ANNEX B6

Environmental Regulatory Assessments (BNG)

This document has been written in line with the requirements of the RAPID gate two guidance and to comply with the regulatory process pursuant to Severn Trent Water's statutory duties. The information presented relates to material or data which is still in the course of completion. Should the solution presented in this document be taken forward, Severn Trent Water will be subject to the statutory duties pursuant to the necessary consenting process, including environmental assessment and consultation as required. This document should be read with those duties in mind.

STSources SRO
Severn Trent Water

Severn Trent Sources Strategic Resource Option

B6. STS SRO Biodiversity Net Gain Calculations

Severn Trent Water Limited

29 July 2022

5213609 / 9.6 / DG / 006

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This document has 34 pages including the cover.

Document history

Document title: B6. STS SRO Biodiversity Net Gain Calculations

Document reference: 5213609 / 9.6 / DG / 006

Revision	Purpose description	Originated	Checked	Reviewed	Authorised	Date
1.0	Draft for Client Review	ED, EM	CW	KS	PMU	27/05/2022
2.0	Revised for Client Review	ED	PW	LMG	SB	17/06/2022
3.0	Revised following NAU Review	ED	MF	LMG	PMU	29/07/2022

Client signoff

Client	Severn Trent Water Limited
Project	Severn Trent Sources Strategic Resource Option
Job number	5213609
Client signature/date	

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1. Introduction

1.1. Background

This report examines compliance of the Severn Trent Sources (STS) Strategic Resource Option (SRO) ('the Scheme') in accordance with the Biodiversity Net Gain (BNG) legislation at Gate 2. The Scheme was identified as an SRO in the PR19 Final Determination, with funding provided to Severn Trent Water (STW) as an individual company. The STS SRO is considered integral to the Severn Thames Transfer (STT) SRO. The central aspect of the STT is the interconnector which enables the transfer of raw water from the River Severn to the River Thames (Deerhurst to Culham pipeline). To support this transfer, additional sources of water are required to support baseline river flows. These additional sources of water will be supported by United Utilities and STW, which comprise of water resources that can be added, or not abstracted (redeployed), from the Rivers Vyrnwy, Severn and Avon. This assessment only considers the STS SRO option, which comprises:

- A transfer of up to 35 Ml/d of final effluent from Netheridge Wastewater Treatment Works (WwTW) to the River Severn at Haw Bridge.
- A 15 Ml/d licence transfer from Mythe Water Treatment Works (WTW) to the Severn to Thames Transfer pipeline abstraction location at Deerhurst.

This report is a Technical Appendix to the STS SRO Interim Environmental Assessment (IEA), which provides further background information to the Scheme.

The ACWG guidelines indicate that the process requires Water Companies to provide the following information related to each SRO at the stage outlined (Figure 1-1).

BNG is an approach that aims to leave the natural environment in a measurably better state than beforehand. The British Standard BS 8683:20214[1] defines BNG as a:

> *"a specific, quantifiable outcome from project activities that deliver demonstrable benefits for biodiversity compared to the baseline situation."*

Natural England's Biodiversity Metric 3.0 provides a way of measuring and accounting for biodiversity losses and gains resulting from development or land management change[2].

Whilst BNG is not currently mandatory, it will become a legal requirement for development once the appropriate provisions of the Environment Act 2021, in relation to nature and biodiversity, come into force. Schedule 14 of the Act makes provisions for planning permission granted in England to be subject to a condition to secure that the biodiversity gain objective is met and that the biodiversity value attributable to the development exceeds the pre-development biodiversity value of the onsite habitat by at least the relevant percentage, which is 10 %.

Delivering net gain for the environment has also become a recent planning policy requirement. The National Planning Policy Framework (NPPF)[3] emphasises the importance of protecting and enhancing the natural environment. The NPPF approach to BNG is set out in Paragraph 179b, which is to:

> *"Promote the conservation, restoration and enhancement of priority habitats, ecological networks and the protection and recovery of priority species; and identify and pursue opportunities for securing measurable net gains for biodiversity."*

The BNG assessment required for Gate 2 is carried out in line with the All Companies Working Group (ACWG) current guidance[4] with respect to environmental assessment, which states that at Gate 2 '*the BNG assessment would be refined through the inclusion of concept designs into the assessment*'. The requirements and outputs of the assessment are also consistent with WRPG guidance[5] for WRMP24.

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[1] The British Standards Institution 2021. BS 8683:2021 Process for designing and implementing Biodiversity Net Gain – Specification. BSI Standards Limited 2021.
[2] Stephen Panks, Nick White, Amanda Newsome, Jack Potter, Matt Heydon, Edward Mayhew, Maria Alvarez, Trudy Russell, Sarah J. Scott, Max Heaver, Sarah H. Scott, Jo Treweek, Bill Butcher and Dave Stone (2021). Biodiversity metric 3.0: Auditing and accounting for biodiversity – User Guide. Natural England.
[3] Ministry of Housing, Communities & Local Government. National Planning Policy Framework. MHCLG, July 2021.
[4] Mott MacDonald (2020) All Companies Working Group WRMP environmental assessment guidance and applicability with SROs. October, 2020.
[5] Environment Agency, Ofwat and Natural Resources Wales (2020) Water Resources Planning Guideline, July 2020. Available from: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/903694/Water_resources_planning_guideline.pdf

The BNG assessment has used Biodiversity Metric 3.0[2] to calculate biodiversity losses and gains. The assessment takes a hierarchical approach to mitigation (method outlined in Section 3.2.6 below) seeking to avoid loss of key habitats (and therefore species), applies the BNG good practice principles (method outlined in Section 3.2.7 below), and identifies strategic opportunities for biodiversity benefits to protect and enhance the environment and provide habitat resilience.

1.2. Purpose of report

This report sets out the BNG calculations for the STS SRO scheme at Gate 2 and builds upon work undertaken at Gate 1 of the design process. The scheme is integral to a larger STT system, which does not form part of this assessment and is being assessed separately.

1.3. Structure of report

The remainder of this report is divided into the following sections:

- Section 2: Severn Trent Sources SRO
- Section 3: Methodology used for the BNG calculations
- Section 4: Calculation results
- Section 5: Conclusions and recommendations

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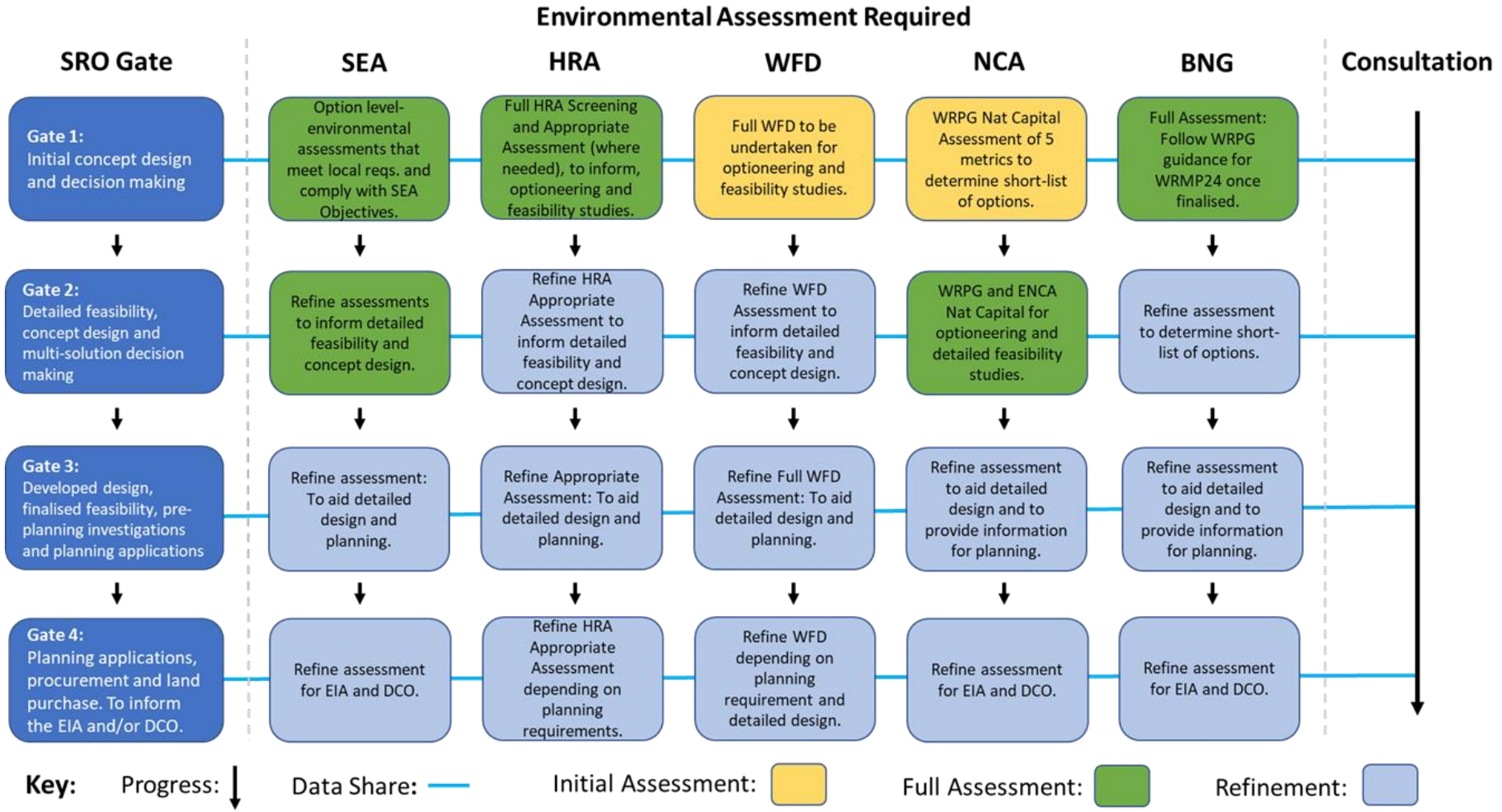

Figure 1-1 - Environmental assessment integration with SRO Gates

2. Severn Trent Sources SRO

2.1. Scheme description

A summary of the two main STS SRO components is provided in Sections 2.2 and 2.3, and their joint operation in Section 2.4. A detailed overview of the scheme is presented within the main IEA report and a map of the STS SRO Scheme is available in Technical Appendix B3.2. The Scheme description provided at Gate 2 (on which Gate 2 assessments have been based) will be subject to further review in Gates 3 and 4.

