Conserving and enhancing the rivers of the Trent catchment for people and wildlife

Image credit: Marie Bond

Charnwood Forest Landscape Partnership Scheme

Natural Flood Management Project Phase 1

Final Report

May 2021

Summary

This document is the Final Report, which satisfies the requirement of Stage 4: Produce Feasibility Report, including fully costed, detailed designs of the Phase 1 Design Brief, as stipulated in the tender requirements.

The report presents the work conducted by The Trent Rivers Trust during this phase of the project, outlines the detailed design of NFM interventions, and estimates expected costs.

Contract

This report provides an update on the work conducted by the Trent Rivers Trust, commissioned by the National Forest Company as part of the Charnwood Forest Landscape Partnership Area. Josh Wells, Nicholas Wilding and Kim Jennings of Trent Rivers Trust completed this work.

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Purpose

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Abbreviations

TRT	Trent Rivers Trust
GIS	Geographical Information System
GPS	Global Positioning System
NFM	Natural Flood Management
BPS	Basic Payment Scheme

1. Introduction

The aim of this project is to refine, design, and cost 15 recommendations made in the Natural Flood Management Opportunities Scoping Study, conducted by the Trent Rivers Trust in 2019. The Scoping Study identified potential interventions in the Wood and Black Brook catchments in Charnwood, Leicestershire. After unsuccessful landowner engagement in the Black Brook catchment since March 2021, a focus has been made on Natural Flood Management (NFM) interventions in the Wood Brook catchment only.

The interventions explored include river restoration, buffer wetland creation, and bank protection measures. These measures have the potential to provide improvements in flood risk management, water quality, and biodiversity within the catchment.

This Final Report accounts the work completed to-date (May 2021), and outlines detailed design and costings of accepted NFM interventions.

2. Methods

2.a Landowner Liaison

Landowners within the Black Brook and Wood Brook catchments, who were identified during the Scoping Study as having potential NFM opportunities present within their landholding, were contacted to discuss the potential for the delivery of features on their land. Landowners from the Black Brook catchment were unwilling to engage further. Two landowners within the Wood Brook catchment were willing to engage with the project.

Site visits were held on the 28th April 2021 to speak to the landowners regarding the proposed interventions. As the ownership situation for Landowner 1 is more complex, an additional site visit with wider stakeholders including land agents and the National Forest Partnership representatives was held on the 18th of May 2021. During this visit, cross slope planting locations were finalised with the landowner and further possible NFM interventions were discussed in greater detail.

An agreement in principle with Landowner 2 has been obtained *via* email. Verbal agreement with Landowner 1 has been gathered at the time of writing this report.

2.b Topographical Surveying

Where applicable, topographical surveys were undertaken using an Imex Laser Level. A grid was created on site using measuring tapes, and subsequently marked using a Garmin handheld GPS. A reduced level method was used to create cross sections of intervention sites.

3. Natural Flood Management Interventions

For the purposes of this report, NFM intervention sites have been renamed since the initial Trent Rivers Trust Scoping Report (2019) for ease of discussion with landowners.

Table 1 shows the intervention ID assigned to each location and gives further detail regarding each proposed intervention. Figure 1 shows the intervention locations within the Wood Brook catchment. Due to landowner concerns, Site E (027 within the Trent Rivers Trust Scoping Report, 2019) has been marginally relocated since the Interim Report submission (Trent Rivers Trust, 2021. Details on consenting and constraints to interventions are documented in .

Table 2. At the time of writing, information relating to the possible requirement of planning permission as well as heritage constraints has not been obtained. This information will follow the report. Designs for each intervention are shown in Appendix A.

Table 1. NFM interventions agreed within the Wood Brook Catchment.

Intervention (from Scoping Study)	Intervention ID (Final Design)	Intervention Type	Design Reference	Further Details
031	A	Cross-slope woodland	A-1	Trees are to be planted adjacent to the field boundary at this location. Access gates must be kept clear. Fencing will be required due to livestock.
019	B	Cross-slope woodland	A-1	Trees are to be planted adjacent to the field boundary at this location. Access gates must be kept clear. Fencing will be required due to livestock.
D (Interim Report)	C	Online pond	A-2	The existing pond is to be desilted. The collapsed weir is to be removed and replaced with soil bund with an outlet pipe to be fitted. A swale is to be dug to connect pond with watercourse. Soil is to be spread on field nearby and seeded.
022	D	Cross-slope woodland	A-1	Trees are to be planted adjacent to the field boundary at this location. Access gates must be kept clear. Fencing will be required due to livestock.
027	E	Cross-slope woodland (location moved in line with landowner preference)	A-1	Trees are to be planted adjacent to the field boundary at this location. Access gates must be kept clear. Fencing will be required due to livestock.

Intervention (from Scoping Study)	Intervention ID (Final Design)	Intervention Type	Design Reference	Further Details
023	F	Offline pond	A-3	The existing pond in the south field is to be expanded. An additional pond is to be created to the north field. Fencing will be required due to Livestock.
024	G	Leaky barriers	A-4, A-5	5 leaky barriers are to be installed along this reach. Leaky barriers are to be installed using materials from site.
025	H	Leaky barriers	A-4, A-5	5 leaky barriers are to be installed along this reach.
C (Interim Report)	I	Bund	A-6, A-7	A soil bund is to be created in an existing hollow. A 300mm outlet pipe is to be fitted. Soil from Site F could be used within the construction. The bund is to be seeded after completion.
026	J	Leaky barriers	A-4, A-5	5 leaky barriers are to be installed along this reach. Leaky barriers are to be installed using materials from site.
B (Interim Report)	K	Paleo channel options	A-6	Living bunds are to be planted along the Paleo channel. Living bunds will consist of Willow. Dense planting will be required. Fencing is required due to livestock.
028	L	Wetland	A-8	The existing wetland is to be expanded south to increase capacity.

Intervention (from Scoping Study)	Intervention ID (Final Design)	Intervention Type	Design Reference	Further Details
A (Interim Report)	M	Wetland meadow	A-9, A-10	A wetland meadow is to be created at this site. The paleo channel is to be used to increase connection with the watercourse. Multiple channels will be created within the wetland along with some deeper areas to allow ponding. Soil can be spread in field to the north. The wetland will need to be seeded with wetland meadow mix. Fencing may be required due to livestock.
029	N	Online storage pond	A-11, A-12	A pond is to be created adjacent to the watercourse. The pond will be connected to the watercourse *via* a swale. A 225 mm outlet pipe is to be fitted to allow the pond to drain.
030	O	Wetland	A-13, A-14	Wetland scrapes are to be created adjacent to the watercourse. These will increase inundation frequency and duration.

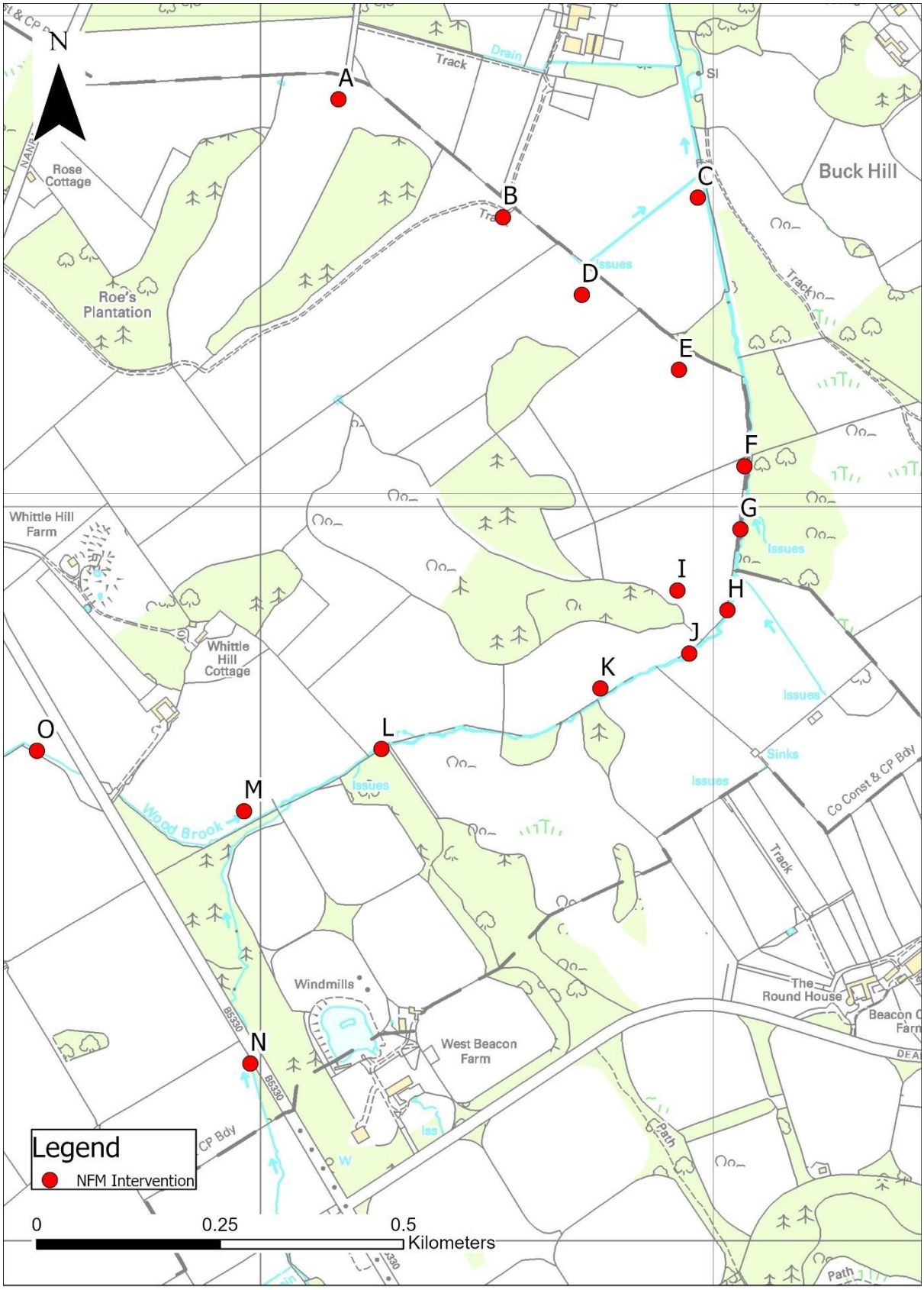

Figure 1. Location of interventions agreed in principle within the Wood Brook Catchment.

Table 2. Consents gathered and constraints for NFM interventions.

Intervention ID (Final Design)	Landowner Agreed in Principle	Drainage consent Application Drafted	Heritage Constraints	Ecological Constraints	Planning Permission required	Service Check completed
A	Verbally	OWC_Homefarm_supporting_information				Yes- No services at site
B	Verbally	OWC_Homefarm_supporting_information				Yes- No services at site
C	Verbally	OWC_Homefarm_supporting_information				Yes- No services at site
D	Verbally	OWC_Homefarm_supporting_information				Yes- No services at site
E	Verbally	OWC_Homefarm_supporting_information				Yes- No services at site
F	Verbally	OWC_Homefarm_supporting_information				Yes- No services at site
G	Verbally	OWC_Homefarm_supporting_information				Yes- No services at site

Intervention ID (Final Design)	Landowner Agreed in Principle	Drainage consent Application Drafted	Heritage Constraints	Ecological Constraints	Planning Permission required	Service Check completed
H	Verbally	OWC_Homefarm_supporting_information				Yes- No services at site
I	Verbally	OWC_Homefarm_supporting_information				Yes- No services at site
J	Verbally	OWC_Homefarm_supporting_information				Yes- No services at site
K	Verbally	OWC_Homefarm_supporting_information				Yes- No services at site
L	Verbally	OWC_Homefarm_supporting_information				Yes- No services at site
M	Verbally	OWC_Homefarm_supporting_information				Yes- No services at site
N	Email received	OWC_Charnwood FF_supporting_information				Yes- No services at site

Intervention ID (Final Design)	Landowner Agreed in Principle	Drainage consent Application Drafted	Heritage Constraints	Ecological Constraints	Planning Permission required	Service Check completed
O	Email received	OWC_Charnwood FF_supporting_information				Yes- No services at site

4. Costings

Estimated costs for intervention delivery are shown in Table 3. The estimated costs include site supervision, contractor costs, fencing, landowner payments and other materials needed such as seed or piping. The costs do not include Planning Permission costs.

Table 3. Cost estimates of NFM interventions.

Intervention ID	Cost Estimate	Additional Notes
A,B,D,E	£8,250	This cost includes tree purchase. Volunteers are to be used for planting to reduce contractor costs.
C	£5,750	
F	£2000	
G,H,J	£6,500	Wood is to be sourced locally. This estimate does not consider costs for imported wood.
I	£1750	
K	£2,500	This cost includes tree purchase. Volunteers are to be used for planting to reduce contractor costs.
L	£2,500	
M	£12,000	A wetland meadow seed mix is included within this estimate.
N	£6000	
O	£3,250	
Other Costs:		
Project Management	£5,500	
Drainage Consent	£100	
Ecological Surveys	£4,000	
Total	**£60,100**	

5. Capital Works Plan

A capital works delivery plan for the interventions is shown in Capital works planTable 4. The optimal delivery date has been determined by a number of factors. The first is landowner constraints, such as the renewal of current Stewardship Schemes and possible Basic Payment Scheme (BPS) payment losses. Ground conditions have been taken into consideration. For some interventions, dry conditions are required for machine access and so delivery in the summer months is necessary. Ecological constraints have also been considered, such as bird nesting season if trees are to be felled for leaky barrier installation.

Table 4. Capital works plan

Intervention ID (Final Design)	Intervention Type	Constraints	Optimal Delivery Period	On Site Delivery Period
A	Cross-slope woodland	The current stewardship scheme is a constraint. To prevent loss of payments and tie in with the correct season to plant trees, this work will need to be undertaken in the 2022.	Jan 2022 -March 2022	3-5 days
B	Cross-slope woodland	The current stewardship scheme is a constraint. To prevent loss of payments and tie in with the correct season to plant trees, this work will need to be undertaken in the 2022.	Jan 2022 -March 2022	3-5 days
C	Online pond	Dry conditions are needed for access.	June 2021-Sept 2021	5-7 days
D	Cross-slope woodland	The current stewardship scheme is a constraint. To prevent loss of payments and tie in with the correct season to plant trees, this work will need to be undertaken in the 2022.	Jan 2022 -March 2022	3-5 days
E	Cross-slope woodland	The current stewardship scheme is a constraint. To prevent loss of payments and tie in with the correct season to plant trees, this work will need to be undertaken in the 2022.	Jan 2022 -March 2022	3-5 days
F	Offline pond	The current stewardship scheme is a constraint. To prevent loss of payments this work will need to be undertaken in 2022. Dry conditions are needed for access.	June 2022 -August 2022	1 day
G	Leaky barriers	Tree felling will be required. Breeding bird season is to be avoided.	Dec 2021 – Feb 2022	2-4 days

Intervention ID (Final Design)	Intervention Type	Constraints	Optimal Delivery Period	On Site Delivery Period
H	Leaky barriers	Tree felling will be required. Breeding bird season is to be avoided.	Dec 2021 – Feb 2022	2-4 days
I	Bund	The current stewardship scheme is a constraint. To prevent loss of payments this work will need to be undertaken in 2022. Dry conditions are needed for access.	July 2022 -August 2022	1-2 days
J	Leaky barriers	Tree felling will be required. Breeding bird season is to be avoided.	Dec 2021 – Feb 2022	2-4 days
K	Paleo channel options	The current stewardship scheme is a constraint. To prevent loss of payments this work will need to be undertaken in 2022. Dry conditions are needed for access.	Dec 2022 – March 2023.	3-5 days
L	Wetland	Dry conditions are needed for access.	August 2021-Sept 2021	1 day
M	Wetland meadow	The current stewardship scheme is a constraint. To prevent loss of payments this work will need to be undertaken in 2022. Dry conditions are needed for access.	July 2022 -August 2022	8-12 days
N	Online storage pond	Dry conditions are needed for access.	June 2021-Sept 2021	3-5 days
O	Wetland	Dry conditions are needed for access.	June 2021-Sept 2021	2-5 days

6. Monitoring Options

Monitoring of NFM interventions is an important consideration for the future delivery phase of the project. Monitoring would enable an assessment of the functioning of the interventions, but could also quantify water storage. To assess the efficiency of the NFM interventions, two methods of monitoring are suggested.

6.a Option 1: Time Lapse Imagery

Time lapse imagery allows for photographic evidence of interventions storing water to be collected during high flow events. This low-cost method (£90 per camera approx.) allows the functioning of the intervention to be assessed to ensure that the intervention performs as designed. It is recommended that a stage board is installed in view of the camera to assess the fill and drain of the intervention.

Although time lapse imagery does have its benefits, there are disadvantages. These include: possible theft of the camera, low temporal resolution data (20 mins), image failure during darkness, camera failure due to extreme weather, and no quantification of water stored.

6.b Option 2: Water level data collection within interventions

Collecting water level data within interventions is achieved through the installation of a water level logger within the intervention itself. This method allows for the functioning of the intervention to be assessed, as the data shows when the intervention fills and drains at a high temporal resolution (5 mins). If this is combined with a topographical survey of the completed intervention, the volume of water stored during high flow events can be calculated. This would allow for a possible comparison of the Wood Brook Hydrograph at Loughborough with water stored within NFM interventions upstream. The method would therefore allow for reductions in discharge as a result of NFM intervention to be quantified. Moreover, the timings of storage can be assessed in greater detail to ensure that the interventions are reducing flows downstream during the peak of the hydrograph.

Disadvantages of this method include: Possible theft of equipment, increased need for data manipulation and higher cost (£1200 for a single logger and £600 for any additional loggers after).

6.c Other monitoring options

NFM aims to restore natural hydrological processes whilst creating wider benefits beyond flood risk. As monitoring options 1 and 2 assess the hydrological functioning of the interventions, methods to monitor ecological gains should be considered. Working with partners such as the Wildlife Trust who already monitor plant species at Home Farm would allow for the future monitoring of species within the constructed wetlands.

Appendices

Appendix A - Detailed Design Drawings

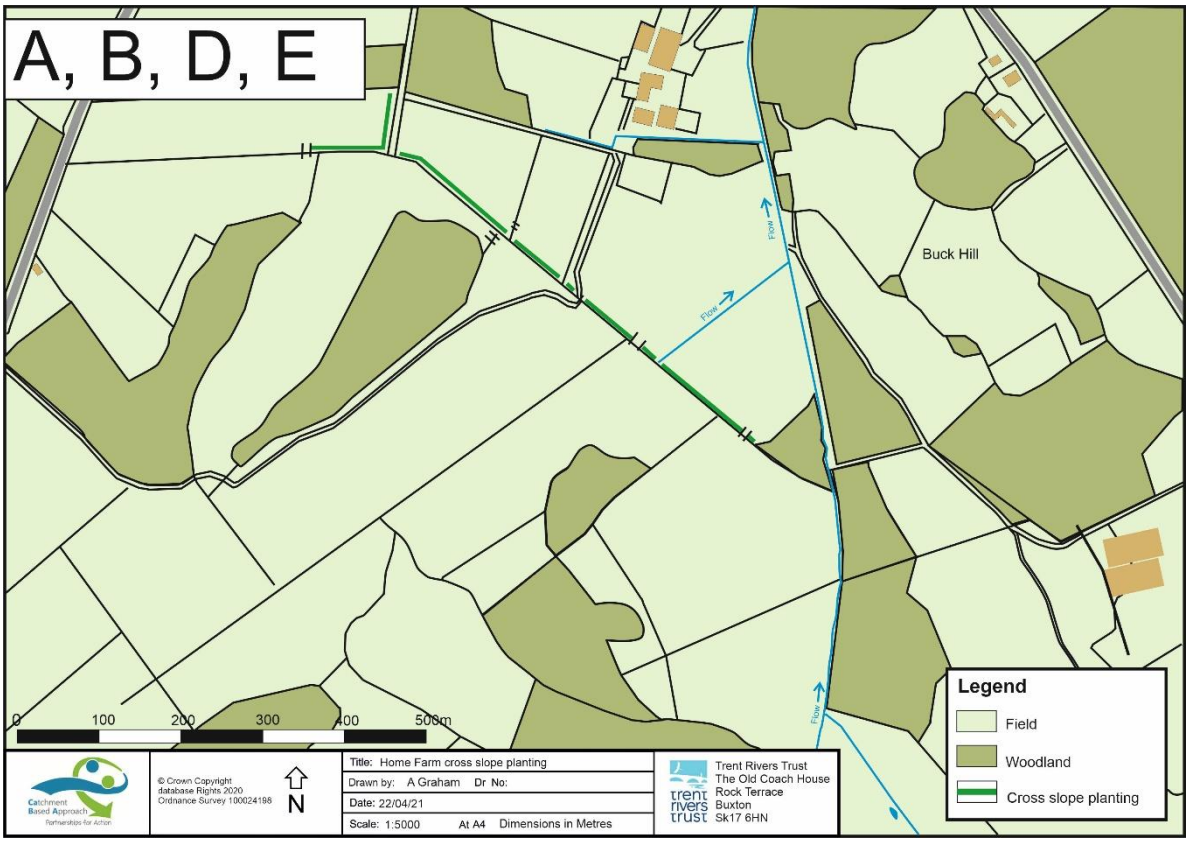

Figure A- 1. Cross slope tree planting sites A,B,D,E. Note: An additional site to the northwest of site A has been added after landowner liaison.

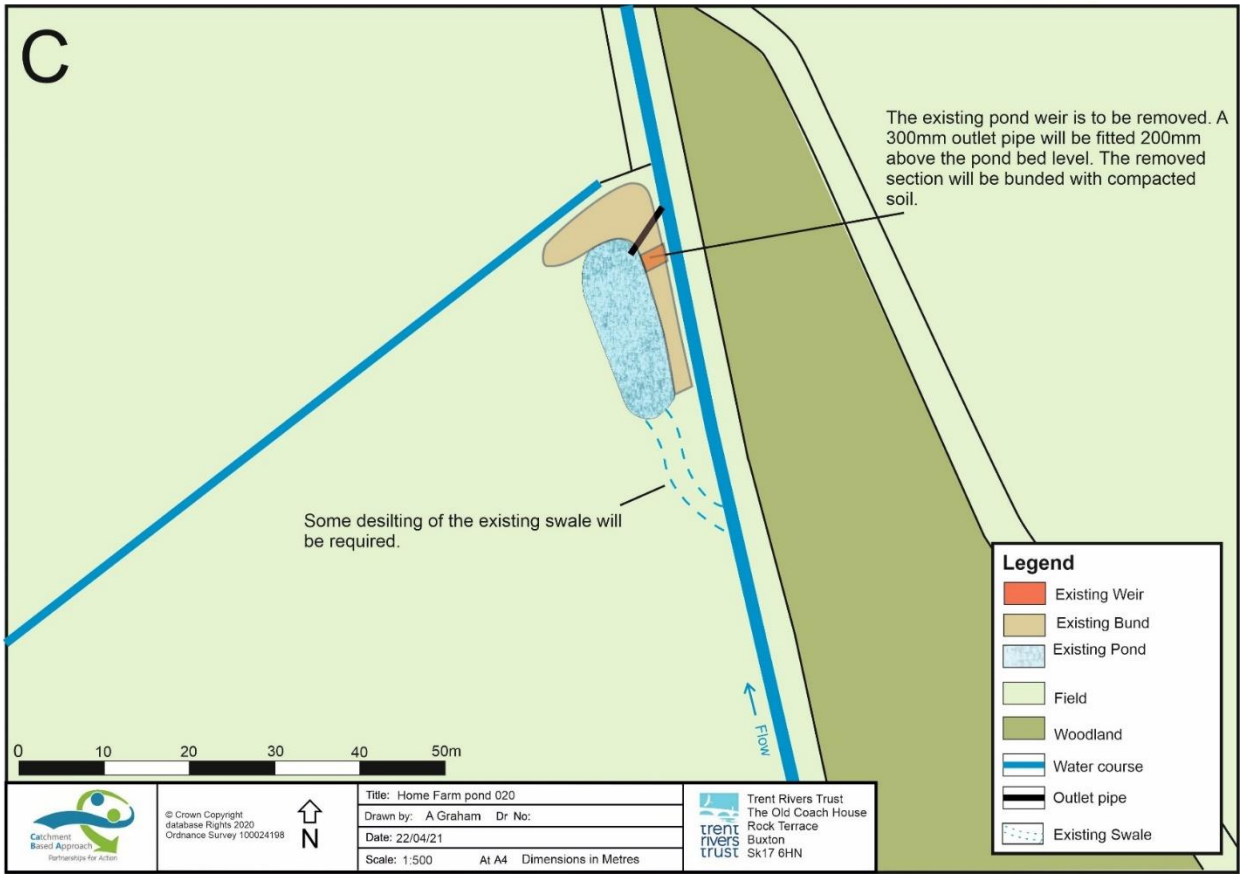

Figure A-2. Site C pond adjustment planform design.

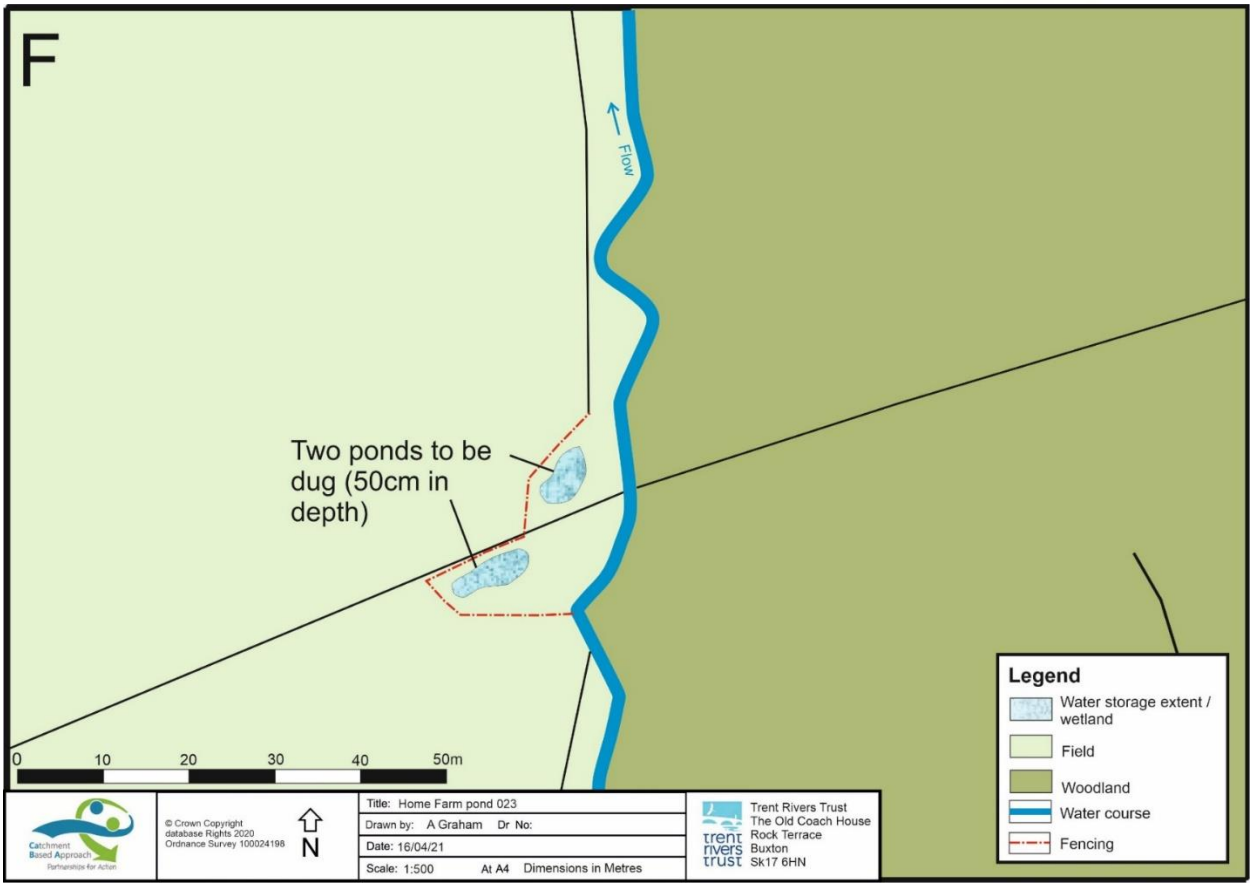

Figure A-3. Site F pond creation planform design.

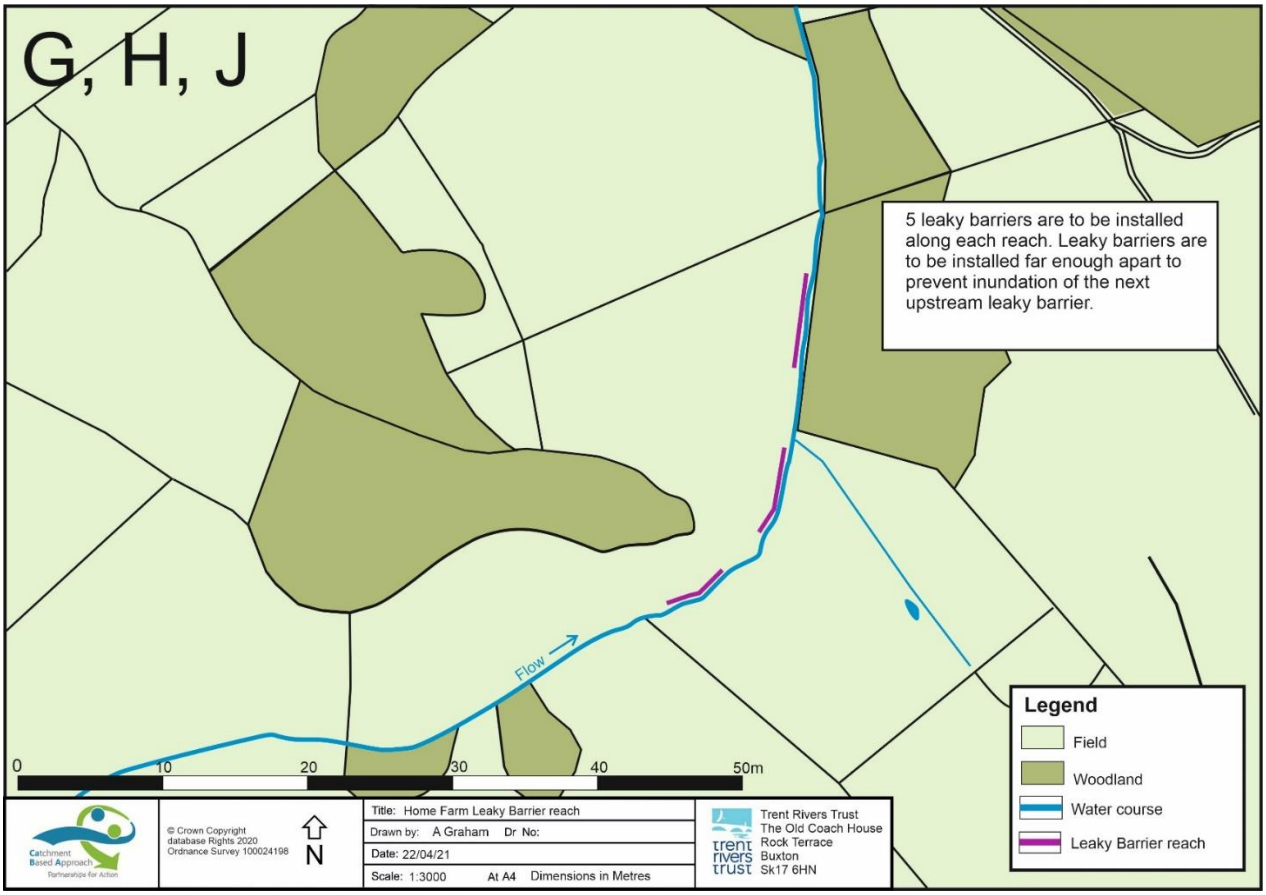

Figure A-4. Leaky barrier installation sites G,H,J.

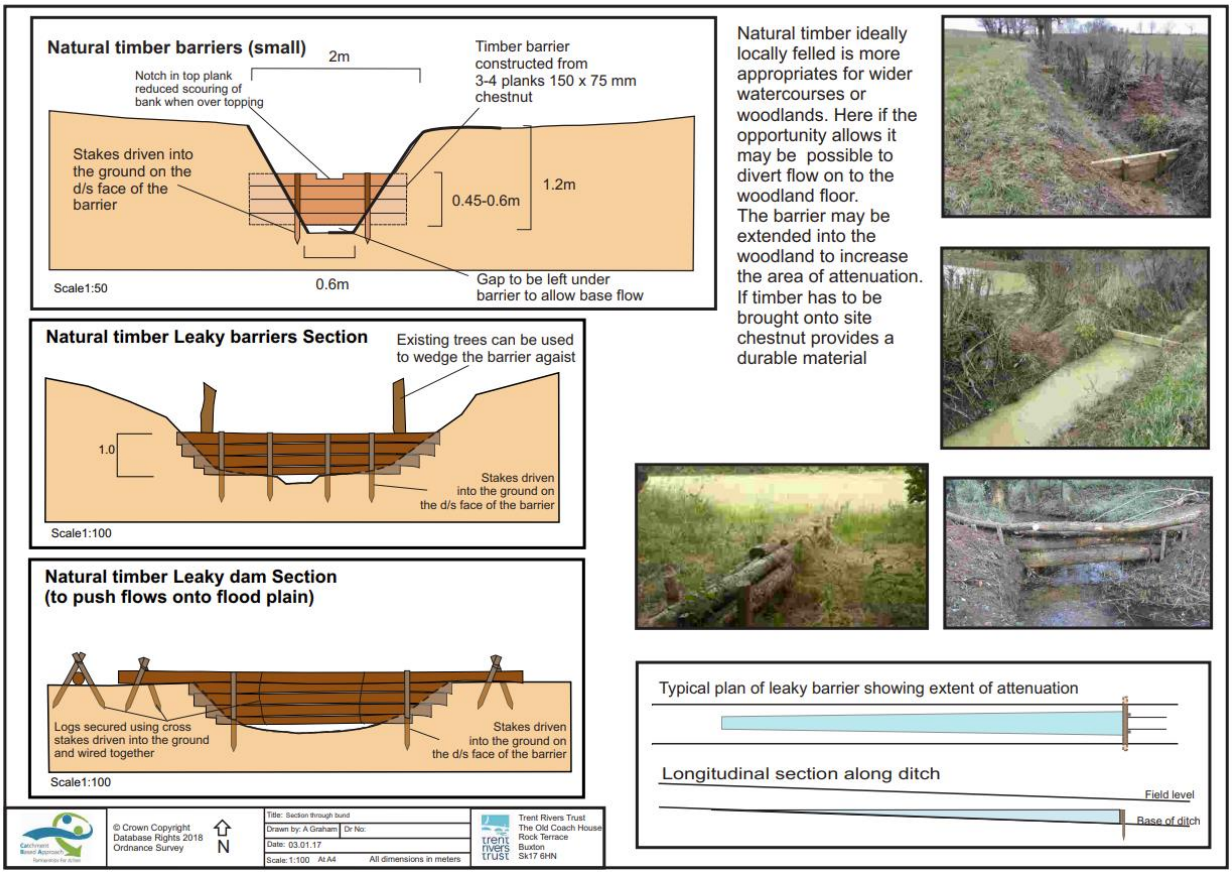

Figure A-5. Typical leaky barrier cross section design.

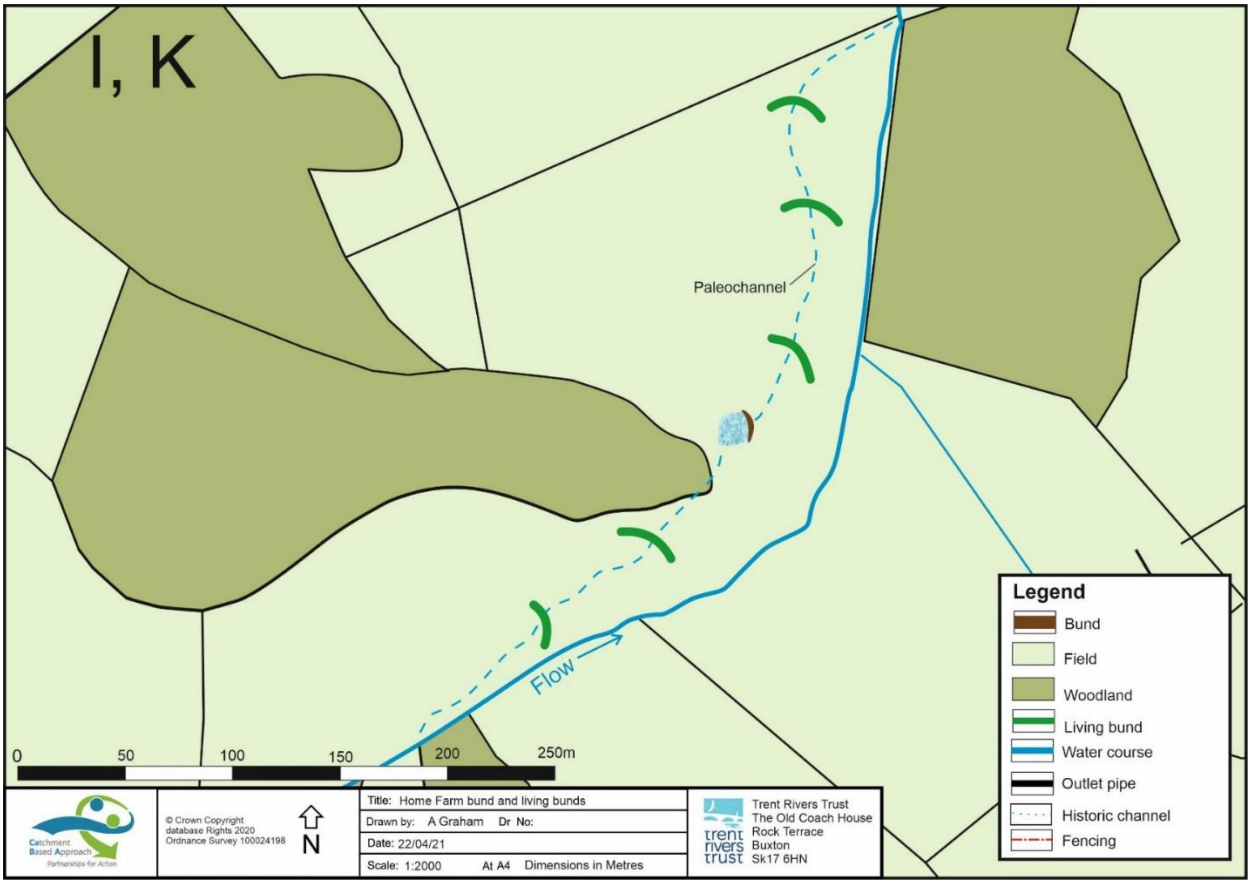

Figure A-6. Sites I and K bund and living bunds planform design.

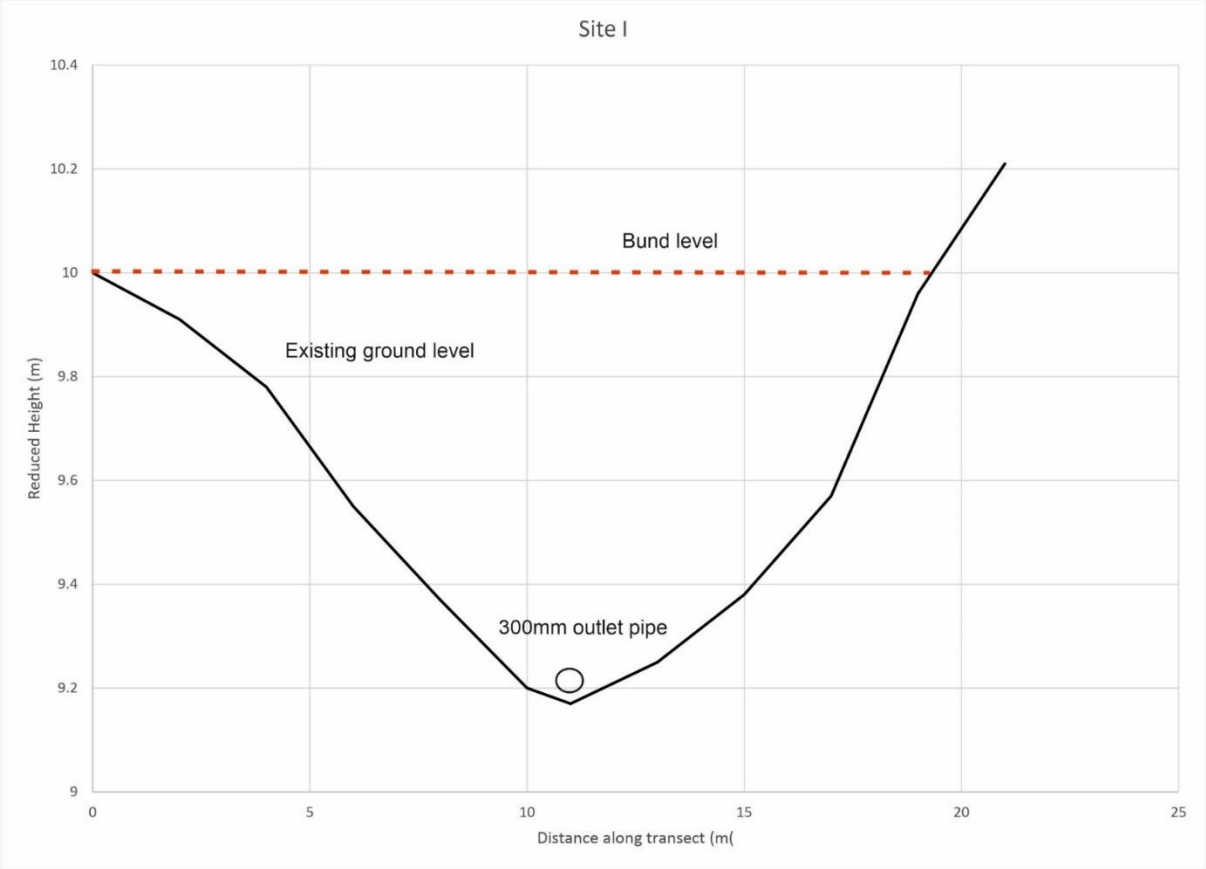

Figure A-7. Site I bund cross section design.

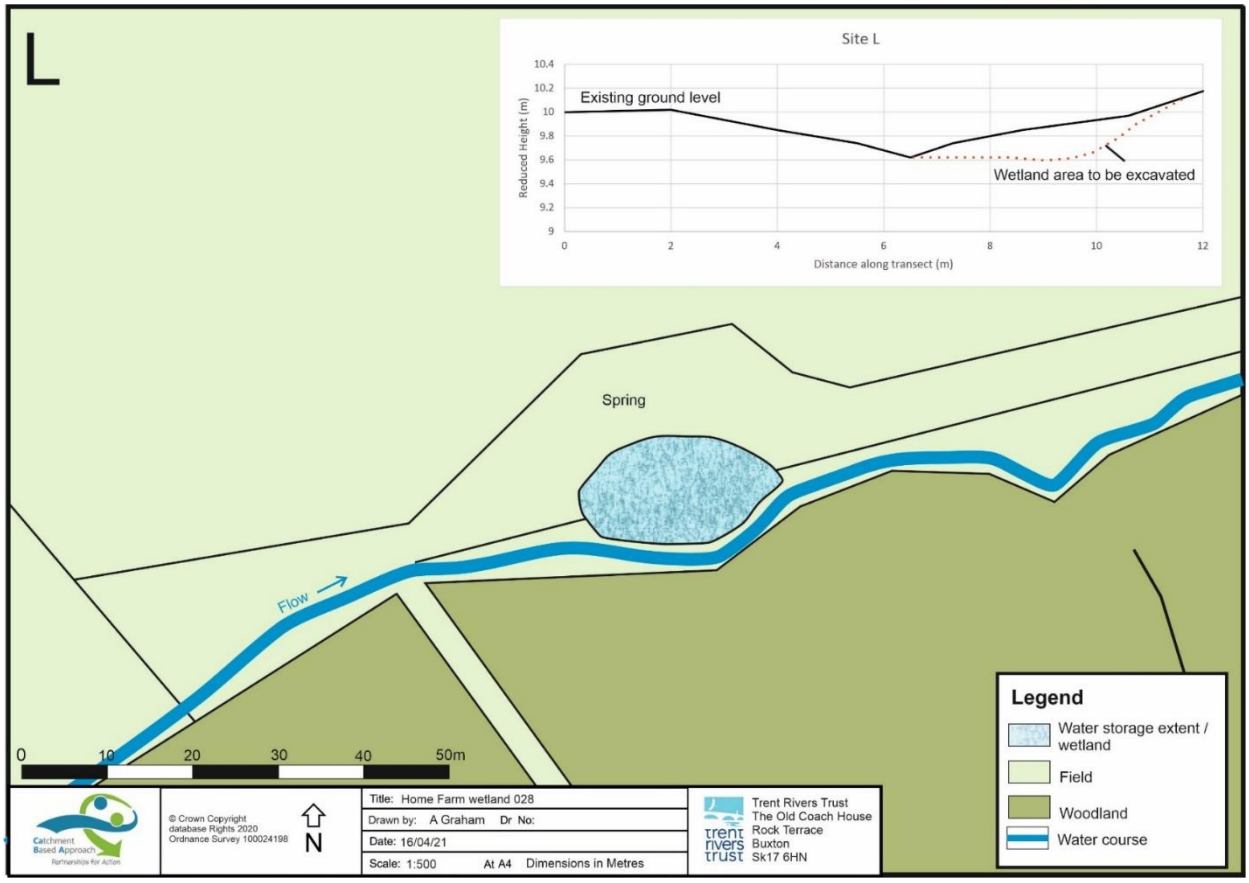

Figure A-8. Site L wetland enhancement planform design.

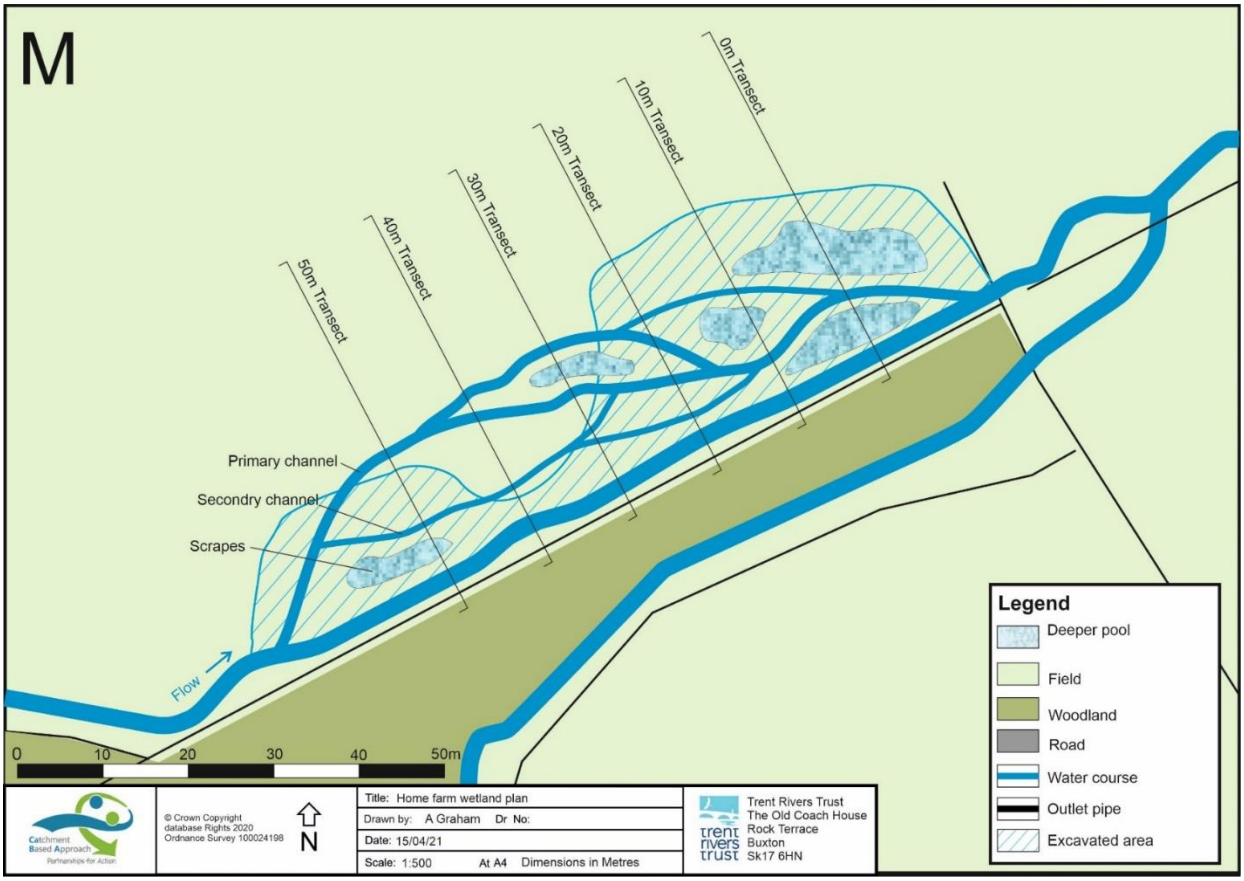

Figure A-9. Site M wetland creation planform design.

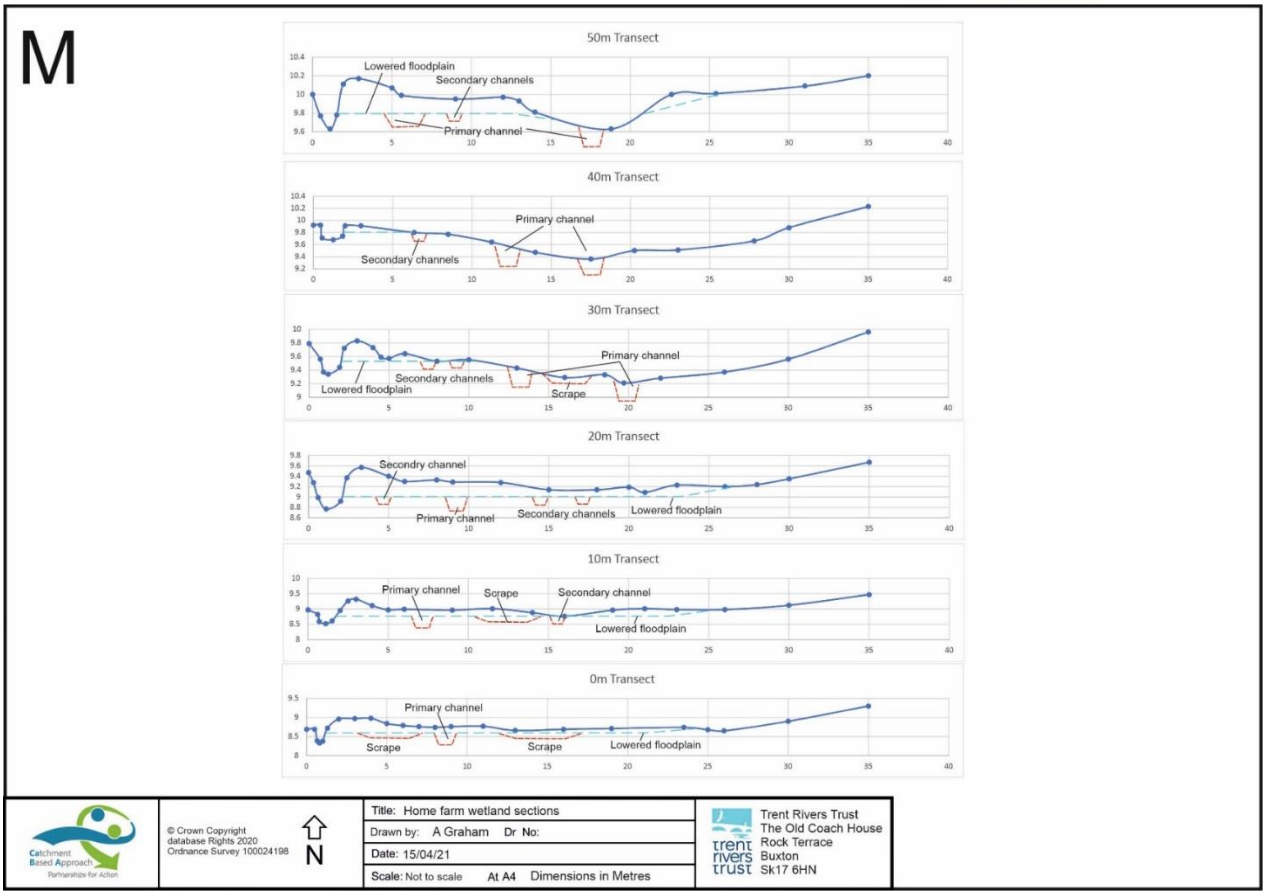

Figure A-10. Site M wetland creation cross section design.

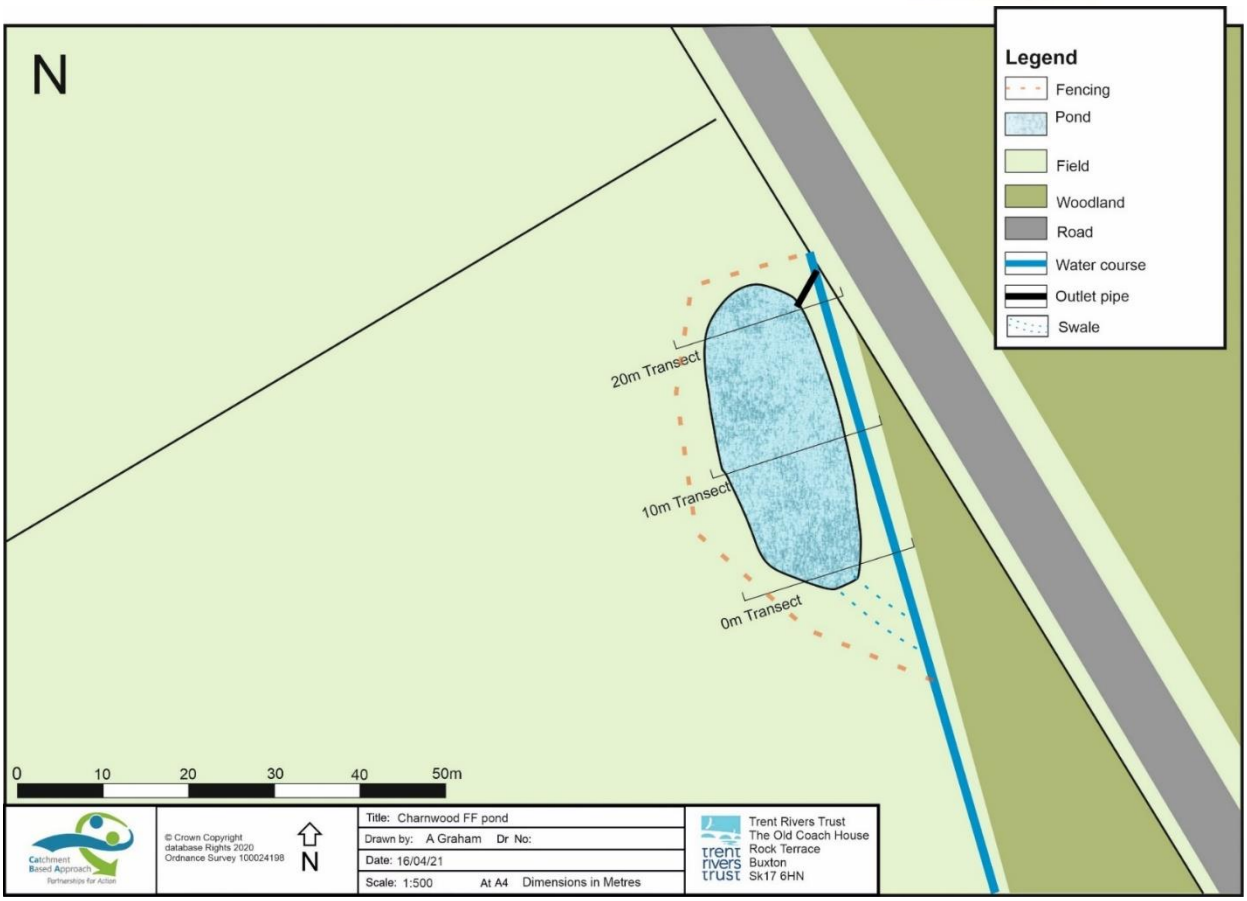

Figure A-11. Site N pond planform design.

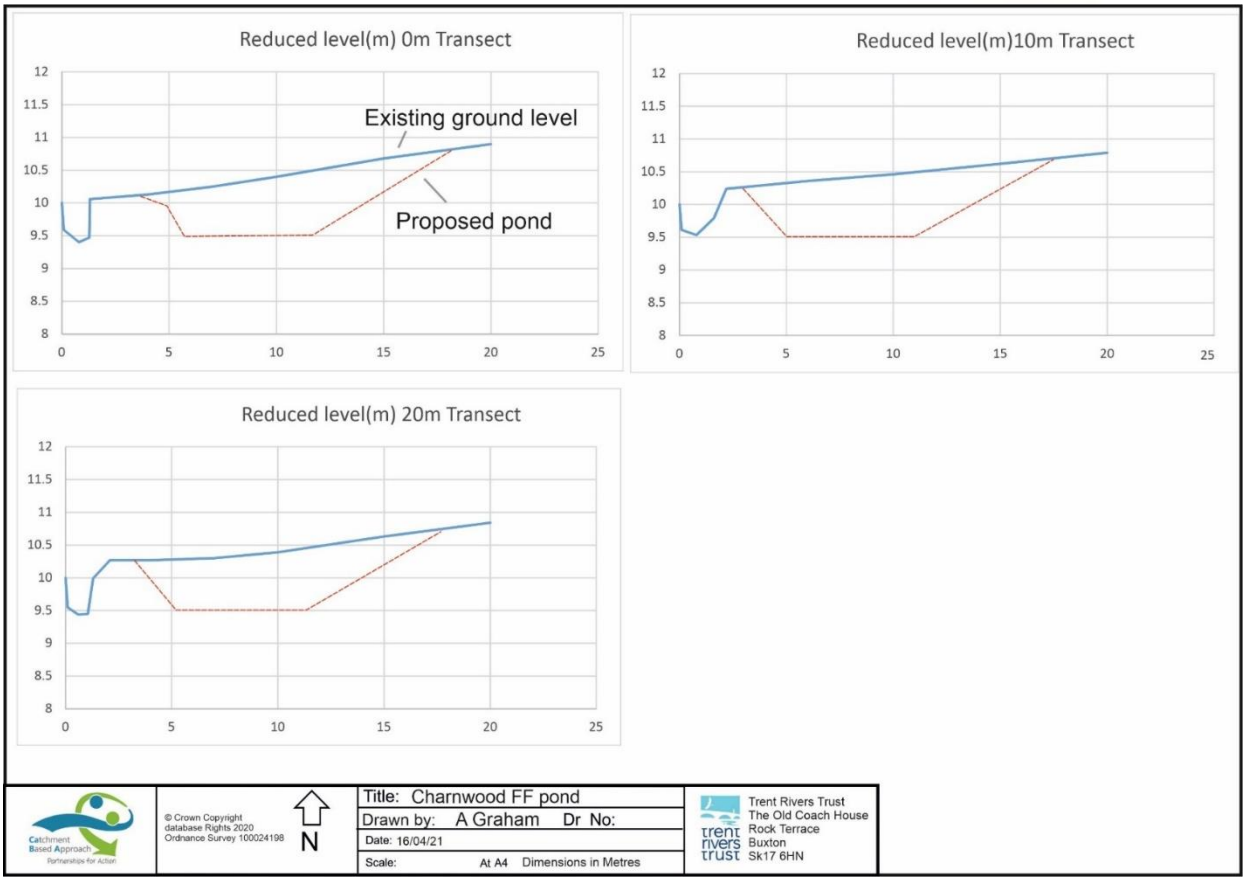

Figure A-12. Site N pond cross section design.

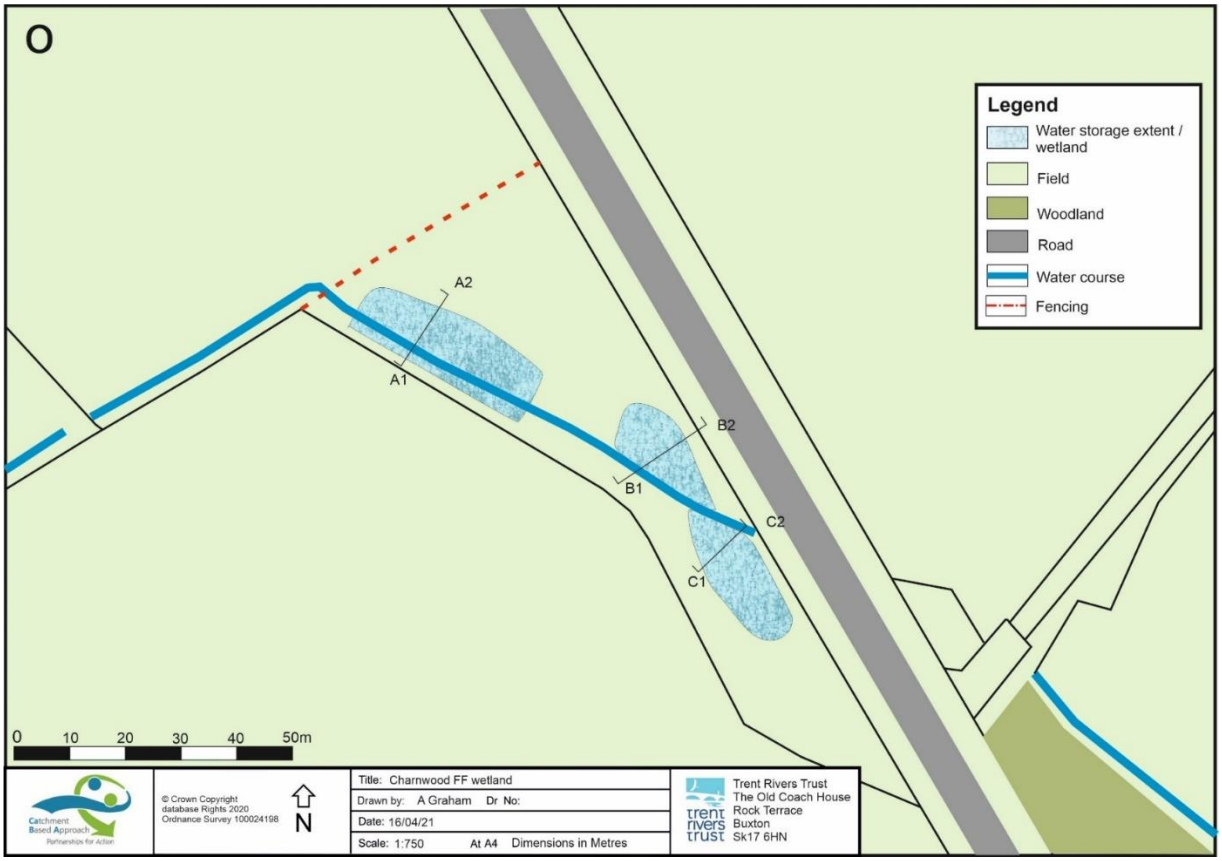

Figure A-13. Site O wetland planform design.

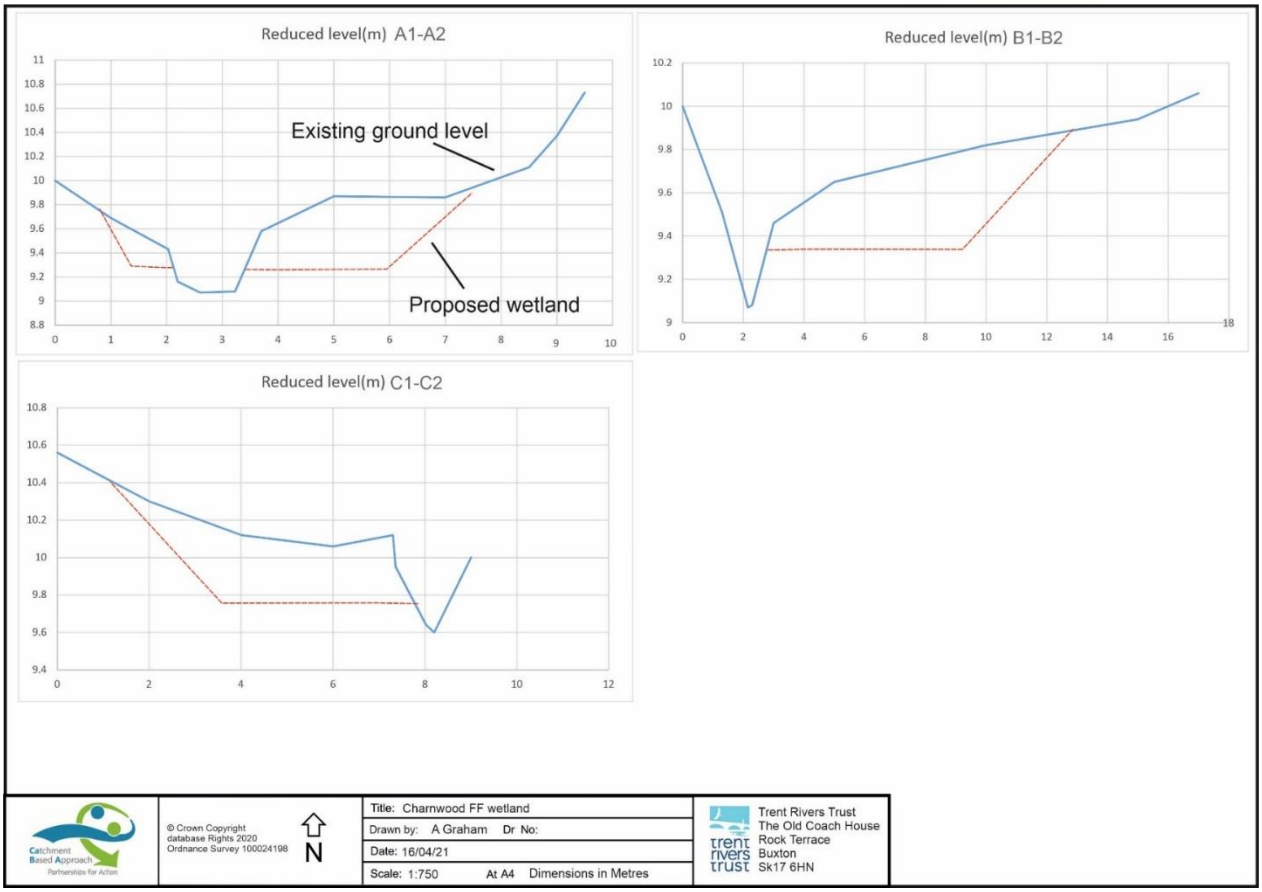

Figure A-14. Site O wetland cross section design.

Appendix B – Ecological Survey Report

Preliminary Ecological Appraisal

Charnwood Natural Flood Management

On Behalf Of:
Trent Rivers Trust

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Job Ref: PE0210 Date: 18th June 2020

Preliminary Ecological Appraisal and NFM constraints appraisal

Charnwood Natural Flood Management

_____

Main Contributors

Louis Andrews BSc ACIEEM and Rob Harrison BSc MSc MCIEEM

_____

Issued By

Signature……

Print Name: Louis Andrews

Date: 18/06/2021

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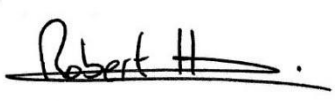
Approved By



Signature……

Print Name: Rob Harrison BSc MSc MCIEEM

Date: 18/06/2021

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1.0 INTRODUCTION

1.1 Terms of reference /site location

1.1.1 Harris Lamb Property Consultancy (HLPC) Ecology Team were commissioned by Trent Rivers Trust (TRT) to undertake a Preliminary Ecological Appraisal and constraints appraisal of proposed Natural Flood Management (NFM) interventions. The site is located at Wood Brook in the area known as Charnwood near Loughborough, Leicestershire (national grid reference: downstream extent - SK505165; upstream extent - SK496156) hereafter termed the 'site' (see Figure 1 below).

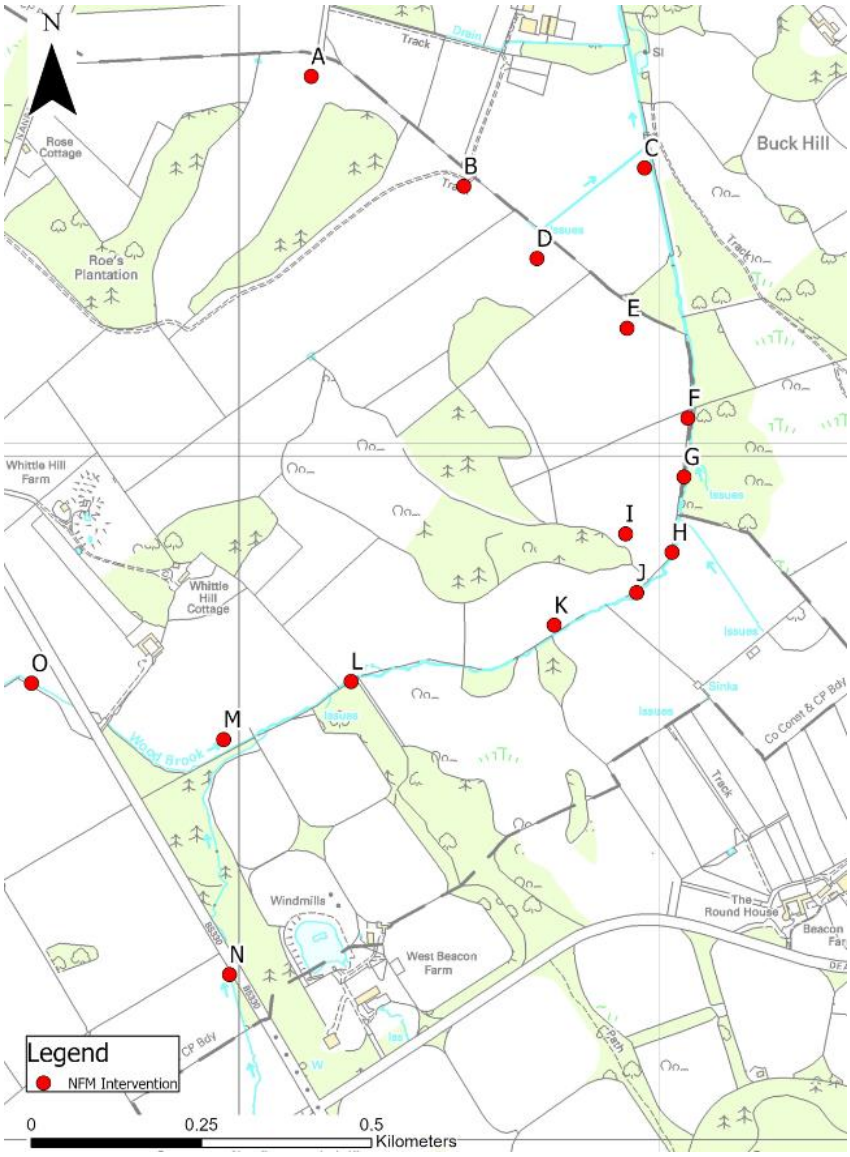

Figure 1: Site location. Not to scale.

1.2 Scope of work

1.2.1 This report has been produced with reference to current guidelines for PEA[1], which involves the evaluation of potential ecological receptors based on Extended Phase I Habitat Survey[2] data and background desk study.

1.2.2 The purpose of this PEA is to identify the potential ecological constraints within, or near the site, that should be considered for NFM interventions. It also seeks to identify the likely requirement for further surveys if required.

1.2.3 The list of proposed NFM interventions has been provided by TRT. Trent Rivers Trust plan to implement fifteen NFM interventions within the Wood Brook catchment (Figure 1). All fifteen interventions have been verbally accepted by the relevant landowners.

1.2.4 The proposed interventions include; bunds, leaky barriers, online and offline ponds, wetland creation and cross-slope tree planting. Table 1 highlights which interventions will be installed, corresponding with Figure 1.

Table 1. NFM interventions

NFM Intervention Reference	**NFM Intervention Type**
A	Cross-slope Woodland
B	Cross-slope Woodland
C	Online Pond
D	Cross-slope Woodland
E	Cross-slope Woodland
F	Offline Pond
G	Leaky Barriers
H	Leaky Barriers
I	Bund

[1] CIEEM (2017) Guidelines for Preliminary Ecological Appraisal, 2nd edition. Chartered Institute of Ecology and Environmental Management, Winchester.

[2] Joint Nature Conservation Committee (2010) Handbook for Phase 1 Habitat Survey. A Technique for Environmental Audit.

NFM Intervention Reference	NFM Intervention Type
J	Leaky Barriers
K	Paleo Channel Options
L	Wetland
M	Wetland Meadow
N	Online Pond
O	Wetland

2.0 POLICY AND LEGISLATION

2.1 Biodiversity Policy Guidance

2.1.1 'Biodiversity: The UK Biodiversity Action Plan (BAP) (UK Biodiversity Partnership, 2007)' was developed in response to The Earth Summit, held in Rio de Janeiro in 1992. The UK BAP lists a number of priority habitats and species for conservation action in the UK. Although the Action Plan does not confer any statutory legal protection, in practice many of the species listed already receive statutory legal protection under UK and/or European legislation and are a material consideration in planning decisions.

2.1.2 As part of the action plan process, LBAPs must be produced for every county in the UK. LBAPs highlight local biodiversity issues and set out a series of objectives and action plans for the conservation of priority species and habitats where they occur in each district, county or region.

2.2 Designated Sites and Nature Conservation

Statutory Designations

2.2.1 Sites with statutory designations receive varying degrees of legal protection under UK statute (i.e. Wildlife and Countryside Act 1981 (as amended)) and European Directives (i.e. the EC Habitats Directive (92/43/EC) which is transposed in England and Wales by The Conservation of Habitats and Species Regulations 2017 (as amended)). There are a number of statutory designations used for sites of high nature conservation value in the UK, which are applied depending upon the importance of the site in a local, regional, national or international context. These include:

- Ramsar Sites (International designation).
- Special Area of Conservation (SAC) and Special Protection Area (SPA) (European designations).
- National Nature Reserves (NNR) and Sites of Special Scientific Interest (SSSI) (National designations).
- Local Nature Reserves (LNR) (Local designation).

2.3 Non-Statutory Designations

2.3.1 Non-statutory sites are afforded no statutory legal protection but are normally recognised by local planning authorities and statutory agencies as being of local nature conservation value. The protection afforded to such sites is usually discretionary, through Local Plan policies. Non-statutory sites are designated by the local authority, usually in partnership with the local Wildlife Trust (or equivalent).

2.4 Protected and Notable Species

2.4.1 A number of species are protected under UK and international legislation. In the UK, primary protection is provided under the Wildlife and Countryside Act (1981) (as amended). Species of European importance receive additional protection in England under the Conservation of Habitats and Species Regulations (2017) (as amended); others may receive protection through specific legislation (such as the Protection of Badgers Act, (1992).

2.4.2 Species listed under Section 41 of the NERC Act (2006), whilst not necessarily being legally protected, can be a material consideration.

2.5 Invasive Non-native Species

2.5.1 Certain invasive non-native animals and plants are listed under Schedule 9 of the Wildlife and Countryside Act 1981 (as amended). This makes it an offence to release, plant them in the wild or otherwise cause them to grow. The Environmental Protection Act (1990) also lists some of these plant species as 'controlled waste' to be disposed of properly. These provisions mean that, if these species occur on a site proposed for development or other work which may disturb the ground, control of these species is likely to be required.

3.0 METHODOLOGY

3.1 Study area

3.1.1 The study area is shown on Figure 1 and was targeted around the NFM intervention areas. The study area was extended beyond the site where appropriate to undertake species-specific appraisals as detailed below.

3.2 Desk study

3.2.1 The desktop study was undertaken in May 2021 and included:

- Leicestershire and Rutland Environment Records Centre (LRERC),
- Multi Agency Geographic Information for the Countryside (MAGIC) website[3],
- Ordnance Survey (OS)[4], and
- Aerial imagery[6].

3.2.2 The geographical extent of the search area for biodiversity information was related to the significance of sites and species and potential zones of influence which might arise from NFM on site. For this site the following search areas were considered to be appropriate:

- 10km around the site boundary for sites of International Importance (e.g. Special Area of Conservation (SAC), Special Protection Area (SPA), Ramsar site));
- 2km around the site boundary for sites of National or Regional Importance (e.g. Sites of Special Scientific Interest (SSSI)), protected or otherwise notable species and non-statutory designated sites of County Importance (e.g. Local Wildlife Sites (LWS);
- 1km for ancient woodland, and
- 2km for biological records.

3.3 Field survey

[3] www.magic.gov.uk accessed June 2021

[4] www.bing.co.uk accessed June 2021

Flora

3.3.1 HLPC carried out an Extended Phase 1 Habitat Survey of the site on 12th May 2021. The survey was carried out by HLPC Principal Ecologist Rob Harrison BSc MSC MCIEEM and Assistant Ecologist Louis Andrew BSc ACIEEM and supported by TRT ecologist Nicholas Wilding. The survey was undertaken in accordance with 'Extended Phase I' methodology[5].

3.3.2 Specific habitat features were mapped to record ecological receptors of note if necessary.

Fauna

3.3.3 The fauna included within this assessment is based on the habitats present, data from the desk-based searches, and the following legislation[6]:

- Wildlife and Countryside Act 1981 (as amended);
- The Protection of Badgers Act 1992;
- The Conservation of Habitats and Species Regulations 2017 (as amended), and
- The NERC Act 2006 – S41 Species of Principal Importance (SPI) for the conservation of biodiversity.

Amphibians

3.3.4 Waterbodies within 250m of the site boundary were identified using online Ordnance Survey maps and aerial imagery[7] and were assessed for their suitability to support great-crested newts *Triturus cristatus* where accessible and relevant to the proposed NFM intervention.

Reptiles

3.3.5 An assessment of the suitability of the habitats present to support common reptile species was undertaken. In accordance with current guidance, this assessment involved a review of habitats and habitat structure for suitable

[5] Joint Nature Conservation Committee (2010) Handbook for Phase 1 Habitat Survey. A Technique for Environmental Audit.

[6] See www.legislation.gov.uk

[7] www.bing.com/maps accessed June 2021

shelter for reptiles such as areas of scrub and woodpiles, grassland with well-developed and varied structure, areas suitable for basking, large tussocks etc.

Birds

3.3.6 Bird species identified at the time of survey were noted and potential nest sites recorded as seen. An assessment of habitats was undertaken to determine the likely value to breeding and foraging birds.

Bats

3.3.7 A ground-based inspection of trees and bridges was undertaken in accordance with best practice bat survey guidelines (Collins, 2016)[8].

3.3.8 Trees within the survey area were assessed for Potential Roost Features (PRFs) which may be used by bats. Examples of suitable PRFs include woodpecker holes, frost cracks, hazard beams and dense ivy Hedera helix. Upon completion of the visual inspection, all trees were classified according to the level of BRP displayed into one of the following categories: Negligible, Low, Moderate, High or Confirmed Roost.

Badgers

3.3.9 Areas of suitable habitat were surveyed for evidence of badger *Meles meles* activity, such as mammal paths, setts, snuffle holes or latrines.

Riparian Mammals

3.3.10 The river was assessed for its potential to provide suitable habitat for water vole *Arvicola amphibius* and otter *Lutra lutra*.

3.3.11 Both banks of the watercourse were surveyed for field signs of water vole activity as detailed below:

- Droppings – 8-12mm long and 4-5mm wide, cylindrical with blunt ends, colour varying from black to green with a texture of putty when fresh;
- Latrines – consist of a flattened mass of old droppings topped with fresh ones, found near the nest, range boundaries and where water voles leave/enter the water;

[8] Bat Conservation Trust (BCT) 2016. Bat Surveys for Professional Ecologists, Good Practice Guidelines, 3rd Edition

- Feeding station – comprise of a neat pile of chewed lengths of vegetation up to 10cm long showing the marks of the two large incisors;
- Burrows – entrances are wider than high with a diameter of between 4-8cm and usually found near the water's edge;
- Lawns – an area of grazed vegetation around land holes, usually found when the female is nursing young;
- Nests – can be found above ground when the vegetation is dense and the water table is high, consist of a ball of finely shredded grasses or reed;
- Footprints – imprints show four toes in a star arrangement from the fore foot and five toes of the hind foot with the outer ones splayed, hind foot measures between 26-34mm;
- Runways – found within 2m of the water's edge, consisting of low tunnels pushed through the vegetation, pathway width may be 5-9cm broad, and
- The presence of water vole can also be confirmed by sightings and from the characteristic 'plop' of the water vole entering the water, which acts as a warning to other voles.

3.3.12 The banks of the watercourse were examined for signs of otter, such as footprints, holts, slides, spraints, rolled vegetation (whisps/twists), couches (vegetation mattresses), refuges and feeding remains.

White-clawed crayfish

3.3.13 Habitat suitability was recorded for white-clawed crayfish *Autropotamobius pallipes* following methods as outlined in the Conserving Natura 2000 Rivers Series: Monitoring the White-clawed Crayfish (Peay, 2003)[9].

Invertebrates

3.3.14 The habitats were assessed for their potential to support a diverse assemblage of priority invertebrates.

Other notable species

3.3.15 Signs of other notable species were recorded as seen.

Legally controlled species

3.3.16 Evidence of species listed on Schedule 9 of the Wildlife and Countryside Act (1981) as amended were recorded as seen.

3.4 Assessment limitations

3.4.1 Ecological surveys are limited by factors that affect the presence of plants and animals, such as the time of year, weather, migration patterns and behaviour. The survey was undertaken in May which is the start of the core season for botanical survey and the majority of faunal species receptors. The survey was considered sufficient to assess habitats and likely species present to inform the assessment on likely impacts and further survey recommendations.

3.4.2 At the time of survey river flows were low which is ideal for survey.

3.4.3 Any absence of desk study records cannot be relied upon to infer absence of a species/habitat as the absence of records may be a result of under-recording within the given search area.

3.4.4 Following survey, an error was spotted in the base mapping for NFM initiative location C, and as such, a pond was surveyed that did not need to be included in detail for the report. This error has been corrected within this report and does not impact the findings or recommendations.

[9] Peay S (2003). Monitoring the White-clawed Crayfish *Austropotamobius pallipes*. Conserving Natura 2000 Rivers Monitoring Series No. 1, English Nature, Peterborough.

3.4.5 Phase 1 Habitat survey aimed to characterise the habitat on site and is not intended to give a complete list of plant species present. Due to the mosaic of habitats present, detailed mapping is difficult to achieve and therefore the Phase 1 Habitat Maps provided show the general habitats present only with written descriptions to detail the mosaics found in each area.

4.0 RESULTS

4.1 Ecological designations

Statutory designation

4.1.1 No SPA, SAC or Ramsar sites were recorded with 10km of the NFM proposals.

4.1.2 Two SSSI sites were identified within 2km of the site, namely Beacon Hill, Hangingstone and Out Wood SSSI (c. 0.36km east at the closest point), Ulverscroft Valley SSSI (c. 1.75km south at the closest point).

Non-statutorily designated sites

4.1.3 Numerous non-statutorily designated sites for nature conservation (Local Wildlife Sites (LWS) etc.) were identified within 1km of the site as shown in Table 2 below.

Table 2. LWS descriptions

LWS name	**Distance from NFM interventions (m)**	**Habitats Description**
Home Farm Wood	258	Broad-leaved woodland.
Five Tree Plantation	389	Mature tree.
Nanpantan Hall Wood	390	Woodland and acid grassland.
Five Tree Plantation, Beech	440	Mature tree.
Five Tree Plantation, Sweet Chestnut 1	445	Mature tree.
Longcliffe Golf Course	551	Acid grassland, woodland, Red Data Book species and mature trees - 5 *Quercus robur*, 1 *Salix fragilis*, 2 *Fagus sylvatica*, 1 unknown, with heathland.
Five Tree Plantation, Sweet Chestnut 2	558	Mature tree.
Nanpantan, The Home Farm grassland	560	Damp grassland supporting Common bird's foot trefoil, Sweet vernal grass and Lesser Stitchwort.
Buck Hill	582	Acid grassland and brook, with woodland, scrub and pond.
Buck Hill Knoll	759	Broad-leaved woodland.
Nanpantan Reservoir	851	Red Data Book species present in reservoir.

4.1.4 The ancient woodland Outwood is also located c. 0.39km east of the site at its closest point. Additional priority habitat deciduous woodland is also located throughout the reach alongside Wood Brook and the NFM proposals.

4.2 Habitats

Habitats recorded within the site are described below and are shown on Figure 2.

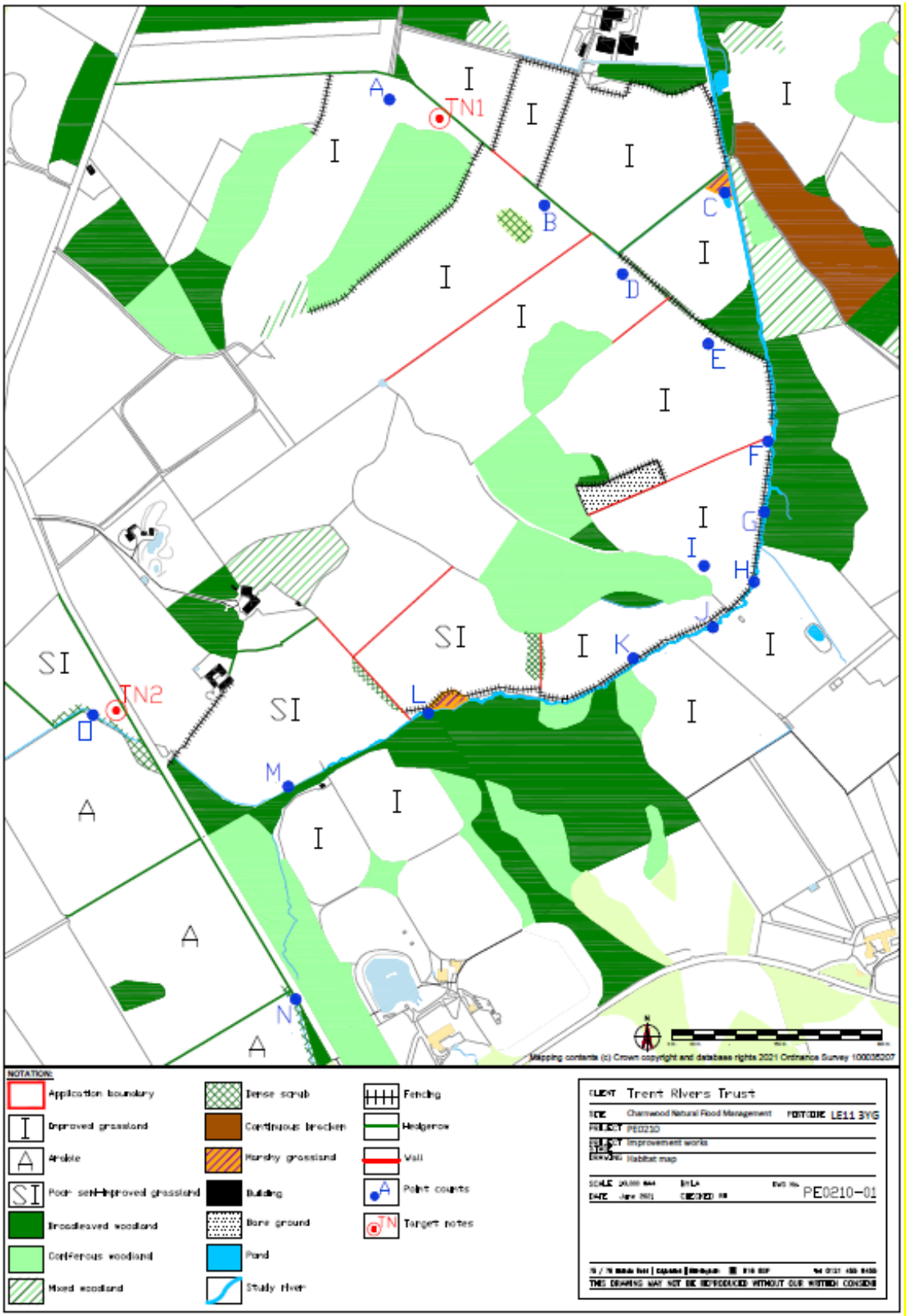

Figure 2: Phase 1 Habitat map

Semi-improved and Improved Grassland / Pasture

4.2.1 The majority of fields in the vicinity of the NFM initiatives are improved grassland fields used for pasture. They contained typical neutral to occasionally acidic grassland species including perennial rye-grass *Lolium perenne*, common bent *Agrostis capillaris*, Sheep sorrel *Rumex acetosella*, hard rush *Juncus inflexus*, soft rush *Juncus effusus*, dandelion *Taraxacum offinalis* agg., red clover *Trifolium pratense,* white clover *Trifolium repens*, chickweed *Stellaria media*, meadow foxtail *Alopecurus pratensis*, sheeps fescue *Festuca ovina* and the moss *Rhytidiodelphus squarrosus*.

4.2.2 Slight variation occurred across the fields and at NFM initiative M the adjacent field contained some more wet tolerant species at the bottom of the slope including reed canary grass *Phalaris arundinacea*, lesser spearwort *Ranunculus flammula*, cuckoo flower *Cardamine pratensis* and meadow buttercup *Ranunculus acris*. Likewise, the field at NFM initiative A was also noted to contain a larger amount of cuckoo flower.

Broadleaved Woodland/Plantation

4.2.3 As shown on Figure 2, there are some significant stands of mature woodland. This was either native broadleaved woodland or mixed plantation.

4.2.4 Species within the woodland areas included include silver birch *Betula pendula*, alder *Alnus glutinosa*, ash *Fraxinus excelsior*, oak *Quercus robur,* scots pine *Pinus sylvestris,* sitka spruce *Picea sitchensis*, holly *Illex aquifolium*, horse chestnut *Aesculus hippocastanum*, hazel *Corylus avellana*, crack willow *Salix fragilis* and goat willow *Salix* capraea.

4.2.5 Ground flora was dominated by wavy hair-grass *Deschampsia flexuosa*, bracken *Pteridium aquilinum,* male fern *Dryopteris filix-mas*, bluebell *Hyancinthoides non-scripta*, dogs mercury *Mercurialis perennis*, common nettle *Urtica dioica*, cow parsley *Anthriscus sylvestris* and wood avens *Geum urbanum*. Bryophytes were also common and noted as most abundant within the ground flora towards Wood Brook.

Wood Brook

4.2.6 Throughout the site flows Wood Brook which is the subject to the NFM initiatives. The brook is characterised by a cobble gravel substrate with earth banks that are approximately 1m high. Channel width varies between approximately 3m and 6m.

The majority of the brook length in this section is shaded by adjacent woodland or alder and crack willow trees that line the banks. In places the crack willow has fallen to provide overhanging limbs and dead wood which will provide important habitat for a range of fauna.

4.2.7 Vegetation was dominated by bryophytes. In channel species present included waterside feather moss *Brachythecium rivulare*, Long-beaked water feathermoss *Platyhypnidium riparioides*, Kneiff's feather-moss *Leptodictium riparium*, lesser pocket-moss *Fissidens bryoides,* the liverworts *Marchantia polymorpha* and *Conocephalum conicum*. The algae *Cladophora glomerata* agg. was also present but never at higher than 5% cover. Crustose lichens were also noted on some rocks. It was noted that there was a fairly significant amount of sedimentation within the channel.

4.2.8 The bankside vegetation and adjacent areas of wet habitats e.g. flushes and wetted depressions consisted of reed canary grass, opposite leaved golden saxifrage *Chrysosplenium oppositifolium*, angelica *Angelica archangelica*, cow parsley, common nettle *Urtica dioica*, red campion *Silene dioica*, brook lime *Veronica beccabunga*, water mint *Mentha aquatica*, garlic mustard *Alliaria petiolata,* sedges *Carex* spp., floating sweet grass *Glyceria fluitans*, water forget-me-not *Myosotis scorpiodes, meadowsweet Fillipendula ulmaria* and hogweed *Heracleum sphondylium*.

Ponds

4.2.9 Ponds present in the area contained typical lowland eutrophic species including reed canary grass, common reed *Phragmites australis*, reedmace *Typha latifolia*, water mint, brook lime, common duckweed *Lemna minor*, rigid hornwort *Ceratophylum demersum* and the charophyte *Chara vulgaris* was noted in the offline pond near NFM initiative C.

Hedgerows

4.2.10 Hedgerows dissect the site often running alongside stone walls denoting the field boundaries. Species present include hawthorn *Crataegus monogyna*, blackthorn *Prunus spinosa*, elder *Sambucus nigra* and dog rose *Rosa canina*. The hedgerows on site were not considered species rich.

Tipped Debris

4.2.11 An area of tipped debris was noted at NFM initiative O (TN2). This was linked to agricultural activity but the contents of the tip were not known.

4.3 Species

Badger

4.3.1 Numerous records of Badger were returned in the LRERC data request and habitats are optimal for this species.

4.3.2 A 5 hole badger sett was recorded between NFM initiatives A and B at the field track at NGR: SK 50214 16501 (TN1).

Riparian mammals

4.3.3 No record of water vole *Arvicola amphibius* were retuned in the data consultation with LRERC. The survey did not find any signs of this species and no evidence of burrows was recorded. Habitats would be suitable for water vole in the sections where the bank profile allows burrowing, therefore, further investigation would be needed if the banks of the brook were to be disturbed.

4.3.4 No records of otter *Lutra lutra* were returned by LRERC. Habitats on site are very suitable for this species, however, no signs of this species were encountered during the survey. No holts or layup sites were found, but due to the suitability of habitat it should be assumed that otter use the brook and for foraging and commuting and could be a receptor for the scheme.

Bats

4.3.5 Bat species reported within 2km of the site by LRERC were; common pipistrelle *Pipistrellus pipistrellus*, soprano pipistrelle *Pipistrellus pygmaeus*, brown long-eared *Plecotus auratus,* Brandt's bat *Myotis brandtii,* natterer's bat *Myotis natteri,* Noctule bat *Nyctalus noctula* and Daubenton's *Myotis daubentoniid*.

The majority of trees within the NFM areas offered moderate to good bat roost potential and habitats were optimal for foraging. Bats are therefore considered a receptor for the scheme should tree removal be required.

Birds

4.3.6 Multiple records of bird species within 2km of the site were provide by LRERC.

4.3.7 The habitats on site are likely to provide suitable foraging and nesting habitat for a range of bird species including numerous sensitive species.

4.3.8 During the survey kingfisher *Alcedo atthis* and dipper *Cinclus cinclus* were not observed, however, habitats would be optimal for these riverine species, and it is highly likely that there could be nest sites present.

Amphibians

4.3.9 Several records of great crested newts *Triturus cristatus* were provided by LRERC. The pond at NGR: SK 50597 16575 was tested via eDNA method. The result was negative for newts. No other ponds within close proximity to NFM initiatives were considered suitable for great crested newt. Of note was the sighting of a smooth newt at the pond at NGR: SK 50597 16575. Due to the negative eDNA result and lack of other suitable ponds, great crested newt are not considered a potential receptor for proposed NFM at the site and are not considered further. Other common amphibian species are likely to use the site.

Reptiles

4.3.10 Records of slow worm *Anguis fragilis* common lizard *Zootoca vivipara* and adder *Vipera berus* have been returned in the data consultation with LRERC. Habitats on site would be suitable for these species especially in proximity to the brook and within the stone walls on site.

Fish

4.3.11 No fish data was returned in the data consultation with LRERC. However, the brook habitat would offer good potential for a range of course fish and bullhead *Cottus gobio* was observed in the brook. The brook habitats offer optimal habitat for feeding and spawning. NFM works are likely to have a sympathetic approach to fish, however, fish will need to be a consideration for potential impacts during the NFM installation.

White-clawed crayfish

4.3.12 Numerous records of white-clawed crayfish *Austropotamobius pallipes* were provided by LRERC and they are known to be present on Wood Brook, although lack of recent records show that the population may have crashed.

Habitats on site were suitable for crayfish, and they could be a possible receptor for any in channel workings during NFM installation.

Invertebrates

4.3.13 Numerous invertebrate species were returned in the data consultation results. However, NFM initiatives are likely to have a positive impact upon them and specific measures for their protection outside of white-clawed crayfish are not anticipated.

Invasive species

4.3.14 No invasive species were seen during the site walkover and currently invasive species are not considered an impact to the site.

5.0 DISCUSSION & RECOMMENDATIONS

5.1 Assessment of effects and general mitigation recommendations

5.1.1 The following general ecological constraints to NFM at the site have been identified (Table 3).

Table 3: Identified ecological constraints for the site generally

Habitat/ Species	Constraints identified	Further Survey required and timing	Design Considerations	Biodiversity gain
Designated Sites	Two SSSI sites and several LWS have been identified locally but lack specific connectivity to the site that would mean that NFM interventions could have a negative impact upon the designations.	None anticipated	None anticipated	NFM would contribute to the general enhancement of the area.
On site habitats	Some land take of improved grassland will be needed.	None anticipated	Retain hedgerows and trees where possible. Replacement planting for hedgerows and trees to be lost with greater number of native species mix. Root protection zones for retained trees will need to be marked out on site.	Enhancement /mitigation could be achieved through additional native tree and hedgerow planting. The general NFM interventions will help achieve biodiversity gains e.g. tree planting and wetland creation.
Riparian Mammals	Habitats on site are suitable for otter and water vole despite them not being found during survey.	Pre commencement check advised prior to in channel and bank side NFM initiatives being implemented.	None anticipated	NFM interventions should improve habitat quality for these species. Consideration could be given to installing an artificial otter holt.
Reptiles and amphibians	Potential for reptiles and amphibians to be present.	None anticipated	Precautionary method of working advised, delivered via toolbox talk. Should site operatives discover reptiles or great crested	The NFM interventions are likely to improve habitats for

Habitat/ Species	Constraints identified	Further Survey required and timing	Design Considerations	Biodiversity gain
			newt then all works should stop and an ecologist consulted for advice.	reptiles and amphibians. Any felled trees can be used as log pile refugia.
Birds	Potential for breeding birds.	If tree and scrub removal is required, then this should be undertaken outside of the breeding bird season (birds typically breed March to August inclusive). Works should generally avoid the breeding bird season or be preceded by a nesting bird check particularly for kingfisher and dipper.	Retention of trees on site and replacement planting to mitigate net loss.	Installation of bird boxes on retained trees. Kingfisher nest boxes would also be a good installation for the site.
Bats (roosting)	Potential for bats to roost in trees on site.	If mature trees with bat roost potential to be felled then further survey will be required to determine presence/absence. Survey could be via a licensed ecologist through the use of tree climbing and endoscope.	Retention of trees on site and replacement planting to mitigate net loss. If bat roosts are found then licensing with Natural England will be required.	Installation of bat boxes on suitable retained trees.
Bats (foraging)	Potential disruption to foraging habitat and commuting routes if hedgerows are not retained.	None anticipated	Retention of boundary trees and hedgerows to maintain commuting routes for bats.	Enhance structural diversity of landscape areas to enhance invertebrate assemblage and value to foraging bats. The NFM interventions should help to achieve this.
Badgers	Potential for disturbance to badger sett on site.	This species is highly mobile and can establish a sett at any time. Recommend a pre-commencement	Retain habitat connectivity. The known sett should be avoided where possible with a 30m buffer.	Enhance structural diversity of landscape areas to benefit

Habitat/ Species	Constraints identified	Further Survey required and timing	Design Considerations	Biodiversity gain
		badger activity survey.		badger. NFM interventions should help achieve this.
White clawed crayfish	Potential for this species to be present in the brook.	For in channel working survey is recommended to determine presence absence and allow recommendations to be made for mitigation.	If present then in channel works would need to be undertaken via method statement and under Natural England licence. There is a small scale works option that could be appropriate for this: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/461990/WML-CL23.pdf	NFM interventions are likely to improve habitat quality for crayfish.
Fish	Potential to disturb fish during in channel works.	None anticipated.	Works should abide by pollution prevention and good biosecurity practices.	NFM interventions are likely to improve habitat quality for fish.
Invertebrates	None anticipated	None anticipated	None anticipated	NFM interventions are likely to improve habitat quality for invertebrates.

5.2 NFM interventions constraints

5.2.1 The following ecological constraints for the implementation of the specific NFM interventions at the site have been identified in Table 4 below.

Table 4: Identified ecological constraints and potential for biodiversity gain for each NFM

NFM Intervention	Constraints identified	Further Survey required	Design Considerations
A Cross-slope Woodland	The area currently consists of species poor pasture which is not a habitat of importance and in terms of biodiversity and NFM would benefit from woodland creation. The access track at NGR: SK 50222 16499 contains a 5 hole main	No further survey anticipated provided badger sett can be avoided.	Species mixes sourced from reputable UK suppliers. Disturbance to the badger sett should be avoided and machine tracking should not be undertaken within a 10m radius of the sett. Alternative access should be considered. Additional consideration for inclusion of habitat features e.g.

NFM Intervention	Constraints identified	Further Survey required	Design Considerations
	badger sett. Disturbance to the sett should be avoided and machine tracking should not be undertaken within a 10m radius of the sett. Alternative access should be considered to avoid disturbance of the sett.		bird and bat boxes (once trees are established), hedgehog boxes, refugia/log piles.
B Cross-slope Woodland	The area currently consists of species poor pasture which is not a habitat of importance and in terms of biodiversity and NFM would benefit from woodland creation.	No further survey anticipated.	Species mixes sourced from reputable UK suppliers. Additional consideration for inclusion of habitat features e.g. bird and bat boxes (once trees are established), hedgehog boxes, refugia/log piles.
C Online Pond	Further survey information to be collected. Crayfish survey required to determine presence absence of white-clawed crayfish. If present then further licensing with Natural England may be required.	Crayfish survey is advised for the online pond to determine whether native white-clawed crayfish are present and would need consideration.	Pond creation should ideally allow natural colonisation of plants endemic to the area. If plant species are introduced these should be from a local UK reputable supplier and be species suitable for the area. Biosecurity measures should be adopted for pond works/creation.
D Cross-slope Woodland	The area currently consists of species poor pasture which is not a habitat of importance and in terms of biodiversity and NFM would benefit from woodland creation.	No further survey anticipated.	Species mixes sourced from reputable UK suppliers. Additional consideration for inclusion of habitat features e.g. bird and bat boxes (once trees are established), hedgehog boxes, refugia/log piles.
E Cross-slope Woodland	The area currently consists of species poor pasture which is not a habitat of importance and in terms of biodiversity and NFM would benefit from woodland creation.	No further survey anticipated.	Species mixes sourced from reputable UK suppliers. Additional consideration for inclusion of habitat features e.g. bird and bat boxes (once trees are established), hedgehog boxes, refugia/log piles.
F Offline Pond	The location for the offline pond is within species poor pasture which is not a habitat of importance and in terms of biodiversity and NFM would benefit from pond creation. There are some existing	No further survey anticipated.	Pond creation should consider root protection zones for adjacent trees. Pond creation should be to method statement and Reasonable Avoidance Measures for reptiles and amphibians due to the presence of the dry stone wall

NFM Intervention	Constraints identified	Further Survey required	Design Considerations
	depressions which were thought to be the area to be enhanced as an offline pond.		which could act as refugia for these species. Pond creation should ideally allow natural colonisation of plants endemic to the area. If plant species are introduced these should be from a local UK reputable supplier and be species suitable for the area. Biosecurity measures should be adopted for pond works/creation.
G Leaky Barriers	The location for leaky barriers would cross the channel and could have interaction with protected species present. Care will need to be taken to reduce impacts to protected species particularly crayfish, bats, fish.	It is advised that the location of each leaky barrier is targeted with a crayfish survey. This will determine whether white-clawed crayfish are present and whether works would need to be undertaken by a licenced ecologist under a low impact licence. If trees are to be removed or pruned particularly the mature Alders and Crack Willow then these would need inspection via endoscope via a licensed bat ecologist.	Works should consider Reasonable Avoidance Measures for fish, common amphibians, biosecurity measures and pollution prevention guidelines. The number of trees to be removed or pruned should be reduced as far as possible, but if required preceded by a bat survey inspection. Measures to protect crayfish would be needed if they are found to be present.
H Leaky Barriers	The location for leaky barriers would cross the channel and could have interaction with protected species present. Care will need to be taken to reduce impacts to protected species particularly crayfish, bats, fish.	It is advised that the location of each leaky barrier is targeted with a crayfish survey. This will determine whether white-clawed crayfish are present and whether works would need to be undertaken by a licenced ecologist under a low impact licence. If trees are to be removed or pruned particularly the mature Alders and Crack Willow then these would need inspection via endoscope via a licensed bat ecologist.	Works should consider Reasonable Avoidance Measures for fish, common amphibians, biosecurity measures and pollution prevention guidelines. The number of trees to be removed or pruned should be reduced as far as possible, but if required preceded by a bat survey inspection. Measures to protect crayfish would be needed if they are found to be present.

NFM Intervention	Constraints identified	Further Survey required	Design Considerations
I Bund	The location for the bund is within species poor pasture which is not a habitat of importance and in terms of biodiversity and NFM would benefit from the bund in this location.	The location of the bund is close to an area of woodland. No signs of badger were identified during survey. Badger are highly mobile and can readily move into new areas. An update badger survey should be undertaken as a pre works check.	Works should consider Reasonable Avoidance Measures for common amphibians.
J Leaky Barriers	The location for leaky barriers would cross the channel and could have interaction with protected species present. Care will need to be taken to reduce impacts to protected species particularly crayfish, bats, fish.	It is advised that the location of each leaky barrier is targeted with a crayfish survey. This will determine whether white-clawed crayfish are present and whether works would need to be undertaken by a licenced ecologist under a low impact licence. If trees are to be removed or pruned particularly the mature Alders and Crack Willow then these would need inspection via endoscope via a licensed bat ecologist.	Works should consider Reasonable Avoidance Measures for fish, common amphibians, biosecurity measures and pollution prevention guidelines. The number of trees to be removed or pruned should be reduced as far as possible, but if required preceded by a bat survey inspection. Measures to protect crayfish would be needed if they are found to be present from further survey.
K Paleo Channel Options	The location for paleo channel options is within species poor pasture which is not a habitat of importance and in terms of biodiversity and NFM would benefit from options brought forward in this location.	No further survey anticipated.	Works should consider Reasonable Avoidance Measures for common amphibians.
L Wetland	The wetland location is within an area that already contains wetland characteristics (slow flowing water) and associated species assemblage. The Crack Willow should be retained if possible.	If the crack willow is to be removed or pruned, then this would require a bat survey.	Works should consider Reasonable Avoidance Measures for common amphibians, biosecurity measures and pollution prevention guidelines. The number of trees to be removed or pruned should be reduced as far as possible, but if required preceded by a bat survey inspection.

NFM Intervention	Constraints identified	Further Survey required	Design Considerations
M Wetland Meadow	The wetland meadow location is at the base of a slope within pasture. The vegetation currently present retains the typical species of pasture but with occasionally more diverse herbs and wetland associated species for example Cow Parsley, Soft Rush and Reed Canary Grass. The enhancement of the area to encourage wetland meadow species assemblages will be of benefit to biodiversity and NFM and no real constraints were identified by this intervention.	No further survey anticipated.	Works should consider Reasonable Avoidance Measures for common amphibians, biosecurity measures and pollution prevention guidelines.
N Online Pond	Willow and Alder trees in this area have good biodiversity value with bat roost potential and should be retained. Crayfish survey required to determine presence absence of white-clawed crayfish. If present then further licensing with Natural England may be required.	Trees if removal or pruning is needed would require further bat survey. Crayfish survey is advised for the online pond to determine whether native white-clawed crayfish are present and would need consideration.	Retention of trees where possible. Pond creation should ideally allow natural colonisation of plants endemic to the area. If plant species are introduced these should be from a local UK reputable supplier and be species suitable for the area. Biosecurity measures should be adopted for pond works/creation. If crayfish are present then refuges within the new pond can be created.
O Wetland	The wetland location is within an area used as pasture, with a debris pile from farming activity. A hedge also boarders the side of the brook. The debris pile could be a source of pollutants depending on its contents. Crayfish survey required to determine presence absence of white-clawed crayfish. If present then further licensing with Natural England may be required.	The debris pile should be investigated further to determine whether wetland creation in this area could cause leaching of pollutants. Crayfish survey is advised for the brook to determine whether native white-clawed crayfish are present and would need consideration.	Works should consider Reasonable Avoidance Measures for common amphibians, biosecurity measures and pollution prevention guidelines.

6.0 CONCLUSIONS

6.1.1 Provided the recommendations in Table 3 and 4 are followed, NFM works as proposed are unlikely to have a significant impact on the ecology of the site and offer substantial opportunity to increase the biodiversity value of the area. Liaison will be needed with The Environment Agency to discuss their requirements for flood prevention. Provided agreement can be made with key stakeholders on the suggested NFM proposals, then NFM initiatives are likely to comply with the relevant environmental legislation and would contribute to biodiversity gain for the area.

APPENDICES

PHOTOGRAPHIC PLATES

Plate 1. Site A

Plate 2. Site B

Plate 3. Site C

Plate 4. Site D

Plate 5. Site E

Plate 6. Site F

Plate 7. Site G

Plate 8. Site H

Plate 9. Site I

Plate 10. Site J

Plate 11. Site K

Plate 12. Site L

Plate 13. Site M

Plate 14. Site N

Plate 15. Site O

Plate 16. Tipped debris near Site O (TN2)

Plate 17. Badger sett location

EDNA RESULTS

SureScreen Scientifics

Folio No: E10317
Report No: 1
Purchase Order: EM0066
Client: HARRIS LAMB
Contact: Rob Harrison

TECHNICAL REPORT

ANALYSIS OF ENVIRONMENTAL DNA IN POND WATER FOR THE DETECTION OF GREAT CRESTED NEWTS (TRITURUS CRISTATUS)

SUMMARY

When great crested newts (GCN), *Triturus cristatus*, inhabit a pond, they continuously release small amounts of their DNA into the environment. By collecting and analysing water samples, we can detect these small traces of environmental DNA (eDNA) to confirm GCN habitation or establish GCN absence.

RESULTS

Date sample received at Laboratory: 14/05/2021
Date Reported: 25/05/2021
Matters Affecting Results: None

Lab Sample No.	Site Name	O/S Reference	SIC	DC	IC	Result	Positive Replicates
4397	P1 (Site 3), Wood Brook	SK 50596 16578	Pass	Pass	Pass	Negative	0

If you have any questions regarding results, please contact us: ForensicEcology@surescreen.com

Reported by: Chris Troth **Approved by:** Chris Troth