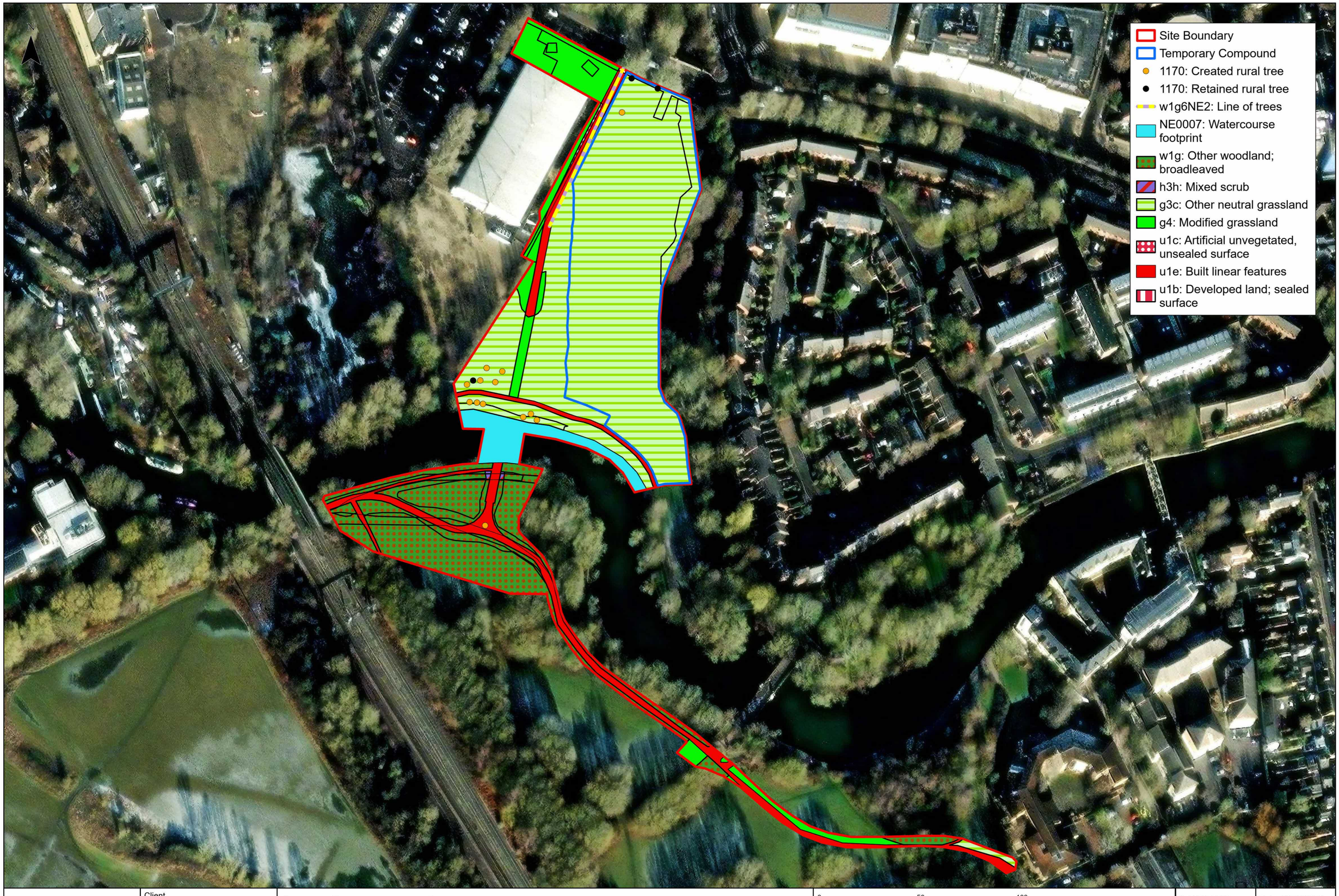

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Client: Oxford City Council

OXPENS RIVER BRIDGE

Post Development UK Habitat Plan

0 50 100 m

World Imagery: Maxar, Microsoft

1:1,650 @ A3	Date: 20/10/2023
Drawn: LW	Checked: JG
Figure 02	Rev A

Document Path: C:\Users\lwignall\Documents\ArcGIS\Projects\330610556\330610556.aprx

Appendix A Landscape Plans

LEGEND

RED LINE BOUNDARY

RETAINED

TREE RETAINED

VEGETATION RETAINED

PLANTING

NATIVE TREE

FEATHERED TREE

MARGINAL MIX

ROCK GARDEN WITH PLANTING

FLOWERING LAWN GRASS

WETLAND GRASS

SHADE TOLERANT GRASS (UNDER BRIDGE)

ECOLOGY

BIRD/BAT BOX

OXFORD ICE RINK

OXPENS MEADOWS

CASTLE MILL STREAM

RIVER THAMES

OXNEY RAIL BRIDGE

GRANDPONT NATURE PARK

N

0 10 20 30 40 50m

SCALE 1:500

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- EA PLAN

0100.6 LANDSCAPING DRAWING P20374-00-001-BASE Landscape PROVIDED BY GILLESPIES.

P02	COMMENTS INCORPORATED	GCP	JWS	2023.10.20
P01	FIRST ISSUE	GCP	JWS	2023.10.13
Issued/ Revision		By	Appd	YYYY.MM.DD

	GCP	JJ	JWS	2023.10.13
	Dwn.	Dsgn.	Chkd.	YYYY.MM.DD

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OXPENS RIVER BRIDGE AND CONNECTING PATHS