2.2. Mythe WTW abstraction licence transfer (15 Ml/d)

This part of the Scheme provides support to the STT System from the Severn catchment by redeploying 15 Ml/d of the existing STW abstraction licence at its Mythe WTW intake in the lower River Severn. This infrequently used licensed volume from Mythe would now remain in the River Severn for abstraction downstream at Deerhurst. STW has advised that no construction works would be required to redeploy the spare licence volume for abstraction. It is understood from STW that no specific additional resource to replace this current abstraction licence volume has been determined to date. The Mythe WTW abstraction licence Scheme will not operate alone and will operate in-combination with the Netheridge WwTW discharge diversion to Haw Bridge.

2.3. Netheridge WwTW discharge diversion to Haw Bridge pipeline (35 Ml/d)

The outfall location to the River Severn will be located just upstream of the level gauge at Haw Bridge (see Scheme map in Technical Appendix B3.2). The discharge diversion from Netheridge WwTW would be pumped by a new pumping station, located at the WwTW via a 700 mm diameter pipeline approximately 15.5 km long with tunnelling under named watercourses, such as the River Severn.

The pipeline discharge to Haw Bridge will not be continuous. It will range from zero (when flows are high enough in the River Severn to support the STT transfer) to 35 Ml/d when fully operational (during periods of lower flows in the River Severn). The pipeline will include nine drain-down points through which water in the pipeline will be discharged during maintenance activities (Technical Appendix B3.3). These drain-down points will be set back at least 10 m from water courses. The Netheridge WwTW final effluent would receive additional treatment to mitigate any water quality issues, which includes the removal of ammonia using a Multi-Bed Bio Reactor (MBBR), removal of phosphorus using 'CoMag'®, and removal of selected organic compounds including phenols, Perfluorooctane sulfonic (PFOS) and some pesticides using Ozone, Biological Aerated Flooded Filter (BAFF) and Granulated Activated Carbon (GAC).

2.4. Indicative operation of STS SRO

There are the following modes of operation. Please note the duration of the Scheme's operation is indicative at this stage and could be refined based on further modelling or changes to river flow triggers.

- **Mode 1 -STT SRO sweetening flow provided by unsupported river abstraction**: STS SRO is not in operation and STT is also off. There is enough water in the River Severn at Deerhurst to provide the 20 Ml/d STT sweetening flow between the River Severn to the Thames, with no undesirable effects on the River Severn.
- **Mode 2- STT SRO sweetening flow provided by STS Netheridge WwTW effluent transfer at 20 Ml/d**: STS is 'on' but STT off. This means 20 Ml/d is piped from Netheridge WwTW to Haw Bridge because STT is not working and thus only requires the sweetening flow, which the river can't provide. This mode of operation would be expected to occur 12 % of the time (modelled over a 47-year period).
- **Mode 3- STT SRO water resources provided by the STS Netheridge WwTW effluent transfer at 35 Ml/d:** STS is 'on' and STT is 'on'. This means 35 Ml/d is piped from Netheridge to Haw Bridge to allow a 35 Ml/d STT abstraction. STT takes the additional 15 Ml/day from Mythe WTW abstraction licence transfer, so STT takes a 50 Ml/d contribution from STS overall. This mode of operation would be expected to occur 16 % of the time (modelled over a 47-year period).

3. Methodology

3.1. Calculating biodiversity units using Biodiversity Metric 3.0

Biodiversity Metric 3.0 (hereafter referred to as 'the Metric 3.0') uses a number of measures to quantify baseline biodiversity value for each habitat type within a development site boundary. These measures include the habitats' intrinsic value (i.e. its distinctiveness), its condition and its area/ length (ha/ km). In addition, the strategic significance of the location of any habitats within the development site boundary is taken into account by applying a spatial multiplier. Metric 3.0 is used for consistency with other SROs, but as noted in the conclusions (see Section 5.1), consideration should be given to a company or industry wide adoption of the more recent version 3.1 as schemes are still in a relatively early stage of design development.

A habitat's distinctiveness score is derived from its intrinsic biodiversity value, reflecting the rarity of the plant community, the time it takes to reach maturity, its value to fauna, and its ecosystem function. This score is pre-assigned and is pre-populated in the Metric 3.0.

The calculation for baseline biodiversity units for any habitat parcel is outlined below in Figure 3-1 below.

Post development biodiversity units are calculated the same way but with the addition of risk multipliers that take into account the difficulty and time it takes to create new habitat or enhance existing habitat, Figure 3-1. These temporal and risk related multipliers are set by Natural England within the Metric 3.0 and cannot be changed (full details are provided in the Technical Supplement of the Metric 3.0[6]). Where habitat creation or enhancement is off-site, a spatial risk multiplier is applied based on the distance of habitat creation or enhancement to the site of habitat loss.

The Metric 3.0 can also take into account whether habitat creation or enhancement is delivered in advance of any impact it is compensating for or whether there will be any significant delay in an intervention relative to the impact. If taken into account, the standard temporal multiplier is adjusted accordingly.

Assumptions were made to determine the strategic significance of the baseline habitats located within the STS SRO indicative scheme boundary. In later Gate stages, national and local plans and policy should be reviewed to refine the strategic significance score.

In order to calculate the overall net change in biodiversity units, the baseline units are subtracted from the post development units, as detailed in Figure 3-1 below.

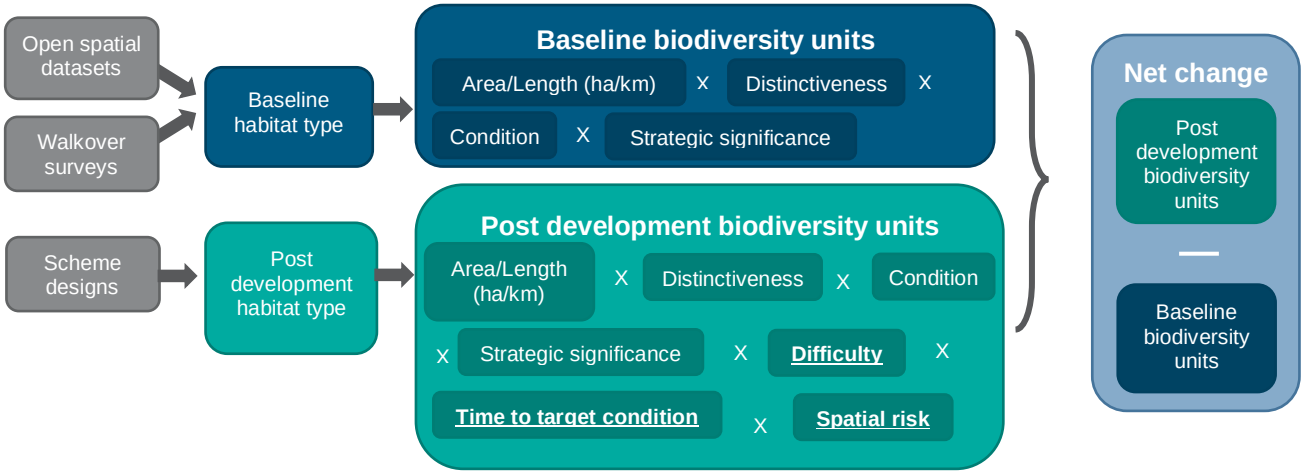

Figure 3-1 - Illustration to depict the data source and biodiversity calculations for Biodiversity Metric 3.0

N.B. Encroachment is only applicable to the Rivers and Streams component of the Metric 3.0. Text underlined indicates a risk factor applied when creating or enhancing habitats.

[6] [redacted] (2021). Biodiversity metric 3.0: Auditing and accounting for biodiversity – Technical Supplement. Natural England.

3.2. On-site baseline

3.2.1. Overall approach

The Gate 1 assessment work[7] used a Geographic Information System (GIS) based system to rapidly assess multiple elements and used the Defra Biodiversity Metric 2.0 (beta version) to calculate biodiversity losses and gains. This was built on by Ricardo undertaking high-level site surveys in June and July 2021 to ground-truth some of the predicted habitats so that a correction factor (by way of a proportional split) could be applied to the habitat. Ricardo also incorporated additional open-source datasets.

