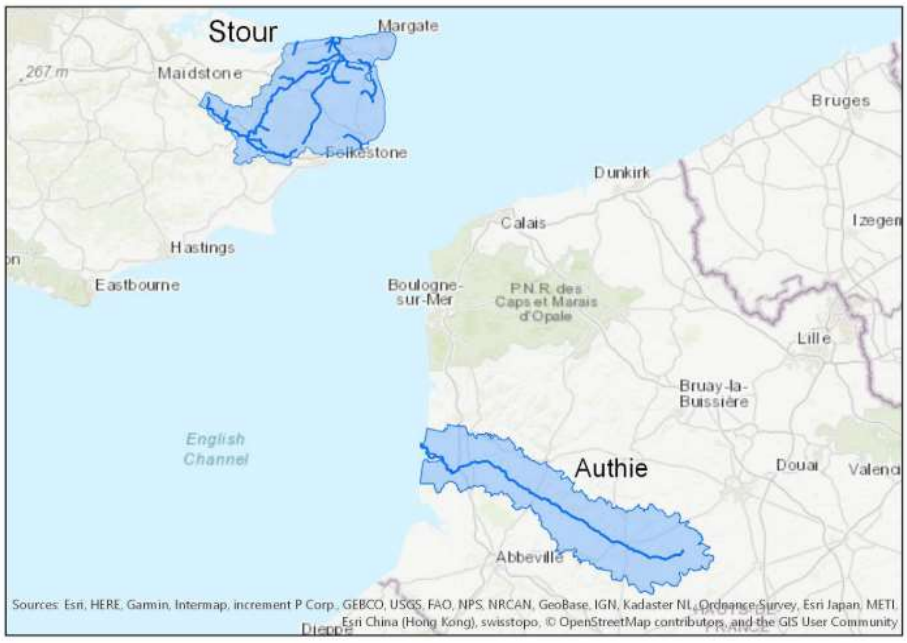
Interreg
EUROPEAN UNION
France (Channel Manche) England
H2O: Source2Sea
European Regional Development Fund

H2O:Source2Sea

Manual for Nature-based Solutions



Viridian
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Kent Wildlife Trust
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Aecom
CPIE Val d'Authie
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Document control

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Contents

Introduction to the H2O:Source2Sea project

The project was created to improve water management and quality, from the hills where rivers first rise all the way to the sea; and to find sustainable solutions to climate change.

Four organisations on each side of the Channel teamed up to make H2O:Source2Sea happen with funding from the Interreg France-Channel-England programme of the European Union. Kent Wildlife Trust was the Lead Partner, working in close collaboration with Kent County Council, CPIE (Centre Permanent d'Initiatives pour l'Environnement), Val d'Authie and Nausicaá National Sea Centre.

The official launch took place on Thursday 13th June 2019 in Sandwich, UK, where the challenges and objectives of the project were presented to stakeholders. The project officially finished in March 2023, although many of its activities continued beyond that date.

The project came about as Kent and Pas-de-Calais regions face the same water management challenges and have similar issues of flooding, drought, and pollution of waterways. These damage our shared ecosystem, the Channel, and affect local communities and businesses alike. Flooding alone costs millions of euros in the UK and France annually, and traditional flood and drought management through hard engineering can be expensive to build and maintain. Climate change is also likely to increase the likelihood of extreme weather events, which could have a severe impact on water resources.

The H2O:Source2Seas project demonstrated that the implementation of Natural Flood and Natural Drought Management measures (NFM and NDM) reduce water management costs while improving freshwater quality, reducing pollution, and benefiting the wildlife, environment and local communities.

Project partners piloted a variety NFM and NDM measures on rivers flowing into the Channel: the Stour and Rother rivers in the UK, and the Authie in France. These pilots engaged with a wide variety of stakeholders, including farmers, local communities, volunteers and professionals.

The project started with the following aims:

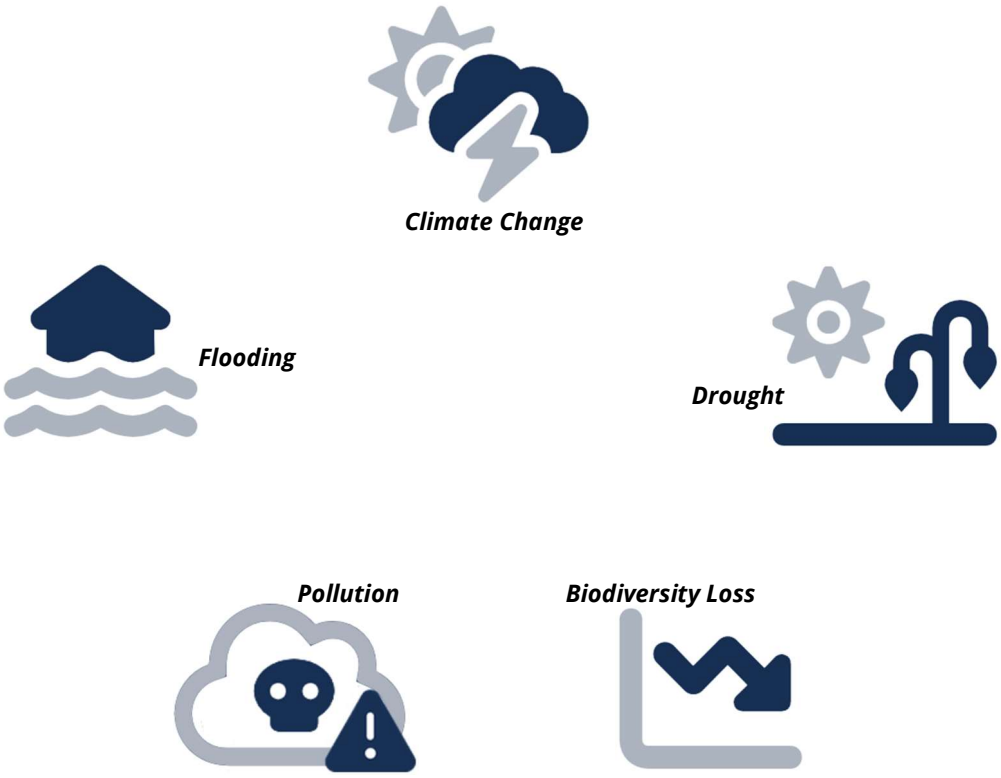
- Restore natural processes throughout the catchment by implementing NFM and NDM measures.