Title

SOFT LANDSCAPE DESIGN OVERVIE SHEET

Project No.
332610335

Scale
1:500

Revision
P02

Drawing No.
OXPEN-STN-GEN-ALL-DR-L-3001

LEGEND

RETAINED

- TREE RETAINED
- VEGETATION RETAINED

PLANTING

- NATIVE TREE
- FEATHERED TREE
- MARGINAL MIX
- ROCK GARDEN WITH PLANTING
- FLOWERING LAWN GRASS
- WETLAND GRASS
- SHADE TOLERANT GRASS (UNDER BRIDGE)

ECOLOGY

- BIRD/BAT BOX

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OXPENS RIVER BRIDGE AND CONNECTING PATHS

Title

SOFT LANDSCAPE DESIGN NORTH

Project No.	Scale
332610335	1:200

Revision	Drawing No.
P02	OXPEN-STN-GEN-ALL-DR-L-3002

LEGEND

RETAINED

- RED LINE BOUNDARY
- TREE RETAINED
- VEGETATION RETAINED
- WOODLAND UNDERSTORY MANAGEMENT / ENHANCEMENT

PLANTING

- NATIVE TREE
- HERBACEOUS WOODLAND PERENNIAL (SEED MIX)
- HERBACEOUS WOODLAND PERENNIAL (PLUG & BULB MIX)
- NATIVE SCRUB

ECOLOGY

- BIRD/BAT BOX

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0100.6 LANDSCAPING DRAWING P20374-00-001-BASE Landscape PROVIDED BY GILLESPIES.

P01 FIRST ISSUE	GCP	JWS	2023.10.13	
Issued/ Revision	By	Appd	YYYY.MM.DD	
	GCP	JJ	JWS	2023.10.13
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OXPENS RIVER BRIDGE AND CONNECTING PATHS

Title

SOFT LANDSCAPE DESIGN SOUTH

Project No.	Scale
332610335	1:200
Revision	Drawing No.
P01	OXPENS-STN-GEN-ALL-DR-L-3003

INDICATIVE SPECIES LIST

NATIVE TREES

ALNUS GLUTINOSA (COMMON ALDER)

ACER CAMPESTRE (FIELD MAPLE)

CRATAEGUS MONOGYNA (HAWTHORN)

FAGUS SYLVATICA F. PURPUREA (COPPER BEECH)

ILLEX AQUIFOLIUM (HOLLY)

PRUNUS AVIUM (WILD CHERRY)

TILIA CORDATA 'GREENSPIRE' (SMALL-LEAVED LIME 'GREENSPIRE')

POPULUS NIGRA SUBSP. BETULIFOLIA (BLACK POPLAR)

ULMUS 'WINGHAM' (ELM)

FEATHERED TREES

SALIX VIMINALIS (WILLOW)

HERBACEOUS WOODLAND PERENNIAL (PLUG & BULB MIX)

ASPLENIUM SCOLOPENDRIUM (HART'S TONGUE FERN)

CYCLAMEN (SOW BREAD)

DIGITALIS PURPUREA (FOXGLOVE)

DRYOPTERIS FILIX-MAS (MALE FERN)

GALANTHUS NIVALIS (COMMON SNOWDROP)

HYACINTHOIDES NON-SCRIPTA (BLUEBELL)

LONICERA PERICLYMENUM (HONEYSUCKLE)

NARCISSUS PSEUDONARCISSUS (WILD DAFFODIL)

VIOLA ODORATA (SWEET VIOLET)

SCRUB MIX

CORYLUS AVELLANA (HAZEL, COBNUT)

CRATAEGUS MONOGYNA (COMMON HAWTHORN)

EUONYMUS EUROPAEUS (SPINDLE)

ILEX AQUIFOLIUM (HOLLY)

PRUNUS SPINOSA (BLACKTHORN)

ROSA CANINA (DOG ROSE) - PLANTED WHERE IT CANNOT OVERHANG PATHS

MARGINAL MIX (SALIX WETLAND SOLUTIONS COIR ROLLS PREPLANTED WITH THE FOLLOWING MIX)

CALTHA PALUSTRIS (MARSH MARIGOLD)

IRIS PSEUDACORUS (YELLOW FLAG)

MENTHA AQUATICA (WATERMINT)

SAGITTARIA SAGITTIFOLIA (COMMON ARROWHEAD)

SPARGANIUM ERECTUM (BUR REED)

VERONICA BECCABUNGA (BROOKLIME)

ORNAMENTAL GRASS MIX

CALAMAGROSTIS × ACUTIFLORA 'KARL FOERSTER' - FEATHERED REED GRASS 'KARL FOERSTER'

STIPA TENUISSIMA - MEXICAN FEATHER GRASS

DESCHAMPSIA CESPITOSA - TUFTED HAIR GRASS

FESTUCA RUBRA - CREEPING RED FESCUE

HERBACEOUS WOODLAND PERENNIAL (SEED MIX)

EMORSGATE EWF1: WILD FLOWERS FOR WOODLAND

WILD FLOWERS 20%

ALLIARIA PETIOLATA - GARLIC MUSTARD

ALLIUM URSINUM - RAMSONS

ARCTIUM MINUS - LESSER BURDOCK

CAMPANULA TRACHELIUM - NETTLE-LEAVED BELLFLOWER

CHAEROPHYLLUM TEMULUM - ROUGH CHERVIL

DIGITALIS PURPUREA - FOXGLOVE

FILIPENDULA ULMARIA - MEADOWSWEET

GALIUM ALBUM - (GALIUM MOLLUGO) - HEDGE BEDSTRAW

GEUM URBANUM - WOOD AVENS

HYACINTHOIDES NON-SCRIPTA - BLUEBELL

IRIS FOETIDISSIMA - GLADDON

PRUNELLA VULGARIS - SELFHEAL

SILENE DIOICA - RED CAMPION

TORILIS JAPONICA - UPRIGHT HEDGE-PARSLEY

VICIA CRACCA - TUFTED VETCH

GRASSES 80%

AGROSTIS CAPILLARIS - COMMON BENT

ANTHOXANTHUM ODORATUM - SWEET VERNAL-GRASS (W)

