River Guardians Program, managed by the Mersey Rivers Trust, trains volunteers to regularly monitor water quality across the Mersey Basin. With over 50 trained volunteers, this citizen science initiative provides valuable data to track water quality changes, supporting conservation efforts and contributing to the Natural Course project. The data gathered helps inform decision-making on water quality management and river health improvement strategies.

Friends of the River Wye Citizen Science Project (UK)

The Friends of the River Wye Citizen Science Project empowers local volunteers to monitor nutrient levels and water quality in the River Wye. The data collected by community members contributes to long-term conservation and river management efforts. This citizen-driven initiative has proven essential in shaping restoration strategies and ensuring that the river's health is continuously evaluated, with the results directly influencing management decisions for the river's preservation.

River Chess Smarter Water Catchment Project (UK)

Launched in 2021, the River Chess Smarter Water Catchment project focuses on enhancing the ecological health of the River Chess in the Chilterns, England. The initiative employs citizen science to monitor water quality and biodiversity. Volunteers' contributions provide valuable insights, which are used to guide habitat restoration efforts and inform water quality improvement decisions. The project fosters community engagement, allowing local residents to actively participate in ongoing river management and restoration strategies.

Sites Selected for GCCSP

The selected case study sites represent the diverse ecological challenges faced by chalk streams, covering both rural and urban environments. This selection ensures a comprehensive understanding of the full range of threats and pressures impacting chalk streams. The chosen sites include four watercourses with six restoration areas, two springhead restoration sites, and one regenerative farming demonstration site. Additionally, there are already established community groups, as well as supportive local parish councils and district councils, who play a crucial role in the success of these projects. Each site will undergo thorough baseline and post-project monitoring, as outlined in the Biological Monitoring section, to assess the effectiveness of the restoration interventions.

River Restoration Sites River Granta

Linton, Abington, and Neville’s Meadow

The River Granta case study sites are in rural South Cambridgeshire at Linton and Abington. Impacts like sedimentation and nutrient runoff are prevalent here from the nearby agricultural activities and sewage treatment works and sewage outfalls, from private misconnections. Monitoring a site in such a location allows us to see the long-term effects of historic farming practices and investigate other sources effecting chalk stream flora and fauna and the chalk stream ecosystems.

The challenges at these sites are listed below:

- Challenge: Channel Straightening

- Impact: Stream channels that have been straightened or modified have reduced habitat complexity and flow diversity.
- Challenge: Bank Erosion
- Impact: Causes increased sedimentation and turbidity leading to degraded in stream habitats.
- Challenge: Habitat Degradation
- Impact: Reduces biodiversity and availability of spawning grounds for fish.

To address these challenges, the river will be subject to initial baseline surveys to determine which targeted interventions are necessary to improve the health of the River Granta. Based on these surveys, interventions will include replanting riparian zones, channel re-meandering, and in-stream habitat enhancement.

River Granta, Abington (Left) River Granta, Linton (Right)

Coldham's Brook, Urban Site

Coldham's Brook faces significant nutrient pollution from urban runoff. The site is ideal for trialling a mix of both traditional restoration techniques and new technology. These techniques aim to improve water quality and support biodiversity.

- Traditional Restoration Techniques: Bank Re-profiling and Re planting Riparian Zones
- Benefit: Encourages vegetation growth. Slows down nutrient runoff. Prevents soil erosion. Acts as a buffer for run-off. Improves habitat quality.
- New Technology: Deploying Floating Wetlands and Solar-Powered Aeration Systems
- Benefit: Improves dissolved oxygen levels. Removes excess nutrients. Creates 'stepping stone' habitats to connect a fragmented urban environment.

Coldham's Brook, degraded urban chalk stream

Cherry Hinton Brook, Urban Site

This site suffers heavily from sedimentation and low flow conditions but is further affected by groundwater abstraction. Restoration efforts at this site will focus on a combination of sediment management techniques and flow simulation methods:

- Sediment management techniques, such as sediment traps and channel narrowing, to prevent the clogging of gravel beds vital for aquatic species.
- Flow simulation methods, including traditional flow enhancements and targeted aeration to ensure well-oxygenated waters for chalk stream flora and fauna.

Cherry Hinton Brook, Starwort beds

Hobson’s Brook, Urban Site

This site was chosen for its distinctive habitat fragmentation caused by urban infrastructure and culverts.

- Challenge: Habitat Fragmentation
- Technique: Building a fish pass at Vicar’s Brook by reinstating an old paleo channel allowing fish passage up stream to areas with good chalk stream water quality parameters for spawning
- Challenge: Poor Water and Habitat Quality in urbanised areas
- Technique: In-Channel enhancements to improve flow conditions and habitat quality

Hobson’s Brook, a geodiverse urban chalk stream

Springhead Restoration Sites

Giant's Grave Springhead

Giants' Grave Springhead is a critical source of flow for the surrounding chalk stream network. Here, the project will focus on improving water quality for better base flows. It will also improve habitat conditions to better support downstream biodiversity.

Giant's Grave, an urban springhead (Aerial view, Left), clear waters at the springhead (Right)

Nine Wells Springhead

Nine Wells Springhead is in an urban area. This case study site demonstrates the necessity of addressing low-flow conditions and urban pollution at spring sources. Habitat enhancements alongside methods of reducing sedimentation and nutrient loads will be implemented to restore this springhead.

Nine Wells Springhead, a rural springhead (Aerial view, Left), clear waters at the springhead (Right)

Regenerative Farming Demonstration

New Shardelowes Farm

This site will showcase best practices in regenerative agriculture, including:

- Rainwater Harvesting Systems: To reduce dependence on groundwater and capture stormwater for irrigation.
- Aquifer Recharge Practices: To enhance chalk aquifers, sustaining base flows in nearby streams.
- Sustainable Farming Techniques: Reducing tillage and crop rotation and using cover crops to minimise sedimentation and nutrient runoff.

New Shardelowes Farm will serve as a living laboratory that demonstrates how regenerative farming can simultaneously improve agricultural productivity whilst reducing pressures on chalk streams.

New Shardelowes Farm, a demonstration site for rainwater harvesting and regenerative farming practices

Why were these sites selected?

The case study sites were chosen for their ecological importance and potential for community engagement. Their proximity to communities makes space for active community involvement greatly benefits ecological restoration projects as it encourages the public to engage with them and learn. The project's sites were also chosen because of the support that councils and community groups have already given. Linton and Abington Parish Councils and Linton Frog and Abington Naturewatch community Groups have supported conservation efforts along the River Granta, and Cambridge City Council has been instrumental in supporting the restoration of urban sites like Hobson's Conduit. Working in partnership with local authorities, Hobson's Conduit Trust and community groups such as Friends of Cherry Hinton Brook and Abbey People improves community engagement and builds a stronger foundation for restoration projects. The GCCSP demonstrates that a case study site approach rooted in evidence, is critical for delivering effective restoration. By combining research at these sites, restoration efforts address the unique challenges of chalk streams in both rural and urban contexts. Through its focus on localised research, innovative technologies, and community involvement, the GCCSP offers a scalable and sustainable model for chalk stream conservation. Investing in this approach is strategic and essential for protecting these globally significant ecosystems for future generations.