- Demonstrate that the measures employed reduce flood risk and pollution.
- Realise the true value of the measures through Natural Capital Valuations.
- Ensure that the tools created and the knowledge gained by the project are widely shared in both England and France.

These aims were achieved through a variety of work streams, including:

- Modelling the most effective places to create nature-based interventions, such as planting hedges or digging new ponds, to help stakeholders decide on the best course of action for their circumstances.
- Appraising the costs and benefits of creating the suggested interventions, including their financial returns.
- Engaging the public in the environment through citizen science.
- Creating some nature-based interventions to demonstrate that they work and investigate their true value.
- Building a variety of digital tools to help farmers, communities and professionals work with nature long after the project finished.

Problems that H2O:Source2Sea addressed:



Outcomes that H2O:Source2Sea achieved:

5 digital tools
created

129 volunteers
doing Citizen Science

2,624m of hedgerows
planted

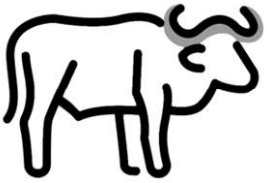
18m of fascine
constructed

2 areas of marsh
restored

22 ponds
created

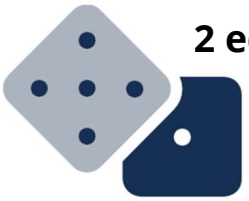
1,343,763 visitors
at 3 Nausicaá exhibitions

4 water buffalo
introduced to the landscape



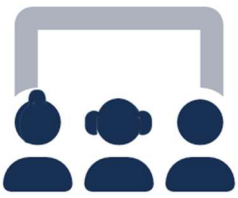
420 aquarium/marine professionals
at the International Aquarium Congress

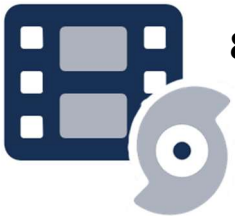
49,500 participants
in Nausicaá quizzes



2 educational games
produced

220 school pupils
visited Nausicaá exhibitions





8 videos
created

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H2O: Source2Sea
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An outline of transitional and coastal habitats

The Stour and Authie catchments are located either side of the English Channel in Kent and Pas-de-Calais/Somme, respectively. They comprise of similar, lowland areas with hills rising to a maximum of 180m. Their habitats include the coastal zone next to the sea, leading to transitional areas such as estuaries and then rolling river valleys further inland.

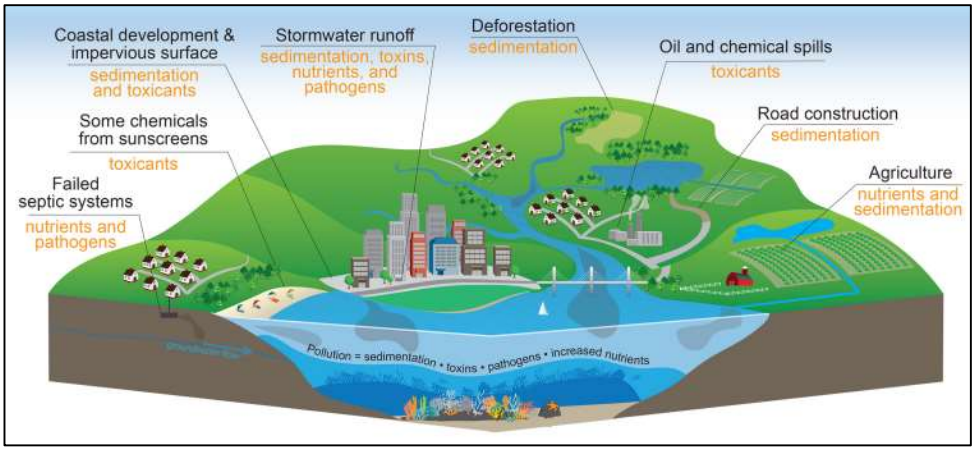
Satellite image of transition between coastal and agricultural land use

The coastal habitats comprise saltmarsh and shingle within reach of the tides and are subject to periodic saltwater inundation and wave action. Pioneer salt- and flood-tolerant species are characteristic of this environment. Coastal habitats are often a priority for nature conservation. This is partly due to the variety of specialised species associated with them, but also because of their scarcity and intrinsic appeal.

Further inland, where the sea seldom reaches, there are coastal sand dunes and cliffs. These areas are typically windswept, arid, and brackish. These areas support highly specialised plants, especially the sand dunes.

Moving further inland, habitats become increasingly terrestrial, with various types of coastal grassland, heathland and scrub predominating. This transition between coastal and inland habitats can be quite sudden, such as where intensive agricultural abuts the coast. Elsewhere it can be more gradual, such as estuarine mudflats slowly giving way to reedbeds, wet coastal grazing and finally arable cultivation.

The inland, transitional and coastal areas are intrinsically linked. Not only do species travel between them, but water flows from the land to rivers and thence the sea. This means that polluting actions inland, such as spraying pesticides or discharging sewage, can rapidly harm transitional and coastal habitats. Conversely, improving wildlife or farming practices inland will help restore coastal habitats.



How catchments can affect the sea. Source: NOAA

Introduction to Digital Tools

Digital tools are defined as 'programs, websites or online resources that can make tasks easier to complete'. The digital tools created by Source2Sea included a Spatial Risk Assessment, nature-based mapping tools, a Water Trading Scheme, Rainwater Harvesting Tool and Natural Capital Valuation tool. We will discuss these below, but first we will explore some features they have in common.

All the digital tools are based on the following elements:

Conceptual underpinning. The tools are generally created to show users various information that help them make decisions. This means that the tools' authors have to decide in advance which information to show and how the tools will work. They do this by considering what users will want and designing a way to show users how their decisions will affect the real world. This requires some simplification, assumption, and approximation to make them work.

