CASE STUDIES IN NET ZERO

archaeology and heritage in flood and coastal erosion management projects

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By its nature, the profession of archaeology and heritage has an intrinsic carbon footprint and implied negative impact on the environment. This stems from, but is not exclusive to, archaeological fieldwork with the production of paper documentation, transport, mobilisation of field units, disturbance of buried soils, digital storage, and operation of plant, welfare, or other equipment. Working towards undertaking archaeology in a sustainable manner is one of the key challenges in the profession. While fellow environmental professionals develop their own strategies to reach environmental targets driven by UK legislation, there are currently no legal requirements specific to the delivery of archaeology and heritage. However, CIfA includes in its policies that members and Registered Organisations adopt and implement environmental protection policies of their own.

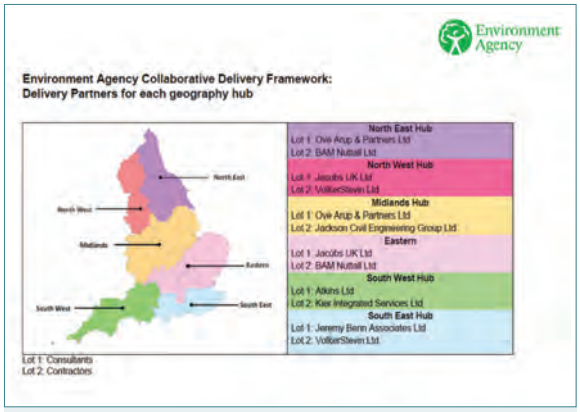
Additionally, there are an increasing number of clients that require a consideration or demonstration of carbon emission reduction and calculation in the development of their projects. The Environment Agency (EA) is one such organisation. They have committed to reaching net zero by 2045 to 2050, reducing their total carbon emissions, including those of their supply chain. Construction accounts for half of their overall carbon emissions, about 148,000 tonnes annually.

Steps to develop a carbon neutral plan within your organisation. Credit: Historic England

Archaeology and heritage accounts for a relatively small part of the carbon cost of construction projects; nevertheless, there are opportunities to reduce our carbon impact.

This article presents two case studies from work undertaken by AtkinsRéalis, the EA, and Kier under the Collaborative Delivery Framework (CDF) where positive contributions were made to carbon efficiencies or reduction from on-site archaeological fieldwork. It was written in collaboration with Greg Chuter, Senior Archaeologist and Historic Environment Adviser, and Jennie Pollard, Carbon Lead for the National Environmental Assessment Service (NEAS) as part of the EA.

The South West has several key landscapes and towns at significant risk of flooding and numerous national and internationally significant archaeological landscapes and sites within these areas. As such, archaeology and heritage are key considerations for CDF projects and in turn influence their 'carbon budget'.



Environment Agency CDF Delivery Partners. Credit: New Civil Engineer 2023

The Collaborative Delivery Framework

The CDF is an EA approach developed in 2019 to deliver the majority of the EA's Flood and Coastal Erosion Risk Management (FCERM) programme across England. To achieve this, key delivery partners are established within each geographical region. AtkinsRéalis, the EA and Kier are delivery partners for the South West

The EA published their Minimum Technical Requirements (MTRs) for overall project delivery in

2023, which has aided carbon reduction or offsetting by allowing for preliminary archaeological screenings, multidisciplinary collaboration and early engagement in optioneering and the design process – meaning, where possible, archaeological risks and impacts can be designed out. Or, alternatively, time is provided to design proportionate mitigation, with innovation and investment in paperless practices by archaeological subcontractors encouraged.

Case study
Bridgwater Tidal Barrier, Somerset

Bridgwater Tidal Barrier is a significant infrastructure scheme aiming to provide hard flood defences on the River Parrett. It will help protect 11,300 homes and 1,500 businesses and has a life expectancy of 100 years (Somerset Council 2024). The scheme includes extensive enabling works and on-site borrow pits.

Model of proposed Bridgwater Tidal Barrier. Credit: Defra 2022

During the development of this scheme, we undertook early engagement with design to produce an informed risk map, followed by geophysical survey, a reduced but targeted archaeological field evaluation as necessitated by design or construction, and geoarchaeological assessment. From these we were able to identify key areas of archaeological risk, including an extensive Iron Age to Romano-British settlement, a post-medieval brick and tile factory, and a deserted medieval village with associated flood defences within the borrow pits. In collaboration with the design and environment teams we were able to reduce the required size of the borrow pits for development without additional material import and subsequent carbon usage, removing most areas of identified archaeology from intrusive impact and creating habitats or reducing construction impact instead. This resulted in the reduction of overall ground disturbance by at least ten hectares and subsequently of on-site or post-excavation consumables and plant or vehicular use. For the post-medieval brick and tile factory, further mitigation was avoided through design and construction to preserve the remains and prioritise protecting encapsulated carbon.

Roman pot recovered from a trench targeting the Iron Age to Romano-British settlement within one of the proposed borrow pits at Bridgwater Tidal Barrier. Credit: AtkinsRéalis

More practically, the use of digital context registers and trench progression supplied by the archaeological subcontractor was encouraged in specifications, and utilised, as well as biofuels, the sharing of GIS datasets, sample strategies refined on site to save unnecessary storage and transportation, and local agencies for radiocarbon dating. Subsequently, this fed into remote sign-off with the addition of a dedicated collaborative messaging system to reduce site visits, digital risk tracking to aid multiple disciplines, day-by-day design review, and calculating bulk soil removal from trench dimensions for carbon calculators. Solar welfare vans were also utilised.