Pioneering Citizen Science in Greater Cambridge

Dr Steve Boreham and Dr Mike Foley have played a fundamental role in advancing evidence-based approaches to chalk stream restoration through their tireless commitment to citizen science. Their invaluable research and data collection efforts have provided critical insights into water quality and ecosystem health, forming a cornerstone for the approach undertaken in this project. Their work has demonstrated that robust scientific data is essential for fully understanding and effectively restoring chalk streams.

The contributions of these two distinguished citizen scientists have not only inspired this project but have also underscored the necessity of using water quality parameters as a benchmark for holistic restoration solutions. By building upon their pioneering research, this project seeks to extend their legacy and further refine data-driven methodologies to enhance the health of these fragile ecosystems.

Dr Steve Boreham – The Visionary Behind Citizen Science in Chalk Streams

Dr Steve Boreham is a geologist and ecologist with a distinguished academic background, having worked extensively in the landscapes of southern England, East Anglia, and the Cambridge District. He has spent decades specialising in peat preservation, geo-conservation, biodiversity enhancement, and geochemical research. His expertise in pollen, diatoms, and plant macrofossils has been applied in both consultancy and academic settings, contributing significantly to environmental science and conservation.

With a unique ability to engage and inspire communities, students, and conservationists, Steve has spearheaded numerous initiatives to investigate the water quality challenges facing chalk streams and springheads. As a trustee of the Hobson's Conduit Trust for over 35 years, he has been at the forefront of water quality monitoring, bacterial and eDNA surveys, and large-scale BioBlitz events along Hobson's Brook.

Steve's approach, whether knee-deep in a springhead or meticulously analysing water samples, exemplifies a dedication to preserving the region's chalk streams. His relentless advocacy has not only expanded scientific understanding while inspiring a new generation of citizen scientists committed to freshwater conservation.

Dr Mike Foley – The Scientific Detective of Chalk Stream Health

Dr Mike Foley is a retired Plant Pathologist with an extensive career in research, advisory roles, and diagnostic clinics within the Ministry of Agriculture. His expertise in plant disease diagnostics and environmental impact assessment has equipped him with the scientific rigour necessary to address critical water quality challenges affecting chalk streams. His background in forensic plant pathology has given him a unique perspective on identifying and mitigating environmental threats.

Since joining the Cam Valley Forum committee in 2016, Mike has led efforts to combat water quality degradation in the Cam catchment. One of his early successes involved tackling the invasive Floating Pennywort, coordinating efforts with the Environment Agency to remove it from key waterways. He has also been instrumental in mapping and controlling Himalayan Balsam within the catchment, ensuring the protection of native flora and habitats.

Mike's investigations into turbidity have been particularly groundbreaking. His meticulous research into sedimentation has highlighted the dangers of elevated turbidity, which can suffocate chalk stream ecosystems. His collaboration with Cambridge University's Department of Zoology has provided crucial insights into the sources of turbidity, including the role of invasive American Signal Crayfish in sediment disturbance.

Beyond sediment studies, Mike has led extensive water quality monitoring efforts, most notably in securing Bathing Water status for Sheep's Green in 2024 through rigorous faecal bacteria assessments. His research into phosphate and nitrate pollution has provided compelling evidence of the impacts of sewage treatment works on nutrient loads, reinforcing the need for regulatory phosphorus limits in upstream catchments.

Continuing the Legacy of Evidence-Based Restoration

The extraordinary efforts of Dr Steve Boreham and Dr Mike Foley have significantly shaped the trajectory of chalk stream restoration in Greater Cambridge. Their unwavering commitment to scientific inquiry and conservation advocacy has not only yielded essential data but has also fostered a culture of evidence-based decision-making in river restoration.

This project is deeply inspired by their work and seeks to build upon their findings to develop innovative, data-driven solutions for chalk stream restoration. Building on their pioneering research, this initiative aims to ensure that water quality remains central to restoration strategies, safeguarding these unique ecosystems for future generations.

Thank you, Steve and Mike, for your dedication, innovation, and inspiration.

Steve Boreham

Mike Foley

Water Quality and Biological Monitoring: A Science-Led and Community-Driven Approach

The Greater Cambridge Chalk Stream Project (GCCSP) is dedicated to implementing a long-term, robust water quality and biological monitoring programme. This initiative is designed to provide high-resolution, evidence-based data to inform restoration efforts, regulatory compliance, and conservation policy development for chalk streams. By ensuring the continuous monitoring of critical environmental trends, this programme enables adaptive management strategies that respond to the growing pressures on these fragile ecosystems.

Chalk streams, among the rarest and most fragile freshwater ecosystems globally, support biodiversity-rich aquatic communities. However, they face escalating threats such as nutrient pollution, habitat degradation, excessive sedimentation, and climate change. Through systematic monitoring of key water quality parameters and biological indicators, the GCCSP aims to offer a comprehensive understanding of the ongoing health of these streams, enabling the development of targeted and effective restoration strategies. Below is a detailed explanation of why each monitoring activity is essential and how it contributes to the overall objectives of the project.

Rationale and Methodology: Comprehensive Monitoring Framework

The GCCSP's monitoring framework employs a structured approach that integrates both water quality sampling and biological assessments over a full 12-month period. This methodology ensures that seasonal variations, fluctuations due to land-use practices, and the impact of restoration interventions are captured accurately. By gathering continuous, reliable data, the project aims to identify key stressors, inform adaptive management decisions, and ultimately guide effective restoration strategies that enhance the ecological health of chalk streams.

Key Water Quality Parameters and Their Ecological Significance

The monitoring programme is structured around seven core water quality indicators, each chosen for its ability to reflect ecosystem health and to align with the standards set by the Water Framework Directive (WFD). Each parameter plays a unique role in assessing the stream's environmental quality and the pressures impacting it.

Nitrate (Nitrate-N)

- **Why it is used:** Nitrate is a critical indicator of nutrient enrichment, especially in agricultural catchments. As a major contributor to eutrophication, excessive nitrate can lead to algal blooms that deplete oxygen levels and disrupt the aquatic food web. Monitoring nitrate concentrations provides an early warning of nutrient pollution and helps guide nutrient management practices to mitigate eutrophication.
- **Impact:** Excessive nitrate disrupts the growth of aquatic plants (macrophytes), affects oxygen dynamics, and reduces biodiversity by altering food web structures. By tracking Nitrate-N (NO_3-N), the project can better understand the sources of nutrient pollution and address agricultural runoff and wastewater discharge.