BRACHYPODIUM SYLVATICUM - FALSE BROME (W)

CYNOSURUS CRISTATUS - CRESTED DOGSTAIL

DESCHAMPSIA CESPITOSA - TUFTED HAIR-GRASS (W)

FESTUCA RUBRA - RED FESCUE

FLOWERING LAWN MIX

EMORSGATE EL1 FLOWERING LAWN MIXTURE

WILD FLOWERS 20%

BETONICA OFFICINALIS - BETONY

CENTUREA NIGRA - COMMON KNAPWEED

GALIUM VERUM - LADY'S BEDSTRAW

LEONTEDON HISPIDUS - ROUGH HAWKBIT

LOTUS CORNICULATUS - BIRDSFOOT TREFOIL

PLANTAGO LANCEOLATA - RIBWORT PLANTAIN

PRIMULA VERIS - COWSLIP

RANUNCULUS ACRIS - MEADOW BUTTERCUP

SALIUM SILAUS - PEPPER SAXIFRAGE

VICIA CRACCA - TUFTED VETCH

MEDICAGO LUPULINA - BLACK MEDIC (AG)

TRIFOLIUM REPENS - SMALL LEAVED WHITE CLOVER (AG)

GRASSES 80%

AGROSTIS CAPPILARIS - COMMON BENT (AG)

CAREX FLACCA - GLAUCOUS SEDGE

CYNOSURUS CRISTATUS - CRESTED DOGSTAIL (AG)

FESTUCA RUBRA - RED FESCUE (AG)

PHLEUM BERTOLONII - SMALLER CAT'S-TAIL (AG)

WETLAND GRASS MIX (SALIX WETLAND SOLUTIONS VMAXC350 EROSION CONTROL BLANKET SEEDED WITH THE FOLLOWING MIX)

EMORSGATE MEADOW MIXTURE FOR WETLANDS EM8

WILD FLOWERS 20%

ACHILLEA MILLEFOLIUM - YARROW

BETONICA OFFICINALIS - BETONY

CENTAUREA NIGRA - COMMON KNAPWEED

DAUCUS CAROTA - WILD CARROT

FILIPENDULA ULARIA - MEADOWSWEET

GALIUM ALBUM - HEDGE BEDSTRAW

GALIUM VERUM - LADY'S BEDSTRAW

LATHYRUS PRATENSIS - MEADOW VETCHLING

LEUCANTHEMUM VULGARE - OXEYE DAISY - (MOON DAISY)

LOTUS CORNICULATUS - BIRDSFOOT TREFOIL

LOTUS PEDUNCULATUS - GREATER BIRDSFOOT TREFOIL

MEDICAGO LUPULINA - BLACK MEDICK

PLANTAGO LANCELATA - RIBWORT PLANTAIN

PRIMULA VERIS - COWSLIP

RANUNCULUS ACRIS - MEADOW BUTTERCUP

RHINANTHUS MINOR - YELLOW RATTLE

RUMEX ACETOSA - COMMON SORREL

SILAUM SILAUS - PEPPER SAXIFRAGE

SILENE FLOS-CUCULI - RAGGED ROBIN

SUCCISA PRATENSIS - DEVIL'S-BIT SCABIOUS

GRASSES 80%

AGROSTIS CAPILLARIS - COMMON BENT (W)

ALOPECURUS PRATENSIS - MEADOW FOXTAIL

ANTHOXANTHUM ODORATUM - SWEET VERNAL-GRASS (W)

BRIZA MEDIA - QUAKING GRASS (W)

CYNOSURUS CRISTATUS - CRESTED DOGSTAIL

DESCHAMPSIA CESPITOSA - TUFTED HAIR-GRASS (W)

FESTUCA RUBRA - RED FESCUE

SCHEDONORUS PRATENSIS - MEADOW FESCUE

SHADE TOLERANT GRASS

EMORSGATE TUSSOCK MIXTURE EG9

AGROSTIS CAPILLARIS - COMMON BENT

ANTHOXANTHUM ODORATUM - SWEET VERNAL-GRASS

BRACHYPODIUM SYLVATICUM - FALSE BROME

CYNOSURUS CRISTATUS - CRESTED DOGSTAIL

DESCHAMPSIA CESPITOSA - TUFTED HAIR-GRASS

FESTUCA RUBRA - RED FESCUE

POA NEMORALIS - WOOD MEADOW-GRASS

OUTLINE PLANTING SPECIFICATION

TIMINGS: ALL PLANTING IS TO BE CARRIED OUT DURING NOVEMBER-MARCH, INCLUSIVE

VEGETATION CLEARANCE: IN AREAS TO BE PLANTED, ALL GRASS AND OTHER HERBACEOUS VEGETATION SHALL BE CUT TO A HEIGHT OF BETWEEN 50mm AND 75mm AND THE ARISING'S REMOVED. PRIOR TO APPLYING HERBICIDE (IF REQUIRED AND APPROPRIATE TO USE IN AREAS OF NEW PLANTING) THE CONTRACTOR SHALL AWAIT ACTIVE VEGETATIVE RE-GROWTH SUFFICIENT FOR THE HERBICIDE TO BE AT ITS MOST EFFECTIVE.

