



# BS 5837:2012 Arboricultural Survey

**Cardiff East Park and Ride**

Presented to **Curtis Hall Ltd**

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Delta-Simons Project No. 20-981.08



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## Report Details

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<b>Report Title</b>	BS 5837:2012 Arboricultural Survey
<b>Site Address</b>	Cardiff East Park and Ride
<b>Project No.</b>	20-0981.08
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## Quality Assurance

Issue No.	Status	Issue Date	Comments	Author	Technical Review	Authorised
1	Draft	18 <sup>th</sup> August 2021	Updated following additional survey	Pete Morrell Principal Arboriculturist	Charlotte Sanderson-Lewis Associate and Ecology Team Leader	Charlotte Sanderson-Lewis Associate and Ecology Team Leader

## About us

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## Executive Summary

<p><b>Purpose</b></p>	<p>Delta-Simons Environmental Consultants Ltd was instructed by Curtis Hall Ltd ('the Client'), to undertake a Tree Survey to BS 5837:2012 standard of an area of land situated off Eastern Avenue, west of Llanrumney in Cardiff, in Wales ('the Site'). The original survey was undertaken on 26<sup>th</sup> January 2021 with a further survey to include areas to the south and west was undertaken on 22<sup>nd</sup> July 2021. The surveys were undertaken to inform a planning application for the Site.</p>
<p><b>Current Site Status</b></p>	<p>The Site comprises an expanse of broadleaved semi-natural woodland with large areas of dense scrub and bracken and several footpaths running through. In the central section of the Site was a hardstanding car park used as a Park and Ride, with scattered scrub, and a security building. An area of bare ground was to the east of the car park. Poor semi-improved grassland was present in the eastern and northern areas of the Site. A small area of seasonal standing water and a drain were present on-Site during the survey in January 2021, however in April, and again in July 2021 they were both noted be dry.</p>
<p><b>Proposed Development</b></p>	<p>It is understood that the proposed development will comprise a warehouse distribution centre and van storage and associated hardstanding in the southern extent, whilst a new park and ride facility will be created in the northern extent of the Site.</p>
<p><b>Results</b></p>	<p>A total of 12 trees, 22 tree groups and 15 woodland groups were identified and assessed as part of the Tree Survey. The results of the desk search undertaken on Cardiff City Council Website on 26/01/2021 indicates that Woodland Group 7 is covered by a Tree Preservation Order (TPO). A search on the Natural Resource Wales (NRW) website also indicated that this area is designated as Semi-Natural Ancient Woodland covering 0.75 ha. Woodland Groups 2, 3, 14 and 15, located adjacent to the river were also covered by a TPO. No further trees were covered by a TPO, and the Site did not lie within a Conservation Area (CA).</p>
<p><b>Recommendations</b></p>	<p><u>Recommendation 1 (Adequate Tree Protection)</u></p> <p>Those trees identified within the proposed development plan for retention will need to be adequately protected during any construction works. Measures to protect trees should follow the best practice principles set out in BS 5837: Trees in Relation to Design, Development and Construction (2012).</p> <p>Prior to any construction or development work proceeding, the Root Protection Area (RPA) of individual trees to be retained should be marked out. Marking out should be completed by a competent person with arboricultural expertise. All trees that could be impacted should be protected by barriers or ground protection around the calculated RPA, and as indicated on the Tree Constraints Plan (TCP) produced in association with this Assessment.</p>
<p><b>This Tree Survey Executive Summary is intended as a summary of the assessment of the Site based on information received by Delta-Simons at the time of production. This Executive Summary should be read in conjunction with the full Report.</b></p>	

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## 1.0 Introduction

### 1.1 Purpose and Scope of the Survey

Delta-Simons Environmental Consultants Ltd was instructed by Curtis Hall Ltd (the 'Client') to undertake an Arboricultural Survey to BS 5837:2012 standard. The survey was undertaken of land off Eastern Avenue, west of Llanrumney in Cardiff, Wales (hereafter referred to as 'the Site'). The survey was undertaken on 26<sup>th</sup> January 2021, with a further survey to include areas to the south and west undertaken on 22<sup>nd</sup> July 2021. The Site location and the area surveyed are shown in Figure 1. The survey was undertaken to inform a planning application for the Site.

The aims of the Tree Survey were to:

- ▲ Identify the individual tree species present at the Site by means of visual inspection;
- ▲ To define the approximate age, condition and canopy spread of all individual mature trees identified and the value of these within the development;
- ▲ To identify any trees that present a risk to existing or proposed foundations or other structures that may be constructed on the Site and recommend actions to remove this risk; and
- ▲ Recommend tree management or mitigation measures where appropriate.

### 1.2 Site Description

The Site is centred at Ordnance Survey (OS) grid reference ST2130680951, to the west of Llanrumney in Cardiff, Wales. The Site covers an area of 18 hectares (ha) and comprises an expanse of broadleaved semi-natural woodland with large areas of dense scrub and bracken and several footpaths running through. In the central extent of the Site was a hardstanding car park used as a park and ride, with scattered scrub, and a security building. An area of bare ground was to the east of the car park. Poor semi-improved grassland was present in the eastern, southern and northern areas of the Site. A small area of seasonal standing water and a drain were present at the Site during the survey in January 2021, however in April 2021 they were noted be dry.

The Site lies with a green corridor between the main city of Cardiff and the eastern district of Trowbridge. An unnamed road lies to the south of the Site and the busy A48 lies to the west of the Site. North of the Site lies a continuation of the on-Site woodland with footpaths adjacent to the A48, whilst to the east lay the River Rhymney corridor, which is designated as a Site of Importance for Nature Conservation (SINC).

The Site layout is shown in Figures 2a - d.

### 1.3 Proposed Development

It is understood that the proposed development will comprise a warehouse distribution centre and van storage and associated hardstanding in the southern extent, whilst a new park and ride facility will be created in the northern extent of the Site.



## 2.0 Legislation

### 2.1 Trees

Local planning authorities look upon trees as being highly beneficial to the locality. To ensure that any important specimens, or significant groups of trees are retained, they may place Tree Preservation Orders (TPOs) on them. In other situations, villages or whole districts may be classified as conservation areas. In these instances certain trees in the designated area will be protected. When trees are protected, legal procedures must be followed before any work is carried out.

When trees are protected by Preservation Orders, no work should be carried out on them without prior written consent from the Local Planning Authority (LPA). Once an application is made, the Authority personnel must inspect the trees, and make a decision within a statutory eight-week period as to whether work can go ahead. If no decision is made within the eight weeks period, the appellant can appeal to the Office of the Deputy Prime Minister for non-determination. If the Local Authority (LA) refuses the application the appellant still has the right to appeal.

If a tree protected by a Preservation Order is either killed or wilfully destroyed, the owners of the tree, and the contractor who did the work, can both be prosecuted. The fines for killing or wilfully destroying a tree can be high, i.e. the current maximum is £20,000 per tree, and there is an automatic requirement to re-plant. The current maximum for minor unlawful infringements, such as pruning, is £2,500.

Trees which are dead, dying, or dangerous are exempt from the legislation, although if such trees are removed, the onus on proving they fell into one of these categories lies with the tree owner. Whenever possible it is strongly recommended that the LA be given at least five days' notice before any work on such trees is carried out.

Trees in a conservation area that are already protected by a TPO are subject to the normal procedures and controls for any tree covered by such an Order.

Trees in a conservation area that are not protected by a TPO are protected by the provision in Section 211 of The Town and Country Planning Act (1990). These provisions require people to notify the LPA, using a 'section 211 notice', six weeks before carrying out certain works on such trees, unless an exception applies. The works may go ahead before the end of the six-week period if the LPA gives consent. This notice period gives the Authority an opportunity to consider whether to make an Order on the tree.