Data. Data are simply facts and figures that have been gathered from the world around us. Examples could be the amount of coffee sold in Canterbury or total area of woodland across Kent. Data can come from measurements or can be created through modelling and is often shown as maps, tables or graphs. Data is only a partial representation of reality, as it is impossible to fully capture the detailed complexity of the real world. For instance, a map may show an area as being 'deciduous woodland', but it cannot show the different characteristics of each individual tree. Data are therefore a simplification or approximation of reality.

Modelling. A model is a simulation, or artificial version, of something that occurs in reality. In digital terms, this involves calculations that describe real structures and processes, leading to the creation of new information. Modelling simply refers to the creation of such a model, and then using it to create insights into the real world it represents. Modelling uses the data and conceptual underpinning discussed above, and can be used to create new maps, charts, or tables. An example is trying to decide where planting trees will be most effective at reducing flooding in Nampont: this model takes in data on rainfall, habitats, farming, soil, and slopes, and runs through lots of calculations to produce maps showing where planting trees will work best.

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H2O: Source2Sea
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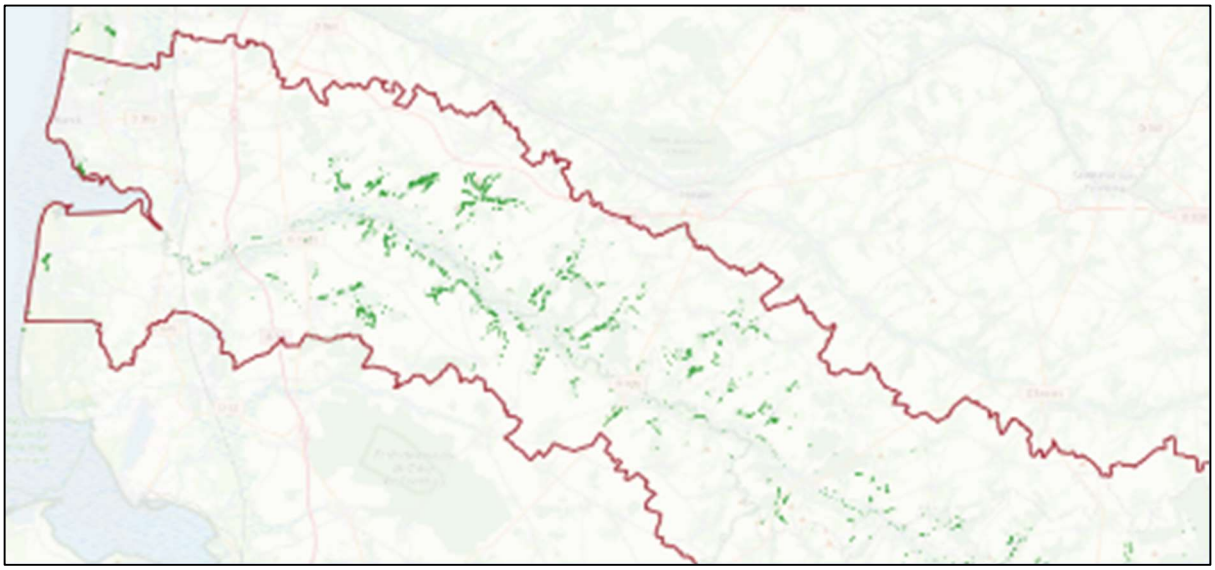
Interface. The way people interact with digital tools is through an interface. This can be as simple as a report to read or a map to look at, but can also be an interactive webpage or specialist software package.



Example model output showing the most effective places to plant woodland to reduce flooding in the Authie catchment, as calculated by the HydroloGIS model.

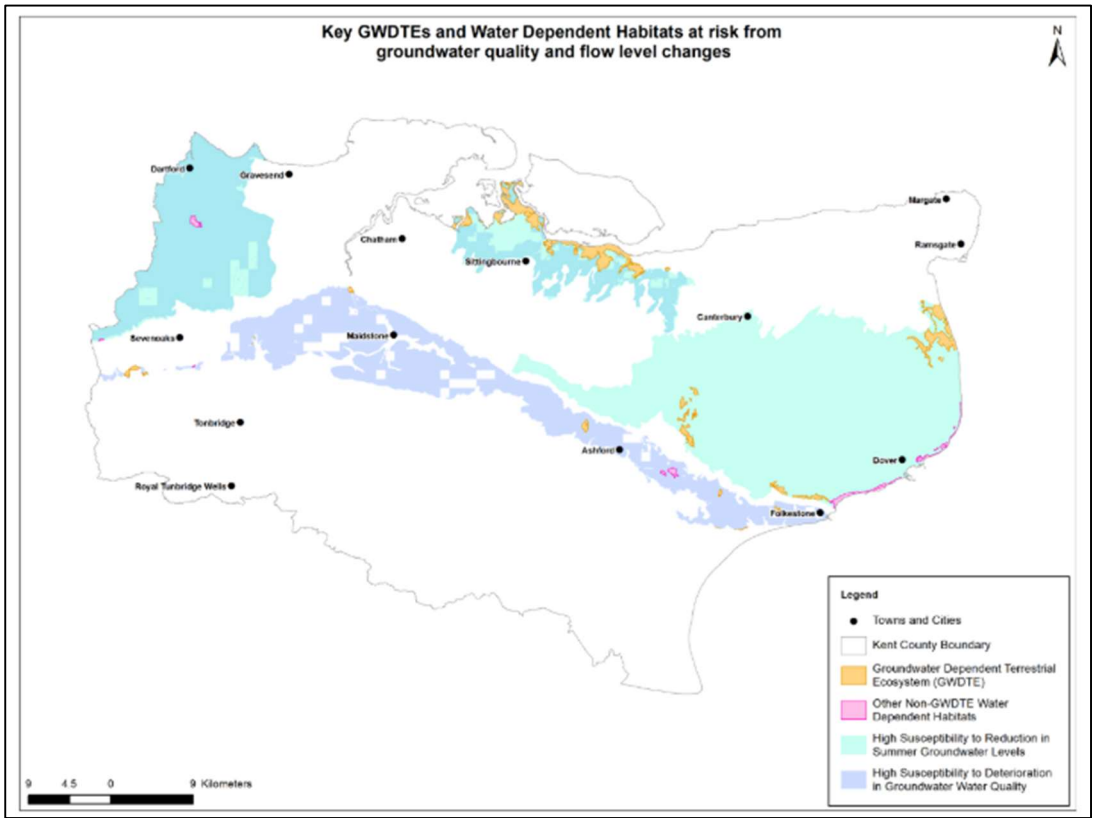
Spatial Risk Assessment (from Kent County Council)