Brick kiln excavated within the location of enabling works at Bridgwater Tidal Barrier. Credit: Oxford Archaeology

Case study
Bude Crescent Flood Defence and River Restoration Project, Cornwall

This project was developed to improve, restore and future-proof existing flood alleviation scheme assets across Bude after the town had been affected by extreme flooding events. The scheme included the restoration of flood embankments and the installation of a sheet pile flood wall to better protect 47 properties and improve ecological potential. Works fell within the Bude Conservation Area (CA) and were close to

heritage assets such as the Grade II listed Nanny Moore's Bridge (NHLE 1141818).

While most of the works were assessed to be of low risk to archaeology and heritage, the design of the sheet pile wall adjacent to Nanny Moore's Bridge had the potential to impact the asset, the CA, and other surrounding assets. Nanny Moore's Bridge is a stone structure of probable 17th- or 18th-century date providing access across the River Neet and probably represents a replacement of an earlier 16th-century structure contemporary with the mill and quay.

During the development of the project, consultation was undertaken with the local planning authority regarding the finish of the sheet pile wall. The use of mudstone cladding would have been most appropriate to reflect the style and colour of the stonework in the vicinity and be in keeping with the surrounding area. However, utilising this across the entirety of the new wall would have resulted in a large carbon footprint. It was therefore agreed that a Reckli La Reunion formliner would be used, except for an area approximately 15m in length adjacent to Nanny Moore's Bridge whereby mudstone cladding would be used.

Reckli La Reunion is a stone-effect concrete cladding and coping that could be manufactured to be in keeping with the character of the Conservation Area, sympathetically mimicking surrounding flood walls while not being confused with the historic development of the walls along the watercourse. Reckli products have a globally certified sustainable supply chain, with 90 per cent renewable resources used instead of fossil fuels, and with manufactured materials being able to be reused up to 100 times.

The use of Reckli allowed for a designed façade appropriate for the surrounding area and assets whilse promoting innovative and environmentally conscious materials.

Conclusion

These case studies illustrate two ways we have worked to reduce the carbon footprint when delivering archaeological work. The success of both can largely be attributed to our working relationship with the design team and the requirements the EA has put in place to achieve their targets.

A key challenge of delivering this work is the balance that must be achieved between appropriate mitigation, cost and a requirement for carbon reduction. The adoption of a cost- and carbon-conscious delivery within archaeology and heritage can be valuable for such projects. Consultants are in a position to champion this approach and with early design

Nanny Moore's Bridge. Credit: Atkins

Reckli-La Reunion Wall in Bude (foreground), with Nanny Moore's Bridge and other flood walls (background). Credit: Kier

Collaborative working between AtkinsRéalis, the EA, and Kier at Bude. Credit: Environment Agency

engagement, collaboration and consultation we are also in a position to create further efficiencies in data sharing and refined but beneficial fieldwork results across disciplines. Ultimately this advocates for archaeology and heritage being valuable additions to a project rather than a constraint to be mitigated.

While we have outlined how projects can be successful for reducing our carbon footprint it must be acknowledged that this practice is still being developed and systems require adjustment to continue to be successful. Obvious carbon wins such as using electric plant on site have not always succeeded as they have required charging on a daily basis and the options for doing so in a rural location are limited. Equally we have had times when communication has broken down, or there have been misunderstandings or data loss, in part due to the reliance on digital methods of communication and storage. These approaches are still part of ensuring sustainability in archaeology and heritage; however, we need to undertake them more thoughtfully. We should continue to look outside of archaeology and heritage to find examples of these approaches succeeding and bring them into our working practices.

Our experience demonstrates that there are many ways to reduce our carbon footprint in delivering fieldwork within the industry. However, they rely on the willingness of the profession to support innovation and, for consultants, to engage early and across every level of the design process.

Sara-Jayne Boughton

Sara-Jayne is a Senior Archaeological Consultant at AtkinsRéalis and is the Lead Archaeologist for Bridgwater Tidal Barrier and Bude Crescent, as well as leading several other CDF projects. Sara-Jayne has a background in archaeological fieldwork, previously working as a Fieldwork Project Officer before joining AtkinsRéalis. She has an interest in prehistoric archaeology, fieldwork management, community archaeology, and the archaeology of the South West.

Jasmin Folland

Jasmin is an Archaeological Consultant and works as part of the CDF team within AtkinsRéalis. Jas works on the archaeology and heritage for the proposed fish and eel passes for Bridgwater Tidal Barrier and leads or supports on a number of other CDF projects.

Jas worked as an archaeological geophysicist before joining AtkinsRéalis. She also has an interest in environmental archaeology and marine archaeology.

Further reading

Department for Environment, Food & Rural Affairs (Defra) (2022) *Press release: 13,000 homes to be protected from floods thanks to new tidal barrier.*

Environment Agency (2021) *The Environment Agency: Reaching Net Zero by 2030*

Environment Agency *Minimum Technical Requirements – Environment and Sustainability*. EA Document ref: LIT 65150

Environment Agency (2024) *Environment Agency: Reaching net zero update (January 2024)*

New Civil Engineer (2023) *Environment Agency renews framework for delivery of £5.2bn flood and coastal erosion risk management infrastructure*

Somerset Council (2024) *Bridgwater Tidal Barrier*. Available at: Bridgwater Tidal Barrier (somerset.gov.uk)