Key points to note about the Gate 2 assessment are that:

- Metric 3.0 has been used; at this stage there has been no update to Biodiversity Metric 3.1 (see Section 3.2.8);
- The majority of the pipeline construction corridor was generated by Ricardo using GIS. The width of the corridor is 40 m, which includes 20 m buffer either side of the pipeline and reduces to 20 m (10 m buffer either side of the pipeline) at sensitive ecological features, including those listed below.
  - Special Areas of Conservation (SAC);
  - Special Protection Areas (SPA);
  - Ramsar sites;
  - Sites of Special Scientific Interest (SSSI);
  - Local Nature Reserves (LNR);
  - Local Wildlife Sites (sourced from requests – only geospatial data provided was used);
  - Ancient woodland;
  - Priority habitats;
  - Hedges (derived from a Ricardo created dataset);
  - Woodland mapped on the National Forest Inventory;
  - Scheduled monuments; and,
  - Listed buildings (5 m buffer around points).
- The construction corridor immediately surrounding Netheridge WwTW was generated by Atkins in discussion with WSP, the Scheme's design leads. WSP supplied polygons showing where buildings/infrastructure are proposed (unbuffered) and a line showing a section of pipeline additional to that provided and buffered by Ricardo (as outlined above). Atkins generated a buffer with a total width of 20 m for this 'new' pipeline section. This was offset in places to avoid overlapping existing Netheridge WwTW infrastructure. The polygons showing proposed buildings/infrastructure remained unbuffered.
- Additional open-source datasets have been used in the baseline habitat predictions (see Section 3.2.2).

Compared to Gate 1, the Gate 2 assessment now also includes land at the Netheridge WwTW and additional connecting pipework, which link the treatment works extension to the extent of habitat assessment undertaken in Gate 1. Both the pipeline route and the Netheridge WwTW footprint have been used for assessment at Gate 2 and form part of the Scheme's indicative site boundary. The assumptions for this assessment are provided below.

3.2.2. Automated habitat prediction

The majority of the baseline habitat data used was received from Ricardo, who have developed a tool that predicts baseline habitats based on open-source data. This is shown in Appendix B6.1. The open-sources Ricardo used are as follows

- National Forest Inventory;
- Ordnance Survey (OS) Zoomstack Surface Water;
- Priority Habitats Inventory (PHI);
- OS Zoomstack Greenspace;
- Copernicus (CORINE) High Res Grassland;
- Copernicus (CORINE) High Res Urban; and

[7] Ricardo (2021) Severn Trent Sources SRO Draft Environmental report, June 2021.

- CORINE Land Cover (CLC) 2018.

Ricardo refined their predictions (including assumed condition assessment scores) by using information gathered on habitat type and condition during a limited number of walkover surveys undertaken on 29/06/2021, 30/06/2021, 01/07/2021, 13/07/2021, 14/07/2021, 15/07/2021 and 16/07/2021.

Once the output of Ricardo's tool was received, the output was translated (where required[8]) to the habitat types used in the Metric 3.0 (which are largely based on the UK Habitat Classification[9]) using professional judgement. Table 3-1 below shows these translations and the justifications for them.

Table 3-1 - Translation from automated habitat predictions to Metric 3.0. habitat types

Open-source	Open-source Habitat Description	Metric 3.0. Habitat Type	Justification
CLC	1.2.1. - Industrial or commercial units and public facilities	Developed land; sealed surface	While the definition of 1.2.1. says it can contain 'vegetation (most likely grass) or other non-sealed surfaces' it states that the majority of the area occupied by this habitat type is likely to be 'buildings, other built-up structures and artificial surfaces (with concrete, asphalt, tarmacadam, or stabilised like e.g. beaten earth)'. Therefore, 'Developed land; sealed surface' is considered to be a reasonable assumption.
CLC	2.1.1. - Non-irrigated arable land	Cereal crops	The definition for 2.1.1. states land of 'agricultural use for annually harvested non-permanent crops'. While the information is not detailed enough to identify the type of crop grown, most of the other types of Cropland habitat used in the Metric 3.0 (e.g. cereal crops other, non-cereal crops, temporary grass and clover leys or cereal crops winter stubble) are of the same distinctiveness and so the selection of 'cereal crops' this would not impact the habitat unit value.
CLC	3.2.2. - Moors and heathland	Mixed scrub	'Lowland heathland' was considered for this translation but considering 'Lowland heathland' is a priority habitat and isn't shown to be within the Scheme's indicative site boundary when looking at the PHI, 'Mixed scrub' has been assigned. This is considering the appropriate definition for 3.2.2. in this instance and it includes: shrubs and dwarf shrubs (dominating the vegetation), trees of dwarf growth form (not higher than 3 m) and herbaceous vegetation (grasses and herbs[10]. With Metric 3.0 mixed scrub is described as patches of shrubs less than 5m tall with continuous cover (>90%).
PHI	Good quality semi-improved grassland	Other neutral grassland	This translation has been undertaken assuming no other priority habitat grasslands have been identified in these areas (e.g. lowland meadows, calcareous or acid grasslands).'Good quality semi-improved' suggests this grassland is not a 'Modified grassland'.
Corine High Resolution Grassland	High res grassland	Other neutral grassland	Detail has not been provided on the type of grassland. It is understood that the Corine High Resolution Grassland dataset contains a variety of grassland types including natural, semi-natural, agricultural and managed grass-

[8] Translation was not required for some habitats as they already directly translate to a Metric 3.0 habitat type, e.g. Lowland meadows.

[9] [redacted] (2020). UK Habitat Classification V1.1. Available at: http://ukhab.org

[10] Copernicus (2022) *Corine Land Cover classes*. Available via: https://land.copernicus.eu/user-corner/technical-library/corine-land-cover-nomenclature-guidelines/html/index-clc-322.html [accessed 24 May 2022]

Open-source	Open-source Habitat Description	Metric 3.0. Habitat Type	Justification
			covered surfaces. It is assumed therefore that 'High res' is not a description of the grassland itself but the dataset. This translation has been undertaken on a precautionary basis and assuming no other priority habitat grasslands have been identified in these areas (e.g. lowland meadows, calcareous or acid grasslands).
PHI	No main habitat but additional habitats present	Floodplain Wetland Mosaic (CFGM)	These areas were looked at individually and of the 'Other Priority Habitats Present' within these areas, Coastal Floodplain Grazing Marsh (CFGM) is mentioned as the/one of the likely main habitat types. Based on this, a high-level assumption has been made that these areas are all CFGM.

Habitat condition and strategic significance assumptions used for the automated habitat predictions are detailed in Section 3.2.8.

Overlapping polygons were identified within the dataset. This would have caused the double counting of baseline areas. These overlaps were removed with the more distinctive habitats being assigned where overlaps occurred. This was on a precautionary basis.

3.2.3. Manual habitat prediction

The baseline habitats have been manually predicted within the construction corridor immediately surrounding Netheridge WwTW. The manual prediction involved assigning Metric 3.0 habitat types to areas within the Scheme's indicative site boundary (not already covered by Ricardo's tool output), based on aerial imagery and using professional judgement.

The habitats predicted are listed below, along with additional information where relevant.

- Lowland mixed deciduous woodland (priority habitat) – coincident with areas shown as deciduous woodland by the PHI.
- Other woodland; broadleaved – any woodland not on the PHI is assumed to be other woodland; broadleaved. This is based on the results of Ricardo's walkover surveys.
- Modified grassland – grassland within the boundary of Netheridge WwTW. From aerial imagery the grassland appears mown. It is assumed this grassland is intensively mown/managed and contains a limited number of plant species.
- Other neutral grassland – all other grassland is assumed to be other neutral grassland on a precautionary basis.
- Developed land; sealed surface – existing built structures and hardstanding areas within Netheridge WwTW.

Open-source data identifying all hedgerow types and arable field margin priority habitats was not available. Therefore, these habitats were manually identified using the methods described below.

Hedgerows, within the whole Scheme indicative site boundary, were manually plotted in Quantum GIS (QGIS) based on aerial imagery.

Identifying arable field margins used the Countryside Stewardship Agreement Management Areas and the Environmental Stewardship Agreements datasets from the Multi Agency Geographic Information for the Countryside (MAGIC)[11]. Where polygons from these datasets coincided with habitats identified as croplands, it was assumed that arable field margins are present. Arable field margins were assumed to 4 m wide and so, for scenarios where the construction corridor was perpendicular to the field margin, the area of field margin was

[11] Department for Environment, Food and Rural Affairs (2022) MAGIC. Available via: https://magic.defra.gov.uk/MagicMap.aspx [accessed on 19 May 2022]

calculated by multiplying the width of the construction corridor (either 20 m or 40 m) at the point of intersection by four. Where intersections between the construction corridor and field margins were not perpendicular to field margins, but ran parallel instead, this parallel length was multiplied by four to calculate the appropriate area. This area was then subtracted/omitted from the remaining area of low distinctiveness cropland (cereal crop). This is likely to be a highly precautionary approach but is taken as best practice.

Habitat and hedgerow condition and strategic significance assumptions used for the manual habitat predictions are detailed in Section 3.2.8.

