BIODIVERSITY NET GAIN AND NATURAL CAPITAL ASSESSMENT

Final Water Resources Management Plan 2024

South Staffs Water

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Ricardo Energy & Environment, Gemini Building, Fermi Avenue, Harwell, Oxfordshire, OX11 0QR, UK | +44(0)1235 75 3000 | ee.ricardo.com
Registered company no. 08229264 | VAT no. GB 212 8365 24

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Contact:
Rachel Ashmole, Ricardo Energy & Environment
Bright Building, Manchester Science Park, Pencroft Way, Manchester M15 6GZ, UK

T: +44 (0) 1235 753 085
E: rachel.ashmole@ricardo.com

Author:
Freya Love (Ricardo)
Imogen Shapland (Ricardo)
Laurence David (Ricardo)
Heather Williams (Wood)
Georgia England (Wood)

Approved by:
Jenny Mant

Signed

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Blithfield Reservoir, South Staffs Water

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EXECUTIVE SUMMARY

This report sets out the Natural Capital and Biodiversity Net Gain assessments that has been completed to support the South Staffs Water's Water Resources Management Plan 2024 (WRMP24) which water companies in England and Wales are required to produce every five years.

Through an extensive optioneering process, considering a wide range of potential options to balance future supply and demand, South Staffs Water have selected a feasible list of options and a preferred programme. The feasible list includes both demand side and supply side options, of which only the latter requires Natural Capital and Biodiversity Net Gain assessments. The results generated from undertaking the Natural Capital and Biodiversity Net Gain assessments of these supply side options are presented.

Through ambitious demand management options the preferred programme does not require supply side options. However, one supply side option has been selected for an adaptive pathway for the preferred plan. The adaptive pathway for the preferred programme would lead to Option 2.2.2.1 being implemented if the demand management options are deemed to fall short of target (refer to overarching WRMP24 for further details).

The biodiversity losses were calculated for Option 2.2.2.1, the increase in BNG after intervention was calculated and the change to ecosystem services was calculated.

Using the Potential Biodiversity Opportunity (PBO) tool potential key biodiversity opportunity areas have also been identified for the option in the adaptive pathway. A heat-map demonstrating the distribution of areas potentially suitable for biodiversity opportunities is presented.

1. INTRODUCTION

1.1 BACKGROUND AND PURPOSE OF REPORT

Water companies in England and Wales have a statutory requirement to prepare a Water Resources Management Plan (WRMP) every five years. The latest Water Resource Planning Guideline (WRPG)[1] produced by the regulatory bodies (Ofwat, The Environment Agency and Natural Resources Wales) states that water companies are required to ensure their WRMP delivers net biodiversity gain where appropriate and uses a proportionate natural capital approach. This report is driven by this requirement and demonstrates how South Staffs Water (SSW) will meet these requirements in the assessment of their WRMP24 feasible options and preferred programme.

The purpose of this report is to provide a Biodiversity Net Gain (BNG) and Natural Capital (NC) assessment of the South Staffs Water options. This is to provide information related to a preliminary assessment of BNG and NC losses and benefits and to inform the options appraisal process.

This report applies the latest methodologies for BNG and NC assessment as set out in the WRMP24 water-resources supplementary guidance[2] and the All Company Working Group (ACWG) guidance[3].

1.2 BIODIVERSITY NET GAIN, NATURAL CAPITAL AND ECOSYSTEM RESILIENCE

Biodiversity Net Gain (BNG) is an approach to the development of land and marine management that aims to leave biodiversity in a measurably better condition than prior to development. BNG seeks to provide a means of quantifying losses or gains in biodiversity value bought about by changes in land use, when designed and delivered well, BNG can secure benefits for nature, people and places, and for the economy[4].

Natural Capital (NC) studies key components of nature which are essential for the long-term provision of benefits on which society relies. These components can have a direct or indirect value to people. A natural capital approach, which has been followed in this assessment, understands that nature underpins human wealth, health, wellbeing and culture and seeks to demonstrate the value of the natural environment for people and the economy[5].

Natural assets provide ecosystem services such as regulating floods and improving air quality, and those ecosystem services provide benefits such as reducing the chance a house will flood or improved health. This benefit can then be valued through use of natural capital metrics and can be used to help in the support of delivery of targets, such as putting a value on the potential delivery of BNG.

1.3 BIODIVERSITY NET GAIN AND NATURAL CAPITAL REQUIREMENTS FOR WRMPS

The purpose of a WRMP is to set out how a water company will achieve a secure supply of water for its customers whilst protecting the environment and demonstrate that it is resilient to a range of future challenges including more extreme droughts, climate change, population growth.

As part of the WRMP, water companies must demonstrate that they have considered a range of environmental legislation and guidance, including the Environment Bill (2021) and Environment (Wales) Act (2016). Additionally, the EA has published separate supplementary guidance on Environment and Society in decision-making[2], which provides more detail about the expectation for Natural Capital in England, and how a Natural Capital Assessment can support decision-making. The purpose of this is to allow water companies and Regional Groups to “make decisions that do not devalue and look to enhance the value of the natural world

[1] Ofwat, NRW & EA (2023), Water Resources Planning Guideline – Updated 14 April 2023
[2] EA (2021) WRPG WRMP24 supplementary guidance – Environment and society in decision-making. Published 24/03/2021
[3] Mott MacDonald Limited (2020). All Companies Working Group WRMP environmental assessment guidance and applicability with SROs. Published October 2020
[4] Natural England (2021), Biodiversity Net Gain – more than just a number. Accessible via: https://naturalengland.blog.gov.uk/2021/09/21/biodiversity-net-gain-more-than-just-a-number/
[5] UK Government (2021), Enabling a Natural Capital Approach (ENCA) – Updated 20 August 2021

for society benefit" (WRPG Supplementary Guidance[2]) together with supporting water companies within WRW to promote plans that have the potential to deliver wider environmental and social benefits.

The requirements for BNG and NC assessments of a water companies WRMP are outlined in the 2023 WRPG[1], as shown in Box 1.

Box 1 WRPG 2023

Section 4.1.1 High-level considerations

England and Wales

Ensure your plan contributes to the conservation and enhancement of biodiversity, delivers net biodiversity gain where appropriate, delivers environmental gain and uses a proportionate natural capital approach.

Consider your duty to conserve biodiversity under section 40 of the Natural Environment and Rural Communities Act (2006) and the list of species and habitats of principal importance set out in section 41 of the Act (England).

Takes a catchment-based approach.

2. APPROACH TO THE BIODIVERSITY NET GAIN AND NATURAL CAPITAL ASSESSMENTS

2.1 OVERVIEW OF APPROACH

2.1.1 Biodiversity Net Gain Approach

The BNG assessment is based on use of the Defra Biodiversity Metric 3.0, to assess losses of biodiversity as a result of the options[6]. A GIS-based system has been used, using national datasets, to provide comprehensive coverage of habitat data.

To ensure South Staffs Water preferred programme contributes to the conservation and enhancement of biodiversity and delivers biodiversity net gain, Defra's Biodiversity Metric 3.0 has been used to demonstrate how net gain could be achieved on and off-site. Any options within the plan that need planning permission are legally required to provide BNG of 10% in England due to the Environment Act (2021). This is not a legal requirement of the WRMP itself, but it is logical to meet this requirement within the plan to demonstrate South Staffs Water commitment to protecting and enhancing biodiversity and demonstrate that 10% BNG can be achieved when required.

For options within the preferred programme, Potential Biodiversity Opportunity (PBO) areas have been identified. These sites are all within 5km from the option locations and are based on a scoring system largely based on the Lawton principles, which is outlined in **Section 2.3**. These sites should then be used in conjunction with the results from the Biodiversity metric, with the metric calculating how much mitigation would be required, and the PBO identification showing potentially beneficial locations for off-site mitigation.

2.1.2 Natural Capital Assessment Approach

WRPG Supplementary Guidance states that NCAs in England should include as a minimum the following five ecosystem services:

- Biodiversity and habitat
- Climate regulation
- Natural hazard regulation
- Water purification
- Water regulation

In addition to those services required as a minimum, a **food production** ecosystem service metric has also been considered (**Agriculture**). Furthermore, the assessment of social benefits is advocated by the Regulators' Alliance for Progressing Infrastructure Development (RAPID), therefore the additional ecosystem services of **recreation and tourism** has been included to support this requirement.