This risk assessment looked at the potential for future problems with the water system across Kent, such as flooding or drought. The risk assessment identified where climate change, population growth and future land uses would have the greatest impact on both water quality and quantity. It also suggested where working with nature could have the greatest potential to reduce the identified problems.

The risk assessment report was based on a wide range of information and data, such as maps, population studies and climate projections. These were modelled through various equations to give an idea of how likely water problems will be in different parts of Kent, as well as how well these can be solved by working with nature. It is a theoretical understanding of what is more or less likely to happen in the future.

The report was aimed at helping government organisations set policy and allocate resources to places or communities that will need it most. It was not intended to help people design practical solutions in specific locations. The report contains many tables and maps to aid the descriptions.

The Spatial Risk Assessment can be downloaded from Kent SRA Report Vol1[1].

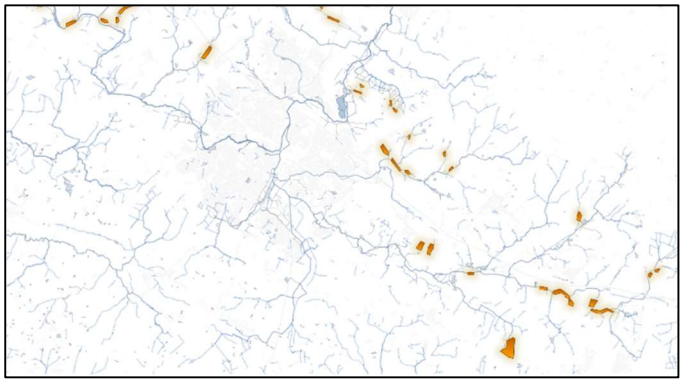


Map from the Spatial Risk Assessment, showing water dependent habitats at risk of groundwater changes. Source: Kent Spatial Risk Assessment for Water 2021 update, for Kent County Council by Aecom.

[1] https://www.kent.gov.uk/__data/assets/pdf_file/0010/138736/Kent-SRA-for-water-Report-vol-1.pdf

Nature-based Mapping Tool

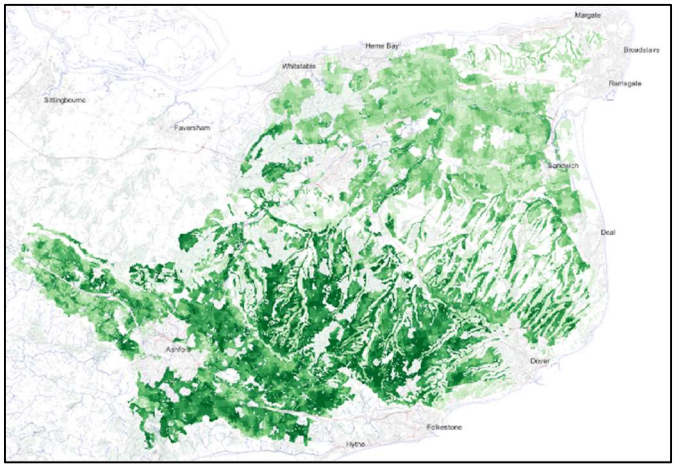
The HydroloGIS[2] system was used to model the Stour and Authie catchments for nature-based answers to water problems. The system identifies the most effective, natural changes to make across the landscape to reduce local flooding, river pollution and erosion (silt washing into streams). It then ranks all the alternative options for how much impact they will have on these problems.



Most effective locations for leaky debris dams in small streams, Stour catchment.

The system initially suggested broad interventions including tree planting, wetland creation or construction of water retention features, and reversion to natural grassland. These were then further analysed to show more detailed options, such as leaky debris dams in streams, bunds to reduce flows across pasture fields, improved agricultural management or marshland restoration.

The outputs also included heat maps ranking the options from the very best down to those that will have no benefit at all. These maps were used to target some of the pilot studies, inform the Natural Capital Valuation Tool and help landowners or communities decide which changes they want to make around their areas.



Heat map of opportunities for reducing phosphorus pollution by planting trees. Darker green shows woodland will reduce pollution more than paler greens

[2] See HydroloGIS - Ecosystems Knowledge Network

Interreg France (Channel Manche) England
H2O: Source2Sea
European Regional Development Fund

Water Trading Scheme

One aspiration of the H2O:Source2Sea project was to help farmers become more resilient to drought in the face of climate change. One way to do this is to help farmers share water resources, so that those with excess water can sell it to those without enough. The driver behind this is that different crops have different irrigation needs depending on their stage of growth, so farmers require varying amounts of water throughout the year.

This results in some farmers reaching their water abstraction limit but requiring more water, whilst others do not need as much as their abstraction licenses allow. This creates a demand imbalance between neighbouring farmers. A solution to this was tried through the Water Trading Scheme (WTA) in the Stour catchment.