## 3.0 Methodology

The methodology set out below is a detailed summary of the suggested approach to tree assessment as described in British Standard 5837:2012. This Report has applied the methodology to all significant individual trees or groups of trees present at or near to the Site. Trees below 15 cm trunk diameter were generally excluded from the survey. All floral names follow the nomenclature of Stace (2010).

### 3.1 Trees

Trees have been broadly assessed based on guidance set out within the British Standard BS 5837:2012 Trees in Relation to Design, Development and Construction. This standard provides recommendations and guidance on the principles to be applied to achieve successful integration of development with trees, shrubs and hedgerows. Where development is to occur, the standard provides guidance on the approach needed to decide which trees are appropriate for retention, and the means for protecting these trees during the development (including demolition and construction works) and the means of incorporating trees into the developed landscape.

Trees on or adjacent to the Site have been divided into one of four categories (based on the cascade chart for tree quality assessment). These are classed as A, B, C or U (Section 4 of BS 5837) within Table 1. This gives an indication as to the tree's importance in relation to the Site, the local landscape and, also, the value and quality of the existing trees on-Site. This assists informal decisions concerning which trees should be removed or retained should development occur. For a tree to qualify under any given category it should fall within the scope of that category's definition (see below).

Categories A, B and C cover trees that should be a material consideration in the development process, each with three further sub-categories (i, ii, iii) which are intended to reflect arboricultural, landscape and cultural (nature conservation) values. Category U trees may have no significant landscape value but it is not presumed that there is any overriding need to remove these unless stated otherwise in the description and recommendations. They are for this reason not considered as being significant within the planning process. In assigning trees to the A, B or C categories, the presence of any serious disease or tree-related hazard is taken into account. If the disease is considered fatal and/or irremediable, or likely to require sanitation for the protection of other trees it may be categorised as U with a recommendation for work or even removal, even if they are otherwise of considerable value.

**Category (A):** Trees whose retention is most desirable and are of high quality and value. These trees are considered to be in such a condition as to be able to make a lasting contribution (a minimum of 40 years) and may comprise:

- ▲ Trees which are particularly good examples of their species, especially rare or unusual, or essential components of groups or of formal or semi-formal arboricultural features (e.g. the dominant and/or principal trees within an avenue);
- ▲ Trees, or groups of trees, which provide a definite screening or softening effect to the locality in relation to views into or out of the Site, or those of particular visual importance (e.g. avenues or other arboricultural features assessed as groups); and
- ▲ Trees or groups of significant conservation, historical, commemorative or other value (e.g. Veteran or wood-pasture trees).

**Category (B):** Trees whose retention is considered desirable and are of moderate quality and value. These trees are considered to be in such a condition as to make a significant contribution (a minimum of 20 years) and may comprise:

- ▲ Trees that might be included in the high category but because of their numbers or slightly impaired condition (e.g. presence of remediable defects including unsympathetic past management and minor storm damage), are downgraded in favour of the best individuals;
- ▲ Trees present in numbers such that they form distinct landscape features and attract a higher collective rating than they would as individuals. Individually these trees are not essential components of formal or semi-formal arboricultural features, or trees situated mainly internally to the Site and have little visual impact beyond the Site; and

- ▲ Trees with clearly identifiable conservation or other cultural benefits.

**Category (C):** Trees that could be retained but are considered to be of low quality and value. These trees are in an adequate condition to remain until new planting could be established (a minimum of ten years) or are young trees with a stem diameter below 150 mm and may comprise:

- ▲ Trees not qualifying in higher categories;
- ▲ Trees present in groups or woodlands, but without this conferring on them significantly greater landscape value and or trees offering low or only temporary screening benefit; and
- ▲ Trees with very limited conservation or other cultural benefits.

**Category (U):** Trees that are considered to have no significant landscape value but it is not presumed that there is any overriding need to remove these unless stated otherwise in the description and recommendations. They are for this reason not considered as being significant within the planning process. These trees will be in such a condition that any existing value would be lost within 10 years and which should in the current context be ignored or removed for reasons of sound arboricultural management. Trees within this category are:

- ▲ Trees that have a serious irremediable structural defect, such that their early loss is expected due to collapse, including those that will become unviable after removal of other category U trees;
- ▲ Trees that are dead or are showing signs of significant, immediate or irreversible overall decline; and
- ▲ Trees infected with pathogens of significance to the health and or/safety of other trees nearby, or very low quality trees suppressing adjacent trees of better quality.

Species have been recorded by common and scientific name. Height has been estimated in metres and stem diameter measured in centimetres unless impractical, taken at a height of 1.5 m from the base of the tree.

In the assessment particular consideration has been given to:

- ▲ The health, vigour and condition of each tree;
- ▲ The presence of any structural defects in each tree and its life expectancy;
- ▲ The size and form of each tree and its suitability within the context of the proposed scheme; and
- ▲ The location of each tree relative to existing Site features, e.g. its value as a screen or as a skyline feature.

Age class is assessed according to the age class categories referred to in BS 5837.

- ▲ Y: Young trees age less than 1/3 life expectancy;
- ▲ SM: Middle age trees 1/3 – 2/3 life expectancy;
- ▲ M: Mature trees over 2/3 life expectancy; and
- ▲ OM: Over mature – declining or moribund trees of low vigour.

The overall condition of any individual tree, or group of trees, has been referred to using one of the definitions listed below. A more detailed description of condition has been noted in the Tree Schedule:

- ▲ G **Good:** A sound tree or trees needing little, if any, attention;
- ▲ F **Fair:** A tree or trees with minor but rectifiable defects or in the early stages of stress, from which it may recover;
- ▲ P **Poor:** A tree or trees with major structural and physiological defects or stressed such that it would be very expensive and inappropriate to retain; and
- ▲ D **Dead:** A tree or trees no longer alive. However, this could also apply to those trees that are dying and will be unlikely to recover, or are becoming or have become dangerous.

Major defects or diseases and relevant observations have also been recorded. Dead wood has been defined as the following:



Twigs and small branch material	-	Up to 5 cm in diameter.
Minor dead wood	-	5 cm to 10 cm in diameter.
Major dead wood	-	10 cm in diameter and above.

The survey was completed from ground level only. Aerial inspections were not undertaken. Evaluations of tree conditions given within this assessment apply to the date of survey and cannot be assumed to remain unchanged, and it may be necessary to review these within 24 months, in accordance with good arboricultural practice.

### 3.2 Tree Plans and Tree Schedules

The extent and positions of significant individual trees or groups of trees close to the Site are shown on the Arboricultural Survey Plan (Figure 2a and 2b). The Root Protection Areas (RPA) of the key trees of value identified for, or recommended for, retention have been marked within the Constraints Plan (Figure 3a and 3b) using the RPAs provided in the Tree Schedule within Table 1.

A summary that includes the trees identified on or near to the Site is included in the Tree Assessment Report detailing information on each group of trees. This is also provided in Table 1. Within the summary table maximum RPAs (m<sup>2</sup>) for estimated tree diameters have been included where appropriate, as well as a calculated corresponding radius of the circle for that RPA. The RPAs are formulated as described below and assist when designing layouts in relation to trees.

### 3.3 Root Protection Area

Below ground constraints to development are represented by the root plate around a tree, which needs protecting in order for the tree to be incorporated into a proposed scheme without adverse harm to the tree or structural integrity of any proposed foundation structures.