For consistency across the companies in Water Resources West (WRW), all of the ecosystem services listed above are included in the assessments for all companies, including this report for South Staffs Water.

The NC Assessment is based on the BNG Metric 3.0 data for permanent loss, temporary loss and mitigation required to meet the 10% net gain. The habitats are categorised into broad habitats which is used as the NC baseline data required for the qualitative, quantitative and monetisation of ecosystem services. The GIS and BNG assumptions followed through into the NC assessment. The following sections summarises the NC and BNG approaches, assumptions and limitations for each ecosystem service.

[6] While a newer version of the metric, v3.1, has now been released, v3.0 has been used for these assessments to provide consistency across multiple WRMPs and through the stages of assessment

2.2 SEQUENTIAL PROCESS

Throughout the WRMP process BNG and NCA have been considered in increasing levels of detail, proportionate to the wider WRMP programme. **Figure 2.1** shows the sequential process followed for the assessments. The approach taken for feasible options and consequent programmes of options is as follows:

- Feasible options – Stages 1 to 3 of **Figure 2.1**
- Preferred programme, and any reasonable alternative programmes– Stages 1 to 6 of **Figure 2.1**.

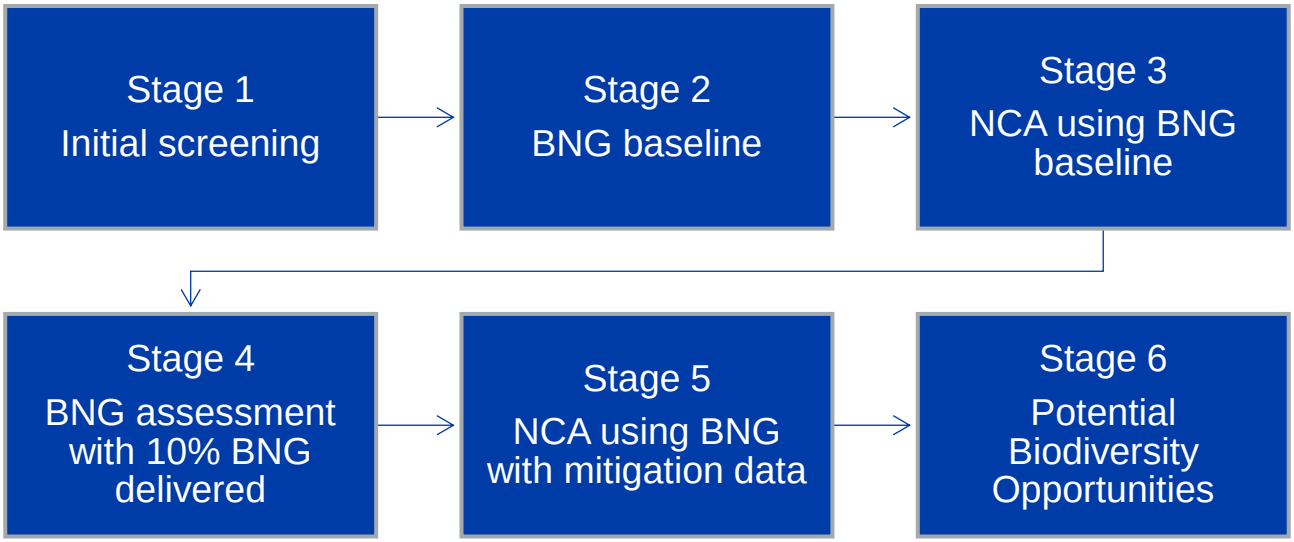

Figure 2.1 The sequential process followed for the Natural Capital and Biodiversity Net Gain assessments

2.3 METHODOLOGY

2.3.1 Stage 1 - Initial screening

This high-level qualitative scoring of the supply side options was used to assist with the development of the SEA and support detailed screening of options (and associated ecosystems) for the identification of the preferred programme. The scoring also fed into Multi Criteria Decision Analysis (MCDA) and helped to support early decision making using the feasible options. Scores from 0 to +3 to 0 to -3 were awarded for each ecosystem service metric as a reflection of the potential level of benefit and disbenefit associated with the metric (allowing for benefits and disbenefits to be recognised separately where appropriate). Overall scores were calculated based on magnitude, scale, and duration of expected impacts, with each of magnitude and duration also being scored between -3 to +3, following the same rules as for the ecosystem services. A brief commentary was also included to describe the benefits or disbenefits. A further detailed methodology is provided in **Appendix A**.

The results of the Stage 1 assessments were used to inform early stages of the options appraisal process and the MCDA at a high level. The NCA is just one assessment of many that goes into the MCDA. As the MCDA considers different types of metrics, each using different units, each measurement needs to be converted into a common scale. This scale is typically represented between 0 and 100, representing the worst possible and acceptable outcome/performance and best possible and achievable outcome/performance respectively. Scores are used to determine how the different performances are valued.

Subsequently, weights are required to denote the relative value of performance changes on different metrics, or the trade-offs between metrics. HR Wallingford facilitated workshops with WRW to develop the weights required. Valuestream1 facilitates the input of data from the SEA and NCA assessments, then elicits scores based on the outputs of these and the weightings applied.

The information assessed at Stage 1 was then used to support the more detailed assessment at Stage 2 within the NCA.

2.3.2 Stage 2 - Biodiversity Net Gain baseline calculation

2.3.2.1 Baseline habitat area and condition

Areas of habitats were calculated in QGIS. The CORINE land cover dataset[7] forms the basis of the habitat data, providing continuous coverage across the whole of the UK. This has been supplemented by other datasets where available, to provide improved resolution:

- The Priority Habitats Inventory[8], covering all nationally mapped areas of priority habitat;
- National Forest Inventory 2018, to provide improved information about areas of forestry;
- OS Zoomstack, providing data about areas of open water and urban extents.

The Zone of Influence (ZoI) was calculated for each option using GIS data provided by South Staffs Water:

- Where shapefile polygons were available for on-site infrastructure such as water treatment works or pumping stations, they were used directly
- Where polygons were not available, a best estimate of area was made using grid references
- For pipelines, a 30m buffer (15m on each side) was assumed around polyline shapefiles

All areas were defined as having either a temporary or permanent loss of habitat. Pipelines were assumed to have a temporary impact, unless passing through woodland. The latter was classed as permanent to recognise the longer time period to reinstatement. All other types of infrastructure were classed as permanent. The areas of permanent and temporary loss were mapped over the habitat data and ran through a model that identified habitats which would be impacted by the construction and operation of the option. This model prioritises the habitat layers that have high resolution, importance and validity. This ensured that the most accurate and important data was not missed due to overlapping data of lower resolution.

All habitats within the construction buffer are assumed to be lost and re-instated with the existing baseline habitat type and restored to the same condition, except those that will be replaced by permanent above-ground infrastructure. The biodiversity condition is assumed to be moderate and the extent of the habitat is sourced from open-source data therefore it is recommended that surveys are undertaken at the planning stage to reduce uncertainty.

2.3.3 Stage 3 - Natural Capital Assessment

2.3.3.1 Data sources, gaps, and assessment

The NCA has been completed using the data sources outlined in **Section 2.3.2.1**, as recommended by the All Company Working Group (ACWG) environmental assessment guidance for SROs[9] and the EA Water Resources Planning Guideline (WRPG) WRMP24 Supplementary Guidance on Environment and Society in Decision-Making[10].

The tools outlined in the WRMP guidance have been reviewed for these assessments and where feasible these have been used. Where not used for a specific service, this has been justified as requested in the guidance noting that many tools have limitations or need a level of detail not necessarily currently available. As such we have applied the WRMP supplementary guidance approach to account for qualitative, quantitative and monetised assessments where proportionally appropriate. At planning stage of any scheme, ecosystem services should be reassessed to incorporate survey data into the assessments. This would provide further information on the condition and extent of habitats. Further details on assumptions are outlined in **Appendix B**.