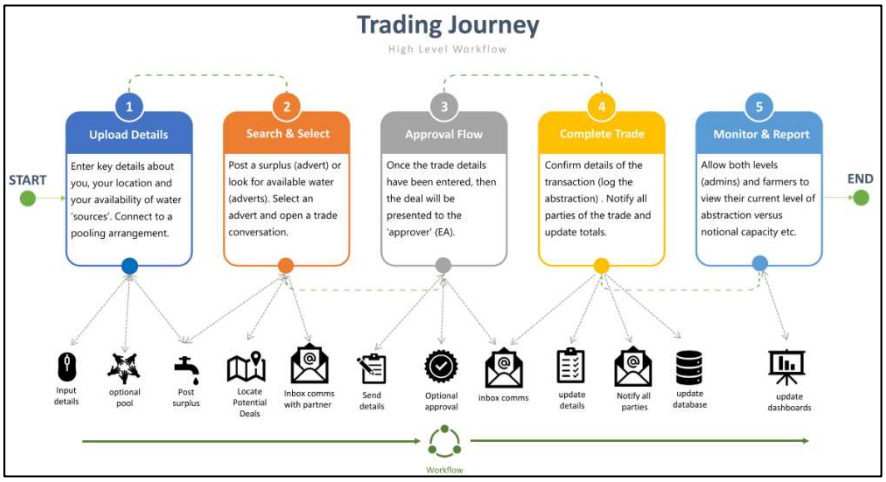
A website was created where farmers could advertise any excess or shortfall of water. The website offered users several benefits, such as:

Management of licences: a simple way to log and manage licences, particularly for those farms with multiple licences, using both mapping and metadata provided by WTA to classify them.

Finding potential trading partners: Using the licences within the database via the mapping interface to find and contact potential trading partners and open a dialogue.

Mapping of water usage and associated analyses: By logging abstractions and allowing farmers to load historical water usage, WTA allows for the study of water usage over time and a simple way to log returns.

The web platform became functional but never attracted an active user base. The Covid-19 pandemic did not allow engagement with farmers in person; a very wet summer in 2021 reduced demand for water sharing (water was so abundant); and Brexit reduced demand for the region's salad crops, in turn reducing the need for irrigation water. The tool may be reactivated in future.



Conceptual structure of the Water Trading Tool

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H2O: Source2Sea
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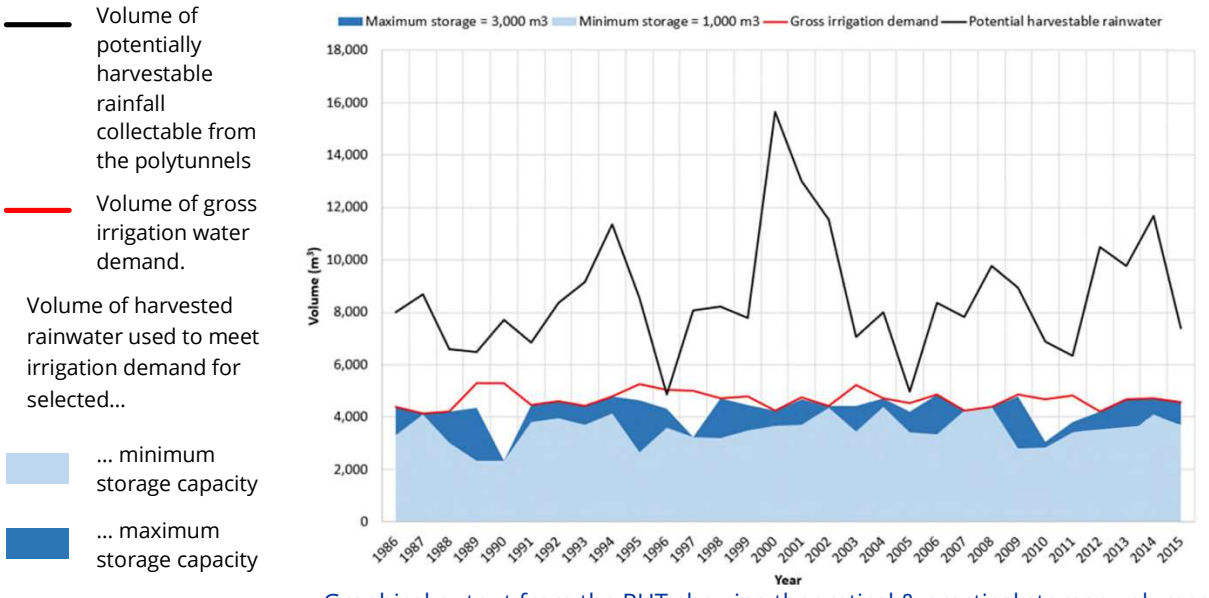
Rainwater Harvesting Tool

The Rainwater Harvesting (RWH) tool was created for soft fruits grown in greenhouses or polytunnels. The RWH tool aims to improve irrigation of the covered crops, whilst reducing runoff from the structures leading to localised flooding and soil erosion. In some catchments, the runoff also deposits high silt and nutrient loads into local watercourses.

The RWH tool is an Excel spreadsheet that can assist horticultural businesses improve their decision-making regarding how best to incorporate RWH into their water management practices. The tool supports them in calculating the most effective RWH system for their circumstances, taking into account local climate as well as farm information on cropped areas, crop types, polytunnel area and available water storage. The RWH tool can be used to:

- assist farmers with existing RWH installations to evaluate the relative performance of their systems and to identify measures to improve rainwater self-sufficiency;
- enable farmers without RWH systems to evaluate potential irrigation water resource benefits, including design & management options, and mains water cost savings; and
- assist others involved in the design of RWH systems for new polytunnel developments to make informed decisions regarding trade-offs between RWH performance and water storage capacity to recommend systems best suited to local circumstances.

The tool allows the user to input aspects of their farm to calculate how effective rainwater harvesting will be and estimates the associated cost of buying mains water to fill any shortfalls.



Graphical output from the RHT showing theoretical & practical storage volumes

The tool can be downloaded from [Cranfield University's Rainwater Harvesting tool website](cord.cranfield.ac.uk/articles/software/)[3].

[3] cord.cranfield.ac.uk/articles/software/

Natural Capital Valuation Tool

The H2O:Source2Sea project is demonstrating the value of using a range of nature-based solutions - such as wetland creation, hedgerow planting and tree planting – to solve water problems. These natural features can each provide a host of benefits at the same time, from reduced flooding through greater biodiversity to more attractive landscapes.

A 'natural capital approach' was used to understand and put a financial value on these benefits. The approach treats the environment as an asset that provides a flow of benefits that can be measured. The flow of benefits was modelled using a variety of data and tools, then financial values assigned to these using figures from research and experience.

