

Warwickshire County Council Natural Environment Investment Readiness Fund Project

Warwickshire Carbon and Environmental Markets

Final Report

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1 Executive summary

This project was supported by the Natural Environment Investment Readiness Fund (NEIRF) to enable Warwickshire County Council (WCC) to investigate opportunities to develop long-term, sustainable funding mechanisms for its environmental ambitions within the mandatory system of Warwickshire's Local Authority consenting regimes. Although the project was carried out for WCC and the NEIRF, this report has also been written to inform any individuals or organisations that are interested in the application and implementation of a natural capital investment approach and the development of ecosystem services (ES) markets. The findings and recommendations of this report will be applicable throughout the UK and are especially relevant to other local authorities or organisations investigating developing similar mandatory systems or markets.

The overall aims of this project were to produce recommendations for the development of a natural capital investment strategy and the establishment of a carbon market and at least one other ES market within Warwickshire. In addition to detailed desk research and interviews, the team worked closely with WCC teams, other consultants, many current researchers and projects (including ongoing NEIRF projects), and specialists in the relevant fields.

The main body of this report is divided into sections covering each main aspect of the project, with each section containing relevant findings, conclusions and recommendations.

The key findings and recommendations from this study are:

1.1 Establishing a Warwickshire carbon market

This study recommends that a **carbon offset market in Warwickshire is viable for funding the planting of 566,000 trees** (to meet WCC's climate change and biodiversity ambitions) by 2030.

This carbon market would be based upon the creation of woodland and would be reliant upon:

- The **adoption of the Warwick District Council (WDC) Net Zero Carbon DPD** within WDC and the other four local authorities in the County.
- The **prioritisation of tree planting** above other carbon offsetting measures as a result of the WDC Net Zero Carbon DPD.
- The inclusion of a requirement to **offset the embodied carbon** (the CO₂ emitted in the construction of a building) of new buildings, in addition to the operational carbon included in the WDC Net Zero Carbon DPD, in the forthcoming joint Local Plan for Warwick and Stratford-on-Avon District Councils (expected to be adopted in 2025).

Other carbon offset mechanisms that may be suitable for use in Warwickshire are currently being developed, these include the emerging **hedgerow and arable soil carbon codes**, though further work would be required to establish the viability of these.

Other carbon sources, such as the whole life carbon of new infrastructure, are unlikely to be viable in the short-term, but should be investigated further in order to feed into the preparation of new Local Plan policies.

Based on the latest consultation document for the WDC Net Zero Carbon DPD, the carbon price to be charged to developers is the value/tonne used in the Government's Green Book, which is currently **~£245 per tCO₂e**. We have calculated that the cost of creating woodland in Warwickshire, on land that is already owned by WCC, and maintaining it in good condition for 100 years would cost approximately **£221 per tCO₂e**. However, should WCC need to purchase this land, it would increase the cost to approximately **£259 per tCO₂e**. So, by combining woodland creation projects on land that is currently owned with new land purchases, **the proposed charge to developers should cover the cost of woodland creation and maintenance in Warwickshire.**

It is recommended that WCC produce a formal **Warwickshire Carbon Standard**, this should specify that any qualifying project must:

- Meet the **UK Woodland Carbon Code** specifications and regulations
Plus
- Cover the creation and maintenance of woodlands for a **period of 100 years**
Plus
- Demonstrate that it adheres to the **Warwickshire Landscape Character Guidelines**
Plus
- Be **within the County of Warwickshire.**

Because WCC will be developing a mandatory market between themselves and developers, we recommend that **WCC act as a carbon project developer and register with the UK Woodland Carbon Code and the UK Land Carbon Registry.**

In this report we recommend a process for establishing a Warwickshire carbon market in the short-term.

1.2 Establishing other ecosystem services markets in Warwickshire

Extensive research was carried out into what ES might offer opportunities for viable markets and which consenting regimes would offer policy 'hooks' to enable them to be enforced in Warwickshire. A common theme was the requirement for appropriate policies and consenting regimes, so it is recommended that:

Within Warwickshire it is important to develop robust policies which can help address the current biodiversity and climate change emergencies. We recommend that the production of an Environmental Net Gain policy (SPD, DPD or inclusion within Local Plans) should be considered by WCC or the District Councils.

Five specific ES markets were currently considered to have potential within Warwickshire and were investigated further, these are **air quality, nutrient neutrality, flood risk mitigation, trading standards and social prescribing.**

1.2.1 A Warwickshire air quality market

Nitrogen deposition is already far above the maximum critical load for many of Warwickshire's designated woodlands, so **there is a need for this market.**

We consider that this could be a **viable market** especially when combined with the current BNG market and proposed carbon market.

Although there isn't currently a UK offsetting market for nitrogen deposition caused by developments and 'operational' use, a pioneering and conservation-focused authority such as WCC would be well-placed to **develop such a market** which could then be replicated elsewhere in the country.

For the development of a Warwickshire air quality market it is recommended that:

- It should be based on **JNCC's emerging UK AERIUS model**, expected to be finalised in 2023.
- **Additional research** needs to be undertaken to establish what the appropriate mitigation measures might be and to calculate their likely costs.
- The development of an **air quality metric**, or offset fee, would need to be developed by WCC.

In this report we recommend a detailed process for developing an air quality market over the next two to three years.

1.2.2 A Warwickshire nutrient neutrality market

We spoke with many current environmental projects which are developing or investigating nutrient neutrality/balancing schemes within the UK. Our research indicated that current schemes which show signs of being successful share two main characteristics; **water treatment facilities which will not be able cope** with the planned increase in demand from development, and they have a **European protected site** (e.g. a SAC) in their catchment.

Neither of these conditions apply in Warwickshire, so we conclude that a mandatory nutrient neutrality/balancing market, related to watercourses, for new housing or industrial developments is **not currently viable within Warwickshire**.

However, we consider that a voluntary nutrient balancing market, probably linked with agriculture, could have significant potential within Warwickshire.

1.2.3 Warwickshire ES markets linked to flood risk mitigation, trading standards and social prescribing

None of these potential ES markets are currently viable in Warwickshire.

1.3 Developing a Warwickshire Natural Capital Investment Strategy

This report outlines options for a Warwickshire Natural Capital Investment Strategy (NCIS) and Plan, and recommends what they could cover and the detailed process by which they could be developed. A summary of the recommended process for developing a natural capital investment approach in Warwickshire is as follows:

1. Achieve political support and build an appropriate partnership, governance structure and identify a lead organisation(s) – working to a shared and focussed vision
2. Secure funding and resources to lead and manage the project
3. Build the required natural capital evidence base – using agreed methodologies and metrics
4. Develop a natural capital income stream and a system to manage the income generated.
5. Develop a natural capital investment strategy
6. Develop a natural capital investment plan
7. Achieve funding, income streams and investible propositions to take forward and deliver the plan and projects
8. Develop and run a pilot or demonstrator project for proof of concept
9. Develop a pipeline of ‘shovel -ready’, investible projects
10. Ongoing project management, evaluation and monitoring

We provide an overview of the range of investment tools, mechanisms or revenue streams that a Warwickshire NCIS or plan could include. A suggested template for the development of a high-level WCC (internal) NCIS is also presented.

2 Introduction

Warwickshire County Council (WCC) has pledged to work with partners to plant a tree for every resident, currently 566,000, by 2030. This will be a key contributor to the Council's commitment to addressing the global climate change emergency and will help restore landscape character areas and improve biodiversity by creating extensive new habitats for wildlife.

WCC has created a nationally acclaimed Biodiversity Net Gain (BNG) market that has generated over £4M in Warwickshire & Coventry since 2015; averaging over £650k a year. This early engagement into natural capital investment has unlocked the realisation that some markets are limited and this market alone will not support WCC's ambition to plant 566,000 trees. Neither will it secure the long-term sustainable funding of Warwickshire's natural environment and WCC's environmental ambitions.

Building on this market establishment knowledge, WCC and local authority partners, aim to establish carbon and other ecosystem services (ES) markets to enable 'Warwickshire Standard' (high standard and high integrity) carbon credits and other ES credits to be sold locally and nationally. These will be generated within the mandatory system of Warwickshire's Local Authority consenting regimes.

The Natural Environment Investment Readiness Fund (NEIRF) has been designed by the Environment Agency, in partnership with Defra and Natural England, to help deliver on commitments in the Government's 25 Year Environment Plan and Green Finance Strategy. It was developed to enable natural environment projects to attract private sector investment, to help tackle a range of environmental issues. Funding will enable organisations (for example environmental organisations, local authorities, businesses, and other public and private sector organisations) to acquire specialist advice, engage investors and build capacity to develop their project to a stage where it is investment-ready and has developed suitable revenue streams. The NEIRF supported this research, titled the Warwickshire Carbon and Environmental Markets project, which has delivered its three main objectives:

1. To produce recommendations for the development of a natural capital investment strategy
2. To produce recommendations for establishing a carbon market
3. To produce recommendations for establishing an ES market (air quality offsetting market)

This project was delivered by the services of an independent, specialist advisory consortium comprised of:

- Chris Bowden (Chris Bowden Consulting), Project Manager and Primary Deliverer.
- Helen Davies (Logika Consultants Ltd), Natural Capital Expert and Environmental Economist.
- Bruce Howard (Ecosystems Knowledge Network), Project Advisor.

- Gregory Valatin (Forest Research), Project Advisor.
- Ben Marner (Air Quality Consultants Ltd), Air Quality Expert.
- Paul Leinster, Project Supporter.
- James Russell (Forest of Marston Vale), Project Supporter.

The project commenced on 11 October 2021 and was completed on 31 March 2022.

As noted by the Financing UK Nature Recovery coalition¹, carbon and other ES markets in the UK are currently in their infancy. For this reason, little published information is currently available and many practitioners are only in the early stages of developing these approaches. During 2022 and 2023, NEIRF projects (including this one) are expected to make a significant contribution to the knowledge base and the development of revenue streams and investible propositions.

2.1 Stacking and bundling

Although it isn't a specific aspect of this project, any approach to developing ES markets and natural capital income streams must demonstrate an awareness of stacking and bundling. These terms refer to different ways of packaging multiple ecosystem goods and services.

Bundling is when a suite of ES produced on a piece of land is sold as a single package, for example a 'Warwickshire woodland credit' could include carbon sequestration, BNG, water quality and flood risk mitigation.

Stacking is when various overlapping ES produced on a given piece of land are measured and separately 'packaged' into different credit types or units of trade that together form a stack. The components of the stack can then be sold individually to different buyers and separate payments received for each set of services. So you would separately sell carbon, BNG or other ES units.

Defra are currently developing guidelines on stacking and bundling and our project team met with them to ensure that our proposed approaches were likely to adhere to their guidance.

Defra want to enable farmers and land managers to combine different funding sources for their work to deliver environmental benefits or outcomes. However, they need to guard against double funding for the same outcome and ensure that payments are made for benefits that are genuinely additional. They are developing rules, principles and guidance for stacking and bundling with this in mind. They will also ensure that any overarching principles are applicable to public grant schemes and incorporated within recognised standards for ES markets as they develop their rules on stacking and bundling. Some of these rules have already been set out (e.g. the UK Woodland Carbon Code (section 3.8.1)), whilst others are in development (e.g. the BNG rules which are currently subject to consultation).

¹ <https://financingnaturerecovery.uk/>

Defra are using feedback from Environmental Land Management scheme (ELMs) trials, NEIRF (especially through the Community of Practice) and other projects, to inform policy development and the wording of their guidance.

3 Establishing a carbon ecosystem services market

The project team carried out research on the current UK and international carbon sequestration markets for the removal of carbon dioxide from the atmosphere (including emerging carbon codes and carbon sources within the UK). They assessed the size of the potential market in Warwickshire, the potential price of carbon credits and therefore the viability of this market. We then investigated how such a market could be established and how to develop a Warwickshire Carbon Standard to ensure a high quality and high integrity carbon 'product'.

In addition to detailed desk research, the team worked closely with WCC teams, other consultants, many current carbon market or code development projects (including ongoing NEIRF projects), and specialists in the field including the Forestry Commission teams who are managing the UK Woodland Carbon Code.

3.1 Overview of the current carbon marketplace

There are two types of carbon market: the compliance market and the voluntary market. The first is a mandatory market, used by companies and governments that by law have to account for their greenhouse gas emissions. The EU Emissions Trading Scheme (ETS), established in 2005, is the largest compliance market (accounting for over 75% of international carbon trading in 31 countries), regulating specific industries through a cap and trade system. A UK ETS was formed in 2021, and applies to energy intensive industries, the power generation sector and aviation. However, it is the voluntary carbon market (VCM) that is of relevance to this project. Voluntary carbon credits are mainly purchased by the private sector, where motivations for purchase include internal net zero emission targets, corporate social responsibility and preserving corporate reputation. Worldwide, voluntary offset transactions are verified through approved auditors such as VERRA, Gold Standard, American Carbon Registry, Climate Action Reserve and Plan Vivo, recorded on online platforms such as the IHS Markit Carbon Meta-Registry, and tracked through websites such as Ecosystem Marketplace.

The only verified VCMs currently available in the UK are the Woodland Carbon Code and the Peatland Code, with projects and carbon units being registered via the UK Land Carbon Registry (and recorded on the IHS Markit Carbon Meta-Registry). The growing demand for a supply of quality carbon offsets to help meet the net zero carbon targets by 2050 has resulted in a desire to develop new, high integrity VCMs. These are being explored via a range of mechanisms, including through some of the NEIRF projects.

3.2 The Warwick District Council (WDC) Net Zero Carbon Development Plan Document (DPD)

In June 2019 members of WDC declared a climate emergency, following this the Council adopted a Climate Emergency Action Programme (CEAP) at its meeting in

February 2020. The Action Programme included a strong recognition of the important influence of planning in tackling climate change. Recognising that the Council had declared a climate emergency, the preparation of a Climate Change Development Plan, ahead of a Local Plan review, was identified as an area for early priority focus when the Executive approved the year 1 priorities in December 2020. This was considered to be an important early element in enabling Warwick District to be as close as possible to net zero by 2030.

The WDC Net Zero Carbon DPD is being produced to focus on minimising carbon emissions from new buildings within the District to support the achievement of national and local carbon reduction targets. From adoption, and earlier where possible, the DPD will aim to ensure that all new developments should be net zero carbon in operation. For the purposes of this DPD, net zero carbon relates to regulated operational energy which results from fixed building services and fittings (space heating, cooling, hot water, ventilation and lighting). The first consultation draft was produced in July 2021, the second consultation draft in February 2022 and it is anticipated that the DPD could be adopted by WDC in early 2023. It is anticipated that this DPD will then be adopted by the other District Councils in Warwickshire.

The project team has been working with WDC and their consultants (Bioregional and Edgars) in the production of the second consultation draft (February 2022) to ensure that the DPD aligns with this project and WCC's ambitions to develop a Warwickshire carbon market.

Note: DPDs are the statutory elements of the Local Plan and as such provide new and extended policies to those found in the Local Plan.

Key points from the WDC Net Zero Carbon DPD (second consultation draft, January 2022):

- The DPD requires new buildings (residential and non-residential, the latter including institutional, commercial and industrial) to be net zero carbon in operation, for a period of 30 years following construction.
- Any residual operational carbon is to be addressed through a robust carbon offsetting policy, where there will be a requirement for:
 - 1) a cash in lieu contribution to the District Council's carbon offsetting fund and/or
 - 2) at the Council's discretion, a verified local off-site offsetting scheme. The delivery of any such scheme must be within Warwickshire and Coventry, guaranteed and meet relevant national and industry standards. If it is a nature-based carbon sequestration scheme, then it must be backed by the national government's Woodland Carbon Code initiative (or future replacement/equivalent national scheme) and meet the Warwickshire ecosystem service market trading protocol.
- It is anticipated that the DPD will apply from early 2023 and is hoped to be rolled out across all Warwickshire Local Authorities.

3.3 Carbon credits likely to be generated in Warwickshire

How much operational carbon is likely to be produced by future residential and employment buildings?

- Based on figures in the London Energy Transformation Initiative (LETI) Embodied Carbon Primer, for a period of 30 years, an emission factor for electricity which accounts for future decarbonisation of the grid, and assuming future buildings are ultra-low energy with gas boilers/heat pumps, operational carbon per m² of floorspace is estimated to be:
 - 73.5 kg CO₂e/m² for medium scale residential buildings;
 - 115.5 kg CO₂e/m² for office buildings.

How much residential floorspace is expected to be built in Warwickshire each year?

Local Authority	Annual housing projections (no. of houses) ²	Required housing mix (% of total) ³				Size of average house (m ² of floorspace)	Total projected floorspace (m ²)
		1 bed (44 m ²) ⁴	2 bed (65 m ²)	3 bed (90 m ²)	4+ bed (172 m ²)		
Warwick	1,312 ⁵	7.50	27.50	42.50	22.50	98.1	128,740
Stratford-on-Avon	525	7.14	35.72	40.48	16.67	91.5	48,019
Rugby	692	7.50	27.50	42.50	22.50	98.1	67,903
Nuneaton and Bedworth	1,180	7.14	35.72	45.48	11.67	87.4	103,090
North Warwickshire	169	7.50	37.50	47.50	7.50	83.3	14,082
TOTAL	3,878					93.3	361,832

² The figures for residential developments come from each Local Authority's Five Year Housing Land Supply Calculations for the period 2021-2026.

³ The figures for Warwickshire's market housing need are from the 2013 Coventry & Warwickshire Joint Strategic Housing Market Assessment (SHMA), with estimates up to 2031. The table shows mid-points of bands used for calculations, ensuring totals add up to 100%.

⁴ The figures for average floorspace of different sized houses come from the UK Government's English Housing Survey:

Floor Space in English Homes – main report, published in 2018. For the period since 2002, the average new build English home is 96 m².

⁵ Note that many of these houses already have outline planning permission. Once the WDC Net Zero Carbon DPD is adopted, it will only be applicable to new planning applications. Consequently, the number of houses to which the DPD applies in Warwick during this period is likely to be much smaller than this.

How much employment⁶ floorspace is expected to be built in Warwickshire each year?

Local Authority	Annual employment land projections (ha) ⁷	Actual employment land completions, average per year (ha) ⁸	Actual floorspace completions, average per year (m ²) ⁹	Average proportion of employment land developed as floorspace (%) ¹⁰	Annual floorspace projections (m ²) ¹¹
Warwick	3.67	2.25	10,105	32.2	11,817
Stratford-on-Avon	1.75	9.30	46,498	55.8	9,765
Rugby	10.40	15.23	89,354	37.8	39,312
Nuneaton and Bedworth	5.39	2.17	10,013	46.1	24,848
North Warwickshire	2.90	20.06	88,500	44.1	12,789
TOTAL	23.70	49.01	n/a	n/a	98,531

⁶ Employment land (as defined in the Coventry and Warwickshire Strategic Employment Land Study 2014) includes land and premises that fall within the “B-class” of the Town and County Planning (Use Classes) Order 1987 (as amended), i.e. used for business, industrial and storage/distribution purposes.

⁷ Annual employment land projections were originally set out in the Coventry and Warwickshire Strategic Employment Land Study 2014 (updated to account for the Coventry and Warwickshire Employment Land Memorandum of Understanding of 2016) for the period 2011-2031. These figures have since been updated in the relevant Local Plans/Authority Monitoring Reports (AMRs) for Warwick, Rugby, and Nuneaton and Bedworth. The most up-to-date figures are included here.

⁸ Figures are taken from each Local Authority's AMR for the period 2011-2020/1. For North Warwickshire, the figures are based on Savills' 2019 update to council document NWBC21, and relate to the period 2011-2019. Most local authorities have completed more employment land than projected, and some are behind target. However, with no updated forecasts, it is not clear how this impacts on the projections going forwards.

⁹ Figures taken from each Local Authority's AMR for the period 2011-2020/1. For North Warwickshire, only completed floorspace for the year 2011-12 is available. The amount of floorspace created each year in North Warwickshire has therefore been approximated based on the average ratio of employment land completions to floorspace completions for the other four Local Authorities, multiplied by North Warwickshire's figure for employment land completions.

¹⁰ Employment land areas (in ha) are the areas of the whole sites, including curtilage around buildings. The proportion of this land actually developed as usable floorspace varies development to development, so these figures are an average based on the ratio of actual floorspace completions to actual employment land completions for each Local Authority. For North Warwickshire, the county average (for the other four Local Authorities) has been used.

¹¹ Floorspace projections are not available, so these have been calculated based on the average proportion of employment land developed as floorspace multiplied by the annual employment land projections for each local Authority up to 2031.

What is the operational carbon footprint of Warwickshire's future residential and employment buildings?

- Using the above figures for the residential and employment floorspace expected to be built in Warwickshire each year (in m²), and the predicted operational carbon of future residential and office buildings (in kg CO₂e/m²)¹², the projected annual carbon footprints (in tonnes CO₂e) for residential and employment developments in each of Warwickshire's Local Authorities has been calculated as follows.

Local Authority	Annual residential carbon footprint (tonnes)	Annual employment carbon footprint (tonnes)	Annual combined carbon footprint (tonnes)
Warwick	9,462	1,365	10,827
Stratford-on-Avon	3,529	1,128	4,657
Rugby	4,991	4,541	9,532
Nuneaton & Bedworth	7,577	2,870	10,447
North Warwickshire	1,035	1,477	2,512
TOTAL	26,595	11,380	37,975

Assuming the operational carbon footprint of Warwickshire's future residential and employment buildings is offset through tree planting, how many trees would need to be planted each year?