2.3.3.2 Natural Capital stocks

The assessment for the NC approach is based on the same available open-source data as used for the Stage 2 BNG assessment. The habitat types used for BNG were converted to broad habitat types to give the total

[7] https://www.data.gov.uk/dataset/cd2c59e7-afd9-471d-a056-c5845619dcd7/corine-land-cover-2018-for-the-uk-isle-of-man-jersey-and-guernsey

[8] https://www.data.gov.uk/dataset/4b6ddab7-6c0f-4407-946e-d6499f19fcde/priority-habitat-inventory-england

[9] All Company Working Group (2020). WRMP environment assessment guidance and applicability with SROs

[10] Environment Agency (2020) Water resources planning guideline WRMP2024 supplementary guidance- Environment and society in decision-making (England).

area of each broad habitat impacted by each option. The conversion from the detailed habitat layers to broad habitat was undertaken and is outlined in **Appendix C**.

Broad habitat groupings were determined following the broad groups identified for calculation of carbon sequestration by land use from the EA's Supplementary Guidance (see **Table 2.1** below). Modified grassland has been classified as arable land and not grassland, as per advice from the Office for National Statistics (ONS) in developing a semi-natural grassland ecosystems account[11]. The UK NEA differentiates semi-natural grassland from improved and amenity grassland, as semi-natural grassland has a much higher species-richness[12]. Where a land cover class could belong in multiple broad habitat groups it was placed within the one that had a lower carbon sequestration rate, to give a more conservative estimate of benefits.

2.3.3.3 Climate Regulation (carbon sequestration)

The carbon sequestration rates for NC stocks have been taken from the EA WRPG Supplementary Guidance, as shown in **Table 2.1**. Carbon sequestration rates of the relevant Natural Capital assets have been converted into monetary values using the Department for Business, Energy, and Industrial Strategy (BEIS) Carbon Values. As the prices published by BEIS are in £2020, GDP deflators were used to adjust them to the £2019 base year of modelling.

It is not currently possible to quantify the non-spatial changes in biodiversity and habitat ecosystem services arising from habitat condition improvement. This is because only planned habitat creation is deciduous woodland and there is significant uncertainty in terms of current condition of woodland due to lack of on-site data. To avoid overestimating the beneficial impact of the change in non-traded carbon sequestration value following BNG habitat creation / reinstatement, this value has been calculated by summing the change in non-traded carbon sequestration value during construction (the temporary loss), the permanent loss and creation.

The monetisation is based on the size of the area, temporary or permanent loss, and biodiversity value of the habitats affected. Higher biodiversity value habitats (e.g., woodland, lowland meadows, heathland) have higher carbon sequestration monetised value. The higher biodiversity habitats are typically more difficult to recreate following completion of the construction phase so loss and reinstatement of these habitats will result in a greater impact relative to lower value habitats (e.g., arable fields or modified grassland). A high-level qualitative assessment was undertaken at Stage 1 – Initial Screening. Further details on assumptions are outlined in **Appendix B.** Natural capital assessment relating to mitigation are undertaken at Stage 5 for preferred supply options.

Table 2.1 Carbon sequestration of land use from EA WRPG Supplementary Guidance

Land use type	C seq rate (t/CO2e/ha/yr)
Woodland (deciduous)	4.97
Woodland (coniferous)	12.66
Arable land	0.10
Pastoral land	0.39
Grassland	0.39
Heathland & shrub	0.7
Urban	0

2.3.3.4 Natural Hazard Regulation

An annual monetary value was only derived for the flood regulating services of woodland and wetland/ floodplain assets (see **Table 2.2**). Robust monetary values for other broad habitat types, and which could be considered comparable to the values in **Table 2.2**, are not currently available. As a result, it has not been possible to provide a monetised estimate of other services.

The high-level qualitative assessment undertaken at Stage 1 – Initial screening was based on the EA flood risk zones[13] and the habitats impacted within the buffer area accounting for both temporary and permanent

[11] Office for National statistics (2018) Developing semi-natural grassland ecosystem accounts

[12] UK Habitat Classification Working Group (2018). UK Habitat Classification - Habitat Definitions V1.0 at hhtp://ecountability.co.uk/ukhabworkinggroup-ukhab

[13] https://flood-map-for-planning.service.gov.uk/location

loss of habitats relative to natural hazard potential risks. Natural capital assessment relating to mitigation is undertaken at Stage 5 for preferred supply side options and supply side options in any adaptive or alternative programmes and pathways.

Table 2.2 Benefit Transfer Values: Natural Hazard Regulation[14]

Broad habitat type	Annual value	Reference
Woodland	115 (£2018/ha)	Forest Research (2018) & ENCA Services Databook
Freshwater (Open waters/ wetlands/ floodplains)	407 (£2011/ha)	Morris & Camino (2011) & ENCA Services Databook

2.3.3.5 Water Purification

The WRPG does not require the monetisation of Water Purification services, as these services are highly dependent on local factors (e.g. proximity to a water body) and there are limited tools available to provide accurate monetised assessment. Thus, at this stage, only a qualitative assessment rather than a monetised assessment of this service has been undertaken. This qualitative assessment is based on habitat data and WFD status information from the EA's Catchment Explorer[15]. The NEVO tool was not used at this stage during the assessment due to data being available at a sub-catchment level (2km grid) which provided coarse high-level data not relevant to the options but has been reviewed at Stage 5. Further details on assumptions are outlined in **Appendix B.** Natural capital assessment relating to mitigation are undertaken at Stage 5 for preferred supply side options and supply side options in any adaptive or alternative programmes and pathways.

Baseline provision of water purification services is dependent on the following:

- Land cover (habitat)
- Proximity to receptor (i.e. a water body)
- Current water quality of receptors
- Interception and removal of contaminants
- Pollutant store opportunities

2.3.3.6 Water Regulation

The WRPG does not require the monetisation of Water Regulation services. It is considered that this service is well represented by the Water Framework Directive (WFD) compliance assessment, so to avoid double counting, Water Regulation has been screened out of the assessment for options in the feasible list, for options in the preferred programme Water Regulation is screened in. A high-level qualitative assessment was undertaken at Stage 1 – Initial Screening. Best practice assessment of reviewing current and future abstractors should be undertaken at the planning stage during stakeholder engagement. Further details on assumptions are outlined in **Appendix B.**

2.3.3.7 Recreation and Tourism

The Outdoor Recreation Valuation Tool (ORVal)[16] has been used to estimate recreation demand from greenspaces, as a proxy for recreation value. Both open greenspaces and public footpaths were considered.

A conditional percentage was applied to the footpath values depending on the number of footpath intersections (and therefore alternative routes) present.

- If there are no intersections, and therefore no alternative routes, then we take 100% of the footpath value;
- If there are 1-2 intersections present, then 50% of the value is taken;

[14] References:
- Forest Research (2018). Valuing flood regulation services of existing forest cover to inform natural capital accounts.
- Morris & Camino (2011) UK National Ecosystem Assessment Economic Analysis Report, School of Applied Sciences, Cranfield University.

[15] https://environment.data.gov.uk/catchment-planning/

[16] https://www.leep.exeter.ac.uk/orval/

- If there are 3-4 intersections present, then 25% of the value is taken;
- And if there are 5+ intersections present, 10% of the value is taken.

The use of the ORVal tool has uncertainties surrounding the 'true' impact that the construction may have on recreation and tourism, with ORVal potentially giving an overstated account of the impact. This uncertainty has been reduced by using a developed conditional multipliers approach as outlined above. Additionally, the uncertainty has been reduced by assuming that the impact to recreation and tourism will be, in almost all cases, a temporary impact, although at this stage of assessment and when using the ORVal tool the actual duration of impact (e.g. a footpath closure) is not known. However, at this level of assessment, ORVal remains the recommended and most informative data set to use. The ORVal values are priced to £2016, and the values have been adjusted to £2019 for this assessment.

2.3.3.8 Agriculture

This assessment adopted the same principles for ecosystem services associated with agriculture as outlined in the UK Natural Capital Accounts, i.e. the distinction between what is considered 'natural capital' and what is 'produced capital' is defined as the "point at which vegetable biomass is extracted"[17]. For the purposes of this assessment, to estimate the annual value per ha of ecosystem services relevant to agricultural production, an adaptation of the whole-farm income method outlined by the UK Office of National Statistics (ONS) Natural Capital Accounts was used[18]. This approach was used as opposed to the industry residual value method adopted for the 2020 ONS Natural Capital Accounts as it allows for differentiation between the provisioning services associated with different farm types (in this case arable and pasture) and was therefore considered more appropriate for this assessment. The marginal values estimated per hectare derived from this method (presented in **Table 2.3** below) remain comparable to the estimated industry residual value per hectare reported by the ONS for their 2020 accounts (£241.80/ ha in 2018).