This area is illustrated by the RPA and is calculated according to the formula set out in BS 5837:(2012). This area is equivalent to a circle with a radius 12 x the stem diameter for single stem trees or the basal diameter for trees with more than one stem arising less than 1.5 m above ground level.

$$\text{RPA (m}^2\text{)} = (\text{stem diameter (mm)} \times 12/1000)^2 \times 3.142$$

This figure should be capped to 707 m<sup>2</sup>, that is, equivalent to a circle with a radius of 15 m, or a square with approximately 26 m sides

Taken from Table 2: Calculating the RPA, BS 5837 (2005).

### 3.4 Limitations to the Survey

There were no limitations to the survey in terms of timing and weather conditions. Where access to trees within on-Site and off-Site land was not possible approximations of the dimensions of the trees were made, including of the stem diameter at breast height. As most trees were clearly visible from the Site this is not anticipated to be detrimental to the survey.

## 4.0 Results

### 4.1 Data Search

The results of the desk search undertaken on Cardiff City Council Website on 26/01/2021 indicates that Woodland Group 7 is covered by a Tree Preservation Order (TPO). A search on the Natural Resource Wales (NRW) website also indicated that this area is designated as Semi-Natural Ancient Woodland covering 0.75 ha. Woodland Groups 2, 3, 14 and 15, located adjacent to the river were also covered by a TPO. No further trees are covered by TPO's and the Site did not lie within a Conservation Area (CA).

### 4.2 Survey Details

The tree inspection took the form of a walkover inspection completed by Peter Morrell TechArborA on 26<sup>th</sup> January 2021 with a further survey to include areas to the south and west was undertaken on 22<sup>nd</sup> July 2021. Each individual mature, semi-mature or young tree of significance that could be impacted upon by any proposed development was identified and visually inspected and classified. The trees identified during the survey at the Site have been individually noted and identified within this Report and are shown in the Tree Survey Plan within Figure 2a and 2b, and within the Photograph Section of this Report (Appendix C).

### 4.3 Mature to Young Trees

A total of six trees, 15 tree groups and 11 woodland groups have been identified and assessed as part of the tree survey. All but an individual tree (T6), two tree groups (TG1, TG20) and four woodland groups (WG2, WG3, WG6, WG11) were within the Site boundary, with TG1, T6, TG4, WG2 and WG3 located immediately beyond the Site boundary. While the majority of the trees within TG7, TG12 and TG20 were beyond the boundaries, sections of these groups were within the Site. Tree Groups 31 to TG34 stand on the southern side of the river.

#### 4.3.1 Species and their Arrangement in the Landscape

There are a range of tree species on and adjacent to the Site, with no dominant species. Ash *Fraxinus excelsior*, cherry *Prunus sp.*, goat willow *Salix caprea*, London plane *Platanus x hispanica*, hawthorn *Crataegus monogyna*, sycamore *Acer pseudoplatanus*, hazel *Corylus avellana*, common alder *Alnus glutinosa* common, apple *Malus sp.*, hawthorn *Crataegus monogyna*, silver birch *Betula pendula*, crack willow *Salix fragilis*, field maple *Acer campestre* and pedunculate oak *Quercus robur* are present in multiple numbers.

The distribution of the trees and tree groups across the Site is such that there are formally planted trees within the Park and Ride area of the Site and others randomly dispersed within tree and woodland groups throughout the remainder of the Site, with a number of larger individual trees standing clear of groups. Continuous tree cover is provided along the boundary with Eastern Avenue (A48).

#### 4.3.2 Height and Significance in the Landscape

The woodland groups and tree groups adjacent to Eastern Avenue standing at heights of up to 18 m, are highly visible when viewed from the west and provide an effective screen and buffer to the Site. As such these trees have been placed within Category B (Table 1), with WG7 being placed in Category A due to its ancient semi-natural woodland designation. Similarly, WG2, WG3, WG14 and WG15 on the western banks of Rhymney River, that stand up to 18 m are prominent when viewed from within the Site, but are shielded by adjacent tree and woodland groups resulting in restricted views within the wider area. The remainder of trees within the Site and outside of the Park and Ride area dominate the immediate area within which they stand, through their contribution to the wider landscape is limited due to adjacent boundary woodland and tree groups and the topography of the land.

The trees within the Park and Ride area are planted formally within areas of hardstanding and their landscape value and significance are limited by their short height and limited canopy extents. As such, these trees and groups have been placed within Category C, where their health and form merit it.

If retained, all of these trees will require protection measures to ensure no impact occurs as a result of any development.

### 4.3.3 Age and Condition

The trees present within the Site range between young and mature, with the majority being semi-mature, with the younger trees mainly present in woodland as self-sets and within areas of formal landscaping within the Park and Ride area. An area of recent planting was also present within the western extent of the Site, within a strip that had been previously used as access during the construction of the Park and Ride. The greater proportion of trees present display no evidence of past management, and what little work that has been undertaken mainly comprises of coppicing during historic woodland management works. Crown reduction and coppicing has been undertaken underneath the length of the overhead power lines that run north to south in the western extent of the Site.

Overall, on-Site trees appear to be in fair condition, with the occasion poor or dead tree present within the groups.

### 4.3.4 Environmental Condition

Given the Site's limited accessibility for vehicles outside of the Park and Ride area and semi-mature age of the majority of the trees, it is surmised that limited damage to the root system of on-Site trees has been sustained through recent on-Site working practices, which have been limited to works associated with the overhead powerlines. The trees on-Site and immediately adjacent to the Site are not in an exposed position, having been protected from prevailing winds by surrounding woodland, the topography of the local area, and buildings.

Groundwater conditions are not assessed to be a significant factor in present or future growth or health of trees as where seasonal standing water was present it appears that the trees in those locations have adapted to those conditions are species that are more tolerant to waterlogging.

## 4.4 Tree Schedule

Table 1 – BS 5837:2012 Tree Schedule

Tree Number	Tree Species		Measurements				Crown (m)				Tree Condition						Management			
	Common Name	Latin Name	Maturity	Height (m)	Stems	Stem Diameter (mm)	Average Height	N	E	S	W	Roots	Stem	Crown	Comments	Structural	Life Expectancy (Yrs)	Category	RPA (m)	Works
TG1	Pedunculate oak	<i>Quercus robur</i>	Y / S M	Av 12	S / M S	Av 300	0	6	6	6	6	No visual defects	Single and multiple stems. Vertical	Rounded canopies that read as one.	Self-set group. Phototropic growth	F	>40	B 2	3.6	
T2	Sycamore	<i>Acer pseudoplatanus</i>	M	20	M S	4 x 600	2	12	12	12	12	No visual defects	Multi-stemmed from base. Vertical	Rounded canopy	Ivy clad stem	F	>40	B 2	14.4	Server and remove ivy
TG3	Hazel Common alder	<i>Corylus avellana</i> <i>Alnus glutinosa</i>	S M	Av 12	S / M S	Av 200	0	4	4	4	4	No visual defects	Single and multiple stems. Vertical	Rounded canopies that read as one	Previously coppiced	F	20 - 40	B 2	2.4	
TG4	Common alder Silver birch Hazel	<i>Alnus glutinosa</i> <i>Betula pendula</i> <i>Corylus avellana</i>	S M	Av 6	M S	Est 200	0	4	4	4	4	No visual defects	Single and multiple stems. Vertical	Rounded canopies that read as one	Group surrounding a pond	F	20 - 40	B 2	2.4	
TG5	Ash	<i>Fraxinus excelsior</i>	M	Av 20	S / M S	Av 500	8	9	9	9	9	No visual defects	Single and multiple stems. Vertical	Rounded canopies that read as one. Scattered deadwood	Self-set group. Phototropic growth	F	20 - 40	B 2	6.0	
T6	Sycamore	<i>Acer pseudoplatanus</i>	S M	17	M S	Est 750	2	6	6	6	6	No visual defects	Single stem. Vertical. TD at 2 m	Balanced rounded canopy.	Standing on bank top	F	20 - 40	B 2	9.0	
TG7	Pedunculate oak Hazel	<i>Quercus robur</i> <i>Corylus avellana</i>	S M	14	S / M S	Av 400	0	6	6	6	6	No visual defects	Single and multiple stems. Vertical	Rounded canopies that read as one.	Self-set group. Phototropic growth	F	>40	B 2	4.8	
T8	Sycamore	<i>Acer pseudoplatanus</i>	S M	18	3	3 x 600	1	10	10	10	10	No visual defects	Single stem. Vertical. TD at 1.5 m	Rounded spreading canopy Scattered deadwood.		F	>40	B 2	12.3	
TG9	Sycamore	<i>Acer pseudoplatanus</i>	M	Av 18	S / M S	Av 3 x 600	2	3	10	10	10	No visual defects	Single and multiple stems. Stubs at base. Vertical	Open, spreading canopy. Scattered deadwood.		F	>40	B 2	12.3	
TG10	Silver birch Hazel Cherry	<i>Betula pendula</i> <i>Corylus avellana</i> <i>Prunus sp.</i>	Y	Av 6	S / M S	Av 100	0	3	3	3	3	No visual defects	Single and multi-stems, vertical	Rounded canopies Scattered deadwood.	Tree guards present	F	20 - 40	B 2	1.2	
TG11	Common alder	<i>Alnus glutinosa</i>	Y	6	S / M S	Av 150	1	2	2	2	2	No visual defects	Single and multiple stems, vertical.	Canopies read as one.	Self-set group	F	20 - 40	C 2	1.8	

TG12	Silver birch Apple Hawthorn Common alder Pedunculate oak	<i>Betula pendula</i> <i>Malus</i> sp. <i>Crataegus monogyna</i> <i>Alnus glutinosa</i> <i>Corylus avellana</i> <i>Quercus robur</i>	Y	6	1	Av 125	0	2	2	2	2	No visual defects	Single stems, vertical.	Rounded canopies	Tree guards present	F	20 - 40	B 2	1.5	
T13	Pedunculate oak	<i>Quercus robur</i>	S M	14	1	700	1	8	8	8	8	No visual defects	Single stem, vertical. TD at 2 m.	Spreading canopy.		F	>40	B 2	8.4	
TG14	Cherry Ash	<i>Prunus</i> sp. <i>Fraxinus excelsior</i>	S M	Av 12	1	Est 200	1	4	4	4	4	No visual defects	Single stems, vertical.	Canopies read as one.	Ivy clad stems	F	20 - 40	B 2	2.4	Sever and remove ivy
TG15	Common alder	<i>Alnus glutinosa</i>	Y	Av 6	1	Av 175	2	2	2	2	2	No visual defects	Single stems. Vertical	Rounded canopies	Formal linear group. Formative pruning evident	F	20 - 40	C 2	2.1	
T16	London plane	<i>Platanus x hispanica</i>	Y	6	1	125	2	3	3	3	3	No visual defects	Single stem, vertical.	Rounded canopies		F	>40	B 2	1.5	
TG17	Ash	<i>Fraxinus excelsior</i>	Y	Av 8	1	Av 200	2	3	3	3	3	No visual defects	Single stems, vertical	Rounded canopies	Formal linear group. Formative pruning evident	F	>40	C 2	2.8	
TG18	Silver birch	<i>Betula pendula</i>	Y	Av 8	1	150	1	2	2	2	2	No visual defects	Single stems, vertical	Rounded canopies	Present on embankment	F	20 - 40	C 2	1.8	
TG19	London plane	<i>Platanus x hispanica</i>	Y	Av 7	1	Av 200	2	3	3	3	3	No visual defects	Single stems, vertical.	Rounded canopies	Formal linear group. Formative pruning evident	F	20 - 40	C 2	2.4	
TG20	Ash	<i>Fraxinus excelsior</i>	Y	Av 6	1	Av 125	0	3	3	3	3	No visual defects	Single stems, vertical.	Rounded canopies that read as one		F	20 - 40	B 2	1.5	
T21	Sycamore	<i>Acer pseudoplatanus</i>	S M	12	1	Est 575	0	8	8	8	8	No visual defects	Single stem, vertical.	Rounded canopy, minor deadwood.		F	>40	B 2	6.9	
TG22	Silver birch Hazel Blackthorn		Y	Av 8	S / M S	Est 150	0	3	3	3	3	No visual defects	Single and multiple stems, vertical.	Rounded canopies that read as one	Scattered small groups of self-sets	F	20 - 40	C 2	1.8	
TG23	Ash Cherry Silver birch Hazel		Y	Av 8	S / M S	Av 15	0	3	3	3	3	No visual defects	Single and multiple stems, vertical.	Rounded canopies that read as one	Parallel plantation woodland separated by footpath	F	20 - 40	C 2	1.8	
TG24	Cherry Hazel Silver birch Common alder		S M	Av 12	S / M S	Av 200	0	5	5	5	5	No visual defects	Single and multiple stems, vertical.	Rounded canopies that read as one		F	20 - 40	B 2	2.4	
T25	Field maple		S M	10	M S	3 x 200	0	5	5	5	5	No visual defects	Multiple stems from base	Rounded canopy		F	20 - 40	B 2	4.2	
T26	Pedunculate oak		M	14	1	Est 900	4	7	7	7	7	No visual defects	Single stem, vertical. Bifurcated at 4 m.	Open canopy. Scattered deadwood.		F	>40	B 2	10.8	



TG27	Common alder	Y	Av 10	1	Av 150	0	3	3	3	3	No visual defects	Single and multiple stems, vertical.	Rounded canopies that read as one	Scattered small groups of self-sets	F	20 - 40	C 2	1.8	
T28	Pedunculate oak	M	19	1	Est 1100	2	12	12	12	12	No visual defects	Single stem, vertical. Extensive bark damage and rot	Open canopy with retrenchment		F	>40	A 2	13.2	
T29	Pedunculate oak	M	19	1	Est 1000	2	12	12	12	12	No visual defects	Single stem, vertical.	Open rounded spreading canopy. Scattered deadwood.		F	>40	A 2	12.0	
T30	Pedunculate oak	S M	15	1	Est 700	2	8	8	8	8	No visual defects	Single stem, vertical.	Open rounded spreading canopy.		F	>40	B 2	8.4	
TG31	Sycamore Common alder	S M	Av 12	S / M S	Av 175	4	8	6	4	6	No visual defects	Single and multiple stems, vertical.	Unbalanced canopies that read as one	Linear group on top of riverbank	F	20 - 40	B 2	2.1	
TG32	Hybrid black poplar Common alder	S M / M	Av 22	S / M S	Av 300	1	9	9	9	9	No visual defects	Single and multiple stems, vertical.	Rounded canopies that read as one	Poplar DBH 800 mm	F	20 - 40	B 2	3.6	
T33	Cherry	M	15	1	625	2	8	8	8	8	No visual defects	Single stem, vertical.	Open rounded spreading canopy.		F	20 - 40	B 2	7.5	
TG34	Sycamore Common alder	S M	Av 18	S / M S	Av 450	0	8	6	6	6	No visual defects	Single and multiple stems, vertical.	Unbalanced canopies that read as one	Linear group with canopies extending over river	F	>40	B 2	5.4	
WG1	Common alder Silver birch	Y / S M	Av 16	S / S M	Av 200	6	4	4	4	4	No visual defects	Single and multiple stems, vertical.	Rounded canopies that read as one.	Self-set trees displaying phototropic growth.	F	>40	B 2	2.4	
WG2	Crack willow Common alder Pedunculate oak	S M	Av 18	S / M S	Av 550	3	8	8	8	8	No visual defects	Single and multiple stems, vertical.	Rounded canopies that read as one.	Linear group along bank of river	F	20-40	B 2	6.6	
WG3	Crack willow Common alder Pedunculate oak	S M	Av 18	S / M S	Av 550	3	8	8	8	8	No visual defects	Single and multiple stems, vertical.	Rounded canopies that read as one.	Linear group along bank of river	F	20-40	B 2	6.6	
WG4	Hazel Ash Field maple Crack willow	Y	Av 14	S / M S	Av 200	0	3	3	3	3	No visual defects	Single and multiple stems, vertical.	Rounded canopies that read as one.	Standing water within low lying areas	F	>40	B 2	2.4	
WG5	Ash Hazel Common alder	S M	Av 16	S / M S	Av 300	0	5	5	5	5	No visual defects	Single and multiple stems. Vertical	Rounded canopies that read as one.		F	>40	B 2	3.6	
WG6	Common alder Pedunculate oak Goat willow Ash	S M	Av 18	S / M S	Av 400	4	6	6	6	6	No visual defects	Single and multiple stems. Vertical	Rounded canopies that read as one.	Previously coppiced	F	20 - 40	B 2	4.8	

WG7	Common alder Pedunculate oak Hazel Sycamore	<i>Alnus glutinosa</i> <i>Quercus robur</i> <i>Corylus avellana</i> <i>Acer pseudoplatanus</i>	S M	Av 16	S / M S	Av 400	0	6	6	6	6	No visual defects	Single and multiple stems. Vertical	Rounded canopies that read as one.	Ancient woodland with hazel understorey	F	>40	A 2	4.8
WG8	Silver birch Pedunculate oak Hazel Ash	<i>Betula pendula</i> <i>Quercus robur</i> <i>Corylus avellana</i> <i>Fraxinus excelsior</i>	S M	Av 16	S / M S	Av 300	0	5	5	5	5	No visual defects	Single and multiple stems. Vertical	Rounded canopies that read as one.	Self-set trees displaying phototropic growth	F	20 - 40	B 2	3.6
WG9	Silver birch Pedunculate oak Hazel Sycamore	<i>Betula pendula</i> <i>Quercus robur</i> <i>Corylus avellana</i> <i>Acer pseudoplatanus</i>	S M	Av 12	S / M S	Av 300	0	6	6	6	6	No visual defects	Single and multiple stems. Vertical	Rounded canopies that read as one.	Self-set trees displaying phototropic growth	F	20 - 40	B 2	3.6
WG10	Silver birch Pedunculate oak Hazel Ash	<i>Betula pendula</i> <i>Quercus robur</i> <i>Corylus avellana</i> <i>Fraxinus excelsior</i>	S M	Av 16	S / M S	Av 300	0	5	5	5	5	No visual defects	Single and multiple stems. Vertical	Rounded canopies that read as one.	Self-set trees displaying phototropic growth	F	>40	B 2	3.6
WG11	Pedunculate oak Cherry Sycamore	<i>Quercus robur</i> <i>Prunus sp.</i> <i>Acer pseudoplatanus</i>	Y	Av 18	S / M S	Av 300	6	5	5	5	5	No visual defects	Single and multiple stems. Vertical	Rounded canopies that read as one.	Self-set trees displaying phototropic growth	F	>40	B 2	3.6
WG12	Ash Goat willow		S M	Av 18	S / M S	Est 600	3	7	7	7	7	No visual defects	Single and multiple stems. Vertical	Rounded canopies that read as one.	Self-set trees displaying phototropic growth	F	>40	B 2	7.2
WG13	Hazel Silver birch		S M	Av 16	S / M S	S/MS	Av 200	0	5	5	5	No visual defects	Single and multiple stems. Vertical	Rounded canopies that read as one.	Hazel understorey	F	20 - 40	B 2	2.4
WG14	Pedunculate oak Ash Silver birch Goat willow Sycamore		S M / M	AV 18	S / M S	Av 450	0	5	5	5	5	No visual defects	Single and multiple stems, vertical.	Rounded canopies that read as one. Occasional larger tree within group	Self-set trees displaying phototropic growth.	F	>40	B 2	5.4
WG15	Common alder Pedunculate oak Cherry Weeping willow		S M / M	AV 18	S / M S	Av 450	0	5	5	5	5	No visual defects	Single and multiple stems, vertical.	Rounded canopies that read as one.	Linear group along bank of river	F	20-40	B 2	5.4

**Table 2 – Key to Tree Schedule**

Measurements	Age – Class	Overall Condition	BS 5837 2005 : Cascade Chart for Quality Assessment/Retention Category	Symbols:
MS – Multi-stemmed	Y - Young	G – Good	A – High	< = less than
Ht - Height in metres	SM – Semi-Mature	F – Fair	B – Moderate	~ = approximately
Stem – Stem Diameter at 1.5m in mm	EM – Early-mature	P – Poor	C – Low	> = greater than
Crown – Crown spread in metres	M – Mature	D – Dead	R – Trees for Removal	
TD - Trunk division (height in metres)	V - Veteran <b>Est Yrs</b> – estimate of years remaining (>40 years; 20 –40 years; <20 years)		<b>Sub-categories:</b> 1 = mainly arboricultural values 2 = mainly landscape values 3 = mainly cultural values.	
RPA = Root Protection Area (equivalent to a circle with a radius 12 x the stem diameter for single stem trees and 10 x the basal diameter for trees with more than one stem arising below 1.5m above ground level).				

## 5.0 Tree Management

### 5.1 Arboricultural Assessment

Around the boundaries of the Site, and scattered within the Site, are a number of woodland and tree groups, together with occasional individual trees, that could be adversely impacted upon by any proposed development. It should be possible to retain and incorporate a number of woodland and tree groups currently present within the Site into the landscaping scheme of the proposals.

Limited previous management has been undertaken to the trees present on-Site, mainly comprising of coppicing during historic woodland management works, with crown reduction and coppicing undertaken underneath the length of the overhead power lines that run north to south in the western extent of the Site.

To ensure that the root areas and canopy extremities of the individual trees and the tree groups that may be retained are not damaged, a Constraints Plan has been prepared to show the locations where protective fencing should be erected for any trees selected for retention (see Figure 3a and 3b). Any tree surgery required is best carried out towards the conclusion of the development so that, if necessary, any known root damage can be corrected by the appropriate crown thinning to restore root /shoot balance.

It is considered that the Site would benefit from native deciduous tree planting as part of the Site landscaping scheme to provide varying age within the on-Site tree stock and to complement retained trees, while a woodland management plan should be implemented ensure the long-term tree cover within the Site and the continued designation of the area of semi-natural ancient woodland.

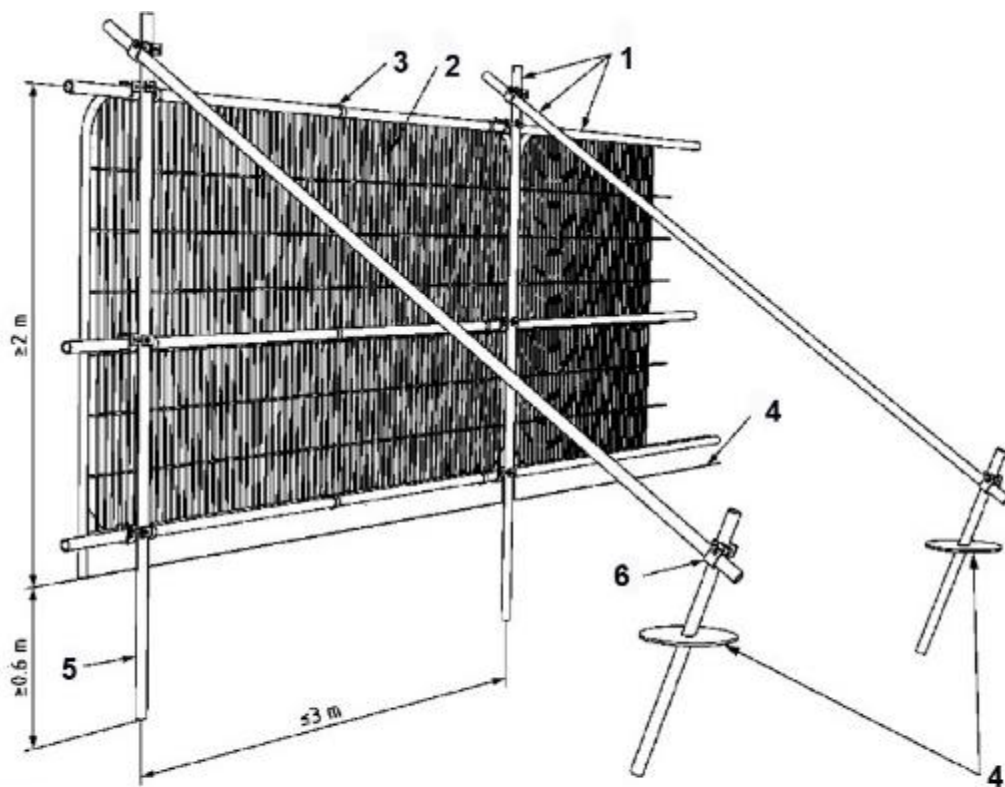
### 5.2 Recommendations

#### Recommendation 1 (Adequate Tree Protection)

Those trees identified within any development plan for retention will need to be adequately protected during any approved development works. As a general rule at this Site, measures to protect trees should follow the best practice principles set out in BS5837: Trees in Relation to Design, Development and Construction (2012). Prior to any construction or development work proceeding, the RPAs of individual trees to be retained should be marked out using the distances provided in the Table 1. Marking out should be completed by a person with arboricultural or horticultural expertise as individual trees will have root zones that may be affected by local conditions and allowances would need to be made to accommodate this.

The best practice principles have been broadly summarised below:

- ▲ All trees retained adjacent to the Site should be protected by barriers or ground protection around the calculated RPA and as indicated on any Tree Constraints Plan (TCP) that may be produced in association with the assessment;
- ▲ Any fencing required should be erected prior to commencement of construction and before demolition including erection of any temporary structures. Once set up fences should not be removed or altered without prior consultation with the arboricultural advisor;
- ▲ Arrangements should be made for an arboriculturist to supervise works and tree protection where trees are particularly vulnerable or sited close to access points;
- ▲ Pre-development works may be undertaken prior to the installation of fencing with the agreement of the local planning authority;



1. Standard scaffold poles
2. Heavy Gauge 2m tall galvanised tube and weld mesh infill panels
3. Panels secured to uprights and cross members with wire ties
4. Ground Level
5. Uprights driven into ground until secure (up to 0.6m)
6. Standard scaffold clamps

- ▲ All tree works should follow best practice procedures as set out in BS 3998 (2010). All trees should be maintained in good condition on-Site and be inspected annually (where overall condition requires) or every two years and after any major storm events, with safety a priority;
- ▲ Fencing should be clearly visible and suitable for the location, type and proximity of construction activity;
- ▲ It may be appropriate on some sites to use temporary site offices as components of the protection barriers;
- ▲ Where it has been agreed and shown on a Tree Protection Plan, construction access may take place within the RPA if suitable ground protection measures are in place (e.g. existing surfaced car park areas). In other areas this may comprise single scaffold boards over a compressible layer laid onto geo-textile materials for pedestrian movements. Vehicular movements over the RPA will require the calculation of expected loading and may require the use of proprietary protection systems;
- ▲ Once areas around trees have been protected by fencing, any works on the remaining Site area may be commenced providing activities do not impinge on protected areas. Notices should be placed on fencing to indicate that operations are not permitted within the fenced area;
- ▲ Wide or tall loads etc should not come into contact with retained trees. Banksman should supervise transit of vehicles, jibs, booms etc where this is in close proximity to retained trees;
- ▲ Oil, bitumen, cement or other material that is potentially injurious to trees should not be stacked or discharged within 10 m of a tree bole. No concrete mixing should be done within 10 m of a tree. Allowance should be made for the slope of ground to prevent materials running towards the tree;



- ▲ No fires should be lit where flames are anticipated to extend to within 5 m of tree foliage, branches or trunk, taking into consideration wind direction and size of fire;
- ▲ Notice boards, telephone cables or other services should not be attached to any part of a retained tree;
- ▲ Where it is deemed necessary to operate a wide or tall load, plant bearing booms, jibs and counterweights or other such equipment, as part of construction works, and such equipment would have potential to cause injurious contact with crown material i.e. low branches and limbs, of retained trees within the RPA fencing, it is best advised that appropriate, but limited, tree surgery be carried out beforehand to remove any obvious problem branches. This is classed as 'Facilitation Pruning' within BS 5837 (2012). Any such pruning should be undertaken in accordance with a specification prepared by an arboriculturist;
- ▲ It is advised that a Pre-Commencement Site Meeting is held with contractors who are responsible for operating machinery, as described above, to firstly highlight the potential for damage occurring to tree crowns and to ensure that extra care is applied when manoeuvring machinery during such operations within close proximity to retained trees to avoid any contact;
- ▲ In the event of having caused any such branch or limb damage to retained trees it is strongly recommended that suitable tree surgery be carried out, in accordance with BS 3998 (2010) Recommendations for Tree Work, to correct the damage, upon completion of development; and
- ▲ All of the above precautionary measures should be applied to minimise the effect of any damage to long-term tree health and safety.

## 6.0 Limitations of the Tree Survey

The recommendations contained in this Report represent Delta-Simons' professional opinions, based upon the information referred to in Section 1.0 of this Report, exercising the duty of care required of an experienced Environmental Consultant.

This Report was prepared by Delta-Simons for the sole and exclusive use of the Client and for the specific purpose for which Delta-Simons was instructed as defined in Section 1.1 of this Report. Nothing contained in this Report shall be construed to give any rights or benefits to anyone other than the Client and Delta-Simons, and all duties and responsibilities undertaken are for the sole and exclusive benefit of the Client and not for the benefit of any other party. In particular, Delta-Simons does not intend, without its written consent, for this Report to be disseminated to anyone other than the Client or to be used or relied upon by anyone other than the Client. Use of the Report by any other person is unauthorised and such use is at the sole risk of the user. Anyone using or relying upon this Report, other than the Client, agrees by virtue of its use to indemnify and hold harmless Delta-Simons from and against all claims, losses and damages (of whatsoever nature and howsoever or whensoever arising), arising out of or resulting from the performance of the work by the Consultant.

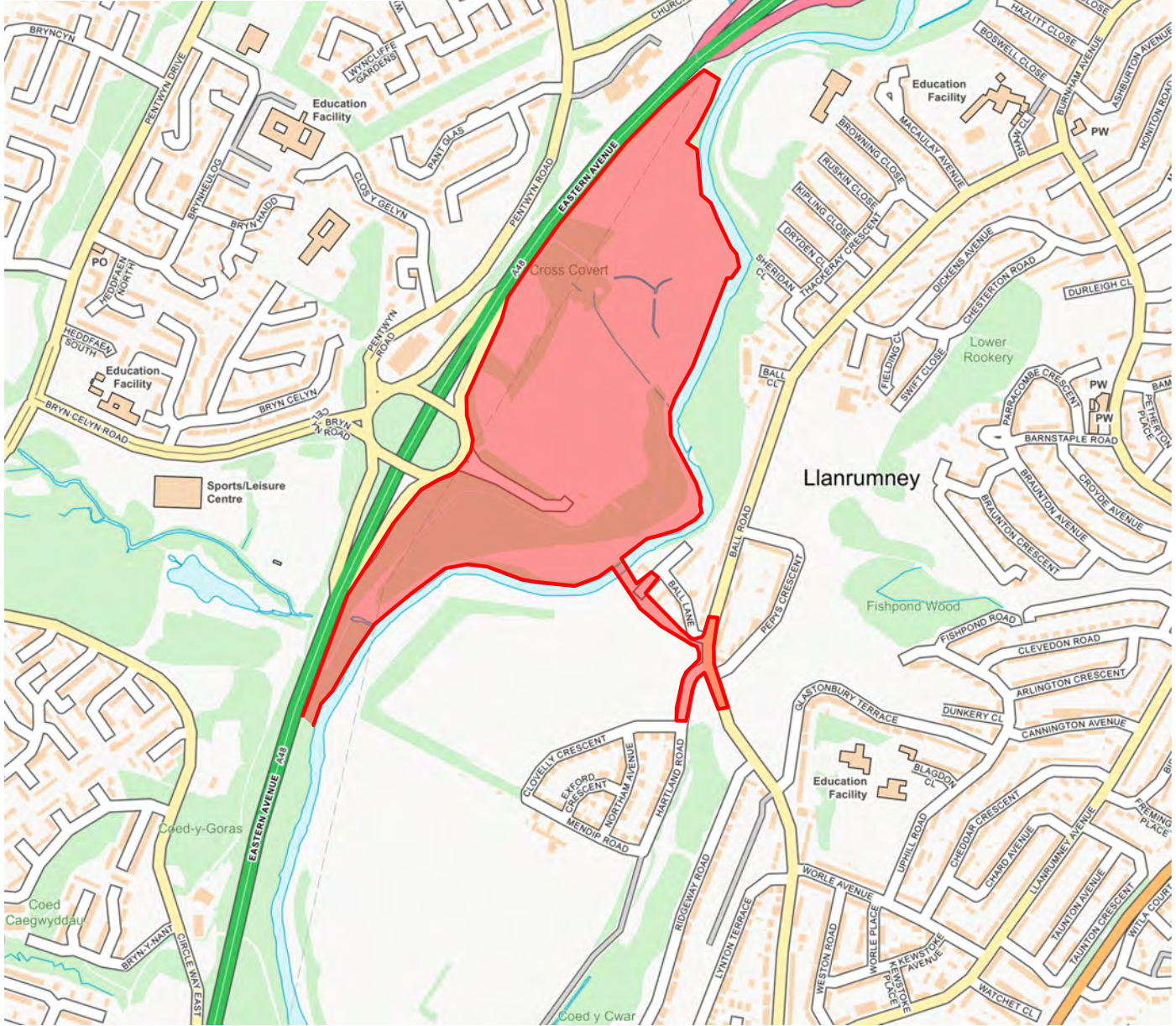
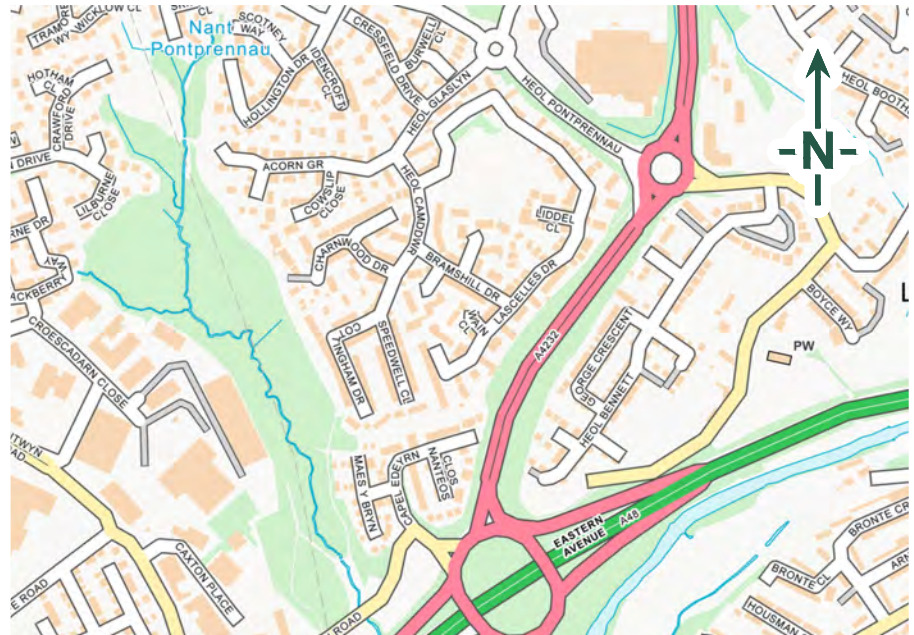
## Figure 1 – Site Location Map





**LEGEND**

Site Boundary



Scale: 1 / 10,000 @ A4

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Site Location Map  
Cardiff Park and Ride

DRAWN BY: YA  
CHECKED BY: PM  
DATE: 11 August 2021

SCALE:  
To Scale@A4  
REVISION: 1

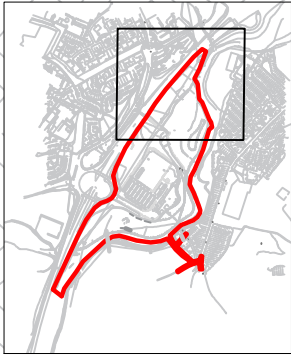
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FIGURE NO:  
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## Figure 2a-d – Tree Survey

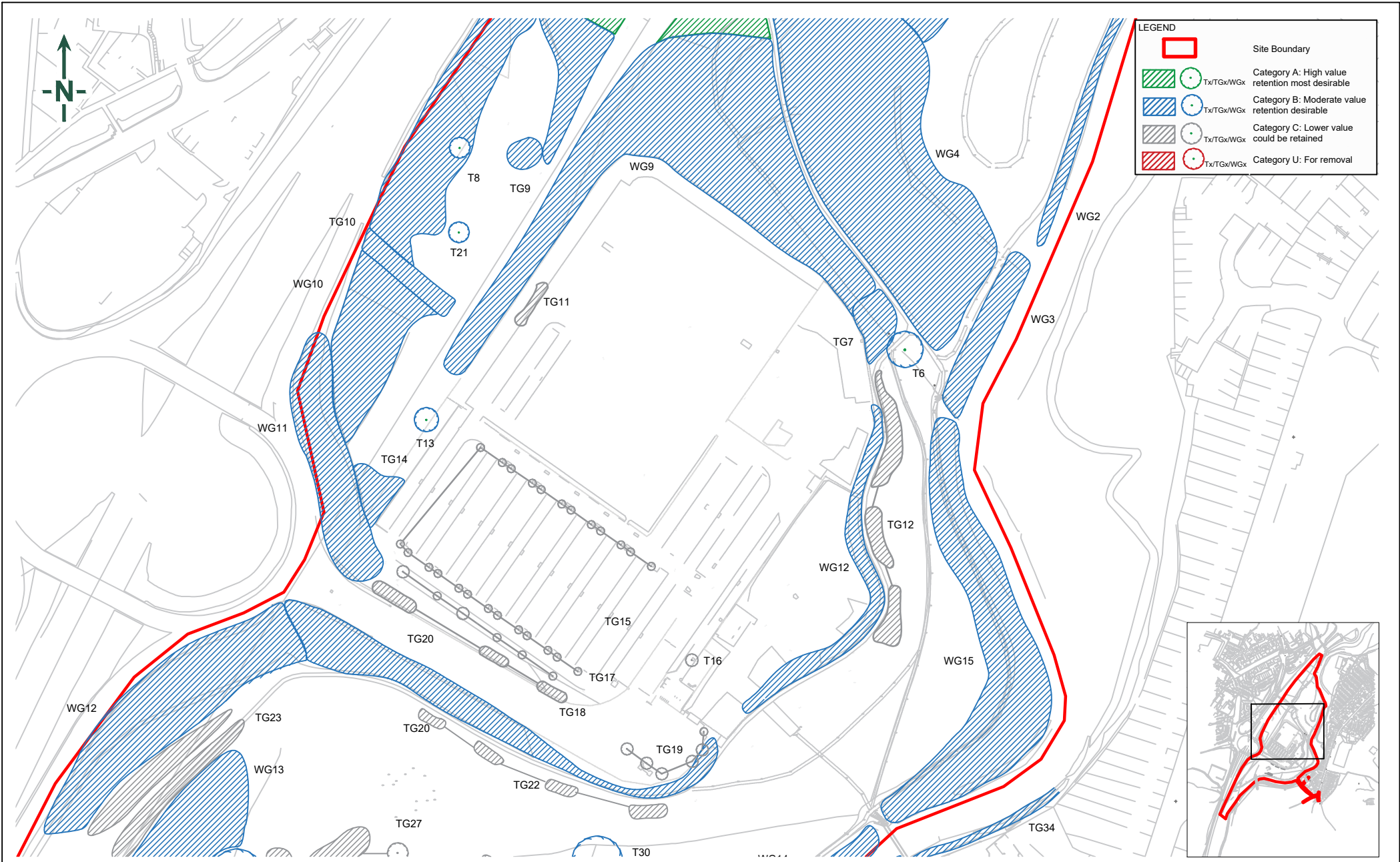




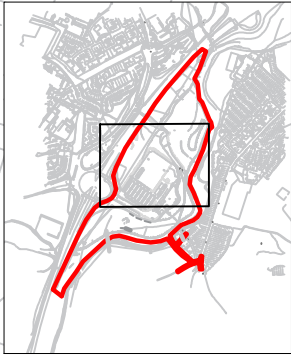
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	Category B: Moderate value retention desirable
	Category C: Lower value could be retained
	Category U: For removal



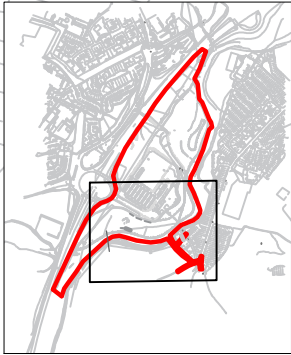
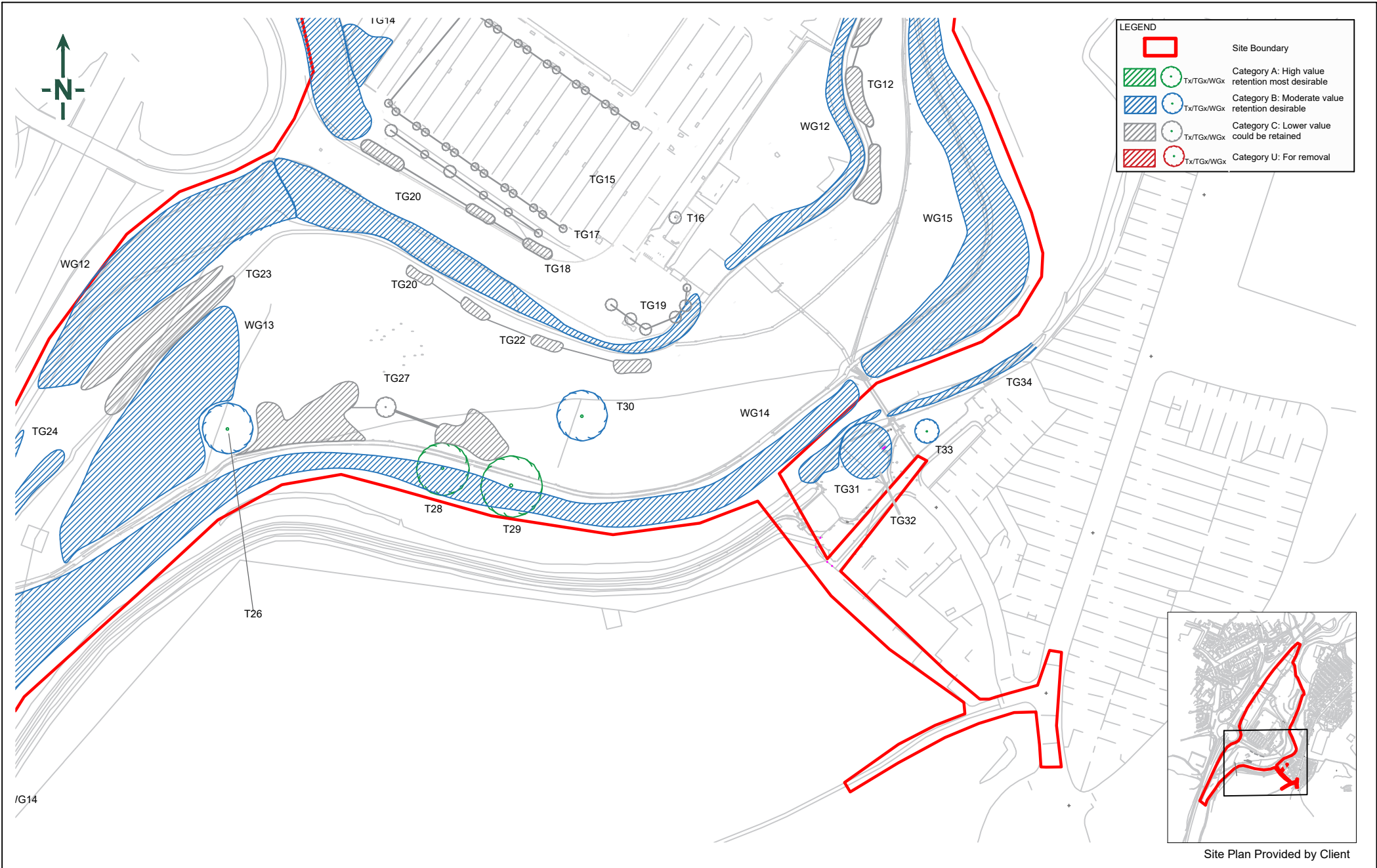
Site Plan Provided by Client



LEGEND	
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	Category C: Lower value could be retained
	Category U: For removal










Site Plan Provided by Client

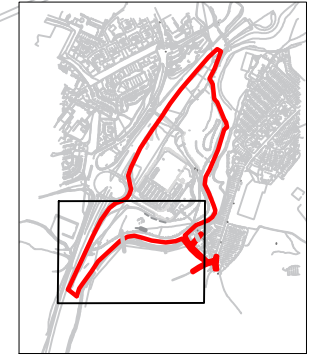