The OS Open Rivers[12] dataset were used to identify watercourses that were cross by the pipeline. Those that were not captured in the OS Open Rivers data were manually digitised from aerial imagery. None were identified as Priority River Habitats[13]. A total of 11 watercourse sections were crossed. As limited data were available, all watercourses were assumed to be 'Other Rivers and Streams' river type as a conservative approach, which results in high distinctiveness classification. The condition of watercourses was assessed from Water Framework Directive (WFD) ecological status and aerial imagery. Most watercourses were classified to be in 'moderate' condition, with 3 watercourses in 'fairly poor' condition due to the over straightening of the channel and lack of variability in vegetation. Encroachment was assessed based on aerial imagery with most watercourses receiving a 'no encroachment' classification and two receiving 'minor' encroachment scores due to the proximity of riparian or watercourse developments. Any watercourses that were WFD water bodies were given a high strategic significance score, all other watercourses scored low for strategic significance.

All habitat data has been processed using GIS. GIS was used to calculate the areas of each habitat type or lengths of hedgerow or watercourse within the Scheme's indicative site boundary, which were further broken down by condition score give the overall area or length of each habitat type of each condition score.

3.2.4. Desk study

A high-level review was undertaken using the MAGIC website to identify whether any of the sites/habitats listed below were present within the Scheme indicative site boundary. All of the sites/habitats listed below are either statutory designated sites and/or irreplaceable habitat.

- LNRs
- National Nature Reserves
- Ramsar sites
- SACs/candidate SACs (cSAC)
- SPAs/ potential SPAs (pSPA)
- SSSIs, including review of surrounding SSSI risk zones for information
- Marine Protection Areas/Marine Conservation Zones
- Ancient Woodland

The Metric 3.0 sets out a number of principles and rules that should be followed when undertaking BNG assessments. Part of Rule 3[2] states:

> *'Losses of irreplaceable or very high distinctiveness habitat cannot adequately be accounted for through the Metric'.*

It should also be noted that (as stated in Construction Industry Research and Information Association's (CIRIA's) Biodiversity net gain guidance document[14]):

> *'…losses of irreplaceable habitats (or statutory designated sites) cannot be offset to achieve biodiversity net gain. Impacts on irreplaceable habitats and statutory designated sites should be avoided'.*

[12] Ordnance Survey Open Rivers. Available at: https://www.ordnancesurvey.co.uk/business-government/products/open-map-rivers
[13] Natural England (2021) Priority River Habitats. Available via: https://data.gov.uk/dataset/20019cdb-9fef-4024-81af-daf1d1b74762/priority-river-habitat-rivers
[14] CIEEM, CIRIA, IEMA. Biodiversity net gain. Good practice principles for development. A practical guide. CIRIA C776a. London, 2019.

3.2.5. On-site post development

There are three relatively small areas of assumed permanent habitat area loss within and adjacent to the Netheridge WwTW. The pipeline outfall at Haw Bridge also creates a permanent loss of river habitat as it will result in modifications to the river bank potentially causing in a decline in condition which is represented in Metric 3.0 as a loss of river habitat. These areas of proposed permanent loss and built development were calculated using GIS and are shown in Appendix B6.3.

It has been assumed that all of the remaining habitats and hedgerows within the Scheme indicative scheme boundary will be lost, as a result of the Scheme construction, with the majority then being reinstated to the same condition as they were previously – with two exceptions.

The first exception is for baseline habitats in good condition where it has been assumed they will be reinstated to moderate condition. This is a precautionary assumption considering the higher level of management generally required to achieve and maintain the target of good condition habitat.

The second exception is regarding temporary loss. Within the Biodiversity metric 3.0 – User Guide it is stated that:

> *"Biodiversity metric 3.0 only considers losses to be temporary when the original baseline habitat will be recreated in the same or better condition within 2 years from the date of the impact occurring. This requires the habitat creation/restoration to be complete, not just that seed has been sown or whips planted. This means that the temporary loss option is only available for habitats that can be restored to target condition (by recreation or enhancement) within 2 years.*
>
> *In these situations, it will not be necessary to record the loss within the metric and the habitat should be recorded as 'retained'. Where the loss is for a period greater than 2 years, even when the same habitat is restored in the same location, you should record this as a loss of baseline habitat and creation of the replacement habitat".*

The following habitat types are being considered as retained for the reason outlines above[15]: cereal crops, modified grassland in poor condition, other neutral grassland in poor condition, arable field margins and developed land; sealed surface. It is possible for these habitat types due to the short time to target conditions, for the creation of these habitat types, set out in the Technical Supplement of Biodiversity Metric 3.0[6,]. There is potential that additional areas could be confirmed to be recordable as retained, for example where some Floodplain Wetland Mosaic fields support arable crops, but this more limited precautionary approach has been taken at Gate 2.

It has also been assumed that all named watercourse crossings will be micro-tunnelled (i.e. those that are WFD water bodies or Environment Agency Main Rivers) will result in no loss of river habitat. All those that remain will be open-cut. This will result in a loss of habitat but for 'fairly poor' watercourses, this loss is temporary as habitat can be reinstated to the same condition in 2 years. It is therefore counted as retained habitat. All other watercourses of condition 'moderate' or better will result in a loss of habitat that will be reinstated, and it is assumed that it will be reinstated to at least the same condition as that lost.

It is assumed that there will be no operational impacts to terrestrial habitats. To reflect the operational impact of the change in flow regime downstream of Haw Bridge in river units, a percentage decrease from baseline has been used based on the modelled percentage decrease in flow. This is not standard BNG methodology but allows the reflection of the decrease in habitat condition that is not available in Metric 3.0.

3.2.6. Mitigation hierarchy

In accordance with good practice[14] the principles of the mitigation hierarchy and the avoidance of impacts to irreplaceable habitats must be applied when committing to achieving BNG. This is reinforced through the publication of the British Standard BS 8683:2021[16].

The sequential approach to applying the mitigation hierarchy, as set in Metric 3.0, is to:

1. Avoid – Where possible habitat damage should be avoided;
2. Minimise – Where possible habitat damage and loss should be minimised;
3. Remediate – Where possible any damaged or lost habitat should be restored; and

[15] The feasibility of this will also rely on the construction programme which is yet to be confirmed.
[16] The British Standards Institution 2021. BS 8683:2021 Process for designing and implementing Biodiversity Net Gain – Specification. BSI Standards Limited 2021.

4. Compensate – As a last resort, damaged or lost habitat should be compensated for[17].

Application of the mitigation hierarchy is encouraged by Metric 3.0 because "*it allows overall biodiversity gains to be achieved more easily through the avoidance of on-site habitat losses, rather than relying solely on the creation of new habitat or the enhancement of existing habitat*"[2] .

3.2.7. BNG good practice principles

In order to achieve BNG, a project must be able to demonstrate that it has followed all ten of the Principles of BNG[18] as detailed in Table 3-2 below. The principles further describe BNG as:

> *"a measurable target for development projects where impacts on biodiversity are outweighed by a clear mitigation hierarchy approach to first avoid and then minimise impacts, including through restoration and / or compensation. Adhering to these Net Gain principles (i.e. pursuing all principles together) will help in under pinning good practice for achieving and sustaining Net Gain."*

Table 3-2 - BNG good practice principles[19]

Principle	In practice
1. Apply the mitigation hierarchy	Do everything possible to first avoid and then minimise impacts on biodiversity. Only as a last resort, and in agreement with external makers where possible, compensate for losses that cannot be avoided. If compensating for losses within the development footprint is not possible or does not generate the most benefits for nature conservation, then offset biodiversity losses by gains elsewhere.
2. Avoid losing biodiversity that cannot be offset by gains elsewhere	Avoid impacts on irreplaceable biodiversity – these impacts cannot be offset to achieve no net loss/net gain.
3. Be inclusive and equitable	Engage stakeholders early, and involve them in designing, implementing, monitoring and evaluating the approach to net gain. Achieve net gain in partnership with stakeholders where possible.
4. Address risks	Mitigate difficulty, uncertainty and other risks to achieve net gain. Apply well-accepted ways to add contingency when calculating biodiversity losses and gains in order to account for any remaining risks, as well as to compensate for the time between losses occurring and the gains being fully realised.
5. Make a measurable Net Gain	Achieve a measurable, overall gain for biodiversity and the services ecosystems provide while directly contributing towards nature conservation priorities.
6. Achieve the best outcomes for biodiversity	Achieve the best outcomes for biodiversity by using robust credible evidence and local knowledge to make clearly justified choices when: • Delivering compensation that is ecologically equivalent in type, amount and condition and that accounts for the location and timing of biodiversity losses; • Compensating for losses of one type of biodiversity by providing a different type that delivers greater benefits for nature conservation; • Achieving net gain locally to development while also contributing towards nature conservation priorities at local, regional and national levels; • Enhancing existing or creating new habitat; • Enhancing ecological connectivity by creating more, bigger, better and joined areas for biodiversity.

[17] Compensation should be undertaken on-site. If this is not possible then off-site habitat compensation may be an option; however, this should be undertaken as close to the Scheme as possible.
[18] CIEEM-CIRIA-IEMA (2016) Biodiversity Net Gain – Good Practice Principles for Development
[19] CIEEM-CIRIA-IEMA (2016) Biodiversity Net Gain – Good Practice Principles for Development

Principle	In practice
7. Be additional	Achieve nature conservation outcomes that demonstrably exceed existing obligations, i.e. do not deliver something that would occur anyway.
8. Create a Net Gain legacy	Ensure net gain generates long-term benefits by: • Engaging stakeholders and jointly agreeing practical solutions that secure net gain in perpetuity; • Planning for adaptive management and securing dedicating funding for long-term management; • Designing net gain for biodiversity to be resilient to external factors, especially climate change; • Mitigating risks from other land users; • Avoiding displacing harmful activities from one location to another; • Supporting local-level management of net gain activities.
9. Optimise sustainability	Prioritising BNG and, where possible, optimise the wider environmental benefits for a sustainable society and economy.
10. Be transparent	Communicate all net gain activities in a transparent and timely manner, sharing the learning with all stakeholders.