Table 2.3 Benefit transfer values: provisioning services supporting agriculture

	All farm types (average value/ha, 2019)	Arable (cropping) (average value/ha, 2019)	Pasture (grazing livestock) (average value/ha, 2019)
Northwest (SSW)	236.83	279.86	207.34
Wales (Welsh Dŵr Cymru)	155.65	NA	158.57
West Midlands (Severn Trent)	325.26	408.86	206.56
East of England (South Staffs Water)	365.68	354.99	286.29

These values represent the average farm output level estimate of the industry residual value for farms in the Northwest of England. Data was obtained from the Farm Business Survey (England)[19] and was subject to the following high-level calculation:

$$\frac{Average\ output\ from\ agriculture\ -Average\ costs\ for\ agriculture}{Average\ total\ farm\ area\ (ha)}$$

The original method outlined by the ONS (2019) was adapted after calculations with Southeast specific data resulted in a negative residual value per hectare for both arable and pasture. This would imply that the provisioning services of these natural assets have no inherent value and that they do not contribute to agricultural production. It is concluded in the literature that a probable explanation of negative resource rents is that they reflect market distortions such as subsidies[20]. The original method outlined by the ONS excludes

[17] ONS (2017) Principles of Natural Capital Accounting. [Last accessed 29/04/2021] Accessible via: https://www.ons.gov.uk/economy/environmentalaccounts/methodologies/principlesofnaturalcapitalaccounting

[18] Office for National Statistics (ONS), 2019. UK natural capital accounts methodology guide: October 2019, s.l.: ONS

[19] https://farmbusinesssurvey.co.uk/

[20] Obst, C., Hein, L., & Edens, B., (2016). National Accounting and the Valuation of Ecosystem Assets and their Services, Environ Resource Econ 64, pp 1-23.

subsidies and agri-environment payments and activities from their calculation, however the adapted method adopted for this assessment includes these factors. An overview of what is included is outlined in **Table 2.4**.

The total annual benefit values calculated for this assessment make use of the Southeast estimated averages calculated for each of the variables and component for each of the high-level farm types associated with this assessment (arable and pasture).

Table 2.4 Components included within the adapted farm income method

Variable	Components included
Output from agriculture	• Output from agriculture (excl. subsidies and agri-environment payments) • Subsidies and payments to agriculture (excl. agri-environment payments • Agri-environment and related payments (incl. HFA) • Basic Farm payment • Output from diversification
Costs for agriculture	• Costs for agriculture (excluding agri-environment activities) • Costs for agri-environment work • Costs of diversification out of agriculture • Costs associated with Basic Payment Scheme

2.3.4 Stage 4 – Biodiversity Net Gain Assessment with mitigation

This and the following stages have only been undertaken for supply side options within the preferred programme and supply side options in any adaptive or alternative programmes and pathways.

The calculation of net loss/gain within the Defra Biodiversity Metric 3.0 considers both direct impacts resulting in habitat loss (whether permanent or temporary) and changes in habitat condition. The areas required to achieve 10% net gain for each option would be identified based on the baseline habitats present within the option footprint and following the requirements of the Defra Biodiversity Metric 3.0. This includes requirements such as requiring the same habitat (for high distinctiveness habitats) or replacement with the same habitat type or one of higher distinctiveness (for low distinctiveness habitats).

The off-site mitigation required used in the assessments is intended to provide an indicative area off site habitat required to achieve 10% net gain for the schemes. Habitats, where possible, would be used in the same proportions as the baseline habitats, excluding habitats which do not provide BNG Units and are not possible to enhance within the metric (e.g., Urban-sealed surface). Moderate to very high distinctiveness habitats could be mitigated through off site enhancement e.g., poor to moderate or moderate to good. It is not possible to enhance cropland in the Biodiversity Metric, so consequently modified grassland would be used for off-site mitigation to offset impacts to crop land using a change in habitat type from poor condition modified grassland to moderate condition neutral grassland. Examples are shown in **Table 2.5** below.

Table 2.5 Off-site habitat enhancement rules used to calculate habitat area required to achieve 10% net gain

On-site baseline habitat lost	Off-site habitat pre-mitigation		Off-site habitat post-mitigation	
	Habitat	Condition	Habitat	Condition
Cropland	Modified grassland	Poor	Other neutral grassland	Moderate
Modified grassland	Modified grassland	Moderate	Other neutral grassland	Moderate
Other neutral grassland	Neutral grassland	Moderate	Other neutral grassland	Good
Woodland (broad leaved)	Modified grassland	Moderate	Woodland (broad leaved)	Moderate
Woodland (mixed)	Modified grassland	Moderate	Woodland (mixed)	Moderate

On-site baseline habitat lost	Off-site habitat pre-mitigation		Off-site habitat post-mitigation	
	Habitat	Condition	Habitat	Condition
Traditional orchards	Modified grassland	Moderate	Traditional orchards	Moderate
Floodplain wetland mosaic (CFGM)	Modified grassland	Moderate	Floodplain wetland mosaic (CFGM)	Moderate
Lowland calcareous grassland	Lowland calcareous grassland	Moderate	Lowland calcareous grassland	Good

2.3.5 Stage 5 – Natural Capital Assessment using the Biodiversity Net Gain Assessment with mitigation

This and the following stage have only been undertaken for supply side options within the preferred programme and supply side options in any adaptive or alternative programmes and pathways.

The NCA that could be undertaken in Stage 5 would present the temporary and permanent loss as at Stage 3, and also take account of the areas planned for habitat creation and habitat improvement, including consideration of required mitigation for BNG (as calculated at Stage 4).

2.3.5.1 Stage 5 additions in comparison to Stage 3

As a proportionate approach has been taken there are key differences with the water purification, water regulation and natural hazard regulation assessments between Stage 3 and 5. The additional work that would be carried out in Stage 5 for these ecosystem services is outlined below. Further details on assumptions are outlined in **Appendix B.**

Water purification

In addition to the qualitative assessment carried out in Stage 3, a baseline quantitative assessment for Water purification would be undertaken using the Natural Environment Valuation Online (NEVO)[21] .

Water regulation

A high-level assessment would be undertaken, based on the WFD status of a waterbody and the CAMS data to assess the water resource availability, identify water bodies status and any potential deterioration caused by the construction and operation of the scheme.

Natural hazard regulation

For the purposes of this assessment, flooding was determined to be the most significant natural hazard risk, however, the drought risk has also been considered. A high-level qualitative assessment would be undertaken based on the EA flood risk zones[22], this assessment would examine the grassland and woodland that would be impacted within the ZoI and would consider both the temporary and permanent loss caused by the construction and operation of the option. The drought risk would be considered in relation to the Catchment Abstraction Management Strategy (CAMS) data with the impact to groundwater and surface water impact reviewed at a high level. This approach would enable a high-level assessment of key questions related to economics, drought mitigation, water storage, and natural function related to the water course to be provided.

2.3.6 Stage 6 – Potential Biodiversity Opportunity areas identification

For supply side options within the preferred programme, Potential Biodiversity Opportunity (PBO) areas could have been identified. These sites would be within 5km of the option locations and would be identified based on a scoring system (as shown in **Table 2.6**). A bespoke model has been developed, as outlined in **Figure 2.1**. It pools together more than 20 datasets (outlined in **Table 2.6**) to identify the PBOs, assign scores to them so they could be prioritised, and identify the most suitable PBOs for habitat restoration or creation. The scoring system is largely based on the Lawton principles[23], whereby effort should be made for new/enhanced habitats to be actively incorporated into a healthy ecological network (including landscape corridors, buffer zones,

[21] https://sweep.ac.uk/portfolios/natural-environment-valuation-online-tool-nevo/

[22] https://flood-map-for-planning.service.gov.uk/location

[23] Prof. J. Lawton (2010), Making Space for Nature. Report for the UK Government

sustainable use areas, etc.), rather than being isolated. In addition to the datasets listed in **Table 2.6**, the system also considers variables from the Biodiversity Metric.