- The general rule of thumb in the industry is 1 tonne of CO₂ per tree. This is supported by Carbon Footprint Ltd who plant one tree (in the UK) for each tCO₂e to be offset, verified to the Verified Carbon Standard (VCS). The reasoning behind this is explained as: "A typical tree can absorb around 21 kilograms of carbon dioxide (CO₂) per year, however this figure is only achieved when the tree is fully grown – saplings will absorb significantly less than this. Over a lifetime of 100 years, one tree could absorb around a tonne of CO₂."¹³
- The number of trees needing to be planted each year in Warwickshire is therefore equal to the predicted annual carbon footprint (in tonnes) for residential and employment developments combined, as follows.

¹² Note that the predicted emissions are based on the LETI Embodied Carbon Primer, which assumes that all future buildings are ultra-low energy with gas boilers/heat pumps, and that decarbonisation of the grid occurs over time. These are therefore considered to be realistic estimates. However, should the WDC Net Zero Carbon DPD achieve its aim for all developments to be zero carbon without the need for offsetting (unlikely in the short-term), then these figures will be a worst case scenario.

¹³ <https://www.viessmann.co.uk/heating-advice/how-much-co2-does-tree-absorb>

Local Authority	No. of trees needed annually
Warwick	10,827
Stratford-on-Avon	4,657
Rugby	9,532
Nuneaton & Bedworth	10,447
North Warwickshire	2,512
TOTAL	37,975

Note that to offset the carbon footprint of the developments, all of these trees will need to be managed in good condition to maturity (i.e. 100 years). Given that some of the trees initially planted are likely to fail, and that woodland thinning may occur (where some trees are removed), it will therefore be necessary to plant more trees than this table suggests.

3.4 Potential for other carbon offset mechanisms

Woodland creation is not the only way to offset carbon emissions. Other nature-based solutions include the creation or enhancement of peatland, coastal, grassland and wetland habitats, along with regeneration of soils on agricultural and urban land.

Recent research by the Environment Agency suggests that there is considerable potential for carbon offsetting mechanisms, however, at present there are only two accredited carbon offsetting standards in the UK – the Woodland Carbon Code and the Peatland Code. We carried out desk research and conducted numerous interviews to investigate the potential viability of other habitat-based offset markets in Warwickshire.

Our research has revealed that a number of emerging carbon codes are currently being developed, however these are all currently ‘work in progress’ (many are NEIRF projects like this), and so little published information is currently available. The table on the following pages summarises the information we have found on all new and emerging carbon codes, taken mainly from interviews, excluding the woodland carbon code which we are already expecting to employ as part of this project.

As a result of our research, we consider that only two emerging carbon codes are potentially viable in Warwickshire; a hedgerow carbon code and an arable soil carbon code. Some work is being carried out on meadows, grassland and pasture soil carbon, but we expect this to eventually be linked with the work currently being carried out on developing the arable soil carbon code.

New and emerging carbon codes

In addition to the woodland carbon code, the following carbon codes exist or are in development.

Name of code	Status	Current viability in Warwickshire	When will it be available?	Cost / income (approx.) £/tCO ₂ e	Where will the money come from	Notes
Freshwater blue carbon	Not being worked on, at pace, at the moment.	None	At least 5 years	Not known	Market	Potential in the future
Floodplain restoration	Not being worked on, at pace, at the moment.	None	Not known	>1,000	Market	Potential in the future
Hedgerow	In development (NEIRF project)	Code in development, but currently trying to calculate financial viability.	2022 code, markets from 2023.	15-30	Initially, farmers wanting to be carbon neutral in their farms and supply chains. Marketing premium, Net Zero Carbon products. Wider markets will be possible.	Significant potential in Warwickshire.
Kelp restoration	Not being worked on, at pace, at the moment.	None	Not known	Not known	Not known	N/A in Warwickshire
Meadow / grassland	Slow progress. Will be linked to UK Farm and Soil Carbon Code.	See Soil management – Arable	See Soil management – Arable	Not known	See Soil management – Arable	Significant potential in Warwickshire.

Marine blue carbon	In development	None	2023-24	Not known	Market	N/A in Warwickshire
Peatland (lowland)	In development	None	2022-23	Not known	Market	N/A in Warwickshire
Peatland (upland)	Peatland carbon code and market exists	None	Available	10-100	Market	N/A in Warwickshire
Ponds	Not being worked on, at pace, at the moment.	None	Not known	Not known	Not known	Potential in the future, but questions over viability.
Saltmarsh restoration	In development	None	2022/3	Not known	Market	N/A in Warwickshire
Seagrass restoration	Not being worked on, at pace, at the moment.	None	Not known	Not known	Not known	N/A in Warwickshire
Soil management – Arable (UK Farm and Soil Carbon Code)	In development (NEIRF project)	<p>Large potential, but rigorous validation required for roll out of the code.</p> <p>Further research is needed to ascertain viability in Warwickshire.</p>	<p>2022-3 production of a code. Trial markets from 2022. Government-backed, validated market 2024.</p> <p>Markets already exist in Australia, Belgium and USA.</p>	25+	<p>1. Landowners / farmers wanting to be carbon neutral in their farms and supply chains.</p> <p>2. Agriculture supply chain.</p> <p>3. Voluntary Carbon Market.</p>	<p>Significant potential in Warwickshire.</p> <p>Multiple co-benefits to increasing soil carbon – not solely carbon trading.</p> <p>Large Consortium of NGO's, Researchers, Scientists and private sector</p>

						actively engaged currently.
Soil management – Pasture (UK Farm and Soil Carbon Code)	Linked to UK Farm and Soil Carbon Code.	As above	As above	As above	As above	As above
Wetlands (constructed)	Not being worked on, at pace, at the moment.	None	At least 5 years	Not known	Market	Slow progress. Key issue is that developing wetlands initially releases significant amounts of methane and NOx gasses.

Nature-based solutions are particularly beneficial because they **remove** existing CO₂ from the atmosphere. Other offset mechanisms exist that work by paying others to **reduce** the level of new emissions that are added to the atmosphere, via carbon reduction, energy efficiency or renewable energy projects, including retrofit of existing buildings. Such schemes do not remove CO₂ from the atmosphere and, as they are not nature-based solutions, they would not be considered as ecosystem services markets – as such they are not considered further here. Nevertheless, given that 80% of buildings expected to be operational in 2050 have already been built, decarbonising the existing building stock through such carbon reduction measures will be key for achieving net zero carbon more broadly.

Warwickshire's Local Authorities are likely to use a range of different carbon offsetting mechanisms, including tree planting, other habitat creation/restoration, and retrofit of council-owned buildings for improved energy efficiency/renewable energy.

3.5 Potential for offsetting other sources of carbon

Adopting WDC's draft Net Zero Carbon DPD in each of Warwickshire's Local Authorities will be the easiest way of establishing the Warwickshire Carbon Market, however, there are other sources of carbon in Warwickshire beyond just operational emissions of new buildings. For example, embodied emissions of new buildings; embodied and operational emissions relating to new infrastructure; operational emissions of existing public and private buildings; and emissions relating to transport, business and agriculture.

Given the focus of this NEIRF project on Local Authority consenting regimes, not all of these sources of carbon emissions are relevant, and some are easier to take forwards than others. The calculations below therefore relate only to embodied emissions of new buildings, with thoughts provided regarding other carbon emission sources.

3.5.1 Embodied carbon of new buildings

- The London Energy Transformation Initiative (LETI) has produced an Embodied Carbon Primer. This shows that as buildings become more energy efficient and electricity generation is decarbonised, operational carbon of new residential buildings will fall to around 23% of the 'whole life' carbon (a building's life expected to be around 60 years), with embodied carbon making up the remaining 77%. For office buildings, the proportion is expected to be 34% operational carbon and 66% embodied carbon. LETI therefore states that claims of net zero should relate to 'whole life' carbon, i.e. operational and embodied combined over a period of 60 years.
- It is envisaged that the next WDC Local Plan will be adopted in 2025 and, due to the reasons outlined above, this is expected to include requirements to offset embodied carbon of new buildings in addition to operational carbon.

- Based on figures in the LETI Embodied Carbon Primer, amended to a period of 30 years¹⁴, the embodied carbon per m² of floorspace of ultra-low energy buildings with gas boilers/heat pumps is estimated to be:
 - 440 kg CO₂e/m² for medium scale residential buildings;
 - 492 kg CO₂e/m² for office buildings.
- Using the previously provided figures for the residential and employment floorspace expected to be built in Warwickshire each year (in m²), and the predicted embodied carbon of future residential and office buildings (in kg CO₂e/m²)¹⁵, the projected annual embodied carbon footprints (in tonnes CO₂e) for residential and employment developments in each of Warwickshire's Local Authorities (and thus also the number of trees required to be planted to offset these emissions) has been calculated as follows.

Local Authority	Annual residential embodied carbon footprint (tonnes)	Annual employment embodied carbon footprint (tonnes)	Annual combined embodied carbon footprint (tonnes) / number of trees required
Warwick	56,646	5,814	62,460
Stratford-on-Avon	21,129	4,804	25,933
Rugby	29,877	19,342	49,219
Nuneaton & Bedworth	45,359	12,225	57,584
North Warwickshire	6,196	6,292	12,488
TOTAL	159,198	48,477	207,675

- However, around half to two-thirds of a new building's embodied carbon is associated with the products and materials used in its construction, i.e. supply chain elements produced elsewhere, which much of the remainder arising from maintenance and replacements (of parts also produced elsewhere). It may therefore be appropriate for embodied carbon to be offset in part through the supply chain rather than solely by developers through the DPD.

¹⁴ The embodied carbon figures provided by LETI are for 60 years, and include Products/Materials (50% and 34% of the total for residential and office buildings respectively), Transport (4% and 2% respectively), Construction (1% and 2% respectively), Maintenance and replacements (20% and 32%), and End of life disposal (both 2%). Reducing these to 30 years removes the emissions associated with end of life disposal, and approximately half of the emissions associated with maintenance and replacements. The figures provided above are therefore 88% of the 60 year figure for residential, and 82% of the 60 year figure for office buildings.

¹⁵ Again, the LETI figures are considered to be realistic estimates for the embodied carbon of future residential and office buildings. However, although the WDC Net Zero Carbon DPD does not include net zero ambitions for embodied carbon, the next WDC Local Plan is expected to. This policy is therefore likely to drive down embodied carbon emissions over time as developers change their supply chains to get as close to net zero carbon as possible. Should this occur (again this is unlikely in the short-term) then these LETI figures could be considered as a worst case scenario.

3.5.2 Infrastructure emissions

- Infrastructure includes that relating to communications, energy, transport, waste and water. The 2013 Infrastructure Carbon Review estimated that the construction, operation and use of infrastructure assets accounted for around half of the UK's carbon emissions.
- The UK's Green Construction Board and the Department for Business, Innovation and Skills produced PAS 2080, the world's first specification for carbon management in infrastructure, to show how carbon in infrastructure can be managed more rationally and strategically, for example selecting the scheme with the lowest carbon impacts. PAS 2080 requires practitioners to calculate a project's whole life carbon baseline and set targets for carbon reduction.
- For new infrastructure developments in Warwickshire, including new roads and flood alleviation schemes (many of which will be publicly funded), the carbon emissions associated with their construction and/or operation could be calculated, and offset, in a similar way as for carbon emissions of buildings. This requires a standardised way of calculating such emissions, which should ideally be set out at a national level. A number of tools are currently available, including the Environment Agency's Carbon Calculator.

3.5.3 Other emissions sources

Operational emissions of existing public and private buildings, and emissions relating to transport, business and agriculture do not relate well to Local Authority consenting regimes, and so were not proposed to be pursued further in this project.

3.6 Setting a price for the carbon offset market

Setting a price for the carbon offset market has two components, firstly reflecting the amount of money that can be asked for from developers through the WDC Draft Net Zero Carbon DPD, and secondly reflecting the amount of money necessary to undertake tree planting and maintain those trees for a period of 100 years.

From meetings with the consultants (Bioregional and Edgars) supporting the drafting of the WDC Net Zero Carbon DPD, we have determined that the carbon price to be charged to developers is the value/tonne used in the Government's Green Book, which is currently ~£245 per tCO_{2e}. This reflects the social cost of carbon and is therefore higher than the typical, current cost of a tonne of carbon. This is stated in the revised DPD which, at the time of writing, is currently out to public consultation. Note that this carbon price may change subject to market conditions and challenge during the planning consultation processes.

The 'evidence base'/ briefing document produced by Bioregional for WDC suggests a process following the London precedent as devised for the Greater London Authority by AECOM. This works as follows:

1. The carbon price charged to developers is the nationally recognised value/tonne of CO₂, for which figures are released by BEIS each year as part of the Treasury's Green Book data set. This value is set to reflect the central estimate for the 'cost of abatement' that would be involved in removing or preventing that carbon, i.e. the real-life costs to deploy a wide variety of carbon-saving measures that are necessary in order for the UK to meet its legislated carbon budgets that run between now and the end goal of net zero carbon in 2050, and the Paris Agreement to limit overall carbon emissions to an amount that keeps the climate change to 1.5-2°C.
2. WDC identifies a range of projects (including large-scale renewable energy, retrofitting energy efficiency measures into existing buildings, and tree planting) that could deliver carbon savings, and works out each project's approximate cost per tonne of carbon saved/sequestered.
3. The fund is spent on a range of projects that deliver, on average, carbon savings at the same cost per tonne that was charged to developers (minus a small margin to allow for the administration/management of the fund itself). Note that some of the funded projects might have a higher cost per tonne than the ~£245 per tCO₂e requested from developers (e.g. retrofitting measures which typically cost around 5 times that of installing energy efficiency measures in new builds), whilst some of the funded projects (e.g. tree planting) might have a lower cost per tonne.

The project team has calculated the cost of creating woodland in Warwickshire followed by its maintenance in good condition for 99 years to be £114,260 per hectare, equivalent to ~£221 per tCO₂e, thus coming in below the ~£245 per tCO₂e price to be charged to developers. This per tCO₂e woodland cost has been calculated based upon the Local Biodiversity Action Plan (LBAP) costings for woodland and the Warwickshire Biodiversity Net Gain (BNG) financial calculator, using a RPIX of 3.61. Further details on these calculations are provided here. The annual, present day, costs for creating, establishing and maintaining woodland habitat have been calculated as follows:

WOODLAND HABITAT	Costs per hectare, per year		
	Create (Year 1)	Establish (Years 2-10)	Maintain (Years 11-99)
Native Woodland	£2,126	£122	£61
Traditional Orchards	£1,123	£250	£125
Wood-Pasture and Parkland	£1,502	£180	£90
Average	£1,584	£184	£92

Using the RPIX of 3.61, establishment costs for years 2-10 and maintenance costs for years 11-99 have been calculated, resulting in an index link figure of 6.44 for the whole 99 year period post-creation.

Provider agreement set-up costs	Average woodland creation cost per ha	Woodland establishment and maintenance cost per ha for 99 years ¹⁶	99 yrs establishment and maintenance plus inflation at 3.61%	Estimated cost of offset	Management cost at 20% (index linked)	Total Cost of Offset Contribution
H	I	$\text{£}184 \times 9 + \text{£}131 \times 90 = J$	$J \times 6.44 = K$	$H + I + K = L$	M	L + M
£7,000	£1,584	£13,452	£86,632	£95,216	£19,043	£114,260

Note that these costs assume that land is already available on which to plant the trees – should WCC need to purchase this land, it would add approximately £20k per hectare, taking the total to £134,260 per hectare, or ~£259 per tCO₂e. This is now above the ~£245 per tCO₂e price to be charged to developers.

Should any additional sources of funding be used towards the cost of woodland creation and establishment, e.g. the England Woodland Creation Offer (EWCO), then this could reduce the cost to developers. For example, the basic EWCO provides up to £8,500 per hectare for planting plus annual maintenance payments of £300 per hectare for 10 years, thus totalling £11,500 per hectare. This represents 10.1% of the total cost of creating, establishing and maintaining a hectare of woodland over a 100 year period. If the EWCO grant was successfully secured for each hectare of woodland planted through the carbon offsetting scheme, this could reduce the amount required from developers to ~£198 per tCO₂e (or £237 per tCO₂e including the cost of purchasing the land). However grant funding is not guaranteed, and should not be relied upon for the purposes of calculating the cost per tonne of carbon sequestered.

At the time of writing, in order to show the significance of income from carbon units, the Woodland Carbon Code requires that projects “shall demonstrate that income from the sale of carbon units, over the project lifetime, equates to at least 15% of the project’s planting and establishment costs up to and including year 10”. However, this requirement is expected to be removed from the Woodland Carbon Code later in Spring 2022, as it is no longer seen as a barrier. As set out above, it is proposed that 100% of the cost of planting, establishing and managing Warwickshire’s new woodlands will be funded through the sale of carbon units.

3.7 Viability of a carbon offset market in Warwickshire

- Assuming that the WDC Draft Net Zero Carbon DPD is adopted by all five of Warwickshire’s Local Authorities (by 2023), a carbon footprint of approximately 37,975 tonnes CO₂e annually would need to be offset.
- Warwickshire County Council has a target of 566,000 trees to be planted with partners across Warwickshire by 2030.

¹⁶ Note that the maintenance cost used in the calculations is that at Year 11

- If the required offsetting for the county-wide Net Zero Carbon DPDs was undertaken solely through tree planting, then at a rate of 37,975 trees per year, by 2030, 265,827 of these trees (i.e. 47.0% of the target) would have been planted through the Net Zero Carbon DPDs alone.
- The remaining 300,173 trees would need to be planted through some other funding mechanism for the 2030 target to be achieved.
- Whilst embodied carbon has not been included in the WDC Net Zero Carbon DPD, it is expected to be included in the forthcoming joint Local Plan for Warwick and Stratford-on-Avon (to be adopted ~2025), along with other future local plans in Warwickshire.
- Offsetting embodied carbon from new buildings across Warwickshire would increase the annual tree planting requirement, from 2025 onwards, to 245,651 trees. Though logistically this is unlikely to be feasible, it would mean that the tree planting target of 566,000 would be met by 2027.
- The WDC Net Zero Carbon DPD does not, in fact, dictate that offsetting is carried out through tree planting, and instead leaves the mechanism open (thus potentially also including carbon reduction measures and other habitat creation/restoration). It is recommended that tree planting is prioritised as the offsetting mechanism in the short-term (by each district or borough adopting such a policy, as close to the development location as possible), to help meet the target of 566,000 trees being planted across Warwickshire by 2030. Once this target is reached, the carbon produced by additional new buildings will need to be offset through other means.
- Other carbon offset mechanisms that may be suitable for use in Warwickshire include the emerging hedgerow and arable soil carbon codes, though further work is required to establish the viability of these for Warwickshire. These are not likely to be required in Warwickshire until after 2030 (or once 566,000 trees have been planted, whichever is sooner), and markets for these will be well-established by then.
- Other carbon sources, such as the whole life carbon of new infrastructure, are unlikely to be viable for offsetting in the short-term, and furthermore would rely on public funds, but could be investigated further in future.
- From meetings with the consultants supporting the drafting of the WDC Net Zero Carbon DPD and our own calculations based on the LBAP costings for woodland and the Warwickshire BNG financial calculator, we have determined that the carbon price proposed to be charged to developers of ~£245 per tCO₂e is higher than the ~£221 per tCO₂e required to cover the cost of creating and maintaining woodland for 100 years. However, if land purchase is also required, the overall woodland costs would increase to ~£259 per tCO₂e.
- This analysis suggests that a carbon offset market based on county-wide Net Zero Carbon DPDs and tree planting is viable, with the number of trees to be

planted each year seeming both reasonable and feasible. However, to meet the target of 566,000 trees being planted across Warwickshire by 2030, offsetting of embodied carbon of new developments will also be required, with tree planting prioritised over other carbon removal/reduction measures until the target is met.

3.8 Establishing a Warwickshire carbon market

3.8.1 The UK Woodland Carbon code

The UK Woodland Carbon Code (UKWCC)¹⁷ is the quality assurance standard for woodland creation projects in the UK, and generates independently verified carbon units. Backed by the Government, the forest industry and carbon market experts, the Code is unique in providing woodland carbon units in the UK. The UKWCC is internationally recognised for high standards of sustainable forest management and carbon management and is endorsed by the International Carbon Reduction & Offset Alliance (ICROA), the global umbrella body for carbon reduction and offset providers in the voluntary market.

The UKWCC sets out robust requirements for voluntary carbon sequestration projects that incorporate core principles of good carbon management as part of sustainable forest management. Landowners and their successors in title must commit to a permanent change of land use to woodland. Specific objectives of the Code are to ensure:

- high standards of sustainable forest management in line with the UK Forestry Standard including the elements of sustainable forest management.
- best practice in woodland carbon accounting.
- scientifically sound forest carbon measurement protocols that enable consistent and rigorous measurement of carbon uptake in woodlands.
- integrity through independent quality assurance (validation and verification).
- open and transparent project registration, issuance, tracking and retirement of carbon units.