Phosphate (Phosphate-P)

- **Why it is used:** Phosphates, another form of nutrient enrichment, drive excessive algal growth that can smother aquatic plants, deplete oxygen, and harm aquatic life. Phosphate monitoring helps assess nutrient balance in chalk streams, enabling better management of agricultural and wastewater effluents.
- **Impact:** High phosphate concentrations lead to excessive periphyton (algae) growth, disrupting biodiversity and impairing water quality. The accurate measurement of phosphate levels (expressed as Phosphate-P, PO_4-P) ensures that the project aligns with regulatory standards and provides a clear picture of nutrient-related impacts.

Ammonia (Ammonia-N)

- **Why it is used:** Ammonia is an important indicator of organic pollution in water. It is toxic to aquatic life, particularly in alkaline conditions. Monitoring ammonia levels offers insights into pollution from organic materials such as wastewater effluent, livestock waste, and decaying organic matter. This indicator is crucial for assessing water toxicity and ecosystem health.

- **Impact:** High ammonia concentrations (NH_3) can cause fish and invertebrate mortality, especially in waters with high pH levels. Ammonia toxicity is influenced by temperature and pH, making continuous monitoring valuable for understanding conditions harmful to aquatic organisms and informing appropriate mitigation strategies.

Dissolved Oxygen (DO)

- **Why it is used:** Dissolved oxygen is essential for aerobic life, including fish, invertebrates, and microbial communities. Low DO levels signal poor water quality and can lead to hypoxic (low-oxygen) conditions, causing stress or mortality in aquatic organisms.
- **Impact:** Low oxygen levels directly affect species health, particularly those higher in the food chain. DO levels are a critical parameter for assessing overall stream health and are used to identify pollution levels. The WFD sets specific DO thresholds, making it crucial for ecological assessment.

Turbidity (Suspended Solids)

- **Why it is used:** Turbidity measures the concentration of suspended particles (sediments) in the water, affecting light penetration and plant growth. High turbidity levels result from erosion, stormwater runoff, and riverbank collapse. Monitoring turbidity helps identify sediment sources and their impacts on water quality and habitat.
- **Impact:** Increased turbidity smothers aquatic habitats and disrupts spawning grounds for species such as brown trout and brook lamprey. By tracking sedimentation rates, turbidity monitoring aids in reducing erosion and improving habitat quality for aquatic life.

E. coli and Faecal Indicator Bacteria

- **Why it is used:** The presence of E. coli and other faecal indicator bacteria signifies faecal contamination, often from wastewater effluent, livestock, or misconnected sewer systems. These indicators are vital for understanding public health risks and ensuring water quality meets safety standards.

- **Impact:** High E. coli concentrations pose public health risks, especially for recreational water use. Regular monitoring supports effective water quality governance, identifying contamination sources and providing insights into water treatment improvements.

pH Levels in Chalk Streams

- **Why it is used:** pH levels influence nutrient solubility, heavy metals, and chemical interactions in water. Chalk streams typically have a slightly alkaline pH, but fluctuations outside the optimal range can harm water quality and aquatic organisms. Monitoring pH helps maintain balanced water chemistry.
- **Impact:** Acidification (low pH) can increase the solubility of harmful metals, while elevated pH enhances ammonia toxicity. Monitoring pH ensures water chemistry remains suitable for aquatic life, preventing detrimental shifts in the ecosystem.

Electrical Conductivity in Chalk Streams

- **Why it is used:** Electrical conductivity (EC) measures dissolved ions in water, serving as a proxy for pollution. It is influenced by urban runoff, agricultural inputs, and industrial discharges. Monitoring EC helps identify pollution sources and assess water quality.
- **Impact:** Elevated EC can indicate pollution from fertilisers, road salts, and industrial activities. Continuous monitoring allows for timely interventions to protect stream health by addressing pollution sources.

Using Sediment Traps and Erosion Pins

Sediment traps and erosion pins are tools designed to monitor sediment transport, deposition, and streambank erosion. These activities are key in determining habitat stability, water quality, and the effectiveness of restoration interventions.

- **Sediment Traps:** These quantify sedimentation rates, providing data on the amount of sediment entering the stream and its effects on water quality. Excessive sediment can carry pollutants such as phosphorus and degrade aquatic habitats.

- **Erosion Pins:** Erosion pins measure changes in streambank stability, providing insights into erosion rates and the impact of restoration activities on reducing sediment loss. Erosion monitoring helps evaluate the success of interventions aimed at stabilising banks and reducing sediment inputs.

Fixed-Point Photography: Documenting Ecological Changes

Why it is used:

Fixed-point photography captures visual changes in habitat over time by taking photos from the same location at regular intervals. This approach helps track vegetation recovery, sediment accumulation, bank erosion, and overall habitat stability.

Impact:

- Provides visual evidence of restoration success, showing how habitats evolve and improve.
- Tracks habitat changes and helps communicate progress to stakeholders and the public.
- Supports long-term monitoring of restoration activities, allowing for easier assessment of project effectiveness over time.

How it is used:

Photographs are taken from predetermined fixed points at consistent intervals. This allows for comparison over time, providing both qualitative and quantitative insights into the restoration process and ongoing stream recovery.

Expert-Led Surveys

Pre- and Post-Restoration Monitoring in Chalk Streams

Successful chalk stream restoration relies on robust scientific monitoring to assess baseline conditions and measure ecological responses to interventions. Two key biological survey methods—macroinvertebrate and macrophyte surveys, are widely used to evaluate changes in water quality, habitat conditions, and overall stream health. These methods provide long-term, evidence-based insights that inform restoration success and guide future management decisions.

Macroinvertebrate Surveys (WHPT Index)

Macroinvertebrates (such as mayflies and caddisflies) are widely recognised as bioindicators of water quality due to their varying tolerance to pollution, sedimentation, and changes in dissolved oxygen levels. The Walley Hawkes Paisley Trigg (WHPT) index is a standardised biological assessment method used by regulatory bodies such as the Environment Agency (EA) and the UK Centre for Ecology & Hydrology (UKCEH). It is preferred because it provides a robust, consistent, and repeatable measure of water quality and ecological health across different monitoring sites.

- **Why it's important:** The WHPT index is particularly valuable because it accounts for both the presence of specific macroinvertebrate taxa and their relative abundance. Unlike simple presence/absence assessments, WHPT assigns weighted scores based on pollution sensitivity, making it more effective at detecting subtle ecological changes before and after restoration. Since macroinvertebrates have relatively long life cycles, they reflect cumulative water quality conditions rather than just short-term fluctuations.
- **What the data tells us:** A high WHPT score typically indicates a diverse, pollution-sensitive invertebrate community, suggesting good ecological health. A lower score post-restoration could indicate unexpected stressors, such as residual sedimentation or poor flow conditions. Conversely, improvements in WHPT scores signal successful habitat restoration, improved water quality, and enhanced ecological resilience.