Table 2.6 Scoring criteria for Potential Biodiversity Opportunity areas

Scoring criteria	Dataset/source	Score			
		3	2	1	0
Distance to pipeline	Pipeline options	<1 km	1-3 km	3-5 km	>5 km
Within same LPA as scheme/option – county boundaries	Pipeline options Ordnance Survey GB Counties	Yes	-	-	No
Non-statutory designation	Local wildlife sites, proposed country parks, ecosites	Yes	-	-	No
Proximity to statutory sites	National Nature Reserves, Ramsar sites, Special Areas of Conservation, Special Protection Areas, SSSI sites, Local Nature Reserves	Within 2 km	Within 5 km	-	No
Strategic significance designation	Canal conservation and restoration, green networks, local greenspace, special landscape, sites for green infrastructure	Yes	-	-	No
Proximity to ancient woodland	Ancient Woodland England and Wales	0.3 km	1 km	-	No
Owned/operated or managed by the relevant water company/companies	Information provided by relevant water company	Yes	-	-	No
Identified as common land	Common Land England	-	-	No	Yes
Size	Calculated using QGIS	>5 ha	1-5 ha	<1 ha	-

3. ASSESSMENT OF THE FEASIBLE OPTIONS

This section outlines:

- The options in the feasible list for South Staffs Water WRMP24
- The final outcomes of the BNG and NC at an option-level for each of the options in the feasible list for South Staffs Water WRMP24.

3.1 FEASIBLE OPTIONS INCLUDED

Through an extensive optioneering process, considering a wide range of potential options to balance future supply and demand, South Staffs Water have selected the most suitable options to make up the feasible options list. This list includes both demand side and supply side options, of which only the latter require a BNG and NC assessment. The supply side options are presented in **Table 3.1.**

Table 3.1 Feasible options included within the WRMP

Option Category	WRMP24 Ref.	Option Name
New surface water	2.1.1.1	40 Ml/d capacity raw water abstraction from the Trent to Blithfield
Reservoir enlargement	2.2.1.1	Increase storage at Blithfield - increase dam height by 1m
Reservoir enlargement	2.2.2.1	Increase storage at Blithfield - increase dam height by 2m
Reservoir enlargement	2.3.1	Chelmarsh Reservoir 15 Ml/d <2m raising
Reservoir enlargement	2.3.2	Chelmarsh Reservoir 30 Ml/d up to 2m raising
New surface water	6.1.1	40 Ml/d capacity treatment works on the Trent, with 14-day storage
New surface water	6.1.3	70 Ml/d capacity treatment works on the Trent, with 14-day storage
External raw water bulk supply/transfer	7.1.2.1	Third Party Option: Canal & River Trust, Birmingham Blithfield surplus
External raw water bulk supply/transfer	7.1.5	Third Party Option: Canal & River Trust, Chasewater options
External raw water bulk supply/transfer	7.5.1.1	United Utilities (UU) Vyrnwy reservoir raw water release 15 Ml/d to River Severn to support SSW
External raw water bulk supply/transfer	7.5.1.2	UU Vyrnwy reservoir raw water release 30 Ml/d to River Severn to support SSW
External raw water bulk supply/transfer	7.5.1.3	UU Vyrnwy reservoir raw water release 45 Ml/d to River Severn to support SSW
External raw water bulk supply/transfer	7.5.1.4	UU Vyrnwy reservoir raw water release 75 Ml/d to River Severn to support SSW
External potable bulk supply/transfer	8.1.1	Third Party Option: potable import
Licence trading	8.1.5	Third Party Option: drill new GW source with licence trade
New reservoir	8.3.1	Third Party Option: new raw water storage reservoir close to the River Trent
Demand Management		9% reduction in Non-household (NHH) demand
Demand Management		50% leakage reduction by 2050
Demand Management		Water Efficiency /Per Capita Consumption (110 l/h/d by 2050)

3.2 STAGE 2 (BIODIVERSITY NET GAIN OUTCOMES)

The results of the Stage 2 Biodiversity Net Gain calculations are presented for all options in **Appendix D**.

Temporary losses of habitat (associated with pipeline construction) vary between 0 and -479.89 Area Based Habitat Units (ABHU) per option. The greatest losses are associated with options that have the longer lengths of new pipeline that will need to be installed. The types of habitats that would be disturbed by pipeline construction vary, with extensive areas of modified grassland but also some high value habitat such as Floodplain Wetland Mosaic (CFGM).

Permanent losses of habitat include those associated with new permanent above-ground infrastructure. Permanent losses vary between 0 and -806.04 ABHU per option. Some permanent infrastructure such as new water treatment works or pumping stations would be located on areas of distinctive, high-quality habitat, causing a moderate impact.

3.3 STAGE 3 (NATURAL CAPITAL OUTCOMES)

The results of the Stage 3 Natural Capital calculations are presented for all options in **Appendix E**. Detailed NC calculations summarised in the sections below are shown in **Appendix D**.

3.3.1 Climate regulation

Temporary losses of the climate regulation service have been valued at between £0 and -£2,767 per year per option. The greatest losses relate to long pipelines that cross areas of floodplain wetland mosaic.

Permanent losses of the climate regulation service have been valued at between £0 and -£2,147 per year per option. The greatest losses are associated with the land loss associated with water storage tanks, some of which are located on semi-natural grassland.

3.3.2 Natural hazard regulation

Temporary losses of the natural hazard regulation service (with a focus on flooding) have been valued at between £0 and -£736 per year per option. As with climate regulation, the greatest losses relate to pipelines crossing floodplain wetland mosaic.

Permanent losses of the natural hazard regulation service have been valued at between £0 and -£553 per year per option. The greatest losses are associated with loss of wetlands due to the expansion of Blithfield Reservoir.

3.3.3 Water purification

Table 3.2 presents the qualitative assessment that has been undertaken. Impacts to water purification services range from negligible to moderate.

Table 3.2 Water purification assessment results for the feasible options

WRMP24 Ref.	WFD status and Waterbody	Assessment
2.1.1.1	Moreton Brook from Source to River Trent: Moderate ecological status	Water purification services are currently provided by greenfield and woodland habitats, as these habitats provide interception and removal of contaminants. The construction of the pipeline will have a temporary negligible impact on water purification.
2.2.1.1	Blithfield Reservoir - Poor status	Water purification services are currently provided by woodland habitats as these habitats provide interception and removal of contaminants, the expansion of the reservoir would decrease water purification services.
2.2.2.1	Blithfield Reservoir - Poor status	Water purification services are currently provided by woodland habitats as these habitats provide interception and removal of contaminants, the expansion of the reservoir would decrease water purification services.

WRMP24 Ref.	WFD status and Waterbody	Assessment
2.3.1	Chelmarsh Reservoir Water Body – Moderate status	Water purification services are currently provided by woodland habitats as these habitats provide interception and removal of contaminants, the expansion of the reservoir would decrease water purification services.
2.3.2	Chelmarsh Reservoir Water Body – Moderate status	Water purification services are currently provided by woodland habitats as these habitats provide interception and removal of contaminants, the expansion of the reservoir would decrease water purification services.
6.1.1	Trent and Mersey Canal, summit to Alrewas - Good Status, Trent - R Tame to R Dove - Poor status	Water purification services are currently provided by greenfield and woodland habitats as these habitats provide interception and removal of contaminants. The construction of the pipeline will have a temporary negligible impact on water purification. Construction and operation of storage tanks likely to have a moderate impact on water purification services due to the arable land that would be lost.
6.1.3	Trent and Mersey Canal, summit to Alrewas - Good Status, Trent - R Tame to R Dove - Poor status	Water purification services are currently provided by greenfield and woodland habitats as these habitats provide interception and removal of contaminants. The construction of the pipeline will have a temporary negligible impact on water purification. Construction and operation of storage tanks likely to have a moderate impact on water purification services due to the arable land that would be lost.
7.1.2.1	Trent from Tittensor to River Sow - Poor Status	Water purification services are currently provided by greenfield and woodland habitats as these habitats provide interception and removal of contaminants. The construction of the pipeline will have a temporary negligible impact on water purification.
7.1.5	Crane Brook - source to Footherley Brook - Poor Status	Water purification services are currently provided by greenfield and woodland habitats as these habitats provide interception and removal of contaminants. The construction of the pipeline will have a temporary negligible impact on water purification.
7.5.1.1	Severn - conf R Worfe to conf R Stour Water Body: Poor ecological status	Water purification impact on raw water transfer should also be considered from the point of transfer in UU area, however, any implications in the UU area have not been considered in this assessment. In the SSW area it is not expected that this scheme option will cause any negative impacts to the water purification services provided by the environment.
7.5.1.2	See 7.5.1.1	See 7.5.1.1
7.5.1.3	See 7.5.1.1	See 7.5.1.1
7.5.1.4	See 7.5.1.1	See 7.5.1.1
8.1.1	Mease from Hooborough Brook to Trent - Moderate Status	Water purification services are currently provided by greenfield and woodland habitats as these habitats provide interception and removal of contaminants. The construction of the pipeline will have a temporary negligible impact on water purification.
8.1.5	Mease from Gilwiskaw Bk to Hooborough Brook - Poor Status	Water purification services are currently provided by greenfield and woodland habitats as these habitats provide interception and removal of contaminants. The construction of the pipeline will have a temporary negligible impact on water purification.
8.3.1	n/a	Water purification services would be moderately impacted by the construction of the reservoir due to the deciduous woodland that would be lost, this impact would be permanent.

3.3.4 Recreation and tourism

Temporary losses of recreational benefits, as calculated using the ORVal tool (described in **Section 2**), have been valued at between £0 and -£765,564 per year per option. The losses are associated with disruption to public footpaths, assuming that footpaths crossed by the pipeline route could not be used during construction. In general, options with longer pipelines and those in more highly populated/visited areas experience the greatest losses of value (the former because a longer pipeline has the potential to cross more footpaths. The latter because footpaths in highly populated/visited areas tend to have a higher value).

The values obtained from ORVal provide a useful comparison between options. However, they should not be compared to the other monetised services that are discussed here, because the ORVal values are considered to be incomparably high.

3.3.5 Agriculture

Temporary losses of the agriculture service have been valued at between £0 and -£20,846 per year per option. The greatest losses relate to long pipelines that cross extensive areas of farmland.

Permanent losses of the agriculture service have been valued at between £0 and -£12,246 per year per option. High loss of agricultural land is caused by the water storage tanks within options 6.1.1 and 6.1.3, these tanks would result in a permanent loss of farmland, whereas the farmland disturbed temporarily for laying of pipelines would subsequently be reinstated.

4. ASSESSMENT OUTCOMES FOR THE PREFERRED PROGRAMME

The WRMP24 does not require any supply options during the planning period of 2025 to 2050 to meet the deficit in the preferred and any reasonable alternatives. This is because the ambitious demand management programme provides the required level of savings. However, the company has explored a wide range of supply options in parallel and tested both demand and supply options to ensure the preferred plan delivers the best value for both customers and the environment (refer to the overarching WRMP24 for further details). As such the following Stages 4 – 6 have not been carried out:

- Stage 4 - Biodiversity Net Gain Assessment with mitigation
- Stage 5 - Natural Capital Assessment using the Biodiversity Net Gain Assessment with mitigation
- Stage 6 - Potential Biodiversity Opportunity areas identification

5. ASSESSMENT OUTCOMES FOR THE ADAPTIVE PATHWAY

5.1 INTRODUCTION

This section presents Stages 4 – 6 assessments for SSW WRMP24 adaptive pathway. These stages of assessments have been included for supply side options in the adaptive pathway. Option 2.2.2.1 is the only supply side option that has been selected for if the demand management options are deemed to fall short of target (refer to overarching WRMP24 for further details).

The Stage 4 (BNG) and 5 (Natural Capital) are presented first in **Section 5.2** and in **Section 5.3**, Stage 6 (Opportunity Mapping) is presented.

5.2 ASSESSMENT OF THE ADAPTIVE PATHWAY

5.2.1 Stage 4 (Biodiversity Net Gain) outcomes

The results of the BNG assessment for Option 2.2.2.1 are presented in **Table 5.1**. This shows the losses that would occur from both temporary and permanent land take. The gains have been calculated to achieve 10% net gain in response to both temporary and permanent losses.

Table 5.1 BNG assessment outputs for the adaptive pathway

Option ID	Land cover loss type	On-site baseline (ABHU)	On-site post-intervention (ABHU)	On-site net % change	Off-site baseline (ABHU)	Off-site post-intervention (ABHU)	Total net unit change (ABHU)
2.2.2.1	Temporary	595.85	424.91	-28.69	327.4	558.97	59.62
	Permanent	575.51	0	0	1095.82	1728.86	57.54

5.2.2 Stage 5 (Natural Capital) outcomes

The results of the ecosystem services which can be monetised in the NC assessment for the adaptive pathway are presented in **Table 5.2**.

Table 5.2 Stage 4 (Natural Capital) outcomes

Option ID	Climate regulation			Natural hazard regulation			Recreation		Agriculture		
	Temporary loss (£/year)	Permanent loss (£/year)	Total future (£/year)	Temporary loss (£/year)	Permanent loss (£/year)	Total future (£/year)	Temporary loss (£/year)	Total future (£/year)	Temporary loss (£/year)	Permanent loss (£/year)	Total future (£/year)
2.2.2.1	-£13,497.41	-£10,554.71	£24,219.74	-£2,775.85	-£5,758.87	£976.41	-£15,127.30	Assume 100% restored	-£31,455.84	-£24,796.48	-£2,796.48

Table 5.2 shows that the total future monetised impact of Option 2.2.2.1 being implemented would be £22,399.67 per year.

5.2.2.1 Climate regulation

Option 2.2.2.1 would cause a significant amount of arable land to be lost due to the raising of the dam and associated flooding of land.

Even with this loss of arable and other land, assuming the BNG presented above, a net gain of the climate regulation service could ultimately be achieved. Significant gain could be provided by the BNG delivered for Option 2.2.2.1.

5.2.2.2 Natural hazard regulation

Assuming the BNG presented above, a net gain of the natural hazard regulation service could ultimately be achieved for Option 2.2.2.1, even with the initial impact of raising the dam and the associated flooding of the land, due to uplift off-site.

A qualitative assessment looking at flood zones and area coverage of woodland and grassland has also been carried out for the option in the adaptive pathway. This assessment found that while deciduous woodland would be lost in relation to Option 2.2.2.1, the reservoir could provide flood management and reduce the risk of flooding, after the initial flooding of the land, as the reservoir would provide additional storage within the catchment. This has potential to support natural hazard regulation since both Blithfield Reservoir and downstream of the reservoir are in flood zones 2 and 3, meaning the area is at high risk of flooding.

The CAMS data for Option 2.2.2.1 shows that water is not available for Q50 and there is restricted water available for licencing for Q95, due to the Hands-off flow (HoF), however, it is currently assumed there would be no change to abstraction licencing and as such this scheme will not increase drought risk.

5.2.2.3 Water purification

At a sub-catchment level the water purification has been studied for Option 2.2.2.1 through the NEVO tool, these results are outlined in **Table 5.** 3. **Table 5.** 3 also highlights which sectors are the Reason for Not Achieving Good (RNAG) in relation to WFD compliance.

Table 5. 3 NEVO tool results for options in the adaptive pathway

Option ID	Quality element			Commentary based on RNAG
	Dissolved Oxygen (mg/l)	Nitrogen (mg/l)	Phosphorus (mg/l)	
2.2.2.1	11.23	5.14	0.39	Failing due to total phosphorus level caused by agricultural and rural land management. Likely to not worsen water purification services, could increase water purification services by absorbing pollutants, overall option is low risk in relation to water purification services.

5.3 MAPPING OF POTENTIAL BIODIVERSITY OPPORTUNITY

Potential Biodiversity Opportunity have been identified according to the methodology set out in **Section 2**. A heat-map demonstrating the distribution of areas potentially suitable for biodiversity opportunities is presented in **Figure 5.1**. Higher scores indicate areas of potentially greater opportunity. These maps and the data from which they are created can be used to identify high-scoring sites that present good opportunities for habitat creation within a wider network. These are most extensive in the areas in lighter greens and yellows in **Figure 5.1,** although localised opportunities may still be found elsewhere. It may be important to consider opportunities within the vicinity of individual options, so that the habitat gain is provided close to the losses, and in order to provide the benefit to local communities.

The mapping has taken into account a range of factors including any LPAs, local designations, proximity to statutory sites, proximity to ancient woodland and others. Taking these types of factors into account when identifying off-site opportunities for net gain allows a strategic approach to be taken to providing benefits to local communities and incorporating habitats into wider ecological networks.

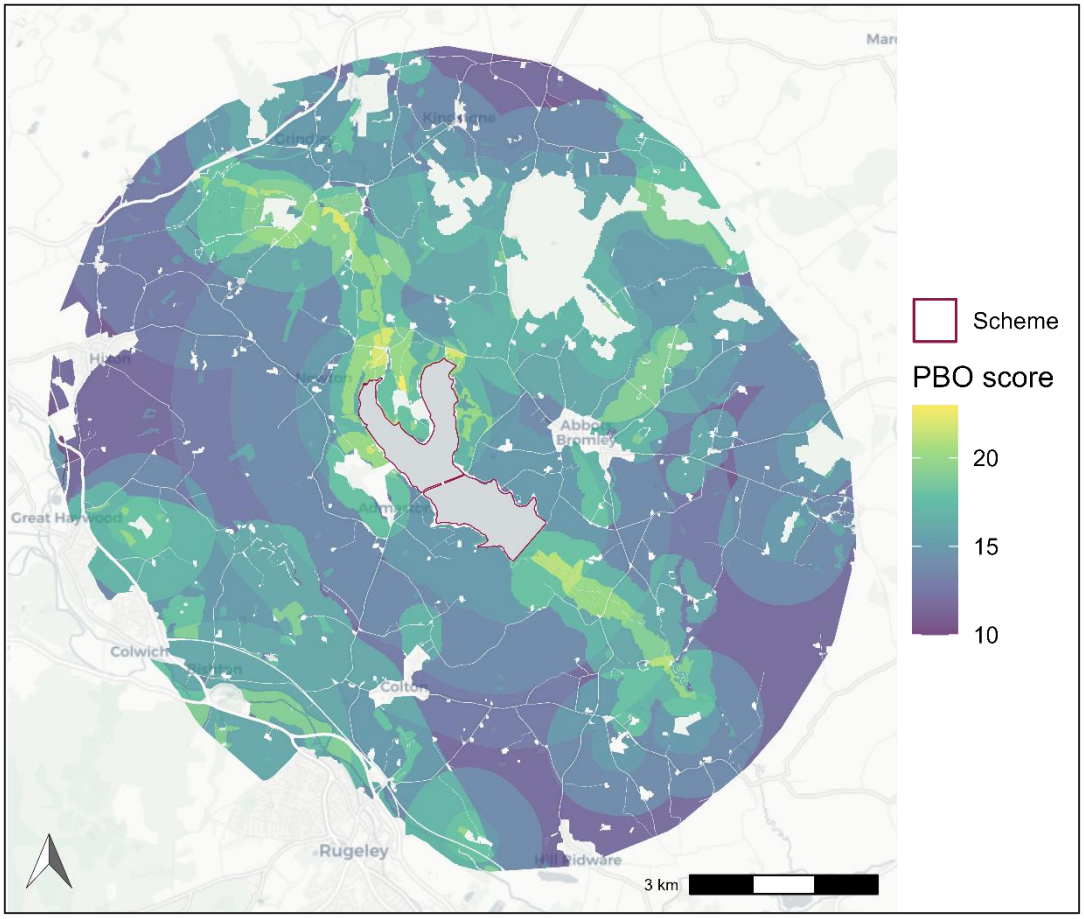

Figure 5.1 Potential Biodiversity Opportunity areas identified for options within the adaptive pathway

6. SUMMARY

This report has presented the Biodiversity Net Gain and Natural Capital Assessments that have been undertaken for South Staffs Water's Water Resources Management Plan 2024. The approaches taken are in line with relevant guidance, notably the WRPG WRMP24 Supplementary Guidance on Environment and Society in Decision-making.

For the feasible options in the WRMP, this report has presented losses of biodiversity associated with all options that involve any temporary or permanent land-take. The losses have been assessed using the Defra Biodiversity Metric 3.0, based on spatial land use and habitat datasets with national coverage. Associated natural capital losses have been calculated for an agreed selection of ecosystem services. The assessment shows that the greatest impacts on biodiversity and associated regulating ecosystem services are associated with the land that would be lost through increasing storage at Blithfield Reservoir through raising of the pre-existing dam. Other significant losses are associated with the creation of water storage tanks. For permanent above-ground infrastructure such as water storage tanks, the greatest losses tend to be associated with options located on areas that are currently arable land.

Through ambitious demand management options the preferred programme does not require supply side options. However, one supply side option has been selected for an adaptive pathway for the preferred plan. The adaptive pathway for the preferred programme would lead to Option 2.2.2.1 being implemented if the demand management options are deemed to fall short of target (refer to overarching WRMP24 for further details).

The biodiversity losses were calculated for the option in the adaptive pathway for the preferred plan. The total habitat units lost as a result of this option are calculated to be -1171 ABHU. However, 10% net gain could be achieved through reinstating 425 ABHU on-site and creating or enhancing habitat equating to 2288 ABHU off-site. Potential Biodiversity Opportunity areas have been identified in this report, showing where possible habitat enhancements or creation offsite could occur.

The ecosystem service impacts were also studied post habitat creation and enhancement, with the total future monetised impact of Option 2.2.2.1 being implemented being £22,399.67 per year. Non-monetised metrics were also studied and showed that, the reservoir could provide flood management services and reduce the risk of flooding, after the initial flooding of the land, as the reservoir would provide additional storage within the catchment.

APPENDICES

Appendix A Stage 1 assessment methodology

Ecosystem service	Benefit / disbenefit score +/-	Definition
Biodiversity and habitat	0	Refer to Biodiversity sub-categories (Below)
	1	
	2	
	3	
Climate regulation	0	No change
	1	Negligible changes
	2	Moderate changes to low sequestering habitats (e.g. farmland, green urban, heath or other grassland/shrub habitats)
	3	Moderate or major changes to high sequestering habitats (e.g. woodland, salt marsh or undamaged peatland)
Natural hazard regulation	0	No land cover change within floodplain where communities downstream are at risk of flooding
	1	Minor land cover change within the floodplain which may result in a minimal change in risk of flooding downstream
	2	Change in land cover (e.g. grassland and heathland) and other regulating habitat within the catchment that impact flood risk (e.g. slow down overland/rapid flows) where communities downstream are at risk of flooding
	3	Change to high values habitats (e.g. woodland, wetland, marsh) within the floodplain which could result in changes related to flood risk to communities downstream
Water purification	0	No change
	1	Negligible changes
	2	Change in land cover (e.g. farmland, green urban, heath or other grassland/shrub habitats) which will have a minor impact to water quality and/or minor change in dilution which could affect water quality
	3	Change in land cover (woodland, wetlands, salt marsh or undamaged peatland) which will have a moderate/ major impact to water quality and/or major change in dilution which could affect water quality
Water regulation	0	No change/ negligible change
	1	Minor change in catchment water availability
	2	Moderate change in catchment water availability
	3	Major change in catchment water availability
Health and Wellbeing & Recreation and tourism*	0	No change
	1	Minor change in visitor numbers or access to recreation asset and/or minor impact to health and wellbeing of local community
	2	Moderate change in visitor numbers and/or moderate impact to health and wellbeing of local community or wider population
	3	Major change in visitor numbers and/or major impact to health and wellbeing of local community or wider population
Agriculture	0	No change
	1	Change to Grade 3 or above agricultural land
	2	Change to Grade 2 agricultural land
	3	Change to Grade 1 agricultural land

Biodiversity subcategory Score

	0	1	2	3
Habitat importance	No significant habitat	Agricultural, or greenfield	Adjacent to designated areas/ priority habitats	Intersects designated areas / priority habitats or enhancement zones / irreplaceable habitats (Ancient Woodland)
Size of the area directly affected (i.e. within the option ZoI)	0	<5km2	<10km2	>15km2
Proximity to option	>1km	1km	<500m	<250m

Scale score

Benefit / disbenefit score	Definition
0	No impact
1	Minor impact (local)
2	Moderate impact (local)
3	High impact (regional)

Duration score

Benefit / disbenefit score	Definition
0	No impact
1	Temporary impact due to construction < 1 year
2	Temporary impacts due to construction >1 year
3	Permanent impact*

Appendix B Natural Capital assumptions and caveats

Along with these assumptions and caveats, it is key to note a proportionate level of assessment has been carried out as recommended in the supplementary guidance Environment and Society in Decision Making. The level of detail undertaken for an assessment depended on whether an option was selected in the feasible list, preferred plan or an adaptive pathway.

Ecosystem service	Compliance level	Type of assessment	Caveats and assumptions
Biodiversity	Minimum	Qualitative	Full best practice not available at this stage as no data related to condition and extent of habitats, will require more detailed assessment at planning stage
	Minimum	Quantitative	Local Nature Recovery Strategy looked at but until more detail on options/preferences needed to understand exactly where BNG habitats will be best placed. Not all Local Plan data was available at the time of writing, so exact location of where BNG implementation would be best placed has not been provided. A heat map approach has been used through PBO tool outputs to suggest possible places where BNG uplift could be beneficial. To mitigate this we have provided a heat map of possible areas for BNG uplift, based on the best information using our PBO tool. Not appropriate at this stage to carry out habitat surveys of options area because of uncertainty of locations options at this stage. To mitigate for this, high-quality open-source data has been used to understand what habitats are present. However, these datasets don't all contain habitat condition, thus moderate condition has been assumed, this causes uncertainty. This uncertainty would be reduced in the future when surveys are conducted.
	N/a	Monetisation	Limited data to apply any proportional monetised approach at this stage. Would require more detailed assessment at planning stage and any future monetisation agree with regulators if required.
	Minimum	Qualitative	The final BNG uplift and mitigation sites will be decided following detailed design, any PBOs identified at this stage are only showing possible suitable locations. A heat map approach has taken to clearly show that potential PBO sites identified at this stage are not certain.
Climate Regulation	Minimum	Qualitative	Knowledge of this in hectares (Ha) provide an assessment of habitats with carbon storage potential that maybe lost (temporary and permanent) with a key focus on grassland and woodland.
Natural Hazard Regulation	Minimum	Qualitative	Based on EA flood risk zone intersections with ZoI, judgement of intersection has been carried out at a high-level.
Water Purification	Minimum	Quantitative and Qualitative	NEVO tool integrated to pull together sub-catchment information on Nitrogen, Phosphorus, Dissolved oxygen and pesticide concentration levels to provide a high-level assessment. Data only at sub catchment level (2 KM + grid) so course information. To mitigate the level of detail currently available further wording has been added to the assessment based on the

Ecosystem service	Compliance level	Type of assessment	Caveats and assumptions
			reason for not achieving good (RNAG) status in relation to the WFD compliance. The RNAG currently provides the best available evidence for a water quality baseline, against which water purification has been assessed.
	Not essential	Monetisation	Not feasible at this stage noting that best practice requires significant data that is not available for options at this stage.
Water Regulation	Minimum	Qualitative	High level assessment at this stage. Future and current abstractors need to be reviewed during stakeholder engagement at detailed planning stage.
	Minimum	Quantitative	Wider stakeholder engagement has not been carried out at this stage, due to programme uncertainty. Therefore, assessment of water reaming for other existing and future users has not been considered at this stage though recognise this is important.
Recreation	Not essential	Monetised (losses only) provided	Values only relate to recreational assets that will be lost temporarily. Any potential recreational benefits of the BNG uplift being implemented has not been calculated.. This is because exact areas for the BNG uplift have not been selected at this stage.

Appendix C Conversion from UKHab to Broad Habitats

Land Cover Classification	Broad habitat type
Cropland – Cereal crops	Arable
Modified grassland	Semi natural grassland
Heathland and shrub	Heathland and shrub
Lowland mixed deciduous woodland	Deciduous woodland
Neutral grassland	Semi natural grassland
Lakes – pond	Freshwater
Other coniferous woodland	Coniferous woodland
No habitat	Urban
Broadleaved woodland	Deciduous woodland
Poor semi-improved grassland	Semi natural grassland
Other rivers and streams	Freshwater
Eutrophic standing waters	Freshwater
Other coniferous woodland	Coniferous woodland
River and streams	Freshwater
Sparsely vegetated land	Sparsely vegetated land
Lowland heathland	Heathland and shrub
Other woodland mixed	Deciduous woodland
Traditional orchards	Semi natural grassland
Lowland meadows	Semi natural grassland
Floodplain wetland mosaic	Semi natural grassland
Traditional orchards	Semi natural grassland
Bramble	Heathland and shrub

Appendix D Results of Stage 2 (feasible options) BNG calculations

WRMP24 Ref.	Total area (ha)	Temporary impacts		Permanent impacts	
		Temporary area lost (ha)	Total units lost (ABHU)	Permanent area lost (ha)	Total units lost (ABHU)
2.1.1.1	11.65	11.4	-6.12	0.25	-0.1
2.2.1.1	2.61	0	0	2.60	-9.68
2.2.2.1	6.70	0	0	6.70	-24.86
2.3.1	2.45	0	0	2.45	-14.23
2.3.2	5.77	0	0	5.77	-33.37
6.1.1	113.81	27.84	-86.50	85.96	-806.04
6.1.3	109.88	36.11	-143.00	73.77	-627.51
7.1.2.1	19.37	18.15	-56.47	1.21	-9.55
7.1.5	4.10	2.53	-12.68	1.57	-6.55
7.5.1.1	0	0	0	0	0
7.5.1.2	0	0	0	0	0
7.5.1.3	0	0	0	0	0
7.5.1.4	0	0	0	0	0
8.1.1	93.18	92.77	-479.89	0.40	-5.34
8.1.5	52.53	52.41	-156.52	0.13	0
8.3.1*	24.22	0	0	24.22	-294.22

* This assessment only assessed the potential storage reservoir, and not any associated new pipelines. This is due to the uncertainty surrounding potential pipeline routes when this assessment was undertaken

Appendix E Results of Stage 3 (feasible options) Natural Capital calculations

WRMP 24 Ref.	Temporary impacts					Permanent impacts				
	Biodiversity	Climate Regulation	Natural Hazard Regulation	Recreation and Tourism	Agriculture	Biodiversity	Climate Regulation	Natural Hazard Regulation	Recreation and Tourism	Agriculture
	Hectares	£2019/year	£2019/year	£2019/year	£2019/year	Hectares	£2019/year	£2019/year	£2019/year	£2019/year
2.1.1	-11.40	-£215	-£47	£0	-£3,906	- 0	-£2	-£1	na	-£87
2.2.1	0.00*	£0*	£0*	£0*	£0*	- 3	-£166	-£249	na	-£570
2.2.2.1	0.00*	£0*	£0*	£0*	£0*	- 7	-£466	-£553	na	-£1,545
2.3.1	0.00*	£0*	£0*	£0*	£0*	- 2	-£285	-£92	na	-£590
2.3.2	0.00*	£0*	£0*	£0*	£0*	- 6	-£659	-£213	na	-£1,404
6.1.1	-27.84	-£339	-£47	-£204,672	-£9,557	- 86	-£1,646	£0	na	-£12,246
6.1.3	-36.11	-£1,117	-£221	-£588,726	-£9,815	- 74	-£2,147	-£301	na	-£11,662
7.1.2.1	-18.15	-£132	-£4	-£254,780	-£5,532	- 1.21	-£18	£0	na	-£262
7.1.5	-2.53	-£15	£0	-£14,524	-£773	- 1.57	-£11	£0	na	-£524
7.5.1.1	0.00*	£0*	£0*	£0*	£0*	£0*	£0*	£0*	£0*	£0*
7.5.1.2	0.00*	£0*	£0*	£0*	£0*	£0*	£0*	£0*	£0*	£0*
7.5.1.3	0.00*	£0*	£0*	£0*	£0*	£0*	£0*	£0*	£0*	£0*
7.5.1.4	0.00*	£0*	£0*	£0*	£0*	£0*	£0*	£0*	£0*	£0*
8.1.1	-92.77	-£2,767	-£736	-£765,564	-£20,846	- 0	-£11	£0	na	-£0
8.1.5	-52.41	-£1,773	-£568	-£296,148	-£10,656	- 0	£0	£0	na	£0
8.3.1	0.00*	£0*	£0*	£0*	£0*	- 24	-£1,958	-£483	na	-£43

* Option did not have any temporary and / or permanent land loss, thus has no temporary or permanent impacts for the ecosystem services studied

Appendix F Natural Capital Workbooks

This Appendix provides the Natural Capital Workbooks for each feasible option detailing the NC calculations summarised in **Section 3.3**.

T: +44 (0) 1235 75 3000
E: enquiry@ricardo.com
W: ee.ricardo.com