The online tool presents a range of benefits and financial values from implementing different nature-based solutions at a landscape scale across the Kent and Pas-de-Calais regions. It is not currently possible to measure or value all benefits associated with the nature-based solutions, so the tool focuses on land use changes. Benefits from other nature-based solutions are not estimated within the tool.

Example outputs for the Lower Stour catchment

The catchments in the Kent and Pas-de-Calais regions have been modelled to identify potential sites where creation of semi-natural habitats could have the most impact (positive or negative) on flooding, drought, water pollution, air quality, health, recreation, timber and agriculture.

The natural capital valuation tool can be found at https://h2o.kentwildlifetrust.org.uk/.

Introduction to Citizen Science

Citizen science is defined as *'the collection and analysis of data relating to the natural world by members of the general public, typically as part of a collaborative project with professional scientists'.* H2O:Source2Sea used volunteering to engage the general public with the project and gather data over as much distance and duration as possible.

Citizen science can be powerful at mobilising a large workforce, but comes with its own challenges. There are instances when using volunteers can be more expensive than using only professionals, since they will need supervision, training, and ongoing mentoring. Insurance can also be problematic and expensive, depending on the campaign.

Citizen science projects need to be carefully planned. Difficult techniques need to be avoided and activities should be enjoyable for volunteers, so they want to stay involved throughout the project. Consistency is important whenever and wherever data is gathered: sampling and monitoring protocols must be consistent or datasets can become confusing or, at worst, meaningless. It is vital for volunteers to know what they should do *and* how they should do it. This involves not only training on the right actions but also careful design of project materials, so it is intuitive for volunteers to record observations in a useful way, using correct terms.

The H2O:Source2Sea project used citizen science for four main initiatives: Riversearch, Shoresearch, PlanktoScope and Nausicaá's community engagement programme. These are described individually below.

RiverSearch

The Kent Wildlife Trust worked with the local community, landowners and businesses to restore ecosystem function in the River Stour catchment and reduce some of the impacts of climate change on communities and wildlife.

Volunteers were asked to monitor and collect information about river health by collecting data on water quality, habitat conditions and pollution sources. They selected a monitoring point, or 500m stretch of waterway, which they monitored throughout the project. The three aspects of health that were monitored were:

Water Quality. Volunteers were provided with water quality testing kits that used colour-change reagents to record nitrates, phosphates and turbidity on a monthly basis.

Habitat Condition. Once a year volunteers assessed the quality of habitats around their monitoring location. This was done using standardised methods and reporting.

Pollution. Volunteers recorded any pollution they noticed in the river on an ad hoc basis.

No prior knowledge of river ecology was necessary to become a RiverSearch'er as all training was provided. The volunteering programme included river cleaning events, habitat survey training, beaver survey training, pollution events training, canoe paddles and other social events. An app and WhatsApp group were created to make it simple for volunteers to ask questions, share knowledge and record data in the field.

The RiverSearch programme has continued after the close of H2O:Source2Sea. It currently involves 53 volunteers monitoring 50 locations. More about RiverSearch can be found at RiverSearch (Kent Wildlife Trust)[4].

RiverSearch volunteer equipment

[4] www.kentwildlifetrust.org.uk/get-involved/our-projects/riversearch

ShoreSearch

ShoreSearch is the UK Wildlife Trusts' national citizen science survey of the intertidal shore, where the sea meets the land. This was incorporated into H2O:Source2Sea for Kent. Volunteers were trained to identify and record the wildlife on the seashore, with the data collected forming part of a national archive. This will help experts monitor our sea life and better understand the effects of pollution, climate change and invasive alien species.

The survey techniques used nationally in ShoreSearch included:

Quadrat Biodiversity Survey. The Quadrat Biodiversity Survey is for shores of hard substrate (rocky, pebbles/shingle, bedrock) and involves collecting species abundance and habitat data at random points, in a selected area of the intertidal zone, using a quadrat.

Box Corer Biodiversity Survey. The Box Corer Biodiversity Survey is for intertidal sediment shores (sand, mud and silt) and involves collecting species abundance and habitat data at random points, in a selected area of the intertidal zone, using a corer.

Timed Species Search. During this survey a select list of species are searched for across an area of shore within a fixed time period to assist with the monitoring of their distribution around Kent.

Walkover Survey. The Walkover Survey is for shores of hard substrate (rocky, pebbles/shingle and bedrock) and involves collecting qualitative information on species found within a selected area of the intertidal zone.

The ShoreSearch programme is ongoing, but during the H2O:Source2Sea project it undertook 9 surveys: 8 walkover surveys and 1 biotope survey. 31 volunteers identified 157 different species and logged 440 records.

More can be found out about Shoresearch at ShoreSearch (Wildlife Trusts)[5].

Shoresearch survey in progress at Hackemdown Point

[5] https://www.wildlifetrusts.org/get-involved/other-ways-get-involved/shoresearch

PlanktoScope

The last piece of citizen science that started in H2O:Source2sea involved PlanktoScope. This is a microscope, mini-computer, and mini camera all in one. A range of Wildlife Trust's around the country were sent a PlanktoScope to add to the National Oceanography Centre (NOC) database on EcoTaxa. Kent Wildlife Trust bought a second PlanktoScope under H2O:Source2Sea, so that staff and volunteers could analyse estuarine and freshwater plankton in the Stour and use them as an indicator of water quality.

No samples were analysed during the H2O:Source2Sea project, but a literature review was undertaken on plankton indicator species and a possible methodology for citizen science was created around the PlanktoScopes. A volunteer day allowed the public to try the PlanktoScopes and learn how they work, so they are ready to start taking and analysing water samples.

More information on PlanktoScopes can be found at www.planktoscope.org.

Nausicaá's community engagement programme

Nausicaá carried out a variety of engagement programmes during the H2O:Source2Sea project. These were largely based at their aquarium in Boulogne-sur-mer, but they also undertook outreach work and engaged local communities to improve water quality and protect wildlife in the Hauts-de-France region.