The UKWCC is aligned with the core requirements of a number of international standards, including:

- UK Peatland Code¹⁸
- Verra's Verified Carbon Standard¹⁹
- The Climate, Community and Biodiversity Standard²⁰
- The Gold Standard²¹

¹⁷

https://www.woodlandcarboncode.org.uk/images/PDFs/Woodland_Carbon_Code_V2.1_March_2021.pdf

¹⁸ <http://www.iucn-uk-peatlandprogramme.org/peatland-code>

¹⁹ <http://verra.org/project/vcs-program/>

²⁰ <http://verra.org/project/ccb-program/>

²¹ <http://www.cdmgoldstandard.org/>

- Plan Vivo²²

Because the UKWCC is aligned with the key international standards, any carbon market which is based upon the UKWCC should be able to trade within any, or all, of these international standards in the future.

Note that the UKWCC, on which the Warwickshire Carbon Standard will be based (see section 3.8.3), stipulates that those seeking to offset their carbon emissions through tree planting can only claim that emissions are neutralised once the trees have grown and actually sequestered the carbon. Therefore, the tree planting will initially generate only 'Pending Issuance Units' or 'PIUs', which, following external verification can start to be converted into 'Woodland Carbon Units' or 'WCUs', generally from year 10 onwards. The verification of WCUs will be carried out by the UKWCC who will then inform the woodland carbon project developer, in this case WCC or the relevant Warwickshire councils. Developers, and the Warwickshire councils planting trees on their behalf, can therefore only claim that they are "working towards carbon neutrality" and not that they have offset the emissions from the new developments. Given that a tree takes a lifetime (of 100 years) to sequester 1 tCO₂e, it will take 100 years for each development's emissions to be fully offset.

3.8.2 The UKWCC Woodland Benefits Tool

The UKWCC Woodland Benefits Tool²³ assesses additional benefits that a woodland, or woodland planting programme, could have related to wildlife, community, water and economy.

It is an online tool which has been designed to support investors in new woodland with voluntary reporting on the many social, environmental and economic benefits that their investment has helped to secure. Through the use of the tool and its reporting output, investors in woodland creation will be able to better understand and communicate the value of their investments to both internal and external stakeholders.

It is anticipated that the key user groups for the tool will include the businesses, site developers, brokers and other stakeholders engaged in using the UKWCC, although it is likely to prove a useful resource for any party with an interest in reporting the benefits of woodland creation.

Note that benefit trade-offs are inherent in woodland creation. This reflects the fact that woodlands vary in their ability to provide certain benefits, either as a result of the woodland's location, its physical characteristics (e.g. the underlying soil type), or the design of the woodland. For example, a woodland focused on delivering community activities may provide fewer benefits for wildlife compared with a more tranquil, less disturbed site.

²² <http://www.planvivo.org/>

²³ <https://forestry.gov.scot/publications/sustainable-forestry/economic-research/policy/613-user-guide-to-the-woodland-benefits-tool>

The UKWCC Woodland Benefits Tool allows a woodland developer to assess additional benefits that a woodland, or woodland planting programme, could have related to wildlife, community, water and economy. The Tool is an easy-to-use Excel-based framework that provides the user with the opportunity to answer a series of questions focused on the potential social, environmental, and economic benefits associated with a woodland creation project. The tool calculates a score for each factor and ‘badges’ are allocated based on the number of questions answered ‘Yes’, a maximum of five badges can be obtained under each category. If a woodland is awarded four or five badges in a particular category, it is considered to be a particular ‘type’ of woodland, for example a wildlife haven, freshwater friendly, a community asset or an economic driver. Woodlands that achieve three badges in all four categories are given the title Multi-purpose.

There are four benefit categories:

- Woodland and wildlife
- Woodland and water
- Woodland and community
- Woodland and economy

The project team investigated using the UKWCC Woodland Benefits Tool in order to help develop a bespoke, high quality and high integrity Warwickshire Carbon Standard. This approach was discussed with WCC partners and the Project Board. However it was decided that, although the costs of these additional benefits might be affordable for WCC, these additional woodland benefits were not considered to be suitable because they would not be regarded as fair and reasonable by developers or woodland project developers.

We have included mention of the UKWCC Woodland Benefits Tool in this report because we consider that these benefits could be helpful and relevant in the future development of a Warwickshire carbon market – especially in the development and establishment of a voluntary market.

3.8.3 Developing a Warwickshire Carbon Standard

The overall objective of this workstream is to establish or join a carbon market and WCC have specified that this needs to be a high quality and high integrity market. As such, the project team have been asked to develop a Warwickshire Carbon Standard. This will specify the key requirements, characteristics and attributes of the WCC carbon product (produced as part of the WCC tree planting programme and managed by the WCC Ecology Team) or any other carbon units which a developer might wish to purchase to offset their carbon in accordance with the WDC Net Zero Carbon DPD.

A local authority is not allowed to enforce a regulation or policy where no competition will be possible, effectively producing a closed market. So, when specifying the Warwickshire Carbon Standard we have been mindful of how others might be able to meet this standard and its specifications, it will also need to be robust to ensure it can be validated, monitored and any transgressions penalised.

WCC will want to offer a fully accredited and independently verified carbon standard which is supported by the UK Government. As such **we recommend that the Warwickshire Carbon Standard is based upon the UK Woodland Carbon Code (UKWCC).**

As a result of the Warwickshire Carbon Standard being based upon the UKWCC and the requirement for trees to sequester their maximum potential of carbon, we recommend that any woodland creation project should **cover the creation and maintenance of woodlands for a period of 100 years.**

When trading through the UKWCC there are a number of project developers and other intermediaries, for example Accelar, Sequest, Wilder Carbon, the Woodland Trust or Zellar, that an investor can work with. WCC will initially be mandating a closed market between themselves and developers, so **we recommend that WCC act as a project developer** and won't need to use such 'middle men'. In doing this, WCC will register with the UKWCC and the UK Land Carbon Registry²⁴. The UK Land Carbon Registry is the database that stores and publicly displays data about the status of Woodland Carbon Code and Peatland Code projects and ownership and use of carbon units. It records transactions and provides a public and transparent picture of UK-based Woodland and Peatland Carbon Units.

Additionally, **we recommend that any habitat designed or developed to be applicable for the Warwickshire Carbon Standard must adhere to the Warwickshire Landscape Character Guidelines²⁵ and it must be within the County of Warwickshire.**

So, to meet the Warwickshire Carbon Standard, we propose that any project will need to meet the following criteria:

- Meet the UK Woodland Carbon Code specifications and regulations
Plus
- Woodland projects should cover the creation and maintenance of woodlands for a period of 100 years
Plus
- Demonstrate that it adheres to the Warwickshire Landscape Character Guidelines
Plus
- Woodland projects must be within the County of Warwickshire.

The above criteria will apply to any woodland creation, or other carbon sequestration, project in Warwickshire which is funded, or receiving payments, as a result of the WDC Net Zero Carbon DPD.

It is expected that 100% of the cost of planting, establishing and managing woodland through the Warwickshire carbon market will be funded through the sale of carbon units. This does not preclude the use of additional sources of funding, for example,

²⁴ <https://woodlandcarboncode.org.uk/uk-land-carbon-registry>

²⁵ <https://www.warwickshire.gov.uk/landscapeguidelines>

around 10% could come from the England Woodland Creation Offer (EWCO)²⁶ or similar government grant schemes. However, any more funding from additional sources beyond 10% is thought likely to adversely affect the value of the carbon sold to developers, and could undermine the market. This will need to be considered within stacking and bundling decisions and mechanisms.

Note that the Warwickshire Carbon Standard is initially designed as a mandatory market focussed upon the sale of PIUs based on the UKWCC and registered with the UK Land Carbon Registry. However, in the future there is the potential for this to be adapted to be applicable for a voluntary market and to also incorporate other carbon codes as they emerge and are validated.

As stated in section 3.4, there are two emerging carbon codes which are potentially viable in Warwickshire; a hedgerow carbon code and an arable soil carbon code (potentially incorporating meadows, grassland and pasture soil carbon in the future). As these, and other carbon codes, are validated we believe that they will all become part of the UK Carbon Registry.

3.8.4 Market engagement

One of the key activities of this project was market engagement and internal fundraising. The project team proposed to approach selected internal (WCC) and external (planning applicants / developers / infrastructure providers) stakeholders and markets to gather feedback on our propositions and adapt and refine them as required.

Because the Warwickshire Carbon Standard will be mandatory, and no additional woodland benefits will be included, it was decided by the Project Lead that there was no reason to carry out external market engagement activities. However, we have shared our proposals with internal WCC teams, through the Project Board and meetings with WCC finance teams, and received support and guidance.

3.9 Conclusions and recommendations for establishing a Warwickshire carbon market

3.9.1 Viability and costs

- 10,827 trees would need to be planted each year in Warwick District to offset the 30 year operational carbon associated with future residential and employment developments if all operational carbon is offset in this way.
- Extending the WDC Net Zero Carbon DPD to all five Warwickshire Local Authorities means a total of 37,975 trees would need to be planted across the county each year if all operational carbon is offset in this way.

²⁶ <https://www.gov.uk/guidance/england-woodland-creation-offer>

- WCC has a target of 566,000 trees to be planted with partners across Warwickshire by 2030. A county-wide DPD, operational from 2023, that prioritises tree planting above other carbon offsetting measures, would result in approximately 265,827 trees being planted by 2030 (i.e. 47% of the target).²⁷ This seems both reasonable and feasible.
- It is envisaged that the next WDC Local Plan (being prepared jointly with Stratford-on-Avon DC) will be adopted in 2025 and this is expected to include a requirement to offset the embodied carbon of new buildings in addition to operational carbon. Although it is difficult to calculate at this early stage, the inclusion of embodied carbon is likely to significantly increase the demand for carbon offsetting and require the overall planting of at least 566,000 trees by 2030.
- Other carbon offset mechanisms that may be suitable for use in Warwickshire include the emerging hedgerow and arable soil carbon codes, though further work would be required to establish the viability of these for Warwickshire. The demand generated by county-wide adoption of the Net Zero Carbon DPD and the inclusion of embodied carbon from 2025 could meet the requirements for the planting of 566,000 trees in Warwickshire. As a result, these new markets may not be required in Warwickshire until after 2030 and they will be well-established by then.
- Other carbon sources, such as the whole life carbon of new infrastructure, are unlikely to be viable in the short-term, but should be investigated further in order to feed into the preparation of new Local Plan policies.
- From meetings with the consultants supporting the drafting of the WDC Net Zero Carbon DPD (Bioregional and Edgars), we have determined that the carbon price to be charged to developers is the value/tonne used in the Government's Green Book, which is currently **~£245 per tCO₂e**.
- The cost of creating woodland in Warwickshire and maintaining it in good condition for 100 years has been estimated at approximately **£114,260 per hectare, or £221 per tCO₂e**. This is based upon the LBAP costings for woodland and the Warwickshire Biodiversity Net Gain (BNG) financial calculator. However, this cost assumes that land is already available on which to plant the trees. Should WCC need to purchase this land, it would add approximately £20k per hectare to the cost, taking the total to around **£134,260 per hectare, or £259 per tCO₂e**. This is now above the ~£245 per tCO₂e price to be charged to developers.

²⁷ Note that in reality, the number of trees planted by 2030 would likely be much lower than this. Firstly, it is expected that other offsetting measures (e.g. retrofitting energy efficiency measures in existing buildings) will also be adopted by the Local Authorities, reducing the funding available to be spent on tree planting. Secondly, developments that already have outline planning permission will not be required to offset. Thirdly, the Net Zero Carbon policy is expected to drive down carbon emissions per building substantially over the years as developers strive to achieve this target with minimal offsetting.

- Overall, we consider a carbon offset market in Warwickshire to be viable for funding the planting of 566,000 trees (to meet WCC's climate change and biodiversity ambitions) by 2030 using the carbon credits that could be generated through county-wide adoption of the WDC Net Zero Carbon DPD and the adoption of embodied carbon from 2025.

3.9.2 The Warwickshire carbon market

- A Warwickshire Carbon Standard should be produced.
- The Warwickshire Carbon Standard should specify that any qualifying project must:
 - Meet the UK Woodland Carbon Code specifications and regulations
Plus
 - Cover the creation and maintenance of woodlands for a period of 100 years
Plus
 - Demonstrate that it adheres to the Warwickshire Landscape Character Guidelines
Plus
 - Be within the County of Warwickshire.
- WCC should act as a carbon project developer and register with the UK Woodland Carbon Code and the UK Land Carbon Registry.
- Whilst writing a Warwickshire Carbon Standard and establishing a Warwickshire carbon market, WCC should be mindful of the opportunities for developing voluntary markets and using additional, emerging carbon codes.

3.9.3 A recommended process for establishing a Warwickshire carbon market

To establish a Warwickshire carbon market, WCC should work with consultants, statutory bodies and external organisations to do the following:

1. Share this report and the findings of this research, both internally (WCC) and externally.
2. Continue meeting with internal (local authority) and external teams, such as the National Farmers Union, landowners and Warwickshire conservation organisations, to identify forthcoming opportunities and champion the concept of a Warwickshire carbon market and a natural capital approach.
3. Support the technical development of the WDC Net Zero Carbon DPD.
4. Act as a champion, or advocate, for the WDC Net Zero Carbon DPD and include it in all relevant literature or presentations.

5. Produce a robust Warwickshire Carbon Standard, including a system of monitoring and verification.
6. Develop suitable legal and financial frameworks.
7. Plan and then commence the planting of 566,000 trees, including land purchases if required.
8. Register with the UK Woodland Carbon Code and the UK Land Carbon Registry.

4 Establishing other ecosystem services markets

The aim of the ES market workstream was to identify which markets could be viable within this project, and Warwickshire, and provide recommendations on how WCC could establish these as revenue streams.

In this report, each ES market is presented separately including a brief methodology, findings, conclusions and recommendations.

A separate and over-arching recommendation is that:

Within Warwickshire it is important to develop robust policies which can help address the current biodiversity and climate change emergencies. We recommend that the production of an Environmental Net Gain policy (SPD, DPD or inclusion within Local Plans) should be considered by Warwickshire County Council or the District Councils.

4.1 Ecosystem services opportunities and associated consenting regimes

Research was carried out, and interviews held, with key stakeholders within WCC to determine what ES might offer opportunities for viable markets and which consenting regimes would offer policy 'hooks' to enable them to be enforced.

In December 2021, a matrix of ES market opportunities and consenting regimes was produced and presented to the Project Board. This is shown on the following pages, including an assessment of their viability for Warwickshire and within the scope of this project. (Note: cells highlighted in yellow were considered to have some viability or potential, whereas those highlighted in pink were considered to be unviable.)

Many options were investigated, however most were either already covered by planning consent, were led by the Environment Agency, were not linked to an appropriate consenting regime or did not represent a viable market.

A common theme that was raised in most of the interviews was the need for appropriate policies and consenting regimes, for example through an SPD, DPD or inclusion within a Local Plan. It is recommended that an Environmental Net Gain (ENG) policy could be produced, this could incorporate air and water quality, biodiversity, require nature-based solutions, a net zero carbon approach and an uplift, for example increased water/air quality or reduced flood risk. It could also cover other ecosystem services.

As a result of our research, five specific ES markets were currently considered to have potential within Warwickshire, these are:

- Air quality - Developing an offsetting market for nitrogen deposition caused by developments and 'operational' use.
- Nutrient neutrality/balancing – A nitrates/phosphates offsetting scheme, related to watercourses, for new housing or industrial developments.
- Flood risk mitigation
- Potential ES markets related to Trading Standards
- Social prescribing (health & wellbeing)

Further research was carried out into each of these and our findings, and recommendations, are presented in this section of the report.

Professional field / Subject area	Consenting regime	Proposal	Viability - project	Viability - future	Detail	Internal / external markets?	Further actions	Commentary
Planning (Minerals & Local)								
Surface water / sustainable drainage / SuDS	Planning regulations	None	None - already covered in planning consent. See commentary.	None - already covered in planning consent. See commentary.	All increases in surface water runoff caused by a development must be mitigated fully (in fact a gain is sought) on-site for consent to be given. For impacts on fluvial floodplains, mitigation can be undertaken offsite, but on the affected watercourse, and again must be mitigated in full (no net loss) for consent to be given. See idea in commentary.	Both	Investigate potential for a surface water drainage charge reduction scheme? Could WCC partner with Severn Trent Water to introduce a county-wide surface water drainage charge reduction scheme like United Utilities has in Greater Manchester? In this, non-domestic customers are charged for wastewater services based on the area of hard surface within their property. By 'softening' their property (e.g. with SuDS and natural features), customers can progress to cheaper charging bands. United Utilities is unique in the UK in having freedom to charge surface water drainage fees according to hard surface area. Any new scheme for Warwickshire would depend upon STW's ability to persuade Ofwat to introduce the scheme, which may be difficult for a rural county.	
Nutrient balancing (nitrates/phosphates) for new housing or industrial developments	*Opportunity to develop an appropriate policy, for example an SPD, DPD or include within a Local Plan. A strong Environmental Net Gain (ENG) policy could incorporate air and water quality, require nature-based solutions, a net zero carbon approach and an uplift, for example increased water/air quality.	Nitrate/phosphate balancing mitigation and offsetting scheme. Severn Trent Water (STW) would be keen on such a scheme and partnership.	Potential	Potential	New developments = more nutrients going into rivers/watercourses. Link to planning regulations and therefore potential for BNG or other ES markets? NBBC & NWBC already have possible Policy hooks in place... mostly NBBC. Opportunity to develop a suitable policy . See *	Both	CB contacting other current projects for information including EA, Wye and Usk, Norfolk Rivers trust, IOW/Solent and 3Keel. Further discussions with STW. Research current policy hooks. Investigate potential for developing ENG, or similar, policies. Potential for NEIRF #2 funding.	Problematic and challenging, but would get considerable support from other initiatives, especially if we can get an ENG policy adopted or develop a wetland water treatment project in Warwickshire linked to a long term catchment balancing programme. There would be a huge appetite from other projects and organisations to support us in developing joined-up catchment systems incorporating nutrient balancing, carbon, BNG, etc.
Air quality	WDC Air Quality and Planning SPD. *Opportunity to develop an appropriate policy, for example an SPD, DPD or include within a Local Plan. A strong Environmental Net Gain (ENG) policy could incorporate air and water quality, require nature-based solutions, a net zero carbon approach and an uplift, for example increased water/air quality.	Air quality impacts mitigation payments. Developing an offsetting market for nitrogen deposition caused by developments.	Potential	Potential	WDC Air Quality & Planning SPD, Jan 2019. AQ is a material planning consideration. Section 106 obligations to improve AQ. WDC has 5 AQMA's. Particular concerns are traffic generation and protection of natural resources. Problems with nitrogen dioxide and fine particulate matter (PM2.5). If on-site mitigation is not possible then WDC will seek compensation for the identified air quality impacts through a Section 106 Agreement or similar agreement. Each development will require an air quality mitigation statement. There may be potential to charge developers, who cause nitrogen deposition on habitats falling under formal protection (e.g. a designated site or ancient woodland), to pay to either improve management at that location or create similar new habitat elsewhere. It has links to BNG, but would need to be separate.	Both	Discuss with Warwickshire planners. Can ES market payments be taken from S106 obligations as with BNG? Investigate potential for developing ENG, or similar, policies.	Clear route to either BNG or Section 106 payments, but is there and any potential for other ES markets? Can ES market payments be taken from S106 obligations in a similar way to BNG? Is there potential to develop an offsetting market for nitrogen deposition caused by developments? Link with an ENG policy? Need to research whether nitrogen deposition is an issue at the County scale in Warwickshire. It is mainly an issue in moorland, where NH4 deposition leads to changes in the species mix.
Noise pollution	Planning regulations	None	None - already covered in planning consent	None - already covered in planning consent	-	Both	None	Consent for noise use/development requires on-site mitigation, so offsetting is not really appropriate. Addressing noise via the nature-based Solution of vegetative barriers is also site specific.
Light pollution	Planning regulations	None	None - already covered in planning consent	None - already covered in planning consent	-	Both	None	No relevant metric
Recreation / green spaces	Planning regulations	None	None - already covered in planning consent	None - already covered in planning consent	-	Both	None	This could feed into a future parks and greenspaces fund/levy to increase and enhance provision of parks and green spaces?
Urban mining	None	None	None	Potential	Urban mining is the process of recovering and reusing a city's materials. These materials may come from buildings, infrastructure, or products that have become obsolete. When the functional lifetime of an object is over. https://www.metabolic.nl/news/urban-mining-and-circular-construction/ Potential for a circular economy-related SPD or include in Local Plans? Refer to Waste (Circular Economy) Regulations 2020	Both	Further research required.	Potential for a circular economy-related SPD or include in Local Plans?