Macrophyte Surveys

Macrophytes (aquatic plants) are essential components of chalk stream ecosystems, playing a key role in stabilising sediments, oxygenating the water, and providing habitat for fish and invertebrates. Because macrophytes respond quickly to changes in water clarity, nutrient levels, and flow conditions, they serve as valuable indicators of both physical and chemical changes in a stream.

- **Why it's important:** Macrophytes are particularly useful for detecting long-term trends in water quality and habitat health. They respond to a range of pressures, including increased sedimentation, nutrient enrichment from agricultural runoff, and altered flow regimes caused by abstraction or restoration work. Because different species have varying tolerances to these pressures, tracking macrophyte composition allows researchers to assess how well a restored site supports a stable and diverse aquatic plant community.
- **What the data tells us:** A shift towards a greater abundance of pollution-sensitive macrophyte species, such as water crowfoot suggests an improvement in water quality and flow conditions. Conversely, an increase in nutrient-tolerant species, such as filamentous algae or duckweed, could indicate excessive nutrient inputs and ongoing ecological imbalance. Post-restoration macrophyte surveys help determine whether habitat modifications are supporting a healthier, more natural stream ecosystem.

By employing standardised and scientifically validated methods such as the WHPT macroinvertebrate index and macrophyte surveys, restoration projects can generate high-quality, evidence-based assessments of their ecological impact. These approaches are not only essential for regulatory compliance but also provide vital information for adaptive management, helping to refine and improve restoration techniques over time. Monitoring both macroinvertebrates and macrophytes ensures that changes in chalk stream ecosystems are accurately documented, enabling restoration practitioners to achieve long-term ecological success.

Wellbeing and Community Engagement

Why monitor wellbeing?:

Community engagement is essential to the success of the Greater Cambridge Chalk Stream Project (GCCSP). By involving local communities in monitoring and restoration efforts, the project not only enhances ecological understanding but also provides significant social and psychological benefits. Active participation in citizen science activities helps foster a sense of ownership and stewardship over local rivers, encouraging ongoing involvement in environmental conservation.

Impact:

- **Physical and Mental Health Benefits:** Engaging with nature through environmental activities has been shown to reduce stress, improve mental wellbeing, and promote physical health. Volunteers involved in monitoring and restoration activities gain a sense of accomplishment and connection to the natural environment, which contributes to improved community resilience.
- **Community Empowerment and Advocacy:** By participating in monitoring and restoration efforts, local residents become more informed and motivated to advocate for policy changes. Volunteers often become active champions for environmental protection, contributing to long-term community-driven conservation initiatives.
- **Strengthening Social Networks:** Citizen science initiatives foster collaboration among diverse community members, strengthening social ties and creating shared goals for river restoration. This sense of community solidarity enhances collective action, ensuring that restoration efforts are well supported and sustainable.
- **Enhancing Environmental Education:** Volunteers learn about the ecological challenges facing chalk streams, providing opportunities for environmental education. These educational experiences not only benefit individual volunteers but also equip the wider community with the knowledge needed to engage in future conservation efforts.

Cambridge City Council nature reserve volunteers, citizen science biological survey

Open Data Accessibility: Supporting Collective Knowledge on Chalk Stream Restoration

The data collected through the Greater Cambridge Chalk Stream Project (GCCSP) will be made openly available to all stakeholders, including local communities, conservation organisations, academic institutions, and policymakers. By sharing this data transparently, the project aims to foster collaboration and support the collective advancement of knowledge on chalk stream restoration. Open data also empowers the public, researchers, and other practitioners to engage with and contribute to the ongoing efforts to protect and restore these vital ecosystems.

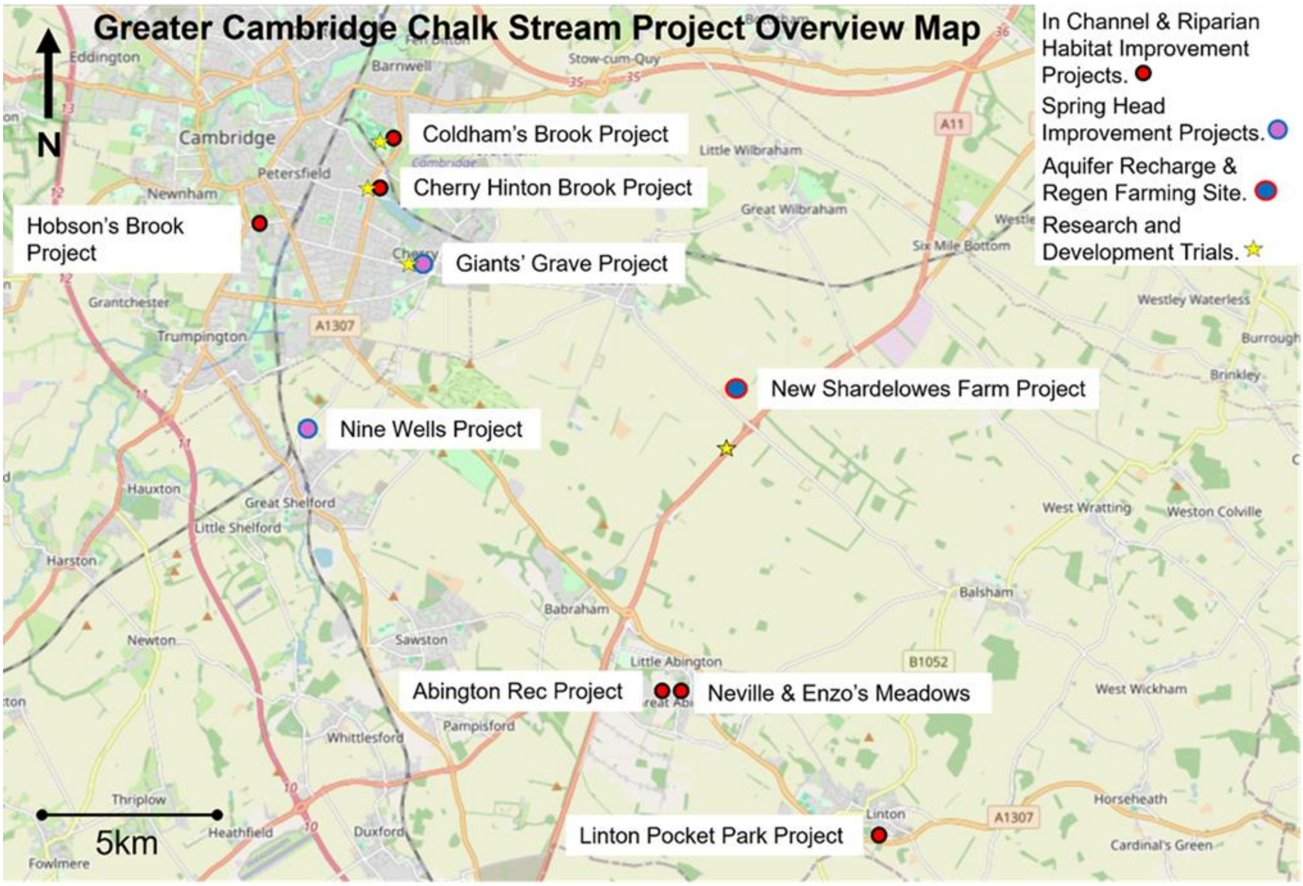
Impact:

- **Enhances Knowledge Sharing:** Open access to monitoring data allows for the exchange of insights between experts, volunteers, and the wider community. This fosters a more collaborative approach to solving the challenges faced by chalk streams.
- **Informs Future Restoration Projects:** The data collected will serve as a valuable resource for future restoration efforts, enabling the development of evidence-based restoration strategies that can be applied across the UK and beyond.
- **Empowers Stakeholders:** Providing open access to data enables local communities and conservation groups to advocate for informed environmental policies and support sustainable management practices based on real, reliable evidence.
- **Supports Research and Policy Development:** By making the data available to researchers, the project helps improve understanding of chalk stream ecosystems, which in turn can influence national and international policies focused on freshwater conservation.

The GCCSP data will be stored in publicly accessible databases and made available through dedicated platforms. Data will be organised, analysed, and presented in user-friendly formats to ensure its usability for diverse audiences, including both technical and non-technical stakeholders. Regular updates and visual reports will be shared to engage a wider audience and encourage the use of the data in ongoing restoration and conservation work.

Each monitoring activity within the GCCSP is designed to provide valuable insights into the ecological health of chalk streams. By incorporating scientific expertise and community involvement, the project builds a comprehensive dataset that drives adaptive management decisions and supports effective river restoration. Through these rigorous monitoring efforts, the GCCSP ensures that chalk stream ecosystems are protected, restored, and preserved for future generations.

Project Sites Map



GCCSP Project Objectives

Linton Pocket Park

- Restoring 462m of chalk stream habitat
- Creating 3 new ponds with a dipping platform for wildlife and education
- Enhancing 500m of streamside vegetation to boost biodiversity
- Trapping up to 900kg of sediment per day to improve water quality
- Rapid sediment removal from key gravel areas within 24-48 hours of spate events
- Boosting mid-channel flow velocity by 20%, from 0.55 m/s to 0.66 m/s
- Increasing dissolved oxygen by 10-20%, supporting aquatic life
- Reducing bank erosion and preventing further channel widening
- Improving 200m of access paths for better community engagement
- Installing essential infrastructure, including: A culverted footbridge & boot scraper, three log benches for relaxation, a small wildlife hide & two kingfisher perches, an inspiring artwork & three interpretation panels
- Training over 10 volunteers in habitat management & citizen science
- Monitoring community wellbeing through engagement and participation
- Pre- and post-restoration surveys to track success, including: water quality assessments, fixed-point photography, invertebrate and macrophyte surveys, erosion and sedimentation studies
- Investing £4,500 in a post-project grant for long-term habitat management
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Abington Recreation Ground

- Restoring 281m of chalk stream habitat for a healthier ecosystem

- Creating an educational pond in Abington Woods with dipping platform to inspire learning
- Enhancing 150m of vegetation along the stream banks to boost biodiversity
- Improving 200m of access paths for better community engagement
- Trapping up to 900kg of sediment per day in spate events to improve water quality
- Removing sediment from vital gravels within 24-48 hours of spate events
- Boosting mid-channel flow velocity by 20%, from 0.55 m/s to 0.66 m/s
- Increasing dissolved oxygen by 10-20%, supporting aquatic life
- Preventing bank erosion and protecting the cricket ground from flood damage
- Developing an engaging nature trail in Abington Woods for education & discovery
- Installing community infrastructure, including: Two log benches for relaxation Two interpretation panels to educate visitors
- Training over 10 volunteers in habitat management & citizen science
- Engaging the community with hands-on conservation and wellbeing surveys
- Pre- and post-restoration monitoring, including: water quality assessments, fixed-point photography, invertebrate and macrophyte surveys, erosion and sedimentation studies
- Investing £4,500 in a post-project grant for long-term habitat management
- Creating a sustainable site management plan to ensure future protection

Enzo and Neville's Meadows

A Partnership with private landowners

- Restoring 400m of chalk stream habitat, preserving existing shallow gravels for fish spawning
- Enhancing 350m of streamside vegetation to boost biodiversity and habitat resilience
- Trapping up to 950kg of sediment per day during spate events to improve water quality
- Rapid sediment removal from vital gravels within 24-48 hours to maintain pristine spawning conditions
- Boosting mid-channel flow velocity by 20%, from 0.55 m/s to 0.66 m/s
- Increasing dissolved oxygen levels by 10-20%, supporting fish, invertebrates, and aquatic plants
- Preventing bank erosion and localised sedimentation, securing the long-term health of the river

Comprehensive pre- and post-restoration monitoring, including:

- Water quality assessments to track improvements
- Fixed-point photography to document ecological changes
- Invertebrate and macrophyte surveys to assess biodiversity gains
- Erosion and sedimentation surveys to evaluate long-term habitat stability
- Supporting PhD and post-doctoral research on sediment dynamics

Hobson's Brook and Vicar's Brook

- Restoring & enhancing 400m of chalk stream habitat to boost biodiversity and ecological resilience
- Creating a fish pass reconnecting an old paleo channel between Hobson's Brook & Vicar's Brook, restoring fish migration and aquatic connectivity
- Trapping up to 45kg of sediment per day to improve water quality

- Boosting mid-channel flow velocity by 10-15%
- Increasing dissolved oxygen levels by 5-10%, supporting aquatic life and improving water quality
- Reestablishing native flora to enhance bankside vegetation and increase biodiversity
- Stabilising banks & reducing sedimentation, preventing erosion and protecting habitats
- Piloting urban sediment trapping strategies to refine sediment control methods in urban chalk streams

Comprehensive pre- and post-restoration monitoring, including:

- Water quality assessments to track improvements
- Fixed-point photography to document habitat changes
- Invertebrate and macrophyte surveys to measure biodiversity gains
- Erosion and sedimentation studies to evaluate long-term habitat stability supporting PhD Research
- Developing a sustainable site management plan for future habitat conservation

Cherry Hinton Brook

- Restoring & enhancing 320m of chalk stream habitat for a healthier ecosystem
- Trapping up to 50kg of sediment per day to improve water quality
- Boosting mid-channel flow velocity to maintain cleaner gravels and enhance aquatic habitat
- Increasing dissolved oxygen levels by 5-10%, supporting fish, invertebrates, and aquatic plants