The engagement programme included:

Exhibitions. The project findings were included in exhibitions for school children, families, tourists and other visitors of Nausicaá aquarium: 'In the Eye of the Climate', 'Ocean' and the exhibition about natural marine parcs.

In the immersive exhibition In the Eye of the Climate, the video about the H2O:Source2Sea project has been screened at the entrance. It has shown the impact of climate change and the role of wetlands. Subjected to floods, fires and storms, the exhibition visitors have been made aware of the urgency of climate action and of the solutions that can be implemented to mitigate global warming and limit its impact. The exhibition is still on show.

Quizzes. Visitors could take part in two quizzes in the Nausicaá hallway. These were called 'Blue Society Forum: H2O:Source2Sea' about water quality management and consumption; and 'Ocean 2150, what if all went fine?' about Nature-based solutions. 49,500 visitors took part in these quizzes, the latter of which is still on show.

Educational games. The escape game 'Sandra Bessudo's Secret Service' is about the systemic approach to water quality issues, eutrophication of waters, habitat degradation, loss of biodiversity, land and sea relations and Nature-based solutions. This game is intended for secondary school pupils and located in the Journey to the High Seas main exhibition area in Nausicaá. 220 pupils had played this game by January 2023.

The 'Mission Clean Water' serious game is an educational board game for families, children over 13 years old, teenagers and adults. The game aims at helping the players understand the role and benefits of Nature-based Solutions in climate change mitigation and resilience in a fun way. It motivates players to act for water quality and climate. The game will be distributed to project partners and their collaborators and downloadable for free.

Nausicaá will continue to propose both games to the schools after the H2O:Source2Sea project is over.

Info-days. During the International Aquarium Congress held in Nausicaa in November 2022, Nausicaá organised info days to promote the H2O:Source2Sea project. Two sister booths presenting the project were set up on the spot and online for 4 days during the event, an oral presentation was made during the conference plenary session and a virtual platform was opened allowing all participants (online and onsite) to follow the congress and learn about the project, its activities and findings. 250 people attended in person and 170 more online.

Communication campaigns. For the launch of the RiverSearch (Mission Rivière) citizen science project, Nausicaá developed a video and held a short communication campaign on social media to attract volunteers.
On the occasion of the 27th Conference of the Parties (COP27) of the United Nations Framework Convention on Climate Change from 6 to 20 November 2022, Nausicaá launched an awareness raising campaign on social media. The campaign was about water management, climate change and Nature-based solutions. Four videos presenting the Nature-based solutions implemented during the project were published on social media for this occasion.

Researching Coastal Nature-based Solutions

The Kent Wildlife Trust commissioned Exo Environmental Ltd, the University of Essex and Kent Wildlife Trust Services Ltd to undertake a broad spectrum of survey work at Sandwich and Pegwell Bay. This was completed during the Autumn and Winter of 2022. The process involved remote sensing and ground truthing (site surveying), which improved knowledge of local conditions affecting opportunities and barriers for Nature-based Solutions.

Preparing the equipment for a sub-tidal grab sample

The results highlighted opportunities and barriers to restoring or creating saltmarsh, seagrass and native oyster beds at Sandwich and Pegwell Bay. The bay is internationally important for birds: it is a designated Ramsar site, SSSI, SAC and SPA.

There was no evidence of extant or historical seagrass beds, nor evidence of historical nearshore native oyster habitats. This was expected for the site given its high energy status. Conversely, other shellfish habitats are extensive on the site, with cockle and clam habitats being important but unlikely to deliver any coastal flooding or surge protection.

The main beach front to the north of the site shows signs of historical erosion but is now in recovery, driven partly by cordgrass encroachment. Increasing the accumulation of cockleshells and sediment would facilitate further cordgrass growth and enhancement of the saltmarsh ridge. This would support a coastal flood or surge barrier, as would increasing the height of the mudflats.

Ground truthing on Sandwich beach

The more established saltmarsh mosaic along the estuary channel banks to the south of the site needs no intervention for coastal flood protection, but has potential to increase sediment holding capacity.

An area further to the south offers the only new opportunity to support additional coastal flood protection, where seawall realignment would divert storm surges to farmlands and recreational (golf) grounds. Whether such an intervention would deliver the desired outcomes would require hydrodynamic modelling.

Some Nature-based Projects in H2O

There has been a substantial amount of practical action carried out under the H2O:Source2Sea project. This has been varied and widely distributed, but some notable examples are described below.

Hedgerow planting by CPIE

CPIE promoted the planting of new hedges to enhance biodiversity as well as improve hydraulic characteristics of the landscape. The benefits to farmers included protection of their crops from storms, natural pest management, and reduced soil loss, which proved a sufficient incentive to engage an increasing number of farmers.

A newly planted hedgerow

Anti-erosion hedges are more effective when coupled with other features, such as flow barriers and grassy strips. It is essential to choose the exact location carefully so that it promotes the infiltration of water, but does not create a preferential path for runoff, which can lead to the appearance of new gullies.

A total of 842m of anti-erosion hedges were planted perpendicular to the direction of water flow. The seedlings were 30 to 40cm high and planted every 1m, between October and March. They were planted on geotextiles to limit weed growth, and encased in game sleeves to prevent damage.

Overland flow barriers by CPIE

A barrier was constructed along a boundary between neighbouring farms, at right angles to the flow path where erosion was most severe. It was 18m long and constructed of willow brash bundles (2 to 3m long and about 30cm in diameter) held between two lines of 1.5m tall willow stakes. The bottom of the barriers were placed in a shallow trench, so that there would be no gap between the barrier and the ground surface.

Newly created overland flow barrier (fascine)

The barriers are effective at slowing flows and so reducing erosion in fields below, as well as depositing any silt washed from the fields above. The willow sticks will take root and grow, thickening the barrier and improving percolation into the ground via their root system.

These types of barrier are particularly effective in retaining sediment, especially when created as part of a network of hedges and barriers that complement each other.