Professional field / Subject area	Consenting regime	Proposal	Viability - project	Viability - future	Detail	Internal / external markets?	Further actions	Commentary
Water / Flooding								
Climate change	Stratford DC Climate Change SPD	None	None	None	-	N/A	-	-
Water	Ordinary watercourse land drainage consent (section 23 Land Drainage Act 1991)	Culvert tax	Potential, but market probably not viable	Potential, but market probably not viable	Don't put in a culvert, but for every culvert built you have to contribute to a fine, or a nature-based scheme (NBS), elsewhere = culvert tax. Also consider BNG and carbon footprint. Culverts are 8/10 consents so ~80 per year. Most are within planning regimes. Potential for net gain but probably not other ES markets.	Both	Talk to Sophie Wynne again - where can we go from here?	-
Flood alleviation	None	Flood risk mitigation or fine - link to Natural Flood Management schemes.	Potential	Potential	Landowner-produced flood risk requires mitigation or a fine – potential here + NBS? Natural flood management fund? River Aire, Rivers Trust, Forest of Bowland, RFCC, Triodos Bank examples? See commentary - IDB proposal.	Both	Discuss further with Sophie Wynne and STW	Given an increasing flood risk position, could WCC gain the legal powers of an Internal Drainage Board, or instigate a structure like an IDB with whom it can work? This would be a first in the UK, but might be worth exploring as a 'blue skies' idea. IDBs are significant because they can charge drainage rates to landowners. They can also charge levies to Local Authorities to reduce flood risk (which could conceivably be passed on to businesses that are exacerbating flood risk). There are IDBs throughout England (mainly lowland areas e.g. Somerset and the Fens), but none covering Warwickshire.
Flood alleviation capital schemes	None	None	None	None	Use EA carbon calculator and need to offset carbon. Therefore contributes to a carbon market, not ES.	Both	None	-
Water quality / nutrient balancing (nitrates/phosphates)	EA consent	None	None	None	Led by Environment Agency	Both	None	-
Water quality credit trading	None at present, but potential for a future policy?	Develop a water quality credit trading scheme	None	Potential, depending upon STW interest	Water quality trading is an innovative programme that allows facilities that discharge wastewater to a stream or river to meet regulatory obligations by: Purchasing equivalent or larger pollution reductions from another source; or Taking action to protect or restore riparian areas, wetlands, floodplains, and aquatic habitat to reduce the impact of pollutants. Trading is based on the fact that sources in a watershed can face very different costs to control the same pollutant. Trading programs allow facilities facing higher pollution control costs to meet their regulatory obligations by purchasing environmentally equivalent (or superior) pollution reductions from another source at lower cost, thus achieving the same water quality improvement at lower overall cost. Example from Oregon, USA: https://www.oregon.gov/deq/wq/wqpermits/Pages/Trading.aspx Can also include thermal water quality trading, pollution trading, and effluent trading. Thermal water trading scheme in Oregon where utilities offset releases of warmer water into watercourses partly through planting riparian woodlands to reduce water temperature.	Both	Discuss with STW.	-
Ecology								
Trees	Tree preservation orders	ES fund or levy	None	None	No viable market and payments would go to BNG	Both	None	-

Professional field / Subject area	Consenting regime	Proposal	Viability - project	Viability - future	Detail	Internal / external markets?	Further actions	Commentary
Environmental health								
Air quality	Taxi licensing	Taxi licensing emissions levy	Low - no viable market	Low - no viable market	Levy for emissions. Low viability due to diminishing taxi trade and emergence of electric and autonomous vehicles. In Stratford all taxis need to be no older than 3yrs, unless electric (6yrs), so no offsetting market.	External	None	-
Air quality	-	AQMA - traffic particulate matter (links with planning but can also be operational)	None	None	If AQMA is too high it leads to localised solutions, therefore no viable ES market? See Stratford AQMA report. Monitoring (ANPR) to test compliance, leading to fines - what then happens to these fines? Could recommend an Air quality SPD? See *	Both	None	-
Air quality	Environment Act. *Opportunity to develop an appropriate policy, for example an SPD, DPD or include within a Local Plan. A strong Environmental Net Gain (ENG) policy could incorporate air and water quality, require nature-based solutions, a net zero carbon approach and an uplift, for example increased water/air quality.	Air quality impacts mitigation payments. Section 106 payments directed to specific ES funds to enable CC resilience and fund WCC CC initiatives? Developing an offsetting market for 'operational' nitrogen deposition and that caused by business and developments.	Potential	Potential	AQMA issues, money goes into section 106 - could we direct some of this to specific ES funds to enable CC resilience and fund WCC CC initiatives? Opportunity to develop a suitable policy . See *	Both	Investigate potential for developing ENG, or similar, policies.	-
Air pollution control	EA consent	None	None	None	Led by Environment Agency, so no LA market	Both	None	-
Noise pollution	Environmental Protection Act - noise abatement	Fines for noise nuisance	None	Future potential depending upon forthcoming govt policy following COP26/Env Act	Not currently linked to linked to a consenting regime? *Opportunity to develop an appropriate policy, for example an SPD, DPD or include within a Local Plan. A strong Environmental Net Gain (ENG) policy could incorporate noise pollution, air and water quality, require nature-based solutions, a net zero carbon approach and an uplift, for example increased water/air quality.	Both	Investigate potential for developing ENG, or similar, policies.	-
Light pollution	None	See planning	None	None	-	Both	None	-
Health & wellbeing / stress at work	None, at present	Quality of life business levy? Potential for NEIRF#2 funding?	None	Potential	Levy to enhance green spaces and improve the environment, especially close to places of work. Not sure what the policy hooks would be for this and/or within which strategy / mechanisms. See Health and Wellbeing / NHS.	Both	None at present	More of a business tax than a consenting regime. Furthermore, it would need to be very location specific to benefit adversely affected staff. Thus it would be better as a general policy to benefit employees throughout the county, whereby each business pays a tax to improve greening around office areas.
Food safety	Legislation	None	None	None	-	External	None	Not linked to a consenting regime
Foodstuffs	Legislation	None	None	None	-	External	None	Not linked to a consenting regime. Food carbon/food miles would contribute to the carbon market, not a different ecosystem service.
Fly tipping	Legislation	Fines for fly tipping	None	None	-	External	None	Not linked to a consenting regime
Alcohol licensing	Legislation	None	None	None	-	External	None	Not linked to a consenting regime

Professional field / Subject area	Consenting regime	Proposal	Viability - project	Viability - future	Detail	Internal / external markets?	Further actions	Commentary
Trading standards								
Licensing	Legislation	None	Potential	Potential	Fines directed to appropriate ES market	External	Jonathon Toy & Martin Harland considering options and will feed back again soon	-
Food safety	Legislation	None	Potential	Potential	Fines directed to appropriate ES market	External	Jonathon Toy & Martin Harland considering options and will feed back again soon	-
Letting & landlords	Energy rating regulations	None	Potential	Potential	Fines directed to appropriate ES market	External	Jonathon Toy & Martin Harland considering options and will feed back again soon	-
Age-restricted sales	Legislation	None	Potential	Potential	Fines directed to appropriate ES market	External	Jonathon Toy & Martin Harland considering options and will feed back again soon	-
Tourism								
Tourism	None at present	None	None	None	-	External	None	Not linked to a consenting regime
Voluntary produce accreditation scheme	None at present	Warwickshire Accredited Produce Scheme	None	Potential	Develop a Warwickshire accreditation scheme for produce, food stuffs or any form of goods? For example 'Shakespeare's Beef', 'Warwickshire Premium Apples', 'Warwickshire carbon neutral flour', local food hubs, etc. Such a scheme could help improve farming methods, promote premium products, improve local trade, improve tourism and it would be viewed as a new ecosystem service market.	External	None	Need to develop an accreditation scheme as seen elsewhere.
Tourist tax	None at present	Tourist tax	None	Potential	Why not have a business tourist tax, like in bath or Edinburgh?	External	None	Not linked to a consenting regime
Visitor payback (voluntary contributions)	None	None	None	None	Visitor payback or visitors voluntary contributions. This has potential, as it can be run on a voluntary basis and there is some research in this arena e.g. http://randd.defra.gov.uk/Default.aspx?Menu=Menu&Module=More&Location=None&ProjectID=18644 Not linked to a consenting regime	Both	None	If voluntary, it isn't a 'consenting regime', although perhaps tourism businesses could gain their local authority consents to operate more quickly if they participate. Peak District and Lake District National Park Authorities have been involved in similar schemes.
Health and wellbeing / NHS								
Social (green) medical prescribing, for increased physical and mental health	None at present	Potential for NEIRF#2 funding?	None	Potential	Link to Environmental Health and Future Parks Accelerator Projects? Currently not a consenting regime.	Both	Could explore further.	Social prescribing is big, but, apart from one small case in Dorset, no one is parting with clinical / public health budget to pay providers of natural outdoor spaces to keep people healthy / help them manage health conditions. There are green prescribing programmes, but these are generally just friendships between GPs and environmental NGOs.
Mental health treatment savings due to woodlands/trees	None at present	Potential for NEIRF#2 funding?	None	Potential	Forest Research study being published on 1st December on the savings in mental health treatment costs to the NHS of existing woodlands and street trees. Is there the potential for a planning consenting regime to apply where trees are removed, to fund further tree planting to help offset such costs or perhaps achieve a health net gain?	External	Discuss with NHS in Warwickshire?	-
Highway Consents								
Highways and major infrastructure	Planning regulations	None	None	None	Airport, University, large estates, HS2, other 'linear infrastructure', Homes England, Highways England	External	None	-

4.2 Air quality market – Developing an offsetting market for nitrogen deposition caused by developments and ‘operational’ use

The project team carried out research on any current air quality markets in the UK and approaches to measuring air quality and designing appropriate mitigation. We also worked closely with Environmental Health Officers from Stratford and Warwick District Councils to determine the current issues relating to air quality in Warwickshire and how air quality is considered at this present time.

For specialist, technical advice we enlisted the support of Ben Marner, Director of Air Quality Modelling & Assessment, at Air Quality Consultants Ltd, a member of the Logika Group.

It should be highlighted that we are not aware of any examples where offsetting has been used specifically for nitrogen deposition in the UK. So, this exploratory research is ground-breaking and would require significantly more resources than are available within this project. However, we sought to determine whether such a market is viable and how Warwickshire County Council could proceed to develop and establish such a market, which would be the first in the UK.

4.2.1 Viability of an air quality market in Warwickshire

4.2.1.1 Air quality markets elsewhere

The project team is not aware of offsetting ever being used specifically for nitrogen deposition in the UK, although the Solent Nutrient Market Pilot targets nitrogen from other sources and the Integrated Approach to Nitrogen (PAS) drives a strategic approach to offsetting nitrogen deposition in the Netherlands. Offsetting occasionally gets mentioned by consultants acting for both developers and local authorities in situations where developments have air quality impacts on European protected sites, but these discussions often become legal arguments on interpretation of the Habitats Directive and associated case law. It is often argued that better site-management can remove the effects of additional nitrogen deposition (although soil stripping may be inappropriate in locations with ground-nesting birds). However, this doesn't mean that offsetting is not appropriate. If there is an adverse effect that cannot be mitigated directly through the development, then payments should be required to implement measures to offset the impact, which could include contributing to better site management (which would also improve the condition of the site more generally).

The most relevant examples to the proposed Warwickshire air quality market come from Wealden and Epping Forest District Councils. The 2018 Submission Wealden Local Plan included a developer-funded strategy to mitigate the impacts of road traffic on Ashdown Forest Special Area of Conservation (SAC). The intention was that developers of every new dwelling, or commercial space, would pay into a fund which would then finance area-wide measures; mainly personalised travel planning for ALL (including existing) residents (which is often the best ‘bang-for-buck’ mitigation option for traffic NO_x), and providing a network of electric vehicle charge

points across the district. The interim tariff was set at £2,697 per dwelling and £15.64 per sq/m of commercial space, but how this was calculated underwent significant scrutiny during Examination in Public of the Submission Plan and, had that Plan not ultimately been withdrawn, the tariff is likely to have been revised.

Epping Forest District Council has recently gone down a similar route and has an interim mitigation strategy for its Submission Local Plan that requires developers to contribute financially to wider emissions-reduction measures, again relating to road traffic. The mitigation strategy in this case targets both ecological and human health, but the principal driver for developing the mitigation strategy is the impacts on Epping Forest SAC. The proposed charge to developers is £335 per dwelling. As with the Ashdown Forest example, this is a standard fee per dwelling, irrespective of the impact that each individual development has. This plan-level, rather than development-specific, approach to addressing air quality impacts has been accepted by Natural England.

Though not yet included in planning policy, Shropshire Council is investigating how to get people to work together to drive the needed improvements to nitrogen deposition at some of their habitat sites. As with Warwickshire, this is likely to require a policy hook and development of a market.

4.2.1.2 The need for an air quality market in Warwickshire

Research undertaken by the project team suggests that air quality impacts on vegetation is a widespread problem across Warwickshire. Annual mean concentrations recorded at Coventry's two Automatic Urban and Rural Network²⁸ monitoring sites over the period 2012-2021 were 24-66 µg/m³ compared to the critical level (for all ecological habitats) of 30 µg/m³. However, annual mean NOx concentrations can vary by a factor of 10 or more over 20m, so monitoring at one site is not particularly helpful. The critical level is typically exceeded alongside most sizeable roads, but not usually exceeded well away from roads.

There is one long-term ammonia monitoring site in Warwickshire, a rural background site to the west of Stratford-upon-Avon, but this has experienced poor recent data capture and so annual mean concentrations are not available. 3-year mean (2017-2019) 5km x 5km average ammonia concentrations, modelled on behalf of Defra, are mostly between 2 and 4 mg/m³ within Warwickshire. These concentrations can be compared with critical levels of 1 mg/m³ for sensitive lichens and bryophytes, and 3 mg/m³ for all higher plants. As with NOx, much higher concentrations can be expected close to emissions sources.

In terms of deposition, critical loads for both nitrogen and acidity are exceeded at most designated ecological sites in the UK²⁹. The 'Site Relevant Critical Loads' tool³⁰ provides modelled deposition fluxes for acidity and nitrogen for designated features

²⁸ 'AURN'. This is a national network organized by central government. There are many more monitoring sites for NOx across Warwickshire, forming parts of the AURN and also those operated by individual local authorities. The Coventry AURN data are presented as an example.

²⁹ <https://data.jncc.gov.uk/data/04f4896c-7391-47c3-ba02-8278925a99c5/JNCC-Report-665-FINAL-WEB.pdf>

³⁰ <http://www.apis.ac.uk/src1>

within every SAC, SPA or SSSI in the UK, and in the case of nitrogen deposition to each 5km x 5km grid square outside of these areas. Taking woodland habitat at five SSSIs in Warwickshire as an example, the critical load for nitrogen deposition is 15-20 kgN/ha/y³¹, whereas the average nitrogen deposition over the period 2017-2019 was:

- 52.4 kgN/ha/y at Long Itchington and Ufferton Woods SSSI in Stratford-on-Avon;
- 38.2 kgN/ha/y at Kingsbury Wood SSSI in North Warwickshire;
- 35.0 kgN/ha/y at Whichford Wood SSSI in Stratford-on-Avon;
- 32.7 kgN/ha/y at Ryton Wood SSSI in Rugby;
- 31.3 kgN/ha/y at Snitterfield and Bearly Bushes SSSI in Stratford-on-Avon.

Nitrogen deposition is therefore already far above the maximum critical load for many of Warwickshire's designated woodlands, suggesting that additional measures are required to address this.³²

4.2.1.3 The likely size of a Warwickshire air quality market

Because air disperses over considerable distances, any new emissions to air may increase concentrations and deposition fluxes significant distances from the source (e.g. any single source may have a non-zero effect on air quality across a whole District, albeit that the maximum effects will usually be localised). Furthermore, a new development which generates traffic may cause emissions to be released from roads some distance from the development itself. The incremental increase from each new development will often be extremely small and, on its own, not significant. However, the increase from all new projects and plans, when considered in combination, is often appreciable. For NO_x concentrations and nitrogen and acid deposition, the 'in-combination' changes are sometimes aggregated together with the forecast effects of national and international plans to reduce future emissions. Adverse changes are thus offset by 'autonomous' emissions reductions and thus judged to be acceptable without project-specific mitigation. This approach is, though, often challenged, including by Natural England officers. For ammonia, the situation is different, since there are currently no firm plans in place to deliver sufficient reductions to offset even small local increases.

Air quality assessments undertaken as part of the planning application process do not usually consider protected sites unless this is requested by the planning authority or through consultation with Natural England officers. When impacts on protected sites are considered (c.5% of all air quality assessments) it is extremely difficult to robustly conclude that impacts are acceptable, even from very small developments which are some distance from any relevant habitats. This is because even very small increments might contribute to significant in-combination impacts, and there is considerable ambiguity in UK guidance on how this should be addressed for all site

³¹ The critical load range for nitrogen deposition reflects uncertainty about how sensitive the site and so, without further information, there is always assumed to be the potential for damage above the lower critical load.

³² AQC recently modelled nitrogen deposition to every 1km of the UK on behalf of JNCC, and can share detailed maps if required.

designation types³³. Furthermore, there is currently no practical means of offering effective offsite mitigation at individual development level. These difficulties are thought to be important reasons why quantitative assessments are often avoided by air quality specialists and not requested more often by Natural England.

If mitigation, or offsetting, was required only for developments that alone have a significant impact on protected sites, then the market would be small. However, in reality, any development which generates traffic or has any form of combustion (heating boilers, etc) will contribute to nitrogen deposition on Warwickshire's protected sites and priority habitats, just as the vast majority of developments will have residual carbon emissions. Therefore, if all developments contribute to the air quality offset market, then the market is likely to be of a similar size to the carbon market.

In terms of the likely size of the market in monetary terms, as mentioned earlier Epping Forest District Council will charge £335 per dwelling to offset impacts to both human and ecological receptors (although this is mainly in relation to impacts on Epping Forest SAC). Wealden District Council proposed a much higher tariff of £2,697 per dwelling, but this is likely to have been revisited even if the Submission Local Plan had not been withdrawn.

Costs collected to mitigate air quality impacts on human health are often calculated based on damage costs published by Defra³⁴. Such an approach is conceptually flawed since the marginal abatement costs of mitigation are independent from the costs of damage to society that a pollutant causes. Damage costs nevertheless underpin this approach, which is most frequently taken across the UK, including within parts of Warwickshire (e.g. Warwick District Council's Air Quality SPD³⁵ uses this approach). It is important to note that Defra's damage costs, upon which monetary mitigation requirements are currently often based, already include an element for damage from reactive nitrogen to biodiversity³⁶. However, this is offset by costed items such as the beneficial effect of the same emissions on commercial crops through fertilisation, to the extent that the net financial cost of reactive nitrogen emissions to "ecosystems" is itemised as being beneficial³⁷.

Separating out the biodiversity loss element from the overall damage costs calculated following Defra's methodology is not straightforward owing to the multiple elements in the calculation and how discounting is applied over time. However, at a high level, the costs for biodiversity loss from reactive nitrogen emissions make up just a few percent (>1%, <10%) of the total damage costs for the same pollutants³⁸.

³³ While the requirement for no significant effects "in combination" originates from the Habitats Directive (and thus, in that context, only applies to Natura 2000 sites), it is also included for SSSIs in the National Planning Policy Framework (NPPF). Guidance from the Institute of Air Quality Management (IAQM), and ad-hoc advice from Natural England, suggests that there is also an equivalent requirement for ancient woodlands and local habitat designations.

³⁴ <https://www.gov.uk/government/publications/assess-the-impact-of-air-quality/air-quality-appraisal-damage-cost-guidance>

³⁵ https://www.warwickdc.gov.uk/downloads/file/5043/air_quality_spd

³⁶ i.e. effects of nitrogen deposition and direct effects of ammonia and NOx

³⁷ <https://www.gov.uk/government/publications/assess-the-impact-of-air-quality/air-quality-appraisal-impact-pathways-approach>

³⁸ i.e. NOx and ammonia.

Furthermore, in practice damage costs calculated for new developments typically include fine particulate matter (PM_{2.5}), which tends to dominate the overall figures. By way of example, a new development which generates 200 vehicle trips per day (e.g. a development of 80 dwellings each generating an average of 1.25 inbound and outbound trips per day) would have a total damage cost for NO_x of £2,800 and for PM_{2.5} of £128,000³⁹. Focusing solely on the costed elements for biodiversity loss from the same development gives total damage costs of just £98 for NO_x and £51 for ammonia⁴⁰.

The Air Quality Expert Group (AQEG) reporting on behalf of the four UK governments has reported an alternative approach to estimating biodiversity-related societal costs of nitrogen deposition, referring to the European Nitrogen Assessment. According to this approach, costs to biodiversity range from €2 to €10 per kg N⁴¹. AQEG also cited research showing that average mitigation (as distinct from damage) costs for nitrogen deposition across Europe were approximately €2.4 per kg N abated, with this relating to the most cost-effective mitigation which was invariably through the agriculture sector. Using the same worked example of a development which generates 200 vehicle trips per day, the biodiversity damage cost would, in this case, be in the range of €616 to €3,079, with mitigation costs of €739.

These costs do not necessarily reflect the cost of local action to reduce nitrogen deposition to sensitive sites in Warwickshire, which might be significantly higher. We are confident that the costs would be greater than €2.4 per kg N and probably less than £2,697 per dwelling, however considerable further research needs to be carried out to determine what would be appropriate in Warwickshire.

4.2.2 Business case for an air quality market in Warwickshire

4.2.2.1 Determining the effects of air pollution on nearby habitat

Developments already undergo various environmental assessments, for example an Environmental Impact Assessment (EIA) for those meeting the threshold, as part of the planning application process and a determination is made as to whether the air quality impacts on receptors are significant or not. Typically, the air quality assessment is conducted with regards only to human health impacts, an assessment of the impact on vegetation tends only to be conducted in relation to large/polluting developments or those in close proximity to European designated sites. However, in assessments where human health impacts are already being predicted, extending the air quality modelling to also cover vegetation would usually require little additional effort so long as the required outputs are stipulated in advance (e.g. in Supplementary Planning Guidance (SPG)) and there is no need to also model impacts from other (in-combination) schemes. This would ensure that the contribution to nitrogen deposition of each development is known.

³⁹ Central present values. This calculation has made a number of assumptions regarding site-specific issues and is not intended to be more than broadly indicative.

⁴⁰ This is a broad simplification, and a more detailed calculation of the impact pathways would give more precise results.

⁴¹ Air Quality Expert Group (2018) Air Pollution from Agriculture. Prepared for: Department for Environment, Food and Rural Affairs; Scottish Government; Welsh Government; and Department of the Environment in Northern Ireland.

As explained above, in terms of impacts on human health, predicting location-specific changes is often only one part of the assessment. Many local planning authorities, including Warwick District Council also require a quantification of total emissions from a development irrespective of where those emissions are released. This reflects the point that emissions released to the air will cause an incremental increase to concentrations some distance away⁴². Damage costs are thus calculated irrespective of where the impacts will occur, although different costings are applied to different setting types. In addition to the difficulties, noted in the last section, of conflating the cost of damage to society with the cost of mitigation⁴³, there are also significant legal difficulties with demonstrating that money collected through S106 agreements is spent on mitigating the precise harm which the contributing development has caused. For this reason, damage costs are most often used as a mechanism for driving a developer to invest in on-site mitigation measures (such as electric vehicle charging, cycle facilities, etc.) rather than being collected and spent by the planning authority as S106 payments.

Where location-specific air quality impacts of developments on local protected sites/habitats have been identified, it will be possible to develop mitigation measures which target those impacts. There are three broad options for how suitable location-specific mitigation measures might be identified:

1. **Require developers to extend air quality modelling**, which is already often being carried out in respect of human health, to identify both the damage to sensitive habitats and suitable mitigation measures which could be taken. This would add to the developer's costs. The costs for this assessment would be highly variable, depending on the specific measures being proposed, but an indicative cost of £2-5K per project would be a realistic estimate based upon our experience.
2. **Identify suitable mitigation measures, and ideally also the adverse effects of new development, using a high-level centralised model which could be run by the local authority.** The most efficient way that such a model could be created would be on a 1 km² grid basis. This could make use of existing national-level modelling⁴⁴, with additional assumptions added in order to link gridded emissions to gridded deposition fluxes. While a 1km² grid is arguably too coarse to identify location-specific impacts and benefits, this is the approach which is currently supported by JNCC when promoting local action. Such a model would be likely to cost c. £20k to set up in Warwickshire. Subsequently, using it to identify suitable mitigation would likely take only a few hours per mitigation measure.

⁴² AQC has developed a similar approach for the Greater London Authority which is termed 'Air Quality Neutral' and relies on calculating the total emissions from a development rather than location-specific impacts.

⁴³ Official marginal abatement costs are updated less frequently than damage costs and are not typically used in this context.

⁴⁴ <https://hub.jncc.gov.uk/assets/04f4896c-7391-47c3-ba02-8278925a99c5>

3. Use the UK AERIUS model, which is currently being developed for JNCC⁴⁵ and which we consider is likely to be the most effective option.

UK AERIUS is part of the Integrating Tools for Air Pollution Assessment (ITAPA) project. ITAPA aims to develop a free, online tool based on the Dutch AERIUS product to support UK risk assessments of air pollution effects on ecosystems and thereby facilitate meeting statutory reporting requirements.

UK AERIUS aims to assist with risk assessment for decision making on individual plans or projects seeking permission from competent authorities. Data generated by the integrated tool will likely contribute to national assessment through providing geographical detail about activity for emission sources. In the UK there are typically separate screening tools used before detailed modelling. The integrated tool output will act in the capacity of both "screening model" and "detailed modelling" combined. The final UK AERIUS detailed model output is expected to be similar to that which is currently used for decision making about whether to allow a new emission source.

UK AERIUS will provide a user interface which is intended for non-experts to quantify the effects of activity changes on location-specific nitrogen deposition. It will allow impacts from new developments to be quantified and is also expected to allow users to test the effects of introducing new practices to ongoing operations. The test version of the UK AERIUS model is expected to be released this year, with the final version following in 2023.⁴⁶ Since the design of the model has not yet been finalised it is difficult to comment precisely⁴⁷, but it is expected that UK AERIUS will allow the effect of a new measure to be quantified with just a few hours of non-specialist time. The UK AERIUS model will not allow the effects of new planting to be quantified, but straightforward methods already exist to allow this to take place⁴⁸.

Once suitable measures have been identified and implemented, they would need to be assessed and monitored. For the carbon offset market, the Woodland Carbon Code requires validated tree planting projects to be initially monitored through internal site visits, then at year five and every subsequent 10 years by an independent verification body to ensure that carbon sequestration is occurring as expected. However, nitrogen deposition can't be measured outside of experimental conditions and neither, in most cases, can emissions. So, the optimum quantification is likely to be the modelling that will already have been used to identify the measures prior to their implementation⁴⁹. The local authority thus would need to ensure that the action has happened, and continues into the future. This is similar to how local authority actions to improve air quality with respect to human health are reported to Defra, in that it focuses on ensuring the activity is in place rather than on its ultimate effect.

⁴⁵ <https://jncc.gov.uk/our-work/uk-aerius-qa/>

⁴⁶ The emerging JNCC model is based on the Dutch calculator, available here: <https://www.aerius.nl/en/about-aerius/products/aerius-calculator>. Given AQC's involvement in the project, if there are specific requirements for Warwickshire, these could potentially be built into the JNCC model.

⁴⁷ Although AQC form part of the model design team, many design decisions have yet to be agreed.

⁴⁸ e.g. <https://www.farmtreestoair.ceh.ac.uk/ammonia-reduction-calculator>

⁴⁹ https://uk-air.defra.gov.uk/library/reports?report_id=1004

4.2.2.2 Existing and required policy hooks for a Warwickshire air quality market

Warwick DC published its Air Quality & Planning SPD in 2019, ensuring that air quality is a material consideration in planning decisions. In particular, the SPD requires Section 106 Agreements with developers to secure mitigation, including offset, on larger schemes where appropriate. These Section 106 agreements must satisfy the following legal tests:

- necessary to make the development acceptable in planning terms.
- directly related to the development.
- fairly and reasonably related in scale and kind to the development.

The focus of the Warwick DC SPD is entirely on human receptors, with green infrastructure referred to only as a potential nature-based solution used to provide a barrier between a pollutant source, such as a trafficked road, and residential accommodation. This may be due to the relative lack of statutory woodland sites in Warwick district. However, protection of natural resources from pollution is covered by Policy NE5 of the Warwick District Local Plan 2011-2029 (adopted in 2017). This states that development proposals will be expected to demonstrate that they: *“do not give rise to soil contamination or air, noise, radiation, light or water pollution where the level of discharge, emissions or contamination could cause harm to sensitive receptors”*.

Therefore, in the proposed situation where developments are additionally assessed as being likely to cause air quality impacts on designated sites/priority habitats, it would be reasonable to expect that Section 106 Agreements could be made to enable Warwick DC to require an additional financial payment from the developers to offset the impact. These payments could then be used to undertake a range of measures that would reduce air quality impacts at the affected sites. However, if the existing S106 process in Warwick is to be used, it may be necessary to ring-fence payments made by developers for impacts on vegetative receptors to ensure that this money is used specifically for measures that reduce nitrogen deposition at affected sites.

Given the relative lack of protected sites and sensitive habitats in Warwick district, the absence of appropriate policies in the other Warwickshire local authorities, and the fact that assessments of impacts on protected sites are rarely undertaken, the proposed air quality market is likely to require a stronger ‘hook’. This could be achieved via a county-level Environmental Net Gain (ENG) policy/SPD/DPD, and/or specific policies on offsetting air quality impacts on vegetative receptors within future Local Plans (where assessments of impacts must be undertaken through the planning application process).

4.2.2.3 What a Warwickshire air quality market might look like

A Warwickshire air quality market is likely to be similar to the carbon market, where the proposed Warwick DC Net Zero Carbon DPD requires developers to offset their residual carbon emissions (which are calculated through an assessment as part of the normal planning application process) themselves (through a local off-site offsetting scheme verified by the WCC Ecology team) or through a cash in lieu contribution to the District Council's carbon offsetting fund. To enable net-zero carbon, the fund is expected to cover project types including; investment in natural assets that will capture carbon (tree planting or other habitat creation/enhancement initiatives), development of large scale renewable energy projects within or close to the District, and/or providing advice/funding to enable the District's existing building stock to be decarbonised.

The main difference between the air quality and carbon markets is that whilst carbon emissions are global, air pollution is local and regional, affecting human and non-human receptors in specific locations. Where air quality impacts cannot be mitigated onsite, development of a strategic level plan would allow the developer to pay the local authority to put in place measures to reduce impacts on the same receptors. The UK AERIUS model will provide a straightforward way to determine what mitigation is appropriate and for quantifying the effects of the mitigation measures. It will also facilitate the storing and combining of multiple modelling projects which will allow a centralised project/mitigation inventory to be compiled. It will not calculate the costs, these will require the development of a specific air quality metric or offset fee.

The impacts of individual developments, and their operational use, will vary depending on their proximity to designated sites and priority habitats. So, to ensure the efficiency of the scheme, the payments required from developers to offset their impacts will need to be based on each development's deposited kg N (calculated as part of the planning application using the UK AERIUS model) rather than the actual cost of mitigating development-specific impacts. This is due to the time and resource implications of calculating this on a development-by-development basis, and the need to avoid prolonging the time it takes to approve a planning application.

Therefore, prior to the launch of an air quality offsetting scheme, WCC will need to develop a register of realistic mitigation measures, based on what are likely to be the optimum ways of addressing the impacts of expected development in the county, along with predicted cost ranges for undertaking such measures. This could usefully draw upon ongoing work by JNCC to identify optimum location-specific actions to mitigate ammonia impacts (at a 1km² scale). It is also likely to be helpful to refer to studies undertaken in Northern Ireland and in the Netherlands to cost up suitable mitigation measures. The UK AERIUS model is expected to be helpful to this process to ensure that the costed suite of measures will work in the local Warwickshire context. This work will enable WCC to set an appropriate offset cost to charge each development per kg N that they will produce.⁵⁰ Regardless of whether people or habitats are affected, developer-funded measures could include traffic calming/reduction measures, installation of electric vehicle

⁵⁰ Note that the average cost of €2.40 per kg N for mitigating nitrogen deposition across Europe referred to in a study mentioned in section 1.1.3 above is thought to be an absolute minimum – the cost in Warwickshire is likely to be much higher.

charging points, more efficient public transport, behaviour change measures, and nature-based solutions such as the creation of green infrastructure in sensitive locations in order to provide a barrier (e.g. planting hedges along the roads near to schools and hospitals etc)⁵¹.

Rather than measures to reduce emissions, in some cases it may be more appropriate to investigate nature-based solutions such as creating new woodland/habitat⁵², undertaking management/restoration measures at the affected sites⁵³, changes to habitat management regimes, or the creation of 'sacrificial' habitat around protected sites/habitats or the expansion of sensitive sites. Which measures are most appropriate will depend upon the locations of the protected sites/habitats and of the emissions sources.

In practice, the most cost-effective measures to reduce nitrogen deposition, and thus offset increases from new development, are often those which target the agriculture sector. This is largely because low-cost measures which target the transport and industry sectors have already been taken through national and international policy. Equivalent low-cost measures to reduce emissions from agriculture have very often not yet been taken. The key air pollutant from agriculture is ammonia, while most new developments generate both ammonia and NOx. However, both pollutants deposit nitrogen (note that ammonia deposits far more readily than NOx) and thus reducing emissions of one pollutant can alleviate the effects of the other on total nitrogen and acid deposition. New housing developments will principally affect habitats alongside roads, while reducing emissions from agriculture will not target roadside locations. However, pollutant dispersion is such that a reduction in agricultural emissions of sufficient magnitude might readily offset smaller increases alongside roads. Thus, targeting agriculture can often provide the most cost-effective way to mitigate impacts from different types of new developments on nitrogen deposition.

The changes required to agricultural activities can often be quite small, and Defra has identified a large number of cost-effective measures which could reduce nitrogen deposition much more efficiently than additional controls on road vehicles**Error! Bookmark not defined.** Relatively small changes to how materials are stored, waste is removed, and fertilizer is applied, can have significant effects on total reactive nitrogen emissions. Measures such as covering of slurry heaps to contain emissions, updating poultry sheds to better manage waste or improving the equipment used to apply fertiliser to fields, can all have significant benefits. Switching from urea-based fertilisers to ammonium nitrate, using tailored diets for livestock at different life stages has also been shown to reduce emissions appreciably. In practice, the optimum measures will depend on the nature of different agricultural activities in Warwickshire and their locations.

⁵¹ AQC has undertaken a detailed review of NOx emissions-reduction measures for Wealden District Council, including effectiveness vs costs, which can be provided if required.

⁵² In practice, the rate at which nitrogen deposits to woodland is relatively slow compared with that at which it is released from new emissions sources. As such, while incremental benefits from any new planting may be quantified, planting is only likely to be the optimum action (ignoring any other co-benefits) where it forms a barrier between an emission source and a sensitive site.

⁵³ <http://nora.nerc.ac.uk/id/eprint/510481/>

4.2.3 Conclusions and recommendations for establishing a Warwickshire air quality market

Although there is currently no such air quality offsetting market in existence in the UK (the similar scheme proposed in Epping Forest District has not yet been adopted), it has long been recognised by air quality specialists and Natural England that something needs to be done to address the incremental deterioration of the UK's habitats due to nitrogen deposition. A pioneering and conservation-focused authority such as WCC would be well-placed to develop such a market which could then be replicated elsewhere in the UK. Here we recommend the steps that WCC could take to develop such an air quality market.

Is there a need for this market? Yes, nitrogen deposition is already far above the maximum critical load for many of Warwickshire's designated woodlands, suggesting that additional measures are required to address this.

Could such a market be viable in Warwickshire? Yes, we consider that this could be a viable market, especially when combined with the current BNG market and proposed carbon market. However, further research needs to be carried out to determine appropriate costs/charges in Warwickshire.

Given the early stage of the concept of an air quality offsetting market, and the fact that the impact of airborne emissions are location-specific (unlike carbon emissions), much work remains to be done before such a scheme can be launched.

For the development of a Warwickshire air quality market it is recommended that:

- It should be based on JNCC's emerging UK AERIUS model, expected to be finalised some time in 2023.
- Additional research needs to be undertaken to establish what the appropriate mitigation measures might be and to calculate their likely costs.
- The development of an air quality metric, or offset fee, would need to be developed by WCC. The JNCC model will allow a straightforward approach to calculate the effects of different actions, but the Council would need to assign a cost to those actions, with those costs forming the metric. This will be a technical task covering emissions inventories and modelling, so it will require the use of a specialist consultancy.

To develop an air quality market over the next two to three years, we recommend that WCC would need to take the following steps:

1. Identify designated sites, sensitive habitats and other areas of priority habitat where nitrogen deposition is already above the critical load.
2. Identify the likely size, nature and locations of future development based on local plans and associated evidence.

3. Use published national-level modelling to identify where agricultural impacts are likely to be in Warwickshire and the contribution from different agricultural sectors⁵⁴.
4. Use the JNCC UK AERIUS model (due to be published in 2023), existing research on suitable mitigation measures for addressing nitrogen and ammonia deposition impacts on habitats, and outputs of the above steps to identify where mitigation is likely to be required and what sort of mitigation would be appropriate, culminating in the production of a Register of Measures.
5. Use existing literature on the costs of such measures (including that in the Netherlands which is currently more advanced) to estimate the likely costs of undertaking mitigation measures to abate nitrogen or ammonia deposition impacts in Warwickshire, and calculate an average cost per kg N abated. This will become the metric, or offset fee, which will also need to cover any administration, verification and monitoring costs.
6. Change policy in Warwickshire, through Local Plans, SPDs or a county-wide Environmental Net Gain SPD/DPD . The existing Warwick DC Air Quality SPD⁵⁵ will need to be revised to require developers to:
 - a. use the UK AERIUS model to quantify their kg N deposition as part of the air quality assessment supporting their planning application, and
 - b. state that this impact will need to be offset by paying the respective council a S106 fee of £x per kg N to enable the council to undertake the 'optimum' mitigation measures (set out in the Register of Measures) in affected locations. This fee will need to be ringfenced to ensure it is spent on mitigating air quality impacts on vegetation.
7. Once each development is approved, update the centralised Warwickshire UK AERIUS model to show the location and kg of nitrogen deposited, and add the offset fee to the ringfenced fund⁵⁶.
8. Use the centralised Warwickshire UK AERIUS model and the Register of Measures to identify what measures to undertake to mitigate the impacts of consented development and where, using the offset fees to pay for their delivery. The model will need to be updated to reflect 'completed' mitigation.
9. Monitor the mitigation being undertaken (either at regular intervals, or through spot checks) to ensure that the benefits continue into the future. For example, verify that slurry heaps remain covered, woodland barrier planting has not been cut down, etc.

⁵⁴ it is expected that the availability and granularity of these data from JNCC will be improved over the next year or so, which will make this more straightforward than it currently is.

⁵⁵ Note that the proposed scheme is different to the S106 payments already requested through the Warwick DC Air Quality SPD relating to social damage costs of air pollution, as it is purely for undertaking mitigation measures for otherwise unaddressed impacts on vegetation.

⁵⁶ Ultimately, the UK AERIUS model is expected to store all approved developments automatically. At that point, it will no longer be necessary to maintain a compendium of model inputs used in Warwickshire (termed here a centralized Warwickshire UK AERIUS model) since the national model will do this. A timescale for this functionality has yet to be agreed.

As stated earlier, developing this ES market is ground-breaking and our work on this project has attempted to do something very ambitious within a relatively short timescale. As such, we have been able to carry out research, identify opportunities and suggest a direction of travel. We have demonstrated that, in Warwickshire, there is a need for an air quality market, it could be viable and practical, and we have recommended the steps that could now be taken. However, in order to develop and establish an air quality offsetting market, WCC will need to work with specialists in this field to carry out significant underpinning research and the development of a metric and offsetting fees.

It should be noted that, in a recent meeting, representatives of the National Farmers Union (NFU) were very interested in the potential for the development of an air quality offsetting market in Warwickshire. A meeting has been organised for May 2022 and it is recommended that WCC, and its partners, work closely with the NFU on this and the development of other ES markets.

4.3 Nutrient neutrality market

4.3.1 Potential for a nutrient neutrality market in Warwickshire

We have spoken to many of the current environmental projects in the UK which are developing or investigating nutrient balancing/neutrality schemes. These included 3Keel, Anglian Water, Defra, Environment Agency, EnTrade, Forestry Commission, Herefordshire County council, National Trust, Poole harbour (NFU), RSPB, Severn Trent Water, Sequest, Solent, Water Resources East, Wildfowl & Wetlands Trust, Wye & Usk Foundation and current NEIRF projects in Greater Lincolnshire, on the River Stiffkey, the Swinton Estate, Wendling Beck and on the rivers Wye & Usk. A number of these are hoping to launch schemes in 2022 or 2023 and some of these, like WCC's aspirations, are developing offsetting schemes linked with planning.

Our research showed us that the current schemes which show signs of being successful share two main characteristics:

- water treatment facilities which will not be able cope with the planned increase in demand from development, and
- a European protected site (e.g. a SAC) in the catchment.

We met with Severn Trent Water's (STW) Head of Wastewater Strategy and he did not consider that it was viable to develop a mandatory nutrient neutrality offsetting market in Warwickshire. He agreed that water quality in the county needed to be improved, but stated that STW's water treatment facilities are able to cope with all planned developments and have plenty of spare capacity for increasing nutrient discharges within the licence given to them by the Environment Agency. He also highlighted the fact that there are no significant European protected sites within the county.

This indicates that a mandatory nutrient neutrality/balancing market (nitrates/phosphates) offsetting scheme, related to watercourses, for new housing or industrial developments is currently not viable within Warwickshire.

At the time of writing this final report we have become aware that North Warwickshire Borough Council has received a communication, from the Department for Levelling Up, Housing and Communities (DLUHC) and Natural England, informing them that they have watercourses and waterbodies which are now considered to be in a Nutrient Neutrality Zone. We have no further information, however there is a possibility that this could be linked to DLUHC funding and support from the Planning Advisory Service. We strongly recommend that WCC investigate this further because this might now make a mandatory nutrient neutrality market viable within North Warwickshire.

Although a mandatory market might not be viable, we consider that a voluntary nutrient balancing market, probably linked with agriculture, could have significant potential within Warwickshire. This potential market is a key element of the WCC bid for the second round of NEIRF funding. Also note that, in a recent meeting, representatives of the National Farmers Union (NFU) were very interested in the potential for the development of a nutrient neutrality market in Warwickshire. A meeting has been organised for May 2022 and it is recommended that WCC, and its partners, work closely with the NFU on this and the development of other ES markets.

In June 2020, Natural England published guidance on achieving nutrient neutral housing and a 'nutrient calculator' to help developers deliver homes that don't discharge excess nitrates into the Solent⁵⁷. This guidance could be helpful in the future development and viability assessments for a voluntary nutrient balancing market in Warwickshire.

Forest Research have recently (March 2022) published 'Towards a Woodland Water Code: exploring options'. Woodlands can provide a wide range of ES benefits and this report investigates options for developing a Woodland Water Code to underpin the quantification of these services/benefits to support and encourage private investment in woodland creation. This investment could help tackle important water pressures, such as diffuse pollution, flooding and rising water temperatures (thermal stress). So, the development and adoption of a Woodland Water Code could help in developing a future nutrient neutrality market in the UK. It could also form the foundations for nitrogen and phosphorous nutrient trading schemes and allow credits to be traded in relevant ES markets. There is the potential that these credits could become part of the UK Woodland Carbon Code or form a similar trading platform or code. It is envisaged that a Woodland Water Code could be launched in two to four years' time and NatureScot are also developing a Woodland Water Code in a similar timescale. We recommend that WCC monitor progress with the Forest Research and NatureScot Woodland Water Codes as they have the potential to underpin proposed nutrient neutrality and flood risk mitigation ES markets within the county.

⁵⁷ <https://www.push.gov.uk/2020/06/11/natural-england-published-nutrient-calculator-and-updated-guidance-on-achieving-nutrient-neutral-housing-development/>

4.3.2 Conclusions and recommendations for establishing a mandatory nutrient neutrality market in Warwickshire

- A mandatory nutrient neutrality/balancing (nitrates/phosphates) offsetting scheme and market, related to watercourses, for new housing or industrial developments is not currently viable within Warwickshire.
- A voluntary nutrient balancing market, probably linked with agriculture, could have significant potential within Warwickshire. We recommend that WCC continue to explore this potential with a range of partners and stakeholders.

4.4 Flood risk mitigation market

A number of meetings and discussions were held with Sophie Wynne, WCC Senior Flood Risk Management Engineer, and Severn Trent Water. However, it was decided that, for the purposes of this project, there was no current and viable ES market available to WCC based upon flood risk mitigation. This is because any new development creating residual flood risk would not be permitted, and thus there would be no impact to offset.

All parties see the potential for such a market in the future, however, and are keen to continue this dialogue. It is recommended that discussions should continue and that there is potential for such an ES market in the future, especially if an ENG policy (or similar policies) is adopted. This policy could require a reduction in flood risk (equivalent to an ES 'gain') from each development rather than simply preventing increased flood risk (equivalent to 'no net loss'). There is also potential for the development of a voluntary flood risk market. In each case, payments could be made by developers, or others, to reduce flood risk locally or in at-risk areas within the wider district or catchment.

Note that the Forest Research Woodland Water Code (see 4.3) also includes the role of woodlands for natural flood risk management and could allow credits to be traded in relevant ES markets.

4.5 Trading standards

The project team met with Warwickshire Trading Standards to investigate the potential for ES markets linked to Trading Standards legislation. Options covered aspects of licensing, food safety, property letting and landlords, and age-restricted sales. However, due to a bird flu outbreak, Trading Standards were not able to meet with us for further meetings to take these options forward.

There remains the potential for ES markets related to Trading Standards and the Warwickshire teams we met with were very positive about the potential. It is recommended that discussions should continue.

4.6 Green social prescribing market

4.6.1 What is green social prescribing?

Green social prescribing is about using exercise outdoors to improve people's health and well-being. The green social prescribing market is only in its infancy in the UK and currently mostly consists of groups of GP surgeries referring patients to local providers who will engage them in a range of health and wellbeing activities. These activities include walking, cycling, working on conservation projects, community gardening and food-growing projects, and outdoor meditation. Most of the service providers are either volunteers or are small organisations reliant on securing sporadic grants to fund their work.

The COVID-19 pandemic has highlighted the importance of being outdoors to people's mental and physical health, as well as the inequality of access to green space. The NHS has committed to significantly expanding the number of social prescribing link workers in primary care and is interested in expanding green social care provision.

In July 2020, Environment Secretary George Eustice announced a cross-government project aimed at preventing and tackling mental ill-health through green social prescribing. The project will test how to embed green social prescribing into communities in order to:

- improve mental health outcomes
- reduce health inequalities
- reduce demand on the health and social care system
- develop best practice in making green social activities more resilient and accessible.

This project is being run by multiple partners and test projects are being run in Bristol (including N. Somerset and S. Gloucestershire), Derbyshire, Greater Manchester, the Humber coast, Nottinghamshire, South Yorkshire and Surrey.

Considerable research is underway looking at the links between human health and wellbeing and nature. For example, Forest Research have just completed a research project (published December 2021) on 'valuing the mental health benefits of forests'.⁵⁸ Forest Research state 'This new research is the first of its kind to value the mental health benefits associated with the UK's woodlands. The values are based on the role of woodland in alleviating mental illnesses, resulting in reduced costs to the NHS and employers. The annual mental health benefits associated with visits to the UK's woodlands are estimated to be £185 million. This research is expected to be of use to policy makers in making the case for continued investment in and expansion of the UK's woodlands and treescapes, and the provision of public access to ensure people reap the benefits of those woodlands.'

⁵⁸ <https://www.forestresearch.gov.uk/research/valuing-the-mental-health-benefits-of-woodlands/>

4.6.2 Opportunities for green social prescribing (health & wellbeing) ecosystem services markets

Ultimately the opportunities for a green social prescribing income stream, based upon a health & wellbeing ES benefit, would focus upon the development of suitable greenspaces and natural habitats/environments which have been designed to consider the needs of the human population. Income would not be taken from individuals or GP practices as part of the universal personalised care model⁵⁹ due to the large amount of funding/revenue that would be required. Instead, the income streams would include investment from the NHS/healthcare sector (as an alternative to drug-related treatments and therapies), local authorities (as part of their Public Health strategies), employers (happier staff being more productive and taking fewer sick days), health insurance companies (fewer pay-outs) and pharmaceutical companies (could invest in green social prescribing projects for CSR and PR purposes).

Ideally such health & wellbeing initiatives would combine a wide range of ES benefits and markets and would meet the multiple needs and wants of nature, the environment and people. For example a new country park would have obvious health & wellbeing benefits, but could also be designed to take advantage of BNG, carbon, air quality, nutrient neutrality, flood risk and many other ES markets. Another example might be the creation of a woodland; in order for it to be funded by green social prescribing (in addition to BNG, carbon, flood risk mitigation, etc) it might be located close to a town or in a deprived neighbourhood, it could be accessible by public transport and would be designed to be suitable for specific health & wellbeing-related activities. This could include the provision of good quality paths, information boards, seating, outdoor exercise facilities, toilets or even a visitor centre and refreshment facility.

Another revenue-generating opportunity would be to combine the health & wellbeing and recreation ES markets (including access to nature, eco-tourism, outdoor sports, and recreation). There is obviously an overlap in the benefit provision, see examples above, and it would open up a wider range of potential markets, beneficiaries and investors.

Warwickshire Wildlife Trust, like the RSPB, National Trust and most Wildlife Trusts throughout the UK, have reported a rapid increase in demand for public access to their reserves since the start of the COVID-19 pandemic and this demand is not expected to decline. This indicates the potential to align a human health and wellbeing market, to other ES markets – providing a wide range of environmental and societal benefits whilst also providing funding to help tackle the biodiversity and climate change emergencies.

The project team met with Louise Pickard (West Midlands Health Lead, Natural England) and Karen Higgins (WCC Commissioner for Family Wellbeing & Social Prescribing), Jane Coates (WCC Public Health Service Manager) and the NHS. As a result of these discussions, we consider that, in the medium-long term, green social prescribing could become a very realistic voluntary ES market within Warwickshire.

⁵⁹ <https://www.england.nhs.uk/personalisedcare/upc/comprehensive-model/>

We have started discussions with interested parties to 'kickstart' thought processes and encourage stakeholders to become involved with WCC's environmental and tree planting initiatives at an early stage. We recommend that these conversations continue and that WCC also engage with the NHS Clinical Commissioning Group.

It would also be important for WCC to help build environmental sustainability into the Warwickshire Health and Wellbeing Strategy and to present the emerging natural capital investment strategy to the Warwickshire Health and Wellbeing Board. WCC should emphasise how the natural capital investment strategy links with the current health & wellbeing agenda and current health priorities which include mental health & wellbeing and the health & wellbeing inequalities gap. To put a strong case forwards, it would help if WCC could develop relevant business intelligence and financially based business cases.

In addition to meeting with the NHS and WCC Public Health teams, it would be worth WCC discussing green social prescribing with other organisations (public, private or third sector) that might be beneficiaries of green social prescribing projects and their outcomes. For example employers, health insurance companies and pharmaceutical companies. Note that Lloyds Pharmacy are owned by Celesio whose UK headquarters are in Warwickshire.

We also recommend that WCC investigate opportunities related to the Future Parks Accelerator Projects programme and the development of country parks.

5 Developing a Warwickshire Natural Capital Investment Strategy

A key objective of this project was to outline how a Warwickshire Natural Capital Investment Strategy could be developed and suggest what it should contain and the process by which it could be developed.

5.1 Background

Natural capital investment planning (ncip) is a relatively new approach, both globally and nationally, however the links between the economy, human well-being and the natural environment are increasingly being realised and understood. There is also a growing recognition that ncip should be evidence-based and used to inform socio-economic decision making across all sectors of our society.

Natural capital approaches to environmental management have a few defining characteristics:

- a focus on the environment as a set of assets (Natural Capital);
- these assets provide services and benefits for people (Ecosystem Services);
- there is an emphasis on a spatial and place-based understanding of these assets;
- opportunities are sought to maximise multiple ecosystem services benefits across issues/sectors and these can help manage multiple risks.

Natural capital approaches typically comprise of natural capital investment strategies and plans, these define a specific vision, programmes of activities and funding models. A natural capital investment strategy (ncis) provides a strategic approach to defining the direction of travel and the vision for a programme of work. Whereas, a natural capital investment plan (ncip) leads from the top-level strategy and details what actions will be required, how they will be carried out, who will be involved and how the plan will be funded.

A natural capital approach, incorporating a ncis and ncip, can be developed by any organisation or at any strategic level. Current UK initiatives are being led by Combined Authorities, Local Authorities, Wildlife Trusts, LNPs, catchment partnerships and a UNESCO Biosphere group, Although there is usually a lead organisation, all current UK natural capital investment projects are run as partnerships with a range of stakeholders from the public, private and third sectors.

Natural capital investment planning is integral to the Environment Act, HM Government's 25 Year Environment Plan for England (25YEP) and Clean Growth and Industrial Strategies which set out its approach to safeguarding the environment and future-proofing the economy by ascribing economic value to natural capital. The Industrial Strategy also includes a commitment to 'work not just to preserve, but to enhance our natural capital – the air, water, soil and ecosystems that support all forms of life – since this is an essential basis for economic growth and productivity over the long term'.

The natural capital investment planning process seeks to uphold and apply the 25YEP's recommendation 'to build on the momentum for more private sector financing and drive further progress in the use of market mechanisms that capture the value of natural capital.' This is an important component of the investment planning process given that natural capital investments have, historically, mostly been derived from public funding and philanthropic sources rather than from the private sector. This 'disconnect' has meant that the benefits of having a good, healthy environment have not been properly valued in private investment terms and opportunities.

5.2 Recommendations from other research

Doubling Nature Investment Plan: Scoping Study

In 2020, the Defra Group OxCam Arc Local Natural Capital Plan team funded the 'Doubling Nature Investment Plan: Scoping Study'⁶⁰ to help inform the development of a Doubling Nature Investment Plan (DNIP), or other potential natural capital investment approaches, in Cambridgeshire or other OxCam Arc counties. This study researched and compared most current approaches to natural capital investment planning in the UK, these included Greater Manchester Combined Authority, Surrey LNP/WT, Warwickshire CC, Sussex LNP, North Devon Natural Capital Project, Bristol Avon Catchment Partnership, West Midlands Combined Authority and 3Keel Landscape Enterprise Networks approach. The research focussed on their approaches, strategies, recommendations, the challenges they faced, the key strengths and weaknesses of their approaches and what advice they would give to a new natural capital investment strategy or plan project.

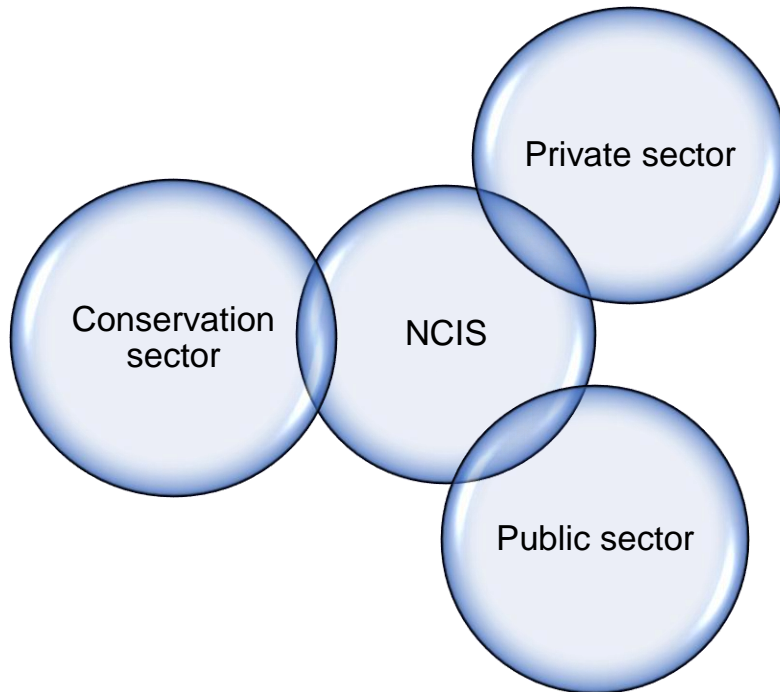
Key findings of this research, relevant to developing a Warwickshire Natural Capital Investment Strategy (developed either by WCC, another Local Authority or a partnership operating within the county) are:

- **There is no 'one size fits all' approach** to developing a ncis or ncip, so you will need to find your own solution.
- A natural capital approach should identify and cover **multiple benefits** including biodiversity, carbon, water and air quality, reducing flood risk, access to green space, leisure, health and wellbeing.
- For sustainable funding you **should develop a hybrid, or blended, funding model** where finances are drawn from a number of different sources. Ideally including both public and private sector funders.
- Because it can act as a strong foundation for any natural capital approach, **net gain policy should be embedded into Local Plans**. This is already the case in Warwickshire, albeit only in the context of biodiversity.

⁶⁰ <https://naturalcambridgeshire.org.uk/news/doubling-nature-investment-plan-scoping-study/>

- Early in the process, you will need to **build a strong evidence base with agreed, and shared, data and metrics**. You also need to **implement a monitoring strategy, measuring success and the quality of your schemes**. This evidence base and monitoring strategy has already been established in Warwickshire.
- **You need a strong leader** and an organisation, or organisations, supporting that person. Ideally, this would include a strong, funded and resilient Local Nature Partnership.
- To deliver a ncis or ncip you **need to have adequate staffing, funding and resources**. You would **need at least one member of full-time staff**, and additional funding to pay for support, technical expertise, specialist services and consultants.
- Working in a relatively new and technical field, **communications will be very important**. Key concepts need to be clearly explained and communicated, using tangible examples to describe less obvious or hidden benefits and using suitable language for your audiences.
- **Close and effective partnership working** is the key to success in natural capital investment. You will need a good understanding of all partners' motivations and the development of a shared vision and way forward.
- When setting up a ncis or ncip, considerable thought should be put into **getting the 'right' people involved**, from a wide range of private sector, NGO, statutory, charity and public sector backgrounds, including landowners and farmers.
- You need to **get businesses and investors interested in nature**, so try to think how they could benefit and what's in it for them.
- To fund projects and develop a sustainable funding model you need to **look for investible propositions** which will generate a return for investors. Other initiatives could include developing pilot, or demonstrator, environmental projects for 'proof of concept', and producing a portfolio of products - a pipeline of 'shovel ready' natural capital projects.
- To make best use of the funding that is available, you should **look for opportunities to maximise the efficiencies and outputs from partner organisations**.
- **Political support and endorsement at governmental, national and local level** is generally regarded as being important.
- Most respondents thought that a ncis would work best if approached from a **county perspective**, because it would fit better with existing local structures, would be more efficient to deliver and would appeal to peoples 'sense of place'.

We should view the role of a natural capital investment approach as being the driver and liaison between the three core players in this emerging market.



This research showed that **there is no single way to progress a natural capital investment plan**, however there was a high degree of similarity between the current approaches. It presented a composite process template of the stages which most current ncip approaches, covered in the research, have taken. This has been updated by the author (on the next page) to include a final stage in the process covering evaluation, ongoing project management, risk management and monitoring.

Revised process template for developing a natural capital investment approach

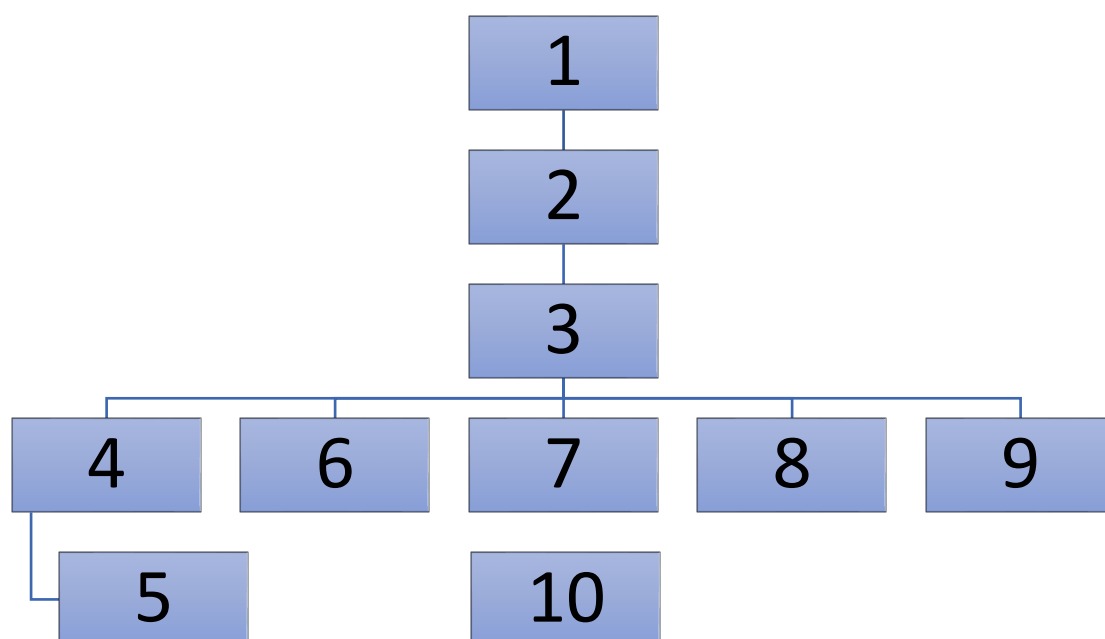
1. Build an appropriate partnership, governance structure and identify a lead organisation/s – working to a shared and focussed vision
2. Secure funding and resources to lead and manage the project
3. Build the required evidence base – using agreed methodologies and metrics
4. Develop a natural capital investment strategy⁶¹
5. Develop a natural capital investment plan⁶²
6. Achieve funding to take forward and deliver the plan and projects
7. Develop and run a pilot or demonstrator project for proof of concept
8. Develop a pipeline of ‘shovel -ready’, investible projects
9. Work with consultants, businesses and investors to identify, develop and run investible propositions
10. Evaluation, ongoing project management, risk management and monitoring

The early stages of this process would probably need to be carried out in the suggested order, but after stage 3 there is considerable flexibility and the different stages could work alongside each other – see the flowchart on the next page.

⁶¹ A natural capital investment strategy provides a strategic approach to defining the direction of travel and the vision for a programme of work. It is the start of a process to plan and coordinate what you aim to accomplish and how you will achieve it.

⁶² In contrast, a natural capital investment plan leads from the top-level strategy and details what actions will be required, how they will be carried out, who will be involved and how the plan will be funded.

Revised process flowchart for developing a natural capital investment approach



Depending upon the strategy and agreed direction, a number of approaches have also incorporated other key stages including:

- Obtain political support
- Ensure that there is a strong local authority environment plan and Environment Board, and that this supports a natural capital approach.
- Work to embed net gain and natural capital into local authority planning and decision making processes.

This proposed process is similar to the recommended six step approach to developing a Local Natural Capital Plan as set out in OxCam LNCP's Natural Capital Approaches and Tools Review⁶³. Natural capital investment planning differs from natural capital planning in that it focusses upon how natural capital can be maintained and enhanced by investment and innovative funding streams, however similar general stages were recommended.

This review recommended a six step approach to developing a Local Natural Capital Plan:

1. Scoping and objectives
2. Evidenced baseline
3. Drivers, pressures and risk register
4. Natural Capital Accounting
5. Plan formulation
6. Implementation

⁶³ <https://www.oxcamlncp.org/defining-our-approach#page-section-5e85e9994331a53f3837c350>

5.3 Options and recommendations for developing a natural capital investment approach in Warwickshire

5.3.1 Options for developing a natural capital investment approach in Warwickshire

Warwickshire (either WCC or a partnership of organisations and stakeholders) could commit to developing a natural capital investment strategy and plan which will inform strategic and economic decision making, and find ways to sustainably finance and rebuild the natural environment (for people, a more resilient economy, increased biodiversity and to mitigate the effects of climate change) by bringing together the conservation, public and private sectors.

The following options are based upon the experiences and recommendations of other research, ncip approaches and the experiences and knowledge of the project team.

Summary of main options:

- A. Do nothing additional at present.** Instead focus on the Warwickshire BNG market and be reactive and await future outcomes of the Environment Act, Local Nature Recovery Strategy policy or other guidance and legislation, from central government and statutory bodies.
- B. Establish a natural capital income stream based upon mandatory BNG and carbon markets.**
- C. Establish a natural capital income stream based upon a range of mandatory and voluntary ecosystem services markets,** including BNG, carbon, air quality, nutrient neutrality, flood risk mitigation and social prescribing.
- D. Develop a natural capital investment strategy and plan that focus upon nature and biodiversity.**
- E. Develop a full-scale environmental, natural capital investment strategy** that seeks investment and revenue for multiple natural capital and environmental benefits.

More detail on recommended main options:

- A. Do nothing additional at present.** Instead focus on the Warwickshire BNG market and be reactive and await future outcomes of the Environment Act, Local Nature Recovery Strategy policy or other guidance and legislation, from central government and statutory bodies.

Pros	No additional investment of time and resources
Cons	<p>Warwickshire will lose its reputation as being an innovative, proactive county.</p> <p>Will be slow to react to changes once future guidance and legislation is published.</p> <p>Income will not be sufficient to fund WCCs ambition to plant 566,000 trees.</p>

- B. Establish a natural capital income stream based upon mandatory BNG and carbon markets.** Using the Warwickshire BNG market and a carbon offsetting market based upon the Warwickshire Carbon Standard, supported by the WDC Net Zero Carbon DPD.

Pros	<p>Relatively straightforward to implement as BNG market is already operational and this report establishes a route to establishing a mandatory carbon market.</p> <p>Mandatory markets will be more straightforward to establish and there will be no, or little, need for project developers or middle-men.</p> <p>Easy for planners and developers to understand and work with, so they will be able to start embedding this approach within their plans and costings.</p> <p>Increased income from BNG and carbon would support the planting of 566,000 trees and other environmental projects.</p>
Cons	<p>Initially reliant upon adoption of the WDC Net Zero Carbon DPD by WDC and all other Warwickshire District and Borough Councils.</p> <p>Limited financial income potential if only utilising two ES markets.</p> <p>Limited financial potential if income stream is only focussed upon mandatory markets.</p> <p>At present the only suitable carbon market is the UK Woodland Carbon Code, though other codes will emerge in future years.</p>

C. Establish a natural capital income stream based upon a range of mandatory and voluntary ecosystem services markets, including BNG, carbon, air quality, nutrient neutrality, flood risk mitigation and social prescribing.

This approach would include developing demonstrator pilot projects for ‘proof of concept’ and it would establish ES markets attracting public and private sector partners and investors.

Pros	<p>Combining voluntary and mandatory markets will open multiple revenue streams, give the model flexibility and have the potential to generate greater revenue.</p> <p>Using a range of ES markets means that you will be able to take advantage of multiple benefits.</p> <p>Using a range of voluntary and mandatory ES markets will allow the production of a portfolio of projects, each with separate revenue streams and benefits profiles.</p> <p>Pilot projects will demonstrate how such investible projects and propositions could work at scale and act as ‘proof of concept’.</p> <p>If properly funded, a small-scale demonstrator project(s) could be commenced within a relatively short timeframe.</p> <p>Good for public relations and will provide practical examples to help communicate the benefits of a natural capital approach.</p> <p>Will start to appeal to businesses and investors.</p> <p>Sends out a positive message that Warwickshire is proactive, innovative and looking for new ways of doing things.</p> <p>Sets the county on the path towards a sustainable and systemic method for funding nature and the environment.</p> <p>Increased income would support the planting of 566,000 trees in a shorter timescale than the previous two options and could fund other, more ambitious, environmental projects.</p>
Cons	<p>More complicated to develop new ES markets and align these with existing mandatory BNG and carbon markets.</p> <p>Businesses and investors are looking for large-scale, investible propositions so might not be attracted by demonstrator pilot projects.</p>

	<p>There is a danger that this approach could lead to a number of very specific projects which will be small-scale and are unlikely to offer multiple benefits.</p> <p>There might be problems in upscaling demonstrator projects.</p>
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D. Develop a natural capital investment strategy and plan that focus upon nature and biodiversity.

This is a more comprehensive approach, but will be focussed upon nature and Warwickshire's biodiversity ambitions and targets.

This could be implemented in two ways:

- Establish ES income streams whilst a NCIS and NCIP are being developed.**

Using the findings of this research project, this approach would have a timeline whereby option C is implemented whilst the natural capital investment strategy and plans are being devised and agreed. This option offers the greatest flexibility and opportunities, and, in reality, the path taken will probably be dictated by the opportunities that arise.
- Focus on developing the NCIS and NCIP, before entering further ES markets (in addition to BNG).**

This option would focus upon developing the strategy, plan and investible propositions first. In many ways it is the ideal solution as the strategy and plan should dictate the mechanisms and income streams employed and any opportunities followed. Also the strategy would be developed faster and a future, fully-funded NCIP should be produced sooner. However, it could take longer for the income stream to be established and for revenues to flow.

Pros	<p>This is an approach which most counties are now considering, but it would be regarded as being innovative because of its foundation upon mandatory ES markets and the combination of both voluntary and mandatory markets and income streams.</p> <p>It incorporates all of the main opportunities focussed upon an investment in nature/biodiversity and is therefore a flexible approach which is ultimately likely to succeed in the long term and be sustainable. It is also likely to generate significant potential income.</p> <p>By incorporating BNG, a range of ES markets (those with strong, tangible links to nature and biodiversity) and demonstrator projects, this approach should be able to demonstrate multiple benefits and appeal to a wide range of public and private sector partners and investors.</p>
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	<p>The county would be committed to taking a natural capital approach and would be taking positive steps towards a sustainable and systemic method for funding nature and natural capital.</p> <p>This is a more holistic approach and the NCIS would bring together a wide range of public, private and third sector partners working together to a shared vision.</p> <p>If properly funded, small-scale projects could be commenced within a relatively short timeframe.</p> <p>Very good for public relations, both for the NCIS/NCIP and all public and private sector partners. It should provide a wide range of practical examples to help communicate the benefits of a natural capital approach, the NCIS and the concept of investing in nature.</p>
Cons	<p>The NCIS and NCIP will require the development of a team, or group of experts, to develop the strategy, look for opportunities and engage with partners. The larger the funding, the faster progress will be.</p>

E. Develop a full-scale environmental, natural capital investment strategy that seeks investment and revenue for multiple natural capital and environmental benefits.

This approach is similar to option D, but is the most comprehensive because it includes all environmental benefits and ecosystem services, not just a focus upon nature and biodiversity. It will include increasing biodiversity, but will also cover water and air quality, reducing flood risk, carbon sequestration, human health and wellbeing, recreation, etc. It will also be more focussed upon the County's ambitions to mitigate against the effects of climate change.

This approach would also fit well with the proposals within this report to develop Environmental Net Gain policies, in line with the ambitions of the UK government and statutory bodies.

Pros	<p>It shares the same innovative properties as option D, but could potentially be the first UK approach to natural capital investment planning that is focussed upon environmental net gain.</p> <p>It incorporates all of the main opportunities for investment in nature, natural capital and the environment and therefore is the most flexible approach which has the best chance of success in the long term. It is also likely to generate the greatest potential income.</p>
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	<p>By incorporating BNG, the whole range of ES markets and demonstrator projects, this approach should be able to demonstrate wider, multiple benefits and appeal to the widest range of public and private sector partner and investors.</p> <p>The county would be committed to taking a natural capital and environmental approach and would be taking positive steps towards a sustainable and systemic method for funding natural capital, benefitting the wider environment and acting to mitigate the effects of climate change.</p> <p>If properly funded, small-scale environmental projects could be commenced within a relatively short timeframe.</p> <p>Very good for public relations, both for the NCIS/NCIP and all public and private sector partners. It should provide a wide range of practical examples to help communicate the benefits of a natural capital approach, the NCIS and the concept of investing in nature and our environment.</p> <p>Opportunities to link public relations and communications to future messaging about climate change and wider issues related to our environment, such as air and water quality.</p> <p>It would have strong links with any current, or forthcoming, climate change strategies and could attract considerable funding for climate change-related initiatives which could provide additional income streams.</p> <p>Grant funding related to climate change mitigation could be used as initial funding to help 'pump prime' large scale environmental projects.</p> <p>Private or public sector organisations, concerned about climate change or the environment, might be prepared to offer 'patient capital' (where the investor is willing to make a financial investment with no expectation of turning a quick profit. Instead, the investor is willing to forgo an immediate return in anticipation of more substantial returns down the road) to help kickstart environmental projects.</p>
Cons	<p>The wider remit of this option could pose communications challenges.</p> <p>Will require the development of a larger team, or group of experts, to develop the strategy, look for opportunities and engage with partners. The larger the funding, the faster progress will be.</p>

5.3.2 Recommended process for developing a natural capital investment approach in Warwickshire

For options D and E, which both involve taking a natural capital investment approach, it is recommended that such an initiative in Warwickshire could follow the process shown below. This is based upon the process template for developing a natural capital investment approach (section 5.2 and adapted from the 2020 Doubling Nature Investment Plan: Scoping Study).

We have attempted to present the stages in a rough sequential order. No timings are offered because they will be directly related to local authority processes, the funding and resources available.

Recommended process for developing a natural capital investment approach in Warwickshire

Stage in the process	What needs to be done
1. Achieve political support and build an appropriate partnership, governance structure and identify a lead organisation(s) – working to a shared and focussed vision	<p>WCC need to engage with partners, businesses and identify key stakeholders to set up an appropriate partnership for the NCIS and develop a strong governance structure. It will be important to ensure you have the right partners, with the necessary buy in, commitment and ability to help resource, add value and make decisions.</p> <p>Partners should include major public, private and third sector landowners.</p> <p>Decide upon the governance structure and the lead organisation(s) to drive the natural capital investment approach forward. Note: There are numerous different governance models employed by current ncis/ncip approaches, however there is no specific guidance nor recognised best practice examples as yet. Some guidance is given within the 2020 Doubling Nature Investment Plan: Scoping Study (section 5.2) and further support could be offered by our project team if required.</p> <p>The findings of this report should be shared with all potential partners.</p> <p>Engage with all partners and stakeholders, internally (within WCC) and externally to ensure that a natural capital investment approach is understood, supported and embedded within relevant plans, teams and organisations. Within WCC it is recommended that the NCIS team should</p>

	<p>seek support from Senior Leaders. Ideally, this would be driven by an Environment Board, or similar. Political support will be very important and the NCIS/NCIP will need an executive director-level champion who really wants this to happen and is prepared to drive it forward. Ideally this needs to be a direct report to the Chief Executive, for example the Chair of the Environment Board. The NCIS team will need to clearly explain the key concepts and income streams, with a focus on tangible examples and demonstrator projects. In Greater Manchester they ran a 'Green Summit' early on in the process. This was found to be a good way to start things off and get support from the Greater Manchester Combined Authority (GMCA) and others. This was followed by a series of natural capital events and biodiversity net gain roadshows to all local authorities – these were successful in achieving buy-in and helped the GMCA decide on their environmental action plan.</p> <p>Whilst working to gain political support, there is also an opportunity to be more aspirational and lobby for 20% biodiversity net gain, an increase in air quality or other ambitious environmental objectives.</p> <p>To aid with the development of a vision, with advocacy and communications it might be beneficial to establish a brand for this NCIS/NCIP. For example 'Greener Warwickshire', 'Towards a Sustainable Warwickshire' or 'Regenerating Warwickshire'.</p> <p>Engage with local Climate Change, Sustainability and Carbon Net Zero teams - inform and involve them in this approach.</p> <p>WCC could lobby for the development of Environmental Net Gain policies.</p> <p>In communications, in addition to de-mystifying key concepts and income streams, WCC should emphasise the County's strong points:</p> <ul style="list-style-type: none"> • A reputation as a leader in innovation for nature recovery, especially with BNG. • At the heart of England, serving major population centres. • A treasured, working landscape that has strong cultural value.
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2. Secure funding and resources to lead and manage the project	Funding and resources will be required. This could come from a number of sources including local authorities, grants, funding, an environmental or climate change strategy, or from income generated through ES markets as outlined in this report.
3. Build the required natural capital evidence base – using agreed methodologies and metrics	It is understood that the WCC Ecology team already have this information.
4. Develop a natural capital income stream and a system to manage the income generated.	<p>Note: this would normally be proposed after stages 5 and 6, and it will be an important aspect of the NCIS and NCIP. However, part of this stage is already in operation and other aspects are incorporated within this research study so could be implemented in the short term.</p> <p>A BNG market is already operating within Warwickshire. WCC need to ensure that the funds are readily available for related BNG activities or to help ‘pump prime’ other environmental initiatives if appropriate.</p> <p>WCC should consider how a voluntary BNG market might be established and managed, and how this income stream could be integrated with the current mandatory one.</p> <p>A Warwickshire carbon market is viable and is outlined in this report. Both mandatory and voluntary markets could be established in the short-medium term.</p> <p>An air quality offsetting market is also viable, but it could be the first of its kind in the UK so will require additional research and specialist input.</p> <p>If additional funding is made available (through WCC, the second round of NEIRF funding or other sources), then further research should be carried out to identify and establish other mandatory and voluntary ES markets including nutrient neutrality, social prescribing and flood risk mitigation.</p> <p>Work with consultants, businesses and investors to identify, develop and establish investible propositions.</p>

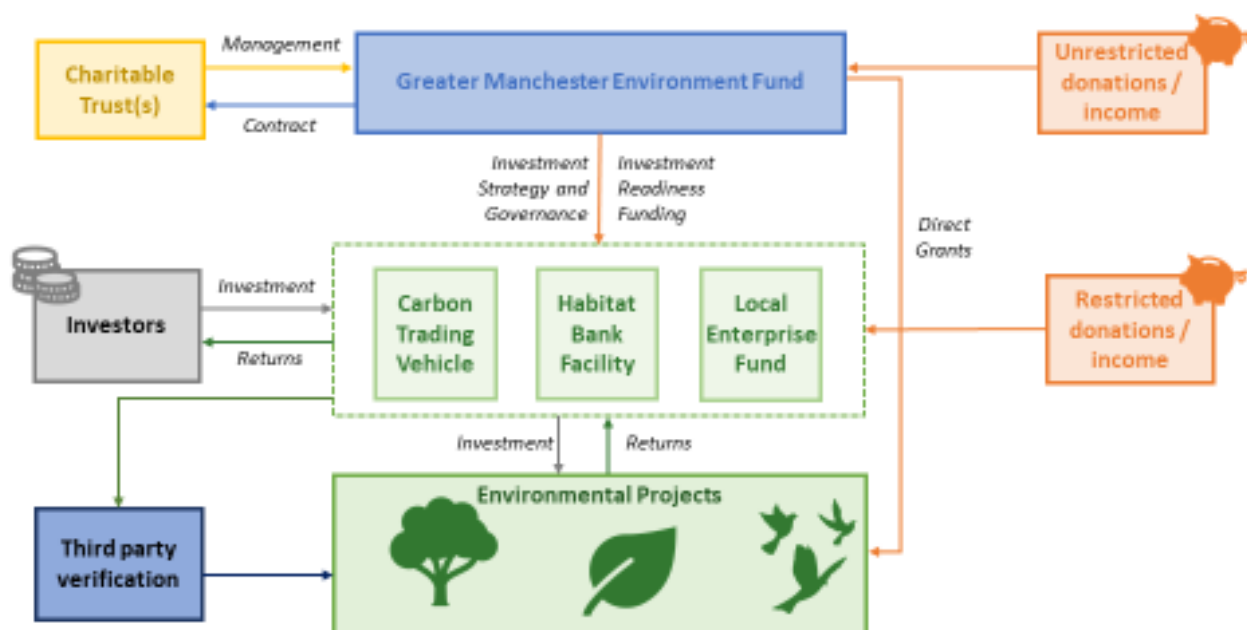
	<p>As the income streams are developed it will be important to set up a suitable system to manage the income generated. Consultants, WCC and other organisations will be able to support this.</p>
5. Develop a natural capital investment strategy	<p>Work towards developing the NCIS with key partners and stakeholders.</p> <p>This strategy could be achieved in the short term if WCC worked closely with consultants to drive this forward.</p>
6. Develop a natural capital investment plan	<p>This will lead on from the agreed NCIS and forms a key part of WCC's bid for financial support in the second round of NEIRF project funding.</p> <p>Again, it would be logical to make use of experienced consultants for this task. It would allow implementation plans to be developed and implemented within a short timescale.</p> <p>Realistically, once governance has been agreed, it should be possible to produce a practical, feasible and detailed natural capital investment strategy and plan within a year, i.e. by summer/autumn 2023.</p>
7. Achieve funding, income streams and investible propositions to take forward and deliver the plan and projects	<p>This would be worked on in conjunction with stages 4, 5 and 6.</p>
8. Develop and run a pilot or demonstrator project for proof of concept	<p>Opportunities for demonstrator projects should be investigated from stages 2 (securing funding) and 4 (developing a natural capital income stream) onwards, alongside developing the NCIS and NCIP.</p> <p>These projects will be developed in partnership with key stakeholders and could be unique, innovative projects or linked to current projects being run by conservation delivery partners (for example the Warwickshire Wildlife Trust, National Trust, RSPB, NE or EA), utility companies, developers or businesses.</p> <p>These projects should be focussed upon demonstrating how environmental projects can generate income or be developed into investible propositions. They also need to be suitable for replication and significant scalability.</p>

<p>9. Develop a pipeline of 'shovel -ready', investible projects</p>	<p>WCC and its NCIS partners should look to identify a pipeline of 'shovel-ready' projects which are suitable for monetising through ES markets and could be developed into investible propositions.</p> <p>Funding and further work with partners is required to develop detailed plans, accurate costings and make the projects effectively 'shovel ready'.</p> <p>External support (from consultants or relevant financial institutions) will be required to investigate how income can be generated from these projects and how they could be turned into investible propositions.</p> <p>This would link with any County-wide opportunity mapping, environmental ambitions or projects.</p> <p>These projects should also be closely linked to the forthcoming Local Nature Recovery Strategy and Environmental Land Management schemes.</p> <p>Initial work will involve working with conservation organisations and local authorities, but future activities should involve landowners, the public sector, businesses and potential investors.</p>
<p>10. Ongoing project management, evaluation and monitoring</p>	<p>Once the NCIP is underway it will require ongoing project management, evaluation and monitoring. This will ensure that it is delivering it's environmental, social and financial goals, all projects/programmes are on schedule and new public and private sector investors/partners are being encouraged to participate.</p> <p>A key long-term goal will be sharing the learning and best practice from this initiative to help develop other ncip approaches within the UK and EU.</p>

5.3.3 What investment tools, mechanisms or revenue streams could a natural capital investment strategy for Warwickshire include?

Based upon current approaches to natural capital investment, there are a number of specific tools, mechanisms or revenue streams which could be implemented in Warwickshire. In reality the NCIS would incorporate a range of these income streams within a natural capital income portfolio, some would be constant sources of revenue and others would be applied opportunistically. However, they would all be combined to produce a long-term, sustainable, nature-based source of income which could benefit Warwickshire's wildlife, natural environment and people for the future.

For example, below is a model for the Greater Manchester Environment Fund which combines a number of different mechanisms, revenue streams, income streams and investors.



The range of investment tools, mechanisms or revenue streams that a Warwickshire NCIS could include are given below.

Establish mandatory and voluntary ecosystem services markets

Warwickshire has the only operational BNG market in the UK at the moment and this project has identified two additional, viable, mandatory ES markets (carbon and air quality) and outlined how WCC could establish these markets and gain long-term revenue streams from them.

There is significant potential for WCC to develop other ES markets, specifically nutrient neutrality, social prescribing and flood risk mitigation, and explore how mandatory and voluntary ES markets could work together within a natural capital investment portfolio.

These ES markets have the potential to provide sustainable funding for environmental projects and because of the breadth of ES this income stream can be linked to a wide range of benefits and is therefore very flexible. This breadth of ES and benefits would allow WCC to develop a portfolio of markets and projects which could prove attractive for a wide range of private, public and third sector investors and funders.

Most ES markets are currently in the early stages of development, but we envisage that a number of accredited schemes will be certified and validated over the coming 2-3 years. It is hoped that Warwickshire will be leading the way with mandatory markets and in developing a UK air quality offsetting market.

Environmental Land Management schemes funding

Nature reserves and conservation projects have traditionally received funding from the UK government's Countryside Stewardship Scheme, this is currently in the process of being replaced by new Environmental Land Management schemes (ELMs). In the coming years, the UK government will be launching three ELM schemes which are intended to support the rural economy while achieving the goals of the 25 Year Environment Plan and a commitment to net zero emissions by 2050. These will reward responsible environmental land management; farmers and other land managers will be able enter into agreements to be paid for delivering clean and plentiful water, clean air, thriving plants and wildlife, protection from environmental hazards, mitigation of and adaptation to climate change, beauty, heritage and engagement with the environment.

The three specific schemes will be:

- Sustainable Farming Incentive - paying farmers to manage their land in an environmentally sustainable way.
- Local Nature Recovery – paying for actions that support local nature recovery and meet local environmental priorities.
- Landscape Recovery – supporting landscape and ecosystem recovery projects.

These schemes will offer an additional revenue stream for environmental projects and initiatives. These schemes are based upon the provision of ES which would also be the focus of the ES markets that are being proposed within Warwickshire. So, there are likely to be significant income opportunities coming from these ELMs, especially in relation to the forthcoming Local Nature Recovery Strategies. As a result, it is recommended that revenue from ELMs are considered as a key component of Warwickshire's developing natural capital income stream, the NCIS and NCIP.

Visitor income opportunities

Another traditional method for funding environmental projects, nature reserves, country parks or greenspaces is by visitor income activities. These range from car parking charges and catering facilities, to guided walks, programmes of activities or dedicated visitor attractions such as zipwires or climbing walls. Over recent years, especially since the Covid-19 pandemic, we have seen a significant increase in visitors to nature reserves, parks and greenspaces and an increased interest in the

natural world and spending time in nature. These have helped to make the visitor income and engagement sector very buoyant and a number of key players, for example the National Trust, are now increasing their investment in this area.

Visitor income initiatives can be run by the owner, manager or by a third-party provider and offer a tangible and straightforward aspect of an income model or an investible proposition. This is why all major conservation organisations have an element of visitor income within their financial modelling.

Develop an environment fund

There are a wide range of different funds being developed which offer funding or loans to help start-up or accelerate environmental projects. Initial funding might come from grant funding, local communities, initial investors or philanthropists. But eventually the funds are designed to attract investment and generate a return on investment. Funds could cover general environmental projects or could be focused upon specific outcomes or assets, for example climate change, rivers, improving water quality, removing non-native species or supporting businesses which could increase biodiversity through their activities (e.g. nature tourism or conservation-friendly agriculture). In Warwickshire, you could establish such a scheme (for example a Warwickshire Environmental Impact Fund) that will direct new sources of finance into significant environmental restoration or climate change mitigation projects.

Greater Manchester have an Environment Fund to provide grant funding to non-statutory environmental initiatives that improve the environment within Greater Manchester and are currently underfunded through existing funding mechanisms. Income for the fund will come from grants and income streams including charges from plastic bags, carbon credits, etc.

In Surrey, the LNP are setting up a company to create investment opportunities and match them with suitable investors. One of their objectives is to create a significant natural capital investment fund of at least £20M to strategically deliver these investments.

Green bonds

A green bond is a fixed income investment in which an investor loans money to an entity which borrows the funds for a defined period at either a variable or fixed interest rate. The loan must be used to finance new and/or existing climate and environmental projects. For example WCC could launch an environmental bond to fund the development of priority habitats or a climate change mitigation project. The loan, and any interest, would be paid by income from ES markets, ELMs or other income streams discussed in this report. Note that any loan carries a risk of default.

Habitat banking

In habitat banking, land (purchased for the bank or that of landowner partners) is developed, or restored, into high quality habitat or greenspaces. This is what WCC are currently operating as a result of their mandatory BNG market and tree planting ambitions. WCC could also develop this into a voluntary market selling biodiversity net gain credits to businesses or investors, enabling them to compensate/mitigate for the environmental impacts of their businesses or other activities.

Habitat banks require up-front funding to get the scheme started, so lend themselves well to being 'accelerator projects'. They give planners and developers a quick, reliable and cost effective solution to the compensation problem, regardless of the size of the development, so that all development can be made sustainable. Whatever number of 'conservation credits' are needed can be bought 'off the shelf' by the developer at the point of planning permission. A key benefit of habitat banking is the pooling of credits from a range of development schemes, so it can combine economy of scale with the power of aggregation to leverage significant private investment into large-scale habitat conservation schemes.

This approach could also include the option to purchase BNG credits from another source (landowner) and then resell them at a future market price. WCC could take this approach if it wanted to help set up a delivery site with a private landowner or if it anticipated a forthcoming need for BNG credits which it was currently unable to fulfil.

Develop a pipeline of projects

A common approach to ncip is to produce a pipeline of investible and 'shovel-ready' environmental projects as recommended within this report. These could offer multiple benefits and might fit into a wider programme containing a portfolio of different projects (all providing a range of benefits). This will give businesses and investors practical examples of what they could invest in, 'proof of concept' and these projects are very valuable for communications and public relations. Ideally, the pipeline or programme will be greater than 10 years long, so investors can see something that they can invest in over a period of time.

One of the aims of the Greater Manchester IGNITION project is to develop a pipeline of natural capital climate adaptation projects at the €10m+ scale which could be attractive to private investors. Warwickshire could look to emulate this approach and develop projects at this scale or larger.

It is widely recognised that institutional investors are looking to invest in environmental propositions and be able to offer their clients truly green, not green-washed, options. To enable this they might be willing to accept a lower return on interest than in their traditional investments, but in order to make it attractive they want to invest at scale. Current conversations suggest that these investors are looking at hundreds of millions or even billion pound propositions. To enable this, the environmental sector needs to be developing large-scale programmes by aggregating smaller projects. This approach will offer multiple benefits, attract a number of partners/investors, help reduce risk and enable investors to achieve the return on investment and scale that they require. However, this aggregation of projects into huge landscape-scale programmes is a significant challenge for the environmental sector and is one which many organisations are grappling with at the moment, for example the RSPB and the Wildlife Trusts.

Trial a beneficiary system

In a beneficiary system, you would aim to link landscape management to the long-term needs of business and society, by enabling businesses to work together and positively influence the landscapes in which they operate. Businesses can achieve required environment-based outcomes, protect their supply chain and reduce organisational risk. This system can benefit landowners/farmers and the

environment, however these are not the key drivers and this is ultimately a business arrangement, not a pure investment. However, it could be an integral aspect of a natural capital income model and might act as a tangible early project to bring partners together and for 'proof of concept'.

A good example of this approach is the 3Keel Landscape Enterprise Networks (LENs) approach which is building up a series of place-based, chains of transactions which enable groups of businesses to jointly procure landscape outcomes from farmers or landowners that can make things happen on the ground. Currently there are eight LENs projects (LENs laboratories) running in the UK. These LENs Laboratories provide practical situations to develop and prove the LENs process, work with trading platforms (for example EnTrade or NatureBid), explore monitoring functions, develop practical governance models and identify, evidence and agree landscape interventions.

There is potential for WCC and its NCIS partners to investigate developing a beneficiary system in Warwickshire, where you would identify:

- Key beneficiaries (i.e. who will pay)
- Environmental functions or benefits (i.e. what will they pay for)
- What ES markets would be applicable
- The assets (i.e. how will it be supplied)
- The suppliers (i.e. who will supply it)

5.4 Suggested template for the development of a WCC strategy

A template for a high-level WCC (internal) Natural Capital Investment Strategy was requested. This is based on the recommended process for developing a natural capital investment approach in Warwickshire (section 5.3.2) and is given as main headings below:

- Summary of actions, roles and responsibilities
- Strategic aims and objectives of the NCIS
- Links to current and forthcoming WCC policies and initiatives
- Political/organisational support
- Internal partners and stakeholders
- External partners and stakeholders
- Governance
- Authority and roles within WCC
- External expertise required
- Funding and resources
- Evidence base and identification of gaps
- Potential natural capital income streams and models
- Main components of the NCIS

6 Lessons learnt

Reflecting on this study it is possible to identify a number of key lessons learnt.

Developing mandatory ES markets within a local authority

During this project, the research and WCC teams identified a number of key factors which should be considered when looking to develop mandatory ES markets within a local authority framework and environment. These are:

- There needs to be a focus upon identifying, or developing new, policies which will support emerging ES markets and income streams. Without these you won't have the necessary 'hooks' or consenting regimes within which to mandate your markets or income streams. Suitable policies might be within Local Plans, DPD's or SPD's. We are recommending that an Environmental Net Gain policy (SPD, DPD or inclusion within Local Plans) should be considered by Warwickshire County Council or the District Councils.
- WCC and local authority teams were very keen to contribute to our project and the Project Board, but there is a requirement to increase awareness (see 'Awareness of a natural capital approach, ES markets and natural capital investment') and to 'warm them up' before initial meetings take place. In our first meetings with WCC teams there was considerable thinking time required, however in subsequent meetings participants were far more able to support us and offer relevant and innovative ideas and solutions. In a project such as this, more time is required to enable stakeholders to 'get up to speed' before the selection of interviewees and the running of research meetings.
- We were lucky when working with WCC and local authority stakeholders, that they were very receptive to the ideas/concepts of natural capital investment and developing ES markets. We presume that this is due to the success they are already achieving through their ground-breaking BNG market. However, other projects should be aware that they might not receive such a positive welcome and that there might be considerable work required to change stakeholders mindsets.
- After completing this research, we consider that mandatory local authority markets and mechanisms have the potential to be swifter to design and develop than voluntary ones. However, they will take longer to implement (typically 1-2 years) due to the need to refine policy, go through appropriate processes and receive the full support of all relevant local authority departments.
- Mandatory regimes and markets will be challenged by developers or others who will be subject to the charges. Therefore, the final mechanisms and regulations will need to be robust and involve legal advice and guidance.

Lessons learnt on the research methodology

This project involved many virtual meetings with WCC and local authority staff members, external organisations and the Project Board. These all helped to increase communications between teams, raised awareness, shared knowledge and started discussions on the subject of developing innovative income streams for environmental projects. We consider that these meetings will be vital to the future success of this initiative and have really helped achieve buy-in to the project throughout WCC and its District and Borough Councils.

Another key feature of the virtual meetings with external organisations, especially current NEIRF projects, was the willingness to help each other, share advice and offer support. The project team have therefore developed an even wider network of contacts within this emerging field and have been actively supporting other teams working to develop similar ES markets. This support has included advice on the production of bids for the second round of NEIRF funding.

All meetings in this project were carried out virtually, via MS Teams or Zoom. The project team and participants all found this to be an extremely efficient and effective way to communicate and share information.

This was a complex project with constantly changing priorities and foci, which ran over a relatively short timescale and involved a wide range and number of participants. So, good project management was key to ensuring that the deliverables were all produced on time and met the requirements of both the project specification and the project leader.

Awareness of a natural capital approach, ES markets and natural capital investment

Most of the people involved in this research as WCC team members, interviewees or Project Board members were aware of what a natural capital approach is and what natural capital investment and ES markets are. However most are still trying to increase their knowledge, collate relevant information and decide how it might be helpful and relevant to them in their professional roles.

Good, clear communication is obviously very important to ensuring the adoption of these approaches and their use in strategy development and decision making processes. Also, more widely, communication is required to embed the general concepts and motivate people to engage with them and help champion this new way of doing things.

The key concepts (natural capital, natural capital investment planning, ES and ES markets) are quite abstract, so they need to be clearly explained and communicated, with a focus on tangible examples and demonstrator projects. For example, in Greater Manchester they ran a 'Green Summit' early on in the process, followed by a series of natural capital listening events and biodiversity net gain roadshows.

To get your message across clearly, you need to talk in a suitable language for your audiences, make it accessible and simple. Explain why natural capital investment matters, what it could achieve and how this could benefit the audience.

With ncis and ncip there will be a wide range of benefits instead of just to nature alone, such as water and air quality, reducing flood risk, access to greenspaces for deprived neighbourhoods, health and wellbeing. In our messaging we should communicate these less obvious or 'hidden' benefits to help appeal to wider audiences.

There is no 'one-size fits all' approach to developing a natural capital investment strategy and plan

From previous research and experience, the project team are aware of the general processes typically followed to develop a ncis or ncip and how these differ according to the organisations involved and the specific requirements of their initiatives. In discussions with WCC teams, they became aware of their specific requirements and this was a useful reminder that investment planning needs to be a bespoke process.

In this report for WCC we have presented options for the NCIS and NCIP, an overview of investment tools and revenue streams, recommended what they could cover and presented a suitable process and template which they could follow. We hope that they follow our advice and recommendations, but would also emphasise the importance of them following the path that suits them and their organisation the best. We would be happy to support them on this journey and hope that dialogue between ourselves will continue.

Funding requirements within NEIRF projects

During this project there were numerous requirements to attend (or present at) webinars, have regular meetings with the Defra NEIRF team, to engage with the NEIRF Community Of Practice (COP) and to complete progress reports or other documentation. These activities were important for both WCC, the project team and the Defra NEIRF team, and helped disseminate advice and share best practice. However, they required additional time and resources.

In addition, the Project Leader (David Lowe) held fortnightly catch-up meetings with the Project Manager and attended many of the research meetings, both with key stakeholders and other NEIRF (or similar) projects.

It is recommended that within the NEIRF funding approximately 10 additional days should be allocated to both the Project Leader and the Project Manager. This will allow them to run the project efficiently whilst also participating in all additional NEIRF and COP-related activities.

Finally, 'have fun'

The project team developed an excellent rapport and working relationship with David Lowe and staff members from WCC. Everyone enjoyed working on the project and maintained high levels of interest and motivation throughout the study. We have all

learnt a great deal from this project and one of the main reasons why is that we all had fun doing it.

We leave this project as valuable, respected, critical friends.

7 Recommendations for further work and research

Here are summaries of future work or research which could be carried out, based upon the findings and recommendations of this project.

7.1 Emerging carbon codes

A number of emerging carbon codes are currently being developed (many of which are NEIRF projects) and will have validated markets within the next few years. It is recommended that WCC aim to keep up to date with the development of these new carbon codes and markets. Research will need to be carried out to establish the viability of these new markets.

7.2 Other sources of carbon

Other carbon sources, such as the whole life carbon of new infrastructure, are considered unlikely to be viable in the short-term, but could be investigated further in the future in order to feed into the preparation of new Local Plan policies, etc.

7.3 A recommended process for establishing a Warwickshire carbon market

In section 3.9.3 we outline what steps WCC should now take to establish a Warwickshire carbon market. We recommended that they should work with consultants, statutory bodies and external organisations to do the following:

1. Share this report and the findings of this research, both internally (WCC) and externally.
2. Continue meeting with internal (local authority) and external teams, such as the National Farmers Union, landowners and Warwickshire conservation organisations, to identify forthcoming opportunities and champion the concept of a Warwickshire carbon market and a natural capital approach.
3. Support the technical development of the WDC Net Zero Carbon DPD.
4. Act as a champion, or advocate, for the WDC Net Zero Carbon DPD and include it in all relevant literature or presentations.
5. Produce a robust Warwickshire Carbon Standard, including a system of monitoring and verification.
6. Develop suitable legal and financial frameworks.

7. Plan and then commence the planting of 566,000 trees, including land purchases if required.
8. Register with the UK Woodland Carbon Code and the UK Land Carbon Registry.

7.4 Development of policies and an Environmental Net Gain (ENG) policy

Most ES that might offer opportunities for viable future markets didn't have suitable consenting regimes or other policy 'hooks' which would enable them to be enforced in Warwickshire. As a result, we recommended that it is important to develop robust policies, especially the production of an ENG policy (SPD, DPD or inclusion within Local Plans) should be considered by WCC or the District Councils.

The development of this ENG policy is also considered important to provide a stronger 'hook' for the proposed air quality market.

7.5 A recommended process for establishing a Warwickshire air quality market

In section 4.2.3 we outline what steps WCC should now take to establish an air quality market. We recommended that they should work with specialist consultants, statutory bodies and external organisations to do the following:

1. Identify designated sites, sensitive habitats and other areas of priority habitat where nitrogen deposition is already above the critical load.
2. Identify the likely size, nature and locations of future development based on local plans and associated evidence.
3. Use published national-level modelling to identify where agricultural impacts are likely to be in Warwickshire and the contribution from different agricultural sectors.
4. Use the JNCC UK AERIUS model (due to be published in 2023), existing research on suitable mitigation measures for addressing nitrogen and ammonia deposition impacts on habitats, and outputs of the above steps to identify where mitigation is likely to be required and what sort of mitigation would be appropriate, culminating in the production of a Register of Measures.
5. Use existing literature on the costs of such measures (including that in the Netherlands which is currently more advanced) to estimate the likely costs of undertaking mitigation measures to abate nitrogen or ammonia deposition impacts in Warwickshire, and calculate an average cost per kg N abated. This

will become the metric, or offset fee, which will also need to cover any administration, verification and monitoring costs.

6. Change policy in Warwickshire, through Local Plans, SPDs or a county-wide Environmental Net Gain SPD/DPD. The existing Warwick DC Air Quality SPD will need to be revised to require developers to:
 - a. use the UK AERIUS model to quantify their kg N deposition as part of the air quality assessment supporting their planning application, and
 - b. state that this impact will need to be offset by paying the respective council a S106 fee of £x per kg N to enable the council to undertake the 'optimum' mitigation measures (set out in the Register of Measures) in affected locations. This fee will need to be ringfenced to ensure it is spent on mitigating air quality impacts on vegetation.
7. Once each development is approved, update the centralised Warwickshire UK AERIUS model to show the location and kg of nitrogen deposited, and add the offset fee to the ringfenced fund.
8. Use the centralised Warwickshire UK AERIUS model and the Register of Measures to identify what measures to undertake to mitigate the impacts of consented development and where, using the offset fees to pay for their delivery. The model will need to be updated to reflect 'completed' mitigation.
9. Monitor the mitigation being undertaken (either at regular intervals, or through spot checks) to ensure that the benefits continue into the future. For example, verify that slurry heaps remain covered, woodland barrier planting has not been cut down, etc.

Note: In order to develop and establish an air quality offsetting market, WCC will need to work with specialists in this field to carry out significant underpinning research and the development of a metric and offsetting fees.

7.6 Further research on ES markets

In this study we were able to identify a number of ES markets which could be viable within our limited project timescale. However this is simply the start of this process and we recommend that WCC continue to research policy 'hooks' and new, potential ES markets.

WCC should start by continuing the work already commenced on nutrient neutrality, flood risk mitigation, trading standards and social prescribing. It should then continue investigating other opportunities and markets, for example tourism and recreation (access to nature).

At the time of writing this final report we have become aware that North Warwickshire Borough Council has received a communication, from the Department for Levelling Up, Housing and Communities (DLUHC) and Natural England, informing them that they have watercourses and waterbodies which are now considered to be in a Nutrient Neutrality Zone. We have no further information,

however there is a possibility that this could be linked to DLUHC funding and support from the Planning Advisory Service. We strongly recommend that WCC investigate this further because this might make a mandatory nutrient neutrality market viable within North Warwickshire. The project team are up-to-date with nutrient neutrality methodologies and markets, so would be able to support WCC with this if required.

The emerging Woodland Water Code could be relevant to future nutrient neutrality, flood risk mitigation and other ES markets. WCC should therefore maintain contact with Forest Research, keep up to date with developments to this code and be prepared to take an active part in any research opportunities.

7.7 The development of voluntary ES markets

This project has demonstrated the viability of a mandatory carbon and air quality market within Warwickshire. However, for these revenue streams to be accepted and adopted, WCC will need to see proof that ES markets can be functional, operational and financially viable. As WCC are the only Local Authority investigating developing a natural capital income stream using markets based upon consenting regimes this proof of concept, in the short-term, will need to be provided by the development of a voluntary ES market. This could be based on either current/developing mandatory markets or on showing how new ES markets (nutrient balancing or social prescribing) will work in combination with, and support the further development of, mandatory markets, and will demonstrate how to make a simple model/concept work in practice - enabling WCC to be investment-ready in a timely manner. It is this premise that WCC has proposed in its application for funding in the second round of NEIRF projects.

Whilst developing ES mandatory markets, WCC should remain mindful of the potential to also investigate and implement voluntary markets with different buyers, sellers, investors and market mechanisms.

Our research for this project has identified particular potential for the development of voluntary ES markets linked to carbon, nutrient neutrality, flood risk mitigation and social prescribing.

7.8 A recommended process for developing a natural capital investment approach in Warwickshire

In section 5.3.2 we present a detailed, recommended process for developing a natural capital investment approach in Warwickshire, either for WCC or a partnership of organisations and stakeholders. A summary of the recommended process is:

1. Achieve political support and build an appropriate partnership, governance structure and identify a lead organisation(s) – working to a shared and focussed vision
2. Secure funding and resources to lead and manage the project

3. Build the required natural capital evidence base – using agreed methodologies and metrics
4. Develop a natural capital income stream and a system to manage the income generated.
5. Develop a natural capital investment strategy
6. Develop a natural capital investment plan
7. Achieve funding, income streams and investible propositions to take forward and deliver the plan and projects
8. Develop and run a pilot or demonstrator project for proof of concept
9. Develop a pipeline of ‘shovel -ready’, investible projects
10. Ongoing project management, evaluation and monitoring

We also present a suggested template for the development of a high-level WCC (internal) natural capital investment strategy.

We recommend that WCC should work with internal teams, consultants, statutory bodies and external organisations to follow and adapt these processes. The project team would be very well qualified to support WCC with this, if required.

7.9 Maintain relationships and keep dialogues going

A key success of this project has been the development of working relationships, both internally within WCC and with many external individuals and organisations. WCC should endeavour to maintain these relationships and work hard to keep these conversations going.

We would especially recommend that WCC continue to discuss their NCIS/NCIP plans with Severn Trent Water, the NFU and other environmental organisations within the county. With regard to social prescribing, we have recommended that in addition to meeting with the NHS (including the NHS Clinical Commissioning Group) and WCC Public Health and Wellbeing teams, it would be worth WCC discussing green social prescribing with other organisations (public, private or third sector) that might be beneficiaries of green social prescribing projects and their outcomes. For example, employers, health insurance companies and pharmaceutical companies.

7.10 Market engagement

One of the activities in this project’s specification was market engagement with external (planning applicants / developers / infrastructure providers) stakeholders and markets to gather feedback on our propositions and adapt and refine them as required. Because we were developing mandatory ES markets, it was decided that

there was no reason to carry out external market engagement activities. However, we think that these activities could be valuable once WCC are closer to launching a carbon or air quality market, or if they decide to develop voluntary ES markets in the future.