- Reestablishing native flora to enhance bankside vegetation and increase biodiversity
- Stabilising banks & reducing erosion, preventing sedimentation and habitat degradation
- Training 5 new citizen scientists to monitor water quality
- Training 10 volunteers in practical habitat management
- Supporting 2 ARU Masters students with chalk stream research

Comprehensive pre- and post-restoration monitoring, including:

- Water quality assessments to track improvements
- Fixed-point photography to document habitat changes
- Invertebrate & macrophyte surveys to measure biodiversity gains
- Erosion & sedimentation studies to evaluate long-term habitat stability

Coldham's Brook

- Restoring & enhancing 500m of modified urban chalk stream
- Trap up to 900kg of sediment per day to improve water quality and regenerate bankside habitat
- Boost mid-channel flow velocity to maintain cleaner gravels and enhance aquatic habitat
- Increase dissolved oxygen levels by 5-10%, supporting fish, invertebrates, and aquatic plants
- Reestablishing native flora to enhance bankside vegetation and increase biodiversity
- Stabilising banks & reducing erosion, preventing sedimentation and habitat degradation
- Install 120m of in-channel brash bundles & log flow deflectors to enhance flow dynamics

- Train 5 new water quality monitoring volunteer citizen scientists
- Train over 10 volunteers in practical habitat management
- Install 2 interpretation panels to educate the public about chalk streams

Comprehensive pre- and post-restoration monitoring, including:

- Water quality assessments to track improvements
- Fixed-point photography to document habitat changes
- Invertebrate & macrophyte surveys to measure biodiversity gains
- Support 1 ARU Masters students with chalk stream research

Giant's Grave

- Removing accumulated sediment to restore natural spring flow and improve water clarity and reveal historic features
- Capturing runoff sediments around the 650m perimeter to protect aquatic habitats
- Managing the tree canopy to increase light penetration and support native vegetation
- Improving public access with upgraded paths
- Enhancing flow dynamics into Cherry Hinton Brook by installing flow deflectors to clean glacial gravels
- Removing invasive *Crassula helmsii* to restore native plant communities
- Implementing Sustainable Drainage System (SuDS) to reduce pollution from urban runoff

Comprehensive monitoring & research, including:

- Water quality testing to track pollution levels and hydrological stability Fixed-point photography & habitat surveys to assess ecological improvements

- Community engagement & volunteer training to support long-term stewardship
- Complete topographic survey of the site
- Developing a long-term site management plan to ensure the preservation of this historic and ecological landmark
- Installing educational interpretation signs to share the site's geological, ecological, and cultural significance

Nine Wells

- Removing accumulated sediment to reestablish natural spring flow and improve water clarity
- Capturing runoff sediments along 250m to protect aquatic habitats
- Managing the tree canopy & remove non-native species to increase light penetration and support native vegetation
- Repairing 50m of flow deflectors into Hobson's Brook headwaters to mobilise silts and clean gravels
- Comprehensive monitoring & research, including:
- Water quality assessments to track pollution levels and hydrological stability
- Fixed-point photography & habitat surveys to assess ecological improvements
- Developing a long-term site management plan to protect Nine Wells

New Shardelowes Farm

Sustaining Chalk Aquifers, A Regenerative Farming & Water Conservation Demonstration

- Harvesting over 1,422m³ of rainwater annually to reduce groundwater abstraction and support aquifer recharge

- Restoring natural hydrology through Managed Aquifer Recharge (MAR) to sustain groundwater levels
- Demonstrating regenerative farming to protect soil, enhance biodiversity, and improve water retention
- Reducing agricultural runoff & pollution with buffer strips
- Supporting farmers & businesses in adopting regenerative techniques for a sustainable agricultural future
- Building a pesticide & herbicide washdown area to demonstrate preventing contamination of sensitive chalk aquifers
- Installing educational signage
- Hosting workshops to raise awareness of sustainable water management
- Monitoring & recording key environmental factors:
- Water levels & recharge rates to assess aquifer sustainability
- Rainwater harvesting efficiency to track water conservation impact
- Soil analysis at recharge sites to evaluate regeneration benefits
- Rainwater quality monitoring to ensure safe and effective use

Research & Development of New Technologies

Advancing evidence-based conservation with research-backed technologies, providing scalable solutions for urban chalk stream restoration!

- Enhancing fish passage and ecosystem connectivity by piloting UV lighting in culverts at Hobson's Brook
- Improving water quality with solar-powered aeration & diffusers, increasing dissolved oxygen levels and mimicking natural chalk stream flow at Coldham's Brook

- Reducing nutrient levels and boosting habitat diversity with floating wetland mats, absorbing excess nutrients and providing shelter for invertebrates and fish pilot project in Jesus Green Trial

Comprehensive monitoring & research, including:

- Water quality testing to track pollution levels and oxygenation improvements
- Species diversity & fish passage monitoring
- Biodiversity surveys to assess habitat improvements over time

Proposed Allocation of Funds

Funding Source	Amount (£)	Purpose
Cambridgeshire & Peterborough Combined Authority (CPCA)	£420,000	Staffing costs (£120,000) and chalk stream restoration projects (£300,000), including water quality monitoring, regenerative farming, and new technologies.
Anglian Water - Get River Positive Fund (Phase 1)	£29,500	Long-term water quality and biological monitoring through citizen science initiatives.
Anglian Water - Get River Positive Fund (Phase 2)	£50,500	Restoration efforts, habitat enhancement, and pollution control measures.
Cambridge City Council – Drainage Team	£31,343	Urban chalk stream projects focusing on drainage and water quality improvements at Cherry

		Hinton Brook and Coldham's Brook.
Hobson's Conduit Trust (HCT)	£19,000	Targeted contributions for chalk stream restoration and urban drainage projects, enhancing ecological health.
South Staffs Water	£41,000	Match funding for multiple chalk stream restoration projects, including Linton Frog, Abington, Cherry Hinton Brook, and Giant's Grave.

Thank you to these funders for their unwavering support in enabling these critical initiatives.

CAMBRIDGESHIRE & PETERBOROUGH COMBINED AUTHORITY
CAMBRIDGE CITY COUNCIL
love every drop anglianwater
South Staffs Water

Thank you to these organisations for their unwavering support in developing this project:

a.r.u.
GREATER CAMBRIDGE SHARED PLANNING
South Cambridgeshire District Council
HOBSON'S CONDUIT TRUST
Cambridgeshire County Council
Environment Agency
The Rivers Trust

The following is a breakdown of the current approximate allocations for the Greater Cambridge Chalk Stream Project (GCCSP). Please note that ongoing negotiations are in progress to secure additional funds, which will help continue and expand this vital project:

Water Quality and Biological Monitoring

- £119,226 – This funding supports ARU project leadership and associated monitoring efforts, including the purchase of equipment and volunteer training. The aim is to ensure the consistent collection of high-quality data for water quality and biological assessments, which are essential for ongoing restoration and conservation work.

In-Channel and Riparian Restoration

- **Linton Pocket Park Project**: £60,368 – Funds will be used to restore in-channel habitats and riparian zones, improving biodiversity and water quality in this area.
- **Abington Recreation Ground**: £31,950 – This allocation supports riparian habitat restoration, creating a healthier environment for aquatic species and improving the local ecosystem.
- **Patchwork Education Village CIC - Abington Woods**: £17,325 – These funds are for creating educational, community-focused spaces through habitat restoration that also serve as demonstration sites for sustainable practices.
- **Hobson's Brook**: £32,000 – These funds are directed towards in-stream restoration works aimed at improving water flow and enhancing biodiversity.
- **Cherry Hinton Brook**: £14,034 – Funding will help restore riparian habitats and improve water quality in this urban chalk stream, tackling urban pressures on the ecosystem. (pending further match funding)
- **Coldham's Brook**: £8,000 – This funding supports targeted restoration interventions to improve water quality and biodiversity. (pending further match funding)
- **Neville's & Enzo's Meadow**: £15,000 (plus £10,000 match funding) – This allocation is for meadow restoration efforts that support both terrestrial and aquatic biodiversity through careful management of the surrounding environment.

Springhead Restoration and Development

- **Giant's Grave**: £43,950 – These funds will go towards the restoration of springhead habitats, ensuring the long-term health of groundwater-fed streams and their surrounding ecosystems. (pending further match funding)
- **Nine Wells**: £12,449 – This will fund spring restoration activities aimed at improving water quality and hydrological health in the region. (pending further match funding)

Regenerative Farming Practices

- **New Shardelowes Farm Project**: £75,500 – Funding will be used to implement regenerative farming practices at Shardelowes Farm, reducing soil erosion and nutrient runoff into nearby watercourses, and contributing to the overall health of the catchment area.

Research and Development

- **Trials of New Technologies**: £12,000 – This funding will support trials of innovative technologies designed to improve water quality and habitat conditions, such as floating wetlands or aeration systems. (pending further match funding)

Small Community & Educational Grants

- £8,344.48 – These funds will be allocated to small community and educational grants to support local initiatives that foster environmental education and public engagement in chalk stream restoration. (pending further match funding)

Events, Miscellaneous Expenses

- £15,374 – This allocation covers the costs of organising events, workshops, and other activities that raise awareness about the restoration project, engage with local communities, and ensure the long-term sustainability of the efforts.

As previously mentioned, ongoing efforts are underway to secure further funds to continue and expand this project. The goal is to ensure the long-term success of the restoration efforts, enhance community engagement, and maintain the health of the chalk streams for future generations.

The Importance of Funding for a Case Study

Project Restoration of chalk stream habitats is both challenging and costly. By funding a detailed case study project like GCCSP, stakeholders are building a robust database to: Demonstrate Value for Money: A focused investment allows for detailed analysis of intervention impacts, ensuring efficient allocation of resources in future large-scale projects.

Enhance Knowledge and Techniques: The case study explores new technologies and best practices, such as urban fish passages and regenerative farming, to inform regional and national efforts. Engage Communities: Local involvement strengthens support for conservation initiatives, creating a legacy of environmental stewardship. Enable Scalable Solutions: Lessons learned from GCCSP will guide cost-effective and impactful interventions for other chalk stream habitats. By funding this case study, partners ensure that every pound invested contributes to the sustainable management and restoration of these irreplaceable natural assets. GCCSP extends its heartfelt thanks to all funders and partners for their contributions to preserving the chalk streams of Greater Cambridge. Together, we are safeguarding these vital ecosystems for generations to come.

Community Grants to Support Chalk Stream Projects

While the primary focus of the Greater Cambridge Chalk Stream Project is on case study site research to investigate key challenges and solutions for chalk stream restoration, we recognise the vital role of community-led initiatives in preserving these ecosystems. To support local efforts, we have allocated small community grants for chalk stream-related projects. These grants have been distributed to schools, local councils, and volunteer groups engaged in activities that enhance awareness, education, and practical conservation.

Examples of funded projects include training sessions for community action teams, educational programs for schools, and equipment testing to support restoration monitoring. These initiatives empower local communities to play an active role in protecting and restoring chalk streams. We hope that the evidence-based findings from our case study projects will inform and inspire combined authorities to allocate future community grants strategically. Although our project funds are limited, it is our hope that we can assist and support other organisations in securing additional funding to enable even more community-based projects. By leveraging our findings and partnerships, we aim to create a framework for scaling up community efforts and achieving long-term ecological success.

Key Questions and Expected Outcomes

Key Questions the GCCSP Seeks to Answer

Understanding the Extent of Chalk Stream Degradation:

- What are the primary sources of pollution affecting chalk streams in Greater Cambridge, and how do they impact biodiversity and water quality?
- How have urbanisation, land use changes, and agricultural practices influenced hydrology, sedimentation, and stream ecology?
- What baseline ecological conditions exist at each restoration site, and how do they compare to historical benchmarks?
- How do urban chalk streams differ from their rural counterparts in terms of resilience and restoration needs?
- What roles do structural modifications such as fish passes, brushwood shelves, flow deflectors, cut and hinged trees, and small-scale gravel augmentation play in restoring ecological connectivity and reducing sedimentation?

Assessing the Effectiveness of Restoration Interventions:

- What measurable improvements in water quality and biodiversity result from targeted interventions such as sediment trapping, habitat enhancements, and innovative flow management solutions?
- How effective are cutting-edge techniques like floating wetlands, solar-powered aeration, and UV lighting in mitigating urban stream degradation?
- What roles do structural modifications such as fish passes, brushwood shelves, flow deflectors, cut and hinged trees, and small-scale gravel augmentation play in restoring ecological connectivity and reducing sedimentation?

- How do different hydrological restoration approaches, including managed aquifer recharge (MAR) and sustainable drainage systems (SuDS), contribute to the resilience of chalk stream ecosystems?

Evaluating Community Engagement, Social Effects, and Awareness:

- How has community involvement influenced the success of the project's interventions?
- What levels of participation have been observed through citizen science programmes, and how has local stewardship been encouraged?
- How have educational outreach efforts changed public perception and awareness of chalk stream conservation?
- What are the social benefits of chalk stream restoration, including access to demonstrative sites showcasing habitat enhancements?
- How does improved public access to chalk streams contribute to community well-being and environmental appreciation?
- How can better interpretation and signage inform the wider community about the ecological and cultural importance of chalk streams?
- What are the key motivators and barriers to sustained community engagement in stream restoration initiatives?
- How do we improve our community engagement and volunteer recruitment to increase participation, sustain volunteers, and engage a much wider demographic?
- How do we improve community engagement and increase interest through better interpretation, communication, and events management?

Understanding Hydrological, Geomorphological, and Ecological Dynamics within a Geodiverse Landscape:

- How do seasonal and climatic variations impact water quality, biodiversity, and hydrological flows in chalk streams?

- What roles do groundwater abstraction and land management practices play in influencing base flow conditions?

- How does sediment transport impact the long-term stability of aquatic habitats and species distribution?
- What indicators of ecological health can be used to inform adaptive management strategies for ongoing restoration efforts?

Identifying Best Practices for Scalable Restoration:

- Which restoration techniques provide the greatest ecological and economic benefits in urban versus rural settings?
- How can urban chalk stream restoration be integrated into regional planning, water resource management, and climate adaptation policies?
- What are the long-term maintenance requirements for restored sites, and how can they be sustainably managed?
- How can findings from this project inform national and international conservation strategies for rare chalk stream ecosystems?

What the GCCSP Hopes to Publish in the End-of-Project Report

Scientific Findings and Data-Driven Insights:

- A comprehensive dataset on pre- and post-intervention water quality, biodiversity, and habitat conditions across multiple case study sites.
- Measured improvements resulting from specific interventions, including reductions in nutrient levels, increased dissolved oxygen, and enhanced species diversity.
- Evaluations of hydrological restoration efforts such as MAR, SuDS, and flow enhancement technologies.
- Case studies demonstrating successful approaches and their long-term sustainability.

Evaluation of New Technologies:

- Performance analysis of innovative restoration tools such as aerated macrophyte islands, floating wetlands, and UV-lit fish passages.
- Comparative effectiveness of traditional restoration methods versus emerging technological solutions in urban settings.
- Recommendations on the feasibility, scalability, and cost-effectiveness of different techniques for wider implementation.

Community and Stakeholder Engagement Outcomes:

- Summary of public participation, including volunteer restoration activities, community science programs, and educational workshops.
- Impact assessments of outreach campaigns on local perceptions and engagement in chalk stream conservation.
- Testimonials and perspectives from local stakeholders, policymakers, and community groups involved in the project.

Policy and Funding Recommendations:

- Evidence-based guidance for integrating chalk stream conservation into local and regional planning frameworks.
- Policy recommendations on managing groundwater abstraction, land use impacts, and long-term funding mechanisms for chalk stream stewardship.
- Insights into securing financial resources for conservation, including public-private partnerships and community-led initiatives.

Future Research and Long-Term Conservation Strategy:

- Identification of key knowledge gaps requiring further study, particularly regarding the long-term effectiveness of novel restoration techniques.
- Suggested frameworks for continuous monitoring and adaptive management of restored chalk streams.
- Roadmap for expanding restoration efforts to additional sites, incorporating findings from case study locations.
- Potential for sustained collaboration between conservation groups, academic institutions, water resource managers, and policymakers.

Conclusion

The final report of the Greater Cambridge Chalk Stream Project (GCCSP) will be a landmark document, not only reflecting on the project's outcomes but also marking a fundamental shift in how chalk stream restoration must be approached in the future. A key message will be the urgent need for a coordinated, landscape-scale strategy rather than isolated, site-specific interventions. The report will emphasise that restoration efforts cannot succeed in isolation; they must be embedded within a broader catchment-wide approach that tackles the root causes of degradation. Addressing water quality, sedimentation, and flow dynamics at a landscape level is essential for achieving long-term success. Just as one would not attempt to establish a chalk grassland on nutrient-rich alluvial clay soils with high moisture content, chalk stream restoration will fail without first resolving the environmental pressures that shape these fragile ecosystems.

Furthermore, site selection must be driven by evidence-based research, ensuring that interventions are not just well-intentioned but scientifically robust. The GCCSP report will highlight the importance of data-led decision-making, reinforcing the principle that effective restoration is only possible when guided by a clear understanding of the broader ecological and hydrological context.

The uncertainty surrounding the national Chalk Stream Restoration Strategy and its Implementation Plan has made this project even more critical. Without clear national coordination or a definitive government commitment, the responsibility for chalk stream protection increasingly falls on local initiatives. The GCCSP will provide the necessary local evidence to drive action, ensuring that restoration efforts are strategic and based on irrefutable, site-specific data. By highlighting the specific pressures facing Greater Cambridge chalk streams and offering science-backed solutions, this project will help bridge the gap left by the lack of a clearly defined national framework.

This project will make it clear that water quality is not just a factor to be measured; it is the key indicator that must guide restoration site selection. Chalk streams are delicate ecosystems with specific water quality parameters that support their unique floral and faunal communities. For these communities to thrive, they need optimal water conditions, which can only be achieved through a landscape-scale approach that first addresses broader issues such as nutrient pollution, hydrological changes, and sedimentation before selecting the right sites for restoration. The report will emphasise that chalk stream-specific floral and faunal communities depend on particular water quality parameters. For example, the right concentrations of dissolved oxygen, pH balance, nutrient levels, and absence of pollutants are essential for supporting biodiversity-rich habitats. These parameters must be considered when determining suitable restoration sites, and only once these conditions are met at the landscape level can we identify the sites truly ready for targeted interventions. In this way, water quality serves as the most important criterion for site selection, ensuring that restoration efforts are effective and sustainable.

Furthermore, the final report will reinforce the idea that landscape-scale solutions must be implemented before selecting the right sites for chalk stream restoration. Only by improving the overall environmental health of the catchment area, through better land management practices, reducing nutrient pollution, and ensuring stable hydrology, can we create the right conditions for chalk streams to recover. Restoration efforts that focus solely on isolated sites without addressing the broader landscape context are unlikely to succeed in the long term. By adopting this landscape-scale perspective, the GCCSP will set a new precedent for how future chalk stream restoration should be approached. The project's findings will emphasise the need for a holistic, evidence-driven approach that looks beyond individual restoration sites and focuses on the wider catchment and its ecological health. This approach, which integrates both water quality monitoring and site-specific restoration, will ensure that interventions are not only scientifically sound but also strategically aligned with the long-term health of the entire chalk stream ecosystem.

In conclusion, this project has demonstrated that chalk stream restoration is a complex, multifaceted endeavour that requires careful planning, coordination, and a deep understanding of the entire landscape. The final report will serve as a powerful call to action, pushing for landscape-wide solutions and evidence-based site selection that will enhance the ecological health and resilience of chalk streams for generations to come. The findings will provide the necessary groundwork for future restoration efforts, ensuring that every investment in chalk stream conservation is scientifically justified, well-planned, and delivered with the long-term sustainability of these vital ecosystems in mind.

For further information, please contact: nature@cambridge.gov.uk