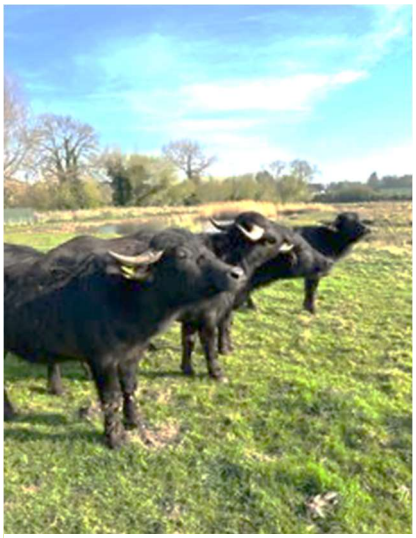
Buffaloes and beavers by Kent Wildlife Trust

The beaver's ability to change the local landscape - damming water and creating ponds, lakes and braided streams - means they can protect us from drought and flooding. By holding water back, they prevent flooding at bottle necks (which are often where we have villages or towns) and by releasing water slowly, they can reduce the impacts of drought by keeping water flowing through the landscape for longer.

Beaver holding sticks

Beavers have been present at Ham fen nature reserve since 2001, proving the UK's longest running beaver reintroduction site. The H2O:Source2Sea project has been working to build on the re-wetted fens in the beaver enclosure, by extending wet features beyond the beaver area into a new extension of the reserve called Mercers farm.

The project has expanded the exploration of beavers as creatures of Nature based solutions, by getting citizen scientists involved in monitoring populations outside of the nature reserve along the river stour. Training was given and an app created to allow the public to identify and record beaver sign, creating a live webmap with real time information showing where beavers were present and how active they were in these areas



Buffalo at Ham Fen

The H2O:Source2Sea project has supported additional infrastructure to allow water buffalo to be introduced to the site. Buffalo can play a unique role to complement the beaver, by entering the water to browse on vegetation and prevent channels from closing over. The buffalo are grazing the site alongside domestic cattle which also play a vital role in managing vegetation cover in around the edges of the fens. The aim is for these animals to create a mosaic of habitat rather than a gradual encroachment of closed canopy woodland.

Peat bog restoration by Kent Wildlife Trust

Two area of lowland fen were restored at Hothfield and Ham Fen. The Hothfield works entailed removal of secondary woodland, which had developed over the bog, with stumps extracted using a long reach excavator. This created areas of open water within a marshy setting. The water table was raised by blocking the cleared drainage network with brash and woody debris, which will help maintain the fenland character of the site.

Restoring the fen at Hothfield

The work at Ham Fen involved removing approximately 50% of the reed and bulrush in the main pod, thereby creating more open water. The vegetation was excavated to just below the main roots to avoid regrowth.

Ditches were also cleared across the fen in general. Vegetation and silt were removed along 20-30m sections of the internal drainage network, creating areas of open water that are separated by approximately 50 metres.

Pond restoration at Ham Fen

These measures will help restore the fen to a functioning bog habitat and increase its biodiversity.

Pond creation by Kent Wildlife Trust

Twenty two ponds were created by Kent Wildlife Trust during the project, including the two featured ponds: one in parkland at Barnham Court, Barham, and one on the River Stour floodplain of Premier Foods, Ashford. The ponds were created on land that is likely to have a comparatively low water table, so both will be rain fed. The Barham pond is located close to a major overland flow path, so will fill sporadically from runoff.

Preparation activities for both ponds included ecological surveys of the proposed areas to ensure no adverse impact; trial pits to confirm appropriate soil types; and acquisition of all permits.

The ponds were excavated to 1m depth with irregular, shallow slopes to provide the best possible habitat diversity. The excavation spoil was spread on-site, away from ecologically sensitive areas, and was sown with a native meadow mix to encourage rapid vegetation cover and increase diversity of grassland species.

The Barham pond is approximately 16m x 7m in size and was located on permeable soils, so had to be sealed to retain water. This was accomplished by pigs being kept on that area for several months. The pond margins were allowed to vegetate naturally once the pigs were removed and the pond had been filled.

The Premier Foods pond is 10m x 30m in extent and was able to fill naturally. The pond margins were plug-planted with native species such as purple loosestrife and water mint. The pond will provide a recreational service to employees of Premier Foods, so three small native trees were planted around a seating area by the pond to provide shade and additional habitat.

The new pond at Barham Court

Completed works at Premier Foods

Useful Links

Kent Wildlife Trust webpage on H2O
https://www.kentwildlifetrust.org.uk/get-involved/our-projects/h2osource2sea

Nausicaá webpage on H2O
https://www.nausicaa.co.uk/article/h2o-source2sea-project/

Natural Capital Valuation Tool
https://h2o.kentwildlifetrust.org.uk/

Kent County council (KCC) webpage on H2O
https://www.kent.gov.uk/environment-waste-and-planning/climate-change/kents-changing-climate
Scroll down for:
Kent Spatial RA (downloadable links)
Rainwater Harvesting Tool (downloadable tool)

Kent Landscape Information System Default (kent.gov.uk)

Citizen Science
https://www.kentwildlifetrust.org.uk/get-involved/our-projects/riversearch

Social media :
Twitter: https://twitter.com/H2OSource2sea/
Facebook: https://www.facebook.com/H2OSource2Sea
Instagram: https://www.instagram.com/h2osource2sea/
Linkedin: https://www.linkedin.com/company/h2o-source2sea-project/

Videos :
Presentation Video : https://www.youtube.com/watch?v=DBv2MJOPur4&t=7s (Fr)
RiverSearch Citizen Science : https://youtu.be/azEpxUlPVm4 (Fr)
Wetland restoration video https://youtu.be/5_ZpaxoJTMM (UK) and https://youtu.be/YG9FyGERNTk (Fr)
Water buffaloes and beavers https://youtu.be/B5fiOcvUXwk (UK) and https://youtu.be/CcDJxqV7p6w (Fr)
Water sharing and rainwater https://youtu.be/aaYoYHB2TPI (uk) and https://youtu.be/7B-NxoCJp4c (Fr)
Hedges and fascines https://youtu.be/FQo3xZTd1g0 (UK) and https://youtu.be/IEG1B7NtaZg (Fr)