WEED CONTROL: IF REQUIRED AND APPROPRIATE TO USE IN AREAS OF NEW PLANTING, THE CONTRACTOR SHALL APPLY A NON-RESIDUAL TRANSLOCATED HERBICIDE TO ALL AREAS TO BE PLANTED AND SEEDED BETWEEN 21 AND 25 DAYS PRIOR TO PLANTING. THE TREATMENT FOR TOTAL HERBICIDE CONTROL SHALL KILL ALL TREATED GROWTH INCLUDING THEIR ROOT SYSTEMS. THE CONTRACTOR SHALL NOT COMMENCE ANY EXCAVATION OR CULTIVATION OF THE AREAS WHERE HERBICIDE HAS BEEN APPLIED UNTIL THE VEGETATION HAS BEEN EFFECTIVELY CONTROLLED.

TOPSOIL AND CULTIVATION: EXISTING SOIL TO BE USED WHERE PRACTICABLE AND FREE OF CONTAMINATION. WHERE TOPSOIL DISTURBANCE OCCURS ON THE SOUTH BANK, GROUND TO BE TOPPED WITH 600mm OF CLEAN IMPORTED TOPSOIL AND SUBSOIL WITH ORANGE MARKER MEMBRANE TO MITIGATE AGAINST THE POTENTIALLY CONTAMINATED UNDERLYING GROUND CONDITIONS

CULTIVATE THE SOIL OF ALL AREAS PRIOR TO SEEDING. THIS SHOULD INCLUDE LOOSENING, AERATING AND BREAKING UP SOIL INTO PARTICLES 2-8mm TO DEPTHS OF 150mm. REMOVE ANY UNDESIRABLE MATERIAL BROUGHT TO SURFACE TO A DEPTH OF 100mm INCLUDING VISIBLE WEEDS, ROOTS AND LARGE STONES OR CLAY BALLS WITH ANY DIMENSION EXCEEDING 30mm. FINAL CULTIVATION PRIOR TO SEEDING TOPSOIL SHALL BE BROUGHT TO A FINE TILTH BY APPROVED MECHANICAL MEANS OR BY HAND RAKING, AND IF NECESSARY RE-GRADING OF THE SURFACE WILL BE CARRIED OUT TO CONFORM TO THE PRESCRIBED FINISHED LEVELS.

PLANT PROTECTION: ALL TREES AND SHRUBS TO BE PROTECTED AGAINST RABBIT GRAZING BY USING TUBEX SHELTERS. FOR SUGGESTED SIZES REFER TO LBMP.

TREE PLANTING:

- ALL TREES TO CONSIST OF FORESTRY TRANSPLANTS PLANTED IN PITS AT THE BASE OF THE EXISTING HEDGEROWS, WITH DEPTH AND WIDTH OF 700mm.
- THE BASE OF EACH PIT TO BE BROKEN UP TO 200mm WITH ALL TOPSOIL THOROUGHLY BROKEN UP FROM THE CAREFULLY EXCAVATED MATERIAL, AND ANY SOIL ADDITIVES AND/OR AMELIORANTS ADDED IN ACCORDANCE WITH BEST PRACTICE, PRIOR TO BACKFILLING.
- TREES SHALL BE SECURED IN POSITION USING ROUND TIMBER STAKES (TOP DIAMETER OF 50-75mm), PEELED OF BARK, STRAIGHT IN LENGTH AND FREE OF SNAGS, PESTS AND DISEASES;WITH ADJUSTABLE 25mm TREE TIES, MADE OF BLACK PVC OR REINFORCED RUBBER
- STAKES FOR ALL TREES SHALL BE FIRMLY DRIVEN AND POSITIONED INTO THE TREE PLANTING PIT BEFORE PLANTING TO A MINIMUM DEPTH OF 300MM BELOW THE BOTTOM OF THE PIT.
- THE STAKE SHALL BE POSITIONED OFF CENTRE ON THE PREVAILING WINDWARD SIDE OF THE TREE AS NEAR TO THE TREE AS POSSIBLE BUT SHALL NOT INTERFERE WITH THE FREE MOVEMENT OF THE BRANCHES AND SHALL CAUSE NO RUBBING.

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- EA PLAN

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P02	COMMENTS INCORPORATED	GCP	JWS	2023.10.20
P01	FIRST ISSUE	GCP	JWS	2023.10.13
Issued/ Revision		By	Appd	YYYY.MM.DD

	GCP	JJ	JWS	2023.10.13
	Dwn.	Dsgn.	Chkd.	YYYY.MM.DD

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OXFORD CITY COUNCIL

OXPENS RIVER BRIDGE AND CONNECTING PATHS

Title

SOFT LANDSCAPE DESIGN NOTES AN SPEC IFIC ATI0 N

Project No. 332610335

Scale

Revision P02

Drawing No. OXPEN-STN-GEN-ALL-DR-L-3004

Appendix B Watercourse BNG Assessment

OXPENS BRIDGE, OXFORD
Water Course Biodiversity Net Gain Assessment

18 Octoberr 2023

Prepared for: Oxford City Council

Prepared by: Stantec UK Ltd

Project Number: 332610335

Revision	Description	Author	Date	Quality Check	Date	Independent Review	Date
Rev 1	Final report	RO	23/09/2022	JR	23/09/2022		
Rev 2	Updated for Metric 4.0	RO	18/10/2023	JG	18/10/2023		

The conclusions in the Report titled Oxpens Bridge Water Course BNG Assessment are Stantec's professional opinion, as of the time of the Report, and concerning the scope described in the Report. The opinions in the document are based on conditions and information existing at the time the scope of work was conducted and do not take into account any subsequent changes. The Report relates solely to the specific project for which Stantec was retained and the stated purpose for which the Report was prepared. The Report is not to be used or relied on for any variation or extension of the project, or for any other project or purpose, and any unauthorized use or reliance is at the recipient's own risk.

Stantec has assumed all information received from Oxford City Council (the "Client") and third parties in the preparation of the Report to be correct. While Stantec has exercised a customary level of judgment or due diligence in the use of such information, Stantec assumes no responsibility for the consequences of any error or omission contained therein.

This Report is intended solely for use by the Client in accordance with Stantec's contract with the Client. While the Report may be provided to applicable authorities having jurisdiction and others for whom the Client is responsible, Stantec does not warrant the services to any third party. The report may not be relied upon by any other party without the express written consent of Stantec, which may be withheld at Stantec's discretion.

Prepared by:

Reviewed by:

Approved by:

[redacted]

Printed Name

Table of Contents

LIST OF APPENDICES

1 Introduction

1.1 Project description

In March 2020 Oxford City Council (OCC) confirmed it would accept Growth Deal Funding from Oxfordshire County Council to deliver a bridge, for use by pedestrians and cyclists, over the River Thames between Oxpens and Grandpont Nature Park, connecting through to Osney Mead and a footpath cycle path link from the northern end of the bridge to Oxpens Road or Osney Lane.

The proposed bridge will include connections at each end, to two sites within the West End development area. The proposed Bridge is to be sited between Grandpont Nature Park, south of the river, and Oxpens development site, north of the river.

The bridge is to be designed as a dry route in times of flood (a continuous pedestrian route that would remain dry during a 1 in 100 annual probability plus climate change flood event).

The bridge will require construction access from the south via Grandpont, Osney Mead in the west and via the Oxpens development site and floodplain in the north. Construction will consist of localised tree clearance, excavation for small reinforced concrete piled bridge foundations and potential flood defence walls to protect the new path works route. The new Oxpens River Bridge and it's approach ramps will be fabricated off-site and installed via a crane.

The design and proposed construction methodology will aim to limit temporary impact on the local environment around the work locations.

The design will need to complement the Proposed Development at Oxpens, to which the bridge will connect. Although to be delivered by the City Council, the bridge is to be owned, adopted and maintained by Oxfordshire County Council, as the highway authority, and the design will therefore need to ensure the works meet requirements for adoption and therefore all details will need to be agreed with the County Council.

1.2 Site Location

The Site is located in The West End of Oxford, within the administrative area of OCC.

The Site (approximately 2.2 ha) is approximately 700m south-west of Oxford City Centre located between Grandpont Nature Park and the Oxpens development site (centred at National Grid Reference (NGR): SP509054). The site of the proposed footbridge is east of the existing Great Western railway line.

Grandpont Nature Park, south of the river, is owned by OCC and is a public open space that has been formed on the site of the former gas works. On the north side, the bridge will land on the Oxpens development site, being brought forward by Oxford West End Development Limited (OxWED), a joint venture between Oxford City Council and Nuffield College. The plans for the OxWED development are seeking to create a new open space adjacent to the river where the bridge will land.

Residential receptors located nearby include Gibbs Crescent, approximately 280m north of the Site, students living in Student Castle approximately 320m to the north, and residents on Trinity Street and Dale Close, approximately 200m east.

Access to the Site is via The Thames Path, which is already a well-used route for walkers and cyclists for both commuting and leisure users. Access to the bridge will connect to and through the Oxpens

development to provide convenient and direct links to the city centre (approximately 450m north-east of the Site) and the railway station (approximately 750m north of the Site).

The proposed bridge lies in Flood Zone 3, which is land assessed as having a greater than 1% annual probability of river or sea flooding, as does an extensive floodplain on the south-western side of the structure. On the downstream (east) side, the southern bank of the Thames lies in Flood Zone 1, while on the north side the Oxpens site is partly in Flood Zones 3 and 2 closest to the watercourse before rising into Flood Zone 1 to the north.

The River Thames within the red-line boundary of the development is approximately 290 m in length.

1.3 Report purpose

Stantec UK Ltd. (Stantec) was asked to produce a River Type and Condition Assessment in support of Biodiversity Net Gain for the Proposed Development. The assessment included a walkover of the River Thames. The results of this survey will support the wider Biodiversity Net Gain (BNG) requirements for the Proposed Development.

This report sets out negative influences on river type and river condition, it also identifies possible options to improve the river condition through the Proposed Development to achieve 5% BNG.

2 Methodology

2.1 Data collection

2.1.1 MODULAR RIVER SURVEY (MOPRH)

The Modular River Physical or MoRPh survey is the foundation level survey within a scaled hydromorphological assessment method known as the Modular River Survey that combines information gathered from three river units of different size (module, sub-reach, reach) based upon both primary field survey and secondary sources, e.g. remotely-sensed and map data.

Module (MoRPh) and sub-reach (MultiMoRPh between 5 and 10 concurrent modular surveys) surveys are conducted in the field using the MoRPh survey method[1], focusing on a single river channel and its immediate margins (banks and land area within 10 m of the bank edges).

As shown in Table 2-1. the length of each module and subsequently MoRPh5 survey length is determined by the river width. Modules, as part of a MoRPh5 survey are surveyed from upstream to downstream.

MoRPh field surveys should normally be conducted at low flow and preferably during Spring or early Summer to capture information on both vegetation and physical properties of the river and its margins.

Surveys were completed for River Thames within the red line boundary of the Proposed Development. MoRPh surveys were undertaken on 25th Febraury 2022.

Table 2-1 Length of module and MoRPh5 survey based on river width

MoRPh river width (m)	River length for each module survey (m)	River length for each MoRPh5 survey (m)
< 5	10	50
5 to < 10	20	100
10 to < 20	30	150
20 to < 30	40	200
≥ 30 or where bed not visible	50	250

The results of each module are averaged over the five modules that form a MoRPh5 survey, features are

[1] The MoRPh Survey. Technical Reference Manual 2020 version. Modular River Survey. Queen Mary university of London.

then assigned a score based on negative or positive indicators. The combination of field and desk study data enables a final condition score for the waterbody within the development area, based on 32-condition, positive or negative indicators that are automatically extracted from MoRPh5 field surveys plus river type information.

Positive indicators score 0 to +4 and reflect 'natural' elements, negative indicators score from 0 to -4 and reflect human pressures and interventions.

The river condition assessment provides a preliminary score. To determine a final score for the river a river type assessment is combined with the river condition preliminary score. The river type assessment is a desk-based assessment of river form and function combined with MoRPh field survey data on channel bed material and bedrock type.

Rivers are assigned a condition score based on the physical features described above and these align with the likely best and worst preliminary conditions scores to define the final condition score, as shown in Table 2-2

Table 2-2 Likely best and worst preliminary condition scores for navigable rivers

River type	**Preliminary condition score (Navigable River)**
Likely best average condition score	1.8
Lower threshold for GOOD status	>1.4
Lower threshold for FAIRLY GOOD status	>0.7
Lower threshold for MODERATE status	>-0.1
Lower threshold for FAIRLY POOR status	>-1.2
Likely worst average condition scores	>-2.5

2.1.2 BIODIVERSITY METRIC 4.0

The Natural England Biodiversity Metric 4.0 (the Metric) Calculation Tool was used to calculate the predicted change in Total Watercourse Units (TWU) between the baseline and post-development scenarios.

For the rivers and streams component of the Metric, there are several elements used to quantify baseline biodiversity value and ultimately calculate the number of TWUs. The equations used to calculate TWU are provided in the Biodiversity Metric 4.0 User Guide[2].

TWUs are linear units and cannot be summed together with the area units calculated for terrestrial habitats. A net gain in TWUs would not automatically correlate to an overall net gain for the Proposed Development as there may be a net loss in terrestrial biodiversity units. Therefore, each of the different module components of the metric need to be considered in parallel but calculated and listed separately. This assessment only focusses on the rivers and streams component of the metric.

To determine the baseline TWUs, four key components are assessed and inputted to the Natural England Biodiversity Metric 4.0 Calculation Tool (along with length of river / stream within the site). These are:

- River distinctiveness;
- Strategic significance;
- River condition; and
- Watercourse and riparian encroachment.

The distinctiveness score is based on the type of habitat present, and its value based on its rarity. In the rivers and streams module of the metric, rivers can be classed as 'very high' in the case of priority river habitat or 'high' for other rivers and streams. Ditches and canals are assigned a distinctiveness score of 'medium', whilst culverts are assigned a distinctiveness score of 'low'. These distinctiveness scores result in different weightings used to calculate TWUs. A higher distinctiveness will contribute to a higher TWU baseline.

Strategic significance is dependent on whether the watercourse has identified actions within River Basin Management Plans, Catchment Plans and Local Plans. Further details on the methods for determining river distinctiveness and strategic significance are detailed in the Metric guidance.

The determination of the river condition has two elements:

- MoRPh survey (field survey) conducted on 25th February 2022;
- MoRPh River Type assessment (desk study) conducted on the 28th February 2022.

The MoRPh survey method records features from bank top (floodplain), bank face (including channel margins) and channel bed. MoRPh survey length is scaled according to river width and in total at least 20% of the total river length within the project site should be surveyed to represent overall river condition. When more than one MoRPh survey is required, one survey must capture the most physically degraded part of the river within the project site.

The river condition assessment also includes a desk-based element in which MoRPh River Type is identified taking into account artificial modifications and functions (e.g. if a river is navigable) and for

[2] Natural England Biodiversity Metric 4.0 User Guide: https://publications.naturalengland.org.uk/file/6188841413902336

non-navigable or artificial watercourses, valley gradient, anabranching, braiding and sinuosity indices, valley length and channel bed material as detailed in the River Condition Assessment guidance. Five condition classes are available for rivers and streams (poor, fairly poor, moderate, fairly good and good). As for distinctiveness and strategic significance, different condition classes are assigned different weightings within the Calculation Tool. A higher condition class will contribute to a higher TWU baseline. Culverts are automatically assigned a condition class of 'poor', whilst the condition of open watercourse habitat is assessed through the MoRPh survey and associated desk study as outlined above.

Where the condition of a river varies across the site, each distinct section of the river is added to the Calculation Tool as a separate row to ensure accurate assessment of TWUs.

2.1.3 POST DEVELOPMENT RIVER HABIAT

2.1.3.1 Habitat creation and river enhancement scenarios

Approximately 290m of the River Thames channel occurs within the red line boundary of the Proposed Development. The River MoRPh survey coverage of 200m represented 69% of the total river sub-reach within the project site location.

Given the length of the River Thames within the site, there are potential opportunities to enhance the watercourse as part of the Proposed Development. An initial assessment of the Proposed Development without river enhancements is considered in this report, followed by an exploration of potential opportunities to enhance the River Thames and its corridor (up to 10m from the river bank top) to improve biodiversity and obtain biodiversity net gain.

Exploration of potential enhancements was undertaken by manipulating the river condition indicator values calculated from the MoRPh survey results to reflect the changes expected if a series of enhancement measures were to be applied (see **Appendix B**).

The enhancement measures suggested were determined with reference to MoRPh field survey observations and results. Along with a comparison of present and potential fish habitat, as noted in section 2.1.4. The list of measures put forward are deemed to be appropriate for the watercourse typology and for targeting improvements in condition by focussing on restoring channel and bankside features which are currently limiting the watercourse's biodiversity potential.

Two enhancement scenarios were considered. The first scenario looked at the potential for addressing the key influences of negative condition contributions. The second scenario looked to increase naturally occurring features to improve overall condition status.

2.1.4 FISH HABITAT ASSESSMENT

As well as obtaining information to support the BNG requirements for the Proposed Scheme fish habitat data was recorded for the surveyed sub-reaches. The purpose of capturing this data was to enable suitable enhancement options to be considered, based on the presence or absence of fish habitat.

2.1.4.1 Fish habitat survey

A walkover was undertaken on 25th February 2022 to determine the structure and type of fish habitat present along the River Thames, from SP50700562 to SP50860562, within the area of the Proposed Development.

The features observed during the walkover survey are provided in Table 2-3

Table 2-3 Fish habitat and flow descriptions

Fish habitat feature	Description	
Flow	Run	Rippled: no waves, disturbed rippled surface
	Glide	Smooth boundary, turbulent flow: perceptible smooth downstream movement, low roughness
	Pool	Scarcely perceptible flow, full channel width: no net downstream flow
	Riffle	Unbroken standing waves: undular standing upstream facing waves
	Deadwater	Scarcely perceptible flow, not full channel width: associated channel margins
Habitat	Overhanging cover	Mostly overhanging trees/shrubs although bridges etc., < 100 cm above water surface. Important cover for fish but also limits vegetation growth.
	Shallow margins	Marginal areas of the river (bankside habitat), mostly slow flow and shallow. Often amongst vegetation/structure. Shallow margins are important for juvenile fish, providing warmer water and refuge from predation
	Backwater features	An area of water out of the main current characterised by still/low flowing water. Often an isolated marginal area or a bank recess. These areas of water remain low flowing during flood events and provide refuge for juvenile fish.
	Submerged macrophytes	Aquatic plants wholly below the water surface. Submerged vegetation provides refuge and spawning habitat for fish

Emergent macrophytes	Aquatic plants with parts that emerge above the water surface. These offer cover for fish, amongst the submerged parts and habitat for egg laying.
Undercut banks	Erosion of bankside creating a recess below the surface of the bank, often associated with tree roots
Weirs	Either a formal engineered or an informal barrier across width of stream. These structures may limit upstream and downstream fish movements and isolate fish populations
Gravel	Areas of the channel bed dominated by gravel. In-channel gravel features may provide spawning habitat for salmonids and some coarse fish species.
Silt	Areas of the channel bed dominated by silt. This may limit habitat structure is silt covers large areas of the channel bed however may also provide suitable juvenile habitat for lamprey species.
Large woody debris	Large woody debris, often trees complete with branches, in river/margin. These add habitat complexity to the river channel, varying flow dynamics and providing cover and foraging for fish.

3 Results

3.1 Baseline River Habitats

MoRPh and fish habitat surveys were conducted in one reach along the River Thames within the site boundary (as shown in Appendix A). The survey location was selected to be representative of the River Thames within the Proposed Development areas.

The overall condition scores and condition classes are presented in Table 3-1.

Positive and negative river condition values for each sub-reach are provided in Appendix D.

Table 3-1 River assessment outcomes

Sub-Reach name	Condition score	River Type	Final Condition
Oxpen Bridge	-0.008	Navigable	Fairly Poor

3.1.1 RIVER HABITAT

The river thalweg is in the centre of the river channel, this is the main navigational route and the deepest point of the river, 3-4m. However, there remains continuous flow across the entire width of the river channel, which varies in width from 21m to 30m. The river profile is influenced by bank protection along the entire right-hand bank (RHB) within the survey reach, largely trapezoidal, with a natural bank on the left-hand bank (LHB), the RHB height was 1-2m and the LHB had a composite slope, as shown indicatively in Figure 1.

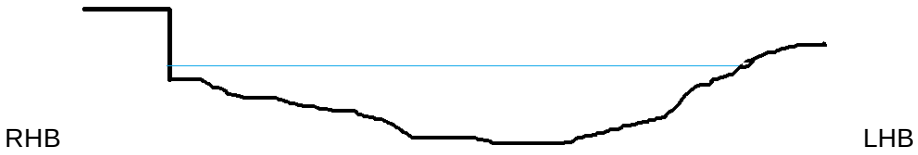

Figure 1 – indicative river profile cross-section

The river thalweg follows the navigable route of the river until the meander where the deepest channel is on the outside of the meander. The channel bed material, in the centre is typically gravel dominated and the channel margins are dominated with finer bed material, such as silt. The inside of the meander bends holds suitable juvenile habitat for lamprey spp.

No macrophytes were observed during the survey.

Upstream of Osney Rail Bridge the Bulstake Stream joins the River Thames at NGR SP50670560. The Castle Mill Stream joins the River Thames, downstream of the survey reach at NGR SP50930554. Both streams offer suitable spawning habitat for salmonids and lamprey species.

Fish species

The Environment Agency (EA) have three fish monitoring locations, surveyed since 2015, within 2km of the Oxpens Bridge location:

> Site ID 71283 Canal confluence to marina (OS Grid ref SP4998907079) – 1km upstream of Osney Bridge on the main River Thames; and
>
> Site ID 13027 Bulstake Stream - Bolney Park (OS Grid Ref: SP5002106510) – 650m upstream of Osney Bridge, a backwater from the River Thames.
>
> Site ID 13112 Bulstake Stream – Fishing News Books (OS Grid Ref: SP5059605572) – 500m upstream of railway bridge on River Thames.

Fish records for these sites indicate the presence of common fish species including bleak *Alburnus alburnus*, chub *Leuciscus cephalus,* common bream *Abramis brama*, dace *Leuciscus leuciscus*, gudgeon *Gobio gobio*, perch *Perca fluviatilis*, pike *Esox Lucius* and roach *Rutilus rutilus*. These species typically spawn between March and July, over gravel and areas of submerged vegetation.

There was a single adult brown/ sea trout *Salmo trutta* recorded within the Bulstake Stream (Site ID 13027). Brown trout are migratory fish that spawn in gravel dominated rivers between November and January. Upstream migration to suitable spawning habitat occurs from September through to November.

EA fish monitoring records prior to 2015 show numbers of brook lamprey *Lampetra planeri* within the Bulstake Stream. Brook lamprey spawn in shallow gravel or small stone dominated riverbeds, once eggs hatch the larvae drift downstream to areas of fine sediment where they burrow and remain, until sexually mature.

MoRPh Survey

The MoRPh survey identified the River Thames as a navigable river type characterised by a deep central channel, heavily modified bank protection and modified riparian habitat on the RHB. The LHB riparian habitat was natural, with trees present within marginal features and at the top of bank. This sub-reach has a river condition class of ‘Fairly Poor’. The key influence in this section is the shading from the rail bridge spanning the river and artificial bank protection (E10 -2) present on the RHB throughout the project site, a lack of margin habitat complexity and a lack of riparian habitat diversity.

3.2 Baseline Watercourse BNG 4.0 Metric units

The Biodiversity Metric 4.0 was run according to the guidance from Natural England. The length, distinctiveness, condition and strategic significance of the on-site river habitat were inputted to the Calculation Tool. No off-site reaches have been assessed as part of this iteration of the Biodiversity Net Gain assessment. The Calculation Tool returned the number of TWUs for the River Thames within the site boundary. The total number of TWU on-site was 2.98. The pre-development baseline units are presented in Table 3-2.

Table 3-2 Baseline river units

Watercourse/structure	Length (within site boundary) (km)	Distinctiveness	Condition	Strategic significance	TWU	Watercourse encroachment	Riparian encroachment
EC6	0.288	High	Fairly Poor	Within River Basin Management Plan	2.98	No encroachment	No encroachment

3.3 Post development potential

3.3.1 OPPORTUNITIES FOR RIVER CHANNEL AND RIVER CORRIDOR ENHANCEMENT

Opportunities have been assessed by reviewing the indicator scores calculated from the MoRPh surveys, as well as having consideration for what measures are appropriate for the watercourse typology as observed on site. The indicator scores from each MoRPh survey were reviewed in turn and changes to these scores were applied with regards to the expected response to each enhancement opportunity listed in Table 3-3.

The opportunity for improvements to River Thames are limited by factors, such as channel size, water level and channel energy (e.g. flow velocity) and development footprint however there is space to achieve betterment in the river corridor. The approach has been to look at improvements that contribute to a positive (positive indicators) or neutral condition indicator (negative indicators) score thereby ensuring enhancement measures suggested target features which are currently not reaching their condition potential, as well as working with existing or potential measures that may improve the fish habitat within the sub-reaches. Improvement for positive indicators were capped at +1 for each enhancement measure to provide a conservative post development value. To complete this exercise, such opportunities are presented in Table 3-3. Baseline and post intervention indicator scores are presented in Appendix B.

A desk-based exercise was undertaken to develop different scenarios of enhancements, described further in Appendix C, directly focusing on strong negative or low positive scoring features, such as lack of marginal vegetation structure and improved nature of riparian zone. Each enhancement opportunity, as listed in Table 3-3, was introduced to determine how the measures improved the baseline river condition score.

Table 3-3 Enhancement opportunities for the River Thames within the site boundary

Enhancement type	Relevant to condition indicators	Potential score increase	Conservative score increase	Years to achieve enhancement
Naturalise bank top ground cover	B5	1	1	1
Marginal planting	D1 and D2	1	1	1

For the habitat improvements to achieve a minimum of 5% net gain the sub-reach would need to be improved to **Moderate** condition.

A breakdown of each scenario and the adjustment of river condition score is presented in Appendix C.

A combination of both enhancement types has the potential to increase the sub reach to Moderate condition, enhancing a total of 50m of river habitat would achieve 20.97% BNG.

There is no proposed loss of watercourse habitat through the development, however there may be a requirement for footpaths to cross the river channel in places. These minor river crossings were not accounted for in the enhancement scenarios as they would not likely lead to a deterioration in natural or enhanced features, based on the size and extent of the designs or account for encroachment.

4 Conclusions

The Natural England Biodiversity Metric 4.0 has been applied to the site for the River Thames, based on the design information available at the time of this report. There is a total of 2.98 baseline TWU within the site comprised of 0.290km of open watercourse. There is no proposed loss of watercourse habitat through the development, however there is a footpath crossing the river channel. The river crossing has not be accounted for in the enhancement scenarios as they would not likely lead to a deterioration in natural or enhanced features, based on the size and extent of the designs.

A minimum of 5% BNG is achievable within the site boundary through the landscaping plans to enhance the riparian ground cover and increase the marginal habitat complexity.

Appendix A Site location