3.2.8. Assumptions and limitations

Biodiversity Metric 3.1 had been released at the time of undertaking this BNG assessment. However, to align and stay comparable with other BNG assessment being carried out by other SROs, version 3.0. has been used for this assessment. Natural England states

> "*projects currently using biodiversity metric 2.0 or version 3.0 are advised to continue to do so unless requested otherwise by their client or consenting body"* and so this is not considered a limitation, but it should be noted that "*biodiversity unit values generated by metric 2.0 and metric 3.0 can differ from each other and may differ from the more current version 3.1 of the metric*"[20].

For Gate 3, consideration should be given to a company or industry wide adoption of the more recent version 3.1 as schemes are still in a relatively early stage of design development.

The Scheme design, including the post development landscaping, compound and access route locations have not yet been either included in designs or finalised. It is therefore likely that the biodiversity units reported at Gate 2 will change and they should be considered a reflection of the biodiversity net change outcomes at this specific moment in the design process for the Scheme.

For areas where trenchless installation of the pipeline has been identified, no baseline has been included in this assessment. In these areas it is assumed works will be underground and there will be no change to the habitat on the surface. These areas have not been included within the Scheme indicative site boundary for calculations.

It is currently assumed that all habitats that are temporarily lost should be reinstated to the same habitat types and condition[21] and that there is no opportunity to create different habitat types or increase habitat conditions on-site.

Areas identified as 'surface water' within Ricardo's habitat prediction tool output have been excluded from the terrestrial 'habitats' assessment. This is because the surface water polygons relate to rivers, streams and/or ditches, which are assessed separately to terrestrial habitats in the Rivers and Streams component of the Metric 3.0. However, it is acknowledged that guidance within the wetland habitat condition assessment sheet states that *"ditches form an integral part"* of Coastal and Floodplain Grazing Marsh *"and should not be recorded separately as linear features in the Rivers & Streams part of the metric"*[20]. For this high-level assessment, this has not been taken into account.

[20] ARCHIVE SITE for the Biodiversity Metric 2.0 and the Biodiversity Metric 3.0 (nepubprod.appspot.com) [accessed 19 May 2022]
[21] With the exception of those baseline habitats in good condition, where it has been assumed they will be reinstated to moderate condition. This is a precautionary assumption considering the higher level of management generally required to achieve and maintain the target of good condition habitat.

The lack of field survey data meant that the habitat conditions needed to be assumed. Condition was assumed as 'moderate' for all habitat area types that do not have a fixed condition assessment score, except where Ricardo was able to assess habitat condition during their walkover surveys. This provides a score of 2 which equates to the average condition score between poor and good and, therefore, is considered to be a reasonable assumption.

All hedgerows were assumed to be 'Native species rich hedgerow' in moderate condition. This provides a score of 4 for habitat distinctiveness and a score of 2 for condition which both equate to the average scores (i.e. medium distinctiveness and moderate condition) and, therefore, this is considered to be a reasonable assumption.

No river condition assessment surveys were conducted. Therefore, all watercourses were assumed to be 'Other Rivers and Streams' although surveys may reveal some watercourses to be ditches. Habitat condition and encroachment has been assumed based on WFD ecological status and aerial imagery due to lack of survey information.

At Gate 1, strategic significance was assumed to be 'medium' in all cases within the on-site habitats and hedgerow baseline and post-development habitats, thus holding this variable constant. This has been carried forward into this Gate 2 assessment. Off-site baseline strategic significance is assumed as 'medium' with off-site creation assumed to be 'high' (see Section 4.4.1), as any offsite compensation would target habitat interventions that meet local strategic priorities. For watercourses, strategic significance was assumed 'low' unless the watercourse was a WFD water body where it was increased to 'high'. For offsite compensation, strategic significance is assumed to be 'low'.

Identifying the priority habitat type, arable field margins used the Countryside Stewardship Agreement Management Areas and the Environmental Stewardship Agreements datasets from MAGIC. Where polygons from these datasets coincided with habitats identified as croplands, it was assumed that arable field margins are present.

A review of the Ancient Tree Inventory[22] has not been undertaken. This forms part of the recommendations within Section 5. If any ancient and/or veteran trees (considered to be irreplaceable habitats) are subsequently identified within the Scheme indicative site boundary, their loss should be avoided. Loss of irreplaceable habitat cannot be adequately accounted for through the Metric 3.0.

In most circumstances it has been assumed that post development habitats within the site boundary will reach moderate condition. This assumes an appropriate management plan will be produced to ensure post development habitats reach their target condition and therefore give surety that the Scheme will deliver the predicted net gain in biodiversity units.

To calculate post development biodiversity units for the habitat creation proposals it is necessary to enter a score for the target condition of the created habitat. Temporal multipliers are applied that reflect the time taken in years for that particular habitat to reach its target condition. Metric 3.0 can take into account whether habitat creation or enhancement is delivered in advance of any impact it is compensating for or whether there will be any significant delay in an intervention relative to the impact. If taken into account, the standard temporal multiplier is adjusted accordingly. For this assessment it is assumed that habitat creation will neither be undertaken in advance or delayed and the standard time to target condition has been applied. This is considered appropriate for a pipeline project.

It has been assumed that all watercourses within the Scheme indicative site boundary that are not named watercourses will be open cut and therefore, the habitat lost during construction. This is based on WSP's assumption that all named watercourses will be micro-tunnelled. It is also assumed that the entire length of the watercourse within the Site boundary will be open cut and therefore lost, however, this length may change when more details of the Scheme construction become available.

To reflect the operational impact of the change in flow regime downstream of Haw Bridge in river units, a percentage decrease in condition from baseline has been used based on the modelled reduction in flow. This is not standard Biodiversity Net Gain methodology but allows the reflection of the decrease in habitat condition that is not available in Metric 3.0. The method assumes that percentage decrease in flow equates directly to a percentage decrease in river habitat condition when this is unlikely to be a 1:1 relationship.

[22] Woodland Trust (2022) Ancient Tree Inventory. Available via: https://ati.woodlandtrust.org.uk/tree-search/?v=2072057&ml=map&z=15&nwLat=51.84821645981762&nwLng=-2.295582767276003&seLat=51.83710705603917&seLng=-2.2433118779937766 [accessed on 22 May 2022]

4. Results

4.1. On-site baseline

4.1.1. Habitat baseline

The total number of on-site baseline habitat units is 352.07. Pre-intervention (i.e. habitat creation and/or reinstatement), the Scheme results in a total loss of 326.02 habitat units. A summary of the on-site habitat baseline is shown in Table 4-1 below.

A loss of 0.25 ha of lowland meadow[23], a habitat of very high distinctiveness, is predicted/assumed to be lost as a result of the Scheme. "*Losses of irreplaceable or very high distinctiveness habitat cannot adequately be accounted for through the metric*"[2]. Therefore, this habitat types has been excluded from the Metric 3.0 calculations. However, for this loss, if it cannot be avoided, "*bespoke compensation should be agreed with the relevant decision maker for any losses or impacts to these habitats*"[2].

In addition, it should be noted that (as stated in Construction Industry Research and Information Association's (CIRIA's) Biodiversity net gain guidance document[14]):

> *'…losses of irreplaceable habitats (or statutory designated sites) cannot be offset to achieve biodiversity net gain. Impacts on irreplaceable habitats and statutory designated sites should be avoided'.*

No ancient woodland or areas covered by national statutory designations were recorded within the Scheme's indicative site boundary. Ancient or other veteran trees, and if present their loss must be avoided / minimised. The Scheme passes through one statutory designated nature conservation site, i.e. Alney Island LNR. However, the above quote, and other references to statutory sites within guidance, refer to nationally statutory designated sites. LNRs are locally statutory designated sites and so the above does not apply. Nevertheless, this designation indicates that the area is of strategic significance, and losses of any designated site should be avoided / minimised in keeping with the requirements of the mitigation hierarchy.

[23] Shown in drawing '5213609_BNG_NCA1' on page 16.

Table 4-1 - On-site habitat baseline

Broad habitat	Metric 3.0 habitat type	Area (ha)	Area retained (ha)	Area lost (ha)	Distinctiveness		Condition		Strategic significance		Ecological baseline – total habitat units	Total habitat units retained	Total habitat units lost
					Band	Score	Band	Score	Band	Multiplier			
Urban	Developed land; sealed surface	0.31	0.31	0.00	V. Low	0	N/A - Other	0	Medium	1.1	0.00	0.00	0.00
Cropland	Cereal crops	10.24	10.24	0.00	Low	2	N/A - Agricultural	1	Medium	1.1	22.53	22.53	0.00
Cropland	Cereal crops	0.16	0.16	0.00	Low	2	N/A - Agricultural	1	Medium	1.1	0.35	0.35	0.00
Grassland	Other neutral grassland	0.26	0.26	0.00	Medium	4	Poor	1	Medium	1.1	1.14	1.14	0.00
Grassland	Other neutral grassland	0.41	0.00	0.41	Medium	4	Moderate	2	Medium	1.1	3.61	0.00	3.61
Grassland	Modified grassland	0.45	0.45	0.00	Low	2	Poor	1	Medium	1.1	0.99	0.99	0.00
Grassland	Modified grassland	0.33	0.00	0.33	Low	2	Moderate	2	Medium	1.1	1.45	0.00	1.45
Grassland	Modified grassland	0.01	0.00	0.01	Low	2	Good	3	Medium	1.1	0.07	0.00	0.07
Heathland and shrub	Mixed scrub	0.8	0.00	0.80	Medium	4	Moderate	2	Medium	1.1	7.04	0.00	7.04
Woodland and forest	Other woodland; broadleaved	0.13	0.00	0.13	Medium	4	Moderate	2	Medium	1.1	1.14	0.00	1.14

Broad habitat	Metric 3.0 habitat type	Area (ha)	Area retained (ha)	Area lost (ha)	Distinctiveness		Condition		Strategic significance		Ecological baseline – total habitat units	Total habitat units retained	Total habitat units lost
					Band	Score	Band	Score	Band	Multiplier			
Woodland and forest	Other woodland; broadleaved	0.02	0.00	0.02	Medium	4	Good	3	Medium	1.1	0.26	0.00	0.26
Urban	Built linear features	0.02	0.02	0.00	V. Low	0	N/A - Other	0	Medium	1.1	0.00	0.00	0.00
Cropland	Cereal crops	0.01	0.01	0.00	Low	2	N/A - Agricultural	1	Medium	1.1	0.02	0.02	0.00
Grassland	Other neutral grassland	0.01	0.01	0.00	Medium	4	Poor	1	Medium	1.1	0.04	0.04	0.00
Grassland	Floodplain Wetland Mosaic (CFGM)	14.56	0.00	14.56	High	6	Moderate	2	Medium	1.1	192.19	0.00	192.19
Woodland and forest	Lowland mixed deciduous woodland	0.03	0.00	0.03	High	6	Moderate	2	Medium	1.1	0.40	0.00	0.40
Grassland	Other neutral grassland	0.33	0.00	0.33	Medium	4	Moderate	2	Medium	1.1	2.90	0.00	2.90
Grassland	Other neutral grassland	9.38	0.00	9.38	Medium	4	Moderate	2	Medium	1.1	82.54	0.00	82.54
Grassland	Floodplain Wetland Mosaic (CFGM)	0.82	0.00	0.82	High	6	Moderate	2	Medium	1.1	10.82	00.00	10.82

Broad habitat	Metric 3.0 habitat type	Area (ha)	Area retained (ha)	Area lost (ha)	Distinctiveness		Condition		Strategic significance		Ecological baseline – total habitat units	Total habitat units retained	Total habitat units lost
					Band	Score	Band	Score	Band	Multiplier			
Grassland	Traditional orchards	0.2	0.00	0.20	High	6	Moderate	2	Medium	1.1	2.64	0.00	2.64
Urban	Developed land; sealed surface	0.3	0.3	0.00	V. Low	0	N/A - Other	0	Medium	1.1	0.00	0.00	0.00
Woodland and forest	Lowland mixed deciduous woodland	0.63	0.00	0.63	High	6	Moderate	2	Medium	1.1	8.32	0.00	8.32
Grassland	Modified grassland	0.37	0.00	0.37	Low	2	Moderate	2	Medium	1.1	1.63	0.00	1.63
Grassland	Other neutral grassland	1.11	0.00	1.11	Medium	4	Moderate	2	Medium	1.1	9.77	0.00	9.77
Woodland and forest	Other woodland; broadleaved	0.14	0.00	0.14	Medium	4	Moderate	2	Medium	1.1	1.23	0.00	1.23
Cropland	Arable field margins tussocky	0.22	0.00	0.22	Medium	4	N/A - Agricultural	1	Medium	1.1	0.97	0.97	0.00
Total area (ha)		**41.25**			**Total habitat units**						**352.07**		
Total area retained			**11.98**		**Total habitat units retained**							**26.05**	
Total area lost (ha)				**29.27**	**Total habitat units lost (prior to habitat reinstatement)**								**326.02**

4.1.2. Hedgerow baseline

The total number of on-site baseline hedgerow units 17.34. Pre-intervention (i.e. hedgerow creation/reinstatement), the Scheme results in a total loss of 17.34 hedgerow units. A summary of the on-site hedgerow baseline is shown in Table 4-2 below.

Table 4-2 - On-site hedgerow baseline

Metric 3.0 hedgerow type	Length (km)	Length retained (km)	Length lost (km)	Distinctiveness		Condition		Strategic significance		Ecological baseline – total hedgerow units	Total hedgerow units retained	Total hedgerow units lost
				Band	Score	Band	Score	Band	Multiplier			
Native Species Rich Hedgerow	1.97	0.00	1.97	Medium	4	Moderate	2	Medium	1.1	17.34	0.00	17.34
Total length (km)	**1.97**								**Total hedgerow units**	**17.34**		
Total length retained (km)		**0.00**							**Total hedgerow units retained**		**0.00**	
Total length lost (km)			**1.97**						**Total hedgerow units lost (prior to habitat reinstatement)**			**17.34**

4.1.3. Rivers and streams baseline

The baseline length, condition and construction method of 11 watercourses that are crossed by the Scheme are summarised in Table 4-3, below. There is a total of 0.3 km of watercourse that are crossed by the Scheme resulting in a baseline of 3.41 river units.

Table 4-3 - On-site rivers and streams baseline

ID*	Name	WFD	EA Main River	Engineering Method	Condition	Length (km)	Baseline River Units	Lost River Units
1	River Severn - bank at Haw Bridge at Northern end of pipe	Yes	Yes	Outflow	Moderate	0.02	0.22	0.22
2	Unnamed stream	No	No	Open cutting	Fairly Poor	0.02	0.18	-
3	Leigh Brook	Yes	Yes	Micro tunnelling	Moderate	0.043	0.59	-
4	Cox's Brook upstream	No	No	Open cutting	Moderate	0.044	0.53	0.53
5	Cox's Brook midstream	No	No	Open cutting	Moderate	0.024	0.29	0.29
6	Cox's Brook downstream	No	No	Open cutting	Fairly Poor	0.022	0.16	-
7	Cox's Brook near confluence with Broadboard Brook	No	No	Open cutting	Moderate	0.02	0.24	0.24
8	Horn's Ditch	No	No	Open cutting	Moderate	0.024	0.29	0.29
9	River Severn, south of Alney Island	Yes	Yes	Micro tunnelling	Fairly Poor	0.041	0.42	-
10	Stream parallel to Rea Lane	No	No	Open cutting	Moderate	0.021	0.24	0.24
11	Stream north of Netheridge Farm	No	No	Open cutting	Moderate	0.021	0.25	0.25
					Total	**0.3**	**3.41**	**2.06**

*Crossing IDs numbered from north to south along the pipeline route

There is an additional 22 km of river baseline on the River Severn from Haw Bridge to Netheridge WwTW / Tidal limit. It is classified as moderate condition based on WFD status and high strategic significance and thus equates to a total of 303.60 baseline river units.

4.2. On-site post development

4.2.1. Habitat creation

The total number of habitat units delivered through habitat creation is 86.87. A summary of the habitat creation is shown in Table 4-4 below.

Habitat creation is the only on-site intervention considered, i.e. no enhancement opportunities have been explored, and it is assumed that creation will result in habitat in the same condition as the habitats currently on the site. There are additional multipliers for habitat creation. As the habitat creation is onsite, the spatial risk multiplier is one, but the difficulty and time to target condition multipliers are applied. These multipliers (with a value of one or less than one) are not shown in the table below, but have been factored in when calculating the 'habitat units delivered' shown below.

Table 4-4 - On-site habitat creation

Broad habitat	Proposed habitat	Area (ha)	Distinctiveness		Condition		Strategic significance		Habitat units delivered
			Band	Score	Band	Score	Band	Multiplier	
Grassland	Other neutral grassland	0.41	Medium	4	Moderate	2	Medium	1.1	3.02
Grassland	Modified grassland	0.33	Low	2	Moderate	2	Medium	1.1	1.26
Grassland	Modified grassland	0.01	Low	2	Moderate	2	Medium	1.1	0.04
Heathland and shrub	Mixed scrub	0.8	Medium	4	Moderate	2	Medium	1.1	5.89
Woodland and forest	Other woodland; broadleaved	0.13	Medium	4	Moderate	2	Medium	1.1	0.67
Woodland and forest	Other woodland; broadleaved	0.02	Medium	4	Moderate	2	Medium	1.1	0.10
Woodland and forest	Lowland mixed deciduous woodland	0.03	High	6	Moderate	2	Medium	1.1	0.04
Grassland	Other neutral grassland	0.33	Medium	4	Moderate	2	Medium	1.1	2.43
Grassland	Other neutral grassland	9.38	Medium	4	Moderate	2	Medium	1.1	69.08
Grassland	Traditional orchards	0.2	High	6	Moderate	2	Medium	1.1	1.29
Woodland and forest	Lowland mixed deciduous woodland	0.04	High	6	Moderate	2	Medium	1.1	0.06
Grassland	Modified grassland	0.21	Low	2	Moderate	2	Medium	1.1	0.80
Grassland	Other neutral grassland	0.07	Medium	4	Moderate	2	Medium	1.1	0.52
Woodland and forest	Other woodland; broadleaved	0.11	Medium	4	Moderate	2	Medium	1.1	0.57
Urban	Developed land; sealed surface	1.83	V. Low	0	N/A - Other	0	Medium	1.1	0.00
Grassland	Floodplain Wetland Mosaic (CFGM)	14.56	High	6	Moderate	2	Medium	1.1	44.41
Grassland	Floodplain Wetland Mosaic (CFGM)	0.82	High	6	Moderate	2	Medium	1.1	2.50
	Total area (ha)	**29.28**					**Total habitat units**		**132.68**

4.2.2. Hedgerow creation

The total number of hedgerow units delivered through hedgerow creation is 14.51. A summary of the hedgerow creation is shown in Table 4-5 below.

Hedgerow creation is the only on-site intervention considered, i.e. no enhancement opportunities have been explored, and it is assumed that creation will result in habitat in the same condition as the habitats currently on the site. There are additional multipliers for habitat creation. As the habitat creation is onsite, the spatial risk multiplier is one, but the difficulty and time to target condition multipliers are applied. These multipliers (with a value of one or less than one) are not shown in the table below but have been factored in when calculating the 'habitat units delivered' shown below. The full details can be seen in the Metric 3.0 spreadsheet

Table 4-5 - On-site creation -hedgerows (linear)

Proposed habitat	Length (km)	Distinctiveness		Condition		Strategic significance		Habitat units delivered
		Band	Score	Band	Score	Band	Multiplier	
Native Species Rich	1.97	Medium	4	Moderate	2	Medium	1.1	14.51
Total length (km)	**1.97**					**Total hedgerow units**		**14.51**

4.2.3. River creation

It has been assumed that all open cut watercourses will result in a loss of habitat that is reinstated through habitat creation to achieve the same condition. As the Biodiversity Metric Tool 3.0 does not allow for a reduction in watercourse condition, it is assumed that condition at the Haw Bridge effluent water release pipe and associated infrastructure (ID 1) will reduce from moderate to fairly poor as a result of the bank modifications. For the pipeline construction, this results in a loss of 0.17 km of watercourse which equates to 2.06 river units lost. Once reinstated following construction, river units totalled 0.54, which is 1.52 units less than the units lost resulting in, a decline in net gain by -44.30 %. A summary of the length of watercourses and river units lost is shown in Table 4-6.

Table 4-6 - On-site loss and creation during construction – rivers and streams (linear). ID

	Name	Length Lost and Created (km)	River Units Lost	River Units Created
1	River Severn - bank at Haw Bridge at Northern end of pipe	0.02	0.22	0.05
2	Unnamed stream	0.00	-	-
3	Leigh Brook	0.00	-	-
4	Cox's Brook upstream	0.04	0.53	0.15
5	Cox's Brook midstream	0.02	0.29	0.08
6	Cox's Brook downstream	0.00	-	-
7	Cox's Brook near confluence with Broadboard Brook	0.02	0.24	0.07
8	Horn's Ditch	0.02	0.29	0.08
9	River Severn, south of Alney Island	0.00	-	-
10	Stream parallel to Rea Lane	0.02	0.24	0.07
11	Stream north of Netheridge Farm	0.02	0.25	0.07
	Total	**0.17**	**2.06**	**0.54**

In terms of operation, 22 km of the River Severn downstream of Haw Bridge to Netheridge WwTW has a minor modelled percentage decrease in flow based on a flow series of a representative 47-year period (STT SRO, Gate 2 Physical Environment Assessment Report – report by Ricardo). These modelled percentage flow reductions downstream of Haw Bridge compared to upstream are used to represent a % decline in river unit as the Biodiversity Metric Tool 3.0 does not allow for a reduction in watercourse condition.

The 22 km the River Severn from Haw Bridge to Netheridge WwTW, at moderate condition, equates to 303.60 baseline river units. The resultant percentage reduction in river units as a result of the change in flow (-15 Ml/day as a result of the transfer of Mythe WTW licence transfer which is not used frequently at this point in time) is minimal (maximum -3.34 river units during minimum flows) is presented in Table 4-7.

Table 4-7 - On-site loss during operation based on percentage flow reduction downstream – rivers and streams (linear).

	Flow reduction	River unit reduction
Minimum flows	1.1%	-3.34
Q99 Exceptionally low flows	0.9%	-2.73
Q95 Very low flows	0.7%	-2.13
Q90 low flows	0.4%	-1.21

4.3. Trading summary

The Metric sets out a number of principles and rules that should be followed when undertaking BNG assessments. Rule 3 states:

> *'Trading down' must be avoided. Losses of habitat are to be compensated for on a "like for like" or "like for better" basis. New or restored habitats should aim to achieve a higher distinctiveness and/or condition than those lost.*
>
> *Losses of irreplaceable or very high distinctiveness habitat cannot adequately be accounted for through the Metric.*

The Metric provides indicative advice regarding the actions to be taken to address habitat and hedgerow losses, which are outlined in the following sections.

Table 4-8 and Table 4-9 in Section 4.4.1 below state the net habitat and hedgerow unit losses, respectively, that will occur as a result of the Scheme when considering the assumptions made within this report (Section 3.2). Table 4-10 and Table 4-11 go on to outline examples of how net habitat and hedgerow unit losses, respectively, could be offset through off-site habitat interventions to achieve no net loss and 10% net gain.

4.3.1. Very high distinctiveness

For very high distinctiveness habitats, Natural England suggests that bespoke compensation is likely to be required.

The very high distinctiveness habitat present within the Scheme indicative site boundary is:

- Lowland meadow[23]

It should be noted that "*Losses of irreplaceable or very high distinctiveness habitat cannot adequately be accounted for through the metric*", and so this habitat type has not been entered into the Metric 3.0 calculations. Bespoke compensation will be required if this loss cannot be avoided.

4.3.2. High distinctiveness

For high distinctiveness habitats, to avoid trading down, it is advised that the same habitat is required, i.e. 'like-for-like' compensation.

High distinctiveness habitats present within the Scheme indicative site boundary are:

- Floodplain Wetland Mosaic (CFGM)
- Lowland mixed deciduous woodland
- Traditional orchards

4.3.3. Medium distinctiveness

For medium distinctiveness habitats, to avoid trading down, it is advised that the same broad habitat or a higher distinctiveness habitat is required.

Medium distinctiveness habitats present within the Scheme indicative site boundary are:

- Mixed scrub
- Other neutral grassland
- Other woodland; broadleaved
- Arable field margins tussocky

- For medium distinctiveness hedgerows, to avoid trading down, it is advised that the same hedgerow type or better is required.
- Medium distinctiveness hedgerows present within the Site are:
- Native Species Rich Hedgerow

4.3.4. Low distinctiveness

For low distinctiveness habitat, to avoid trading down, it is advised that the same distinctiveness or better habitat is required.

Low distinctiveness habitats present within the Scheme indicative site boundary are:

- Cereal crops
- Modified grassland

4.3.5. Very low distinctiveness

No compensation is required for the loss of very low distinctiveness habitats.

The very low distinctiveness habitat present within the Scheme indicative site boundary is:

Developed land; sealed surface

4.4. Biodiversity Net Gain opportunities

4.4.1. Terrestrial (Habitats and hedgerows)

Excluding any off-site habitat interventions (discussed below), the Scheme is predicted to result in the following net unit losses:

- a **net loss** of **193.34** habitat units, with a predicted total net change of **-54.92 %**; and
- a **net loss** of **2.83** hedgerow units, with a predicted total net change of **-16.32 %**.

A further breakdown of these net unit losses area is shown within Table 4-8 and Table 4-9.

Table 4-8 – Net unit losses per habitat type (post on-site intervention and pre- off-site compensation)

Habitat Type	Units Losses Not Accounted for On-site
Floodplain Wetland Mosaic (CFGM)	156.10
Traditional orchards	1.35
Lowland mixed deciduous woodland	8.61
Other neutral grassland	23.78
Mixed scrub	1.15
Other woodland; broadleaved	1.30
Modified grassland	1.05
Total	**193.34**

Table 4-9 – Net unit losses per hedgerow type (post on-site intervention and pre- off-site compensation)

Hedgerow Type	Units Losses Not Accounted for On-site
Native Species Rich Hedgerow	2.83

Table 4-10 and Table 4-11 below give an example of how off-site interventions[24] could be used to ensure the Scheme reaches no net loss (NNL) and satisfies the trading rules of the Metric 3.0, outlined in section 4.3. They also give an example of how 10 % net gain could be achieved through off-site interventions. For the habitat area interventions, the illustrative examples takes trading rules into account and assumed all units would be delivered through habitat creation on areas supporting cereal crops.

Table 4-10 - An example of off-site habitat creation to achieve no net loss and then 10 % BNG for the Scheme for habitat areas

Habitat Type	Habitat/ Units	Area in ha
Off-site measures to meet trading requirements and reach NNL		
Floodplain Wetland Mosaic (CFGM)	156.10	48.95
Traditional orchards	1.35	0.20
Lowland mixed deciduous woodland	8.62	5.92
Other neutral grassland	23.87	3.09
Mixed scrub (compensating for scrub losses)	1.15	0.15
Other woodland; broadleaved	1.29	0.24
Other neutral grassland	1.08	0.14
Mixed scrub (additional to reach NNL)	31.95	25.00
Additional measures to reach 10% BNG		
Other neutral grassland OR Mixed scrub	50.81	6.60
Total area for offsite habitat creation	**N/A**	**90.29**
Total off-site net unit change[25]	**229.01**	**N/A**

Table 4-11 - An example of off-site habitat creation to achieve no net loss and then 10 % BNG for the Scheme for hedgerows

Hedgerow Type	Hedgerow Units	Length km
Offsite measures to meet trading requirements and reach NNL		
Native Species Rich Hedgerow	2.85	0.37
Additional measures to reach 10% BNG		
Native Species Rich Hedgerow	1.77	0.23
Total	**4.62**	**0.60**

Including the off-site habitat interventions, the Scheme is predicted to result in the following:

- a **net gain** of **35.67** habitat units, with a predicted total net change of **+10.13 %**; and

[24] The baseline has been assumed as cereal crop (low distinctiveness habitat) in an area of high strategic significance. The habitats created are assumed to be in moderate condition, in an area of high strategic significance and inside the LPA or NCA, or deemed to be sufficiently local, to site of biodiversity loss. Moderate condition was selected on a precautionary basis. It is considered achievable but is likely to require a level of monitoring and maintenance. It has been assumed that off-site locations will be chosen that are of strategic significance and therefore can be afforded to corresponding score within the Metric 3.0. High and medium distinctiveness habitats were assumed to be compensated for by the same habitat types. Low distinctiveness habitats (i.e. cereal crop and modified grassland), were replaced by other neutral grassland and mixed scrub respectively.

[25] The offsite baseline habitat units (and therefore off-site habitat unit loss) totals 207.67.

- a **net gain** of **1.79** hedgerow units, with a predicted total net change of **+10.33 %**.

The Gate 1 assessment should be referred to for information on land that has been identified as providing opportunities for terrestrial habitat enhancement or creation - referred to as Biodiversity Opportunity Areas (BOAs). Consultation is on-going to see whether there is client-owned land suitable for habitat enhancement/creation.

4.4.2. Rivers

To achieve ≥10 % net gain, off-site mitigation is required. If 2.1 km of river is enhanced by 1 condition category offsite but within the same WFD water bodies as those where watercourses are lost, +12.44 % net gain can be achieved for Rivers and Streams.

Alternatively, if the watercourses undergoing open cutting were enhanced by 1 condition category whilst they were reinstated, net gain onsite would be +5.9 %. Only 0.2 km of off-site enhancement would be required within the same WFD water bodies to achieve +11.30 %.

5. Conclusions and recommendations

Metric 3.0 has been applied to the Scheme, based on the route option provided for Gate 2 assessment including its connection to Netheridge WwTW, and an expansion of Netheridge WwTW to accommodate additional tertiary treatment.

Excluding any off-site habitat interventions (discussed in the Section 4), the Scheme is predicted to result in:

- a **net loss** of **193.34** habitat units, with a predicted total net change of **-54.92 %**; and
- a **net loss** of **2.83** hedgerow units, with a predicted total net change of **-16.32 %**; and;
- a **net loss** of **1.90** river units, with a predicted total net change of **-44.30 %**.

Detailed breakdowns of these losses, and the areas / lengths they equate to, are provided in the results section. The assumptions used for the BNG calculations are also provided in the methodology.

These quoted results do not include the loss of the lowland meadow[23] (a very high distinctiveness) habitat that will occur as a result of the Scheme. This is because "*losses of irreplaceable or very high distinctiveness habitat cannot adequately be accounted for through the metric"*[2]. If this loss cannot be avoided, "*bespoke compensation should be agreed with the relevant decision maker for any losses or impacts to these habitats*"[2].

The strategy for achieving BNG, including its definition in relation to the proposed biodiversity improvement parameters, will need to be discussed and agreed with local stakeholders and must be based on ecological functionality with regard to local conservation priorities and local biodiversity targets.

The assessment demonstrates how carefully thought-out biodiversity improvements designed to deliver ecological functionality and local conservation priorities also have to consider the BNG process carefully to deliver net gain of biodiversity units, as measured using Metric 3.0 (including compliance with the habitat trading rules).

The initial design work and undertaking of this BNG assessment have followed the mitigation hierarchy and the principles and rules of Metric 3.0. It is likely that the predictions, particularly in relation to habitat area units, are over precautionary and that (1) substantial savings can be made through further environmentally sensitive design options; and (2) further reductions may be possible to confirm in relation to some losses being temporary and countable as retention rather than losses followed by habitat creation. However, this precautionary approach shows the importance of sensitive design, both to protect ecological features in themselves, and to result in subsequent cost savings.

Based on the current, precautionary assessment, illustrative estimates of potential offsite compensation needs have been calculated and are detailed above in the BNG opportunities section. As already noted, they are likely to be overestimates. Assuming habitat units would meet trading rules and would be delivered through habitat creation on areas supporting cereal crops, for habitat areas, a net gain in value of 229.01 units would need to be delivered on 90.29 ha to reach no net loss and then provide ≥10 % net gain. For hedgerows, 4.62 units would need to be delivered by planting 0.6 km of species-rich native hedgerow to reach no net loss and then provide ≥10 % net gain. For watercourses, 2.1 km of river would need to be enhanced to reach no net loss and then provide ≥10 % net gain. However, through good design to reduce losses and build habitat enhancement into the proposals these requirements can be reduced. For example, if the watercourses undergoing open cutting were enhanced by 1 condition category whilst they were reinstated, only 0.2 km of offsite enhancement would be required.

During detailed design an appropriate BNG management and maintenance plan will be produced. This will detail the measures required to ensure the habitat creation proposals reach their target condition and give confidence that every effort will be made to enable the Scheme to achieve BNG.

5.1. Next steps

The ACWG[26] states that during Gate 3, the BNG assessment will be further updated, if required, in lieu of developed design and/or mitigation.

As design progresses, opportunities to reduce on-site habitat loss will be sought and any Scheme design change will be reflected in the calculation of biodiversity units accordingly.

[26] All Companies Working Group, WRMP Environmental Assessment Guidance and Applicability with SROs, October 2020

The BNG assessment will be refined through greater detail on the construction methods and construction easement to provide greater clarity on the impact pathways and habitat scores through the Biodiversity Metrics.

Currently, it is anticipated that there will be a loss of lowland meadow[23] – considered a habitat of very high distinctiveness. This area is shown on an inventory, and is close to Alney Island LNR. This 'lowland meadow'[23] area should be a priority for field survey to confirm its status, and for design review to see if it can be protected. During Gate 3, development of designs should (following the mitigation hierarchy) aim to avoid this loss, considering. Rule 3 within Metric guidance[2] states, *'Losses of irreplaceable or very high distinctiveness habitat cannot adequately be accounted for through the Metric'.* If loss cannot be avoided, bespoke compensation will be required.

In keeping with the requirements of the mitigation hierarchy, the LNR (Alney Island) identified within the Scheme's route should be avoided / minimised. The LNR designation indicates that the area is of strategic significance, and losses of any designated site should be avoided where possible. It is understood that losses have been reduced through design by following the route of a historic train / tram line through the reserve, and detailed design should continue to seek to minimise losses.

In following the mitigation hierarchy, design should also aim to minimise loss of other priority habitat, e.g. lowland mixed deciduous woodland.

Further baseline surveys should be undertaken to increase the accuracy of the BNG assessment – ground-truthing the assumptions made on habitat types and habitat conditions.

ACWG guidance includes the requirement to include data on Local Wildlife Sites (LWS). This data should be incorporated into the BNG assessment at Gate 3. The Local Environmental Records Centre should also be approached for records of LWS and to enquire as to whether they hold records of priority hedgerows and arable field margins (as they are not open-source information). If they hold this data, it should be purchased to improve the accuracy of the baseline information.

A review of the Ancient Tree Inventory[27] should be undertaken. If any ancient and/or veteran trees (considered to be irreplaceable habitats) are identified within the Scheme's indicative site boundary, their loss should be avoided. Loss of irreplaceable habitat cannot be adequately accounted for through the Metric 3.0.

A detailed review of national and local plans and policy should be undertaken to enable more refined strategic significance scores to be assigned within the Metric 3.0. These local plans and policies may also guide the types/locations of off-site compensation.

Stakeholder consultation should continue, with the aim of identifying areas that are suitable for off-site compensation. This could be through further discussion with the client about client-owned land or with local wildlife groups for example. Undertaking surveys of these off-site locations (to inform the Metric 3.0) should be undertaken if suitable candidates are identified.

Habitat enhancement should be considered during the reinstatement of habitats to maximise the delivery of on-site biodiversity units. This may involve conversations with relevant stakeholders regarding the commitment to long-term monitoring and maintenance.

The BNG assessment should be updated to Biodiversity Metric 3.1 (or the latest metric version at the time of assessment) in Gate 3. However, the approach selected should be applied consistently across projects, and this should be raised for industry wide agreement as soon as possible to allow for a consistent approach going forwards.

[27] Woodland Trust (2022) Ancient Tree Inventory. Available via: https://ati.woodlandtrust.org.uk/tree-search/?v=2072057&ml=map&z=15&nwLat=51.84821645981762&nwLng=-2.295582767276003&seLat=51.83710705603917&seLng=-2.2433118779937766 [accessed on 22 May 2022]

Technical Appendices

B6.1. Automatically generated habit map

B6.2. Manually generated habitat map

B6.3. Map of area lost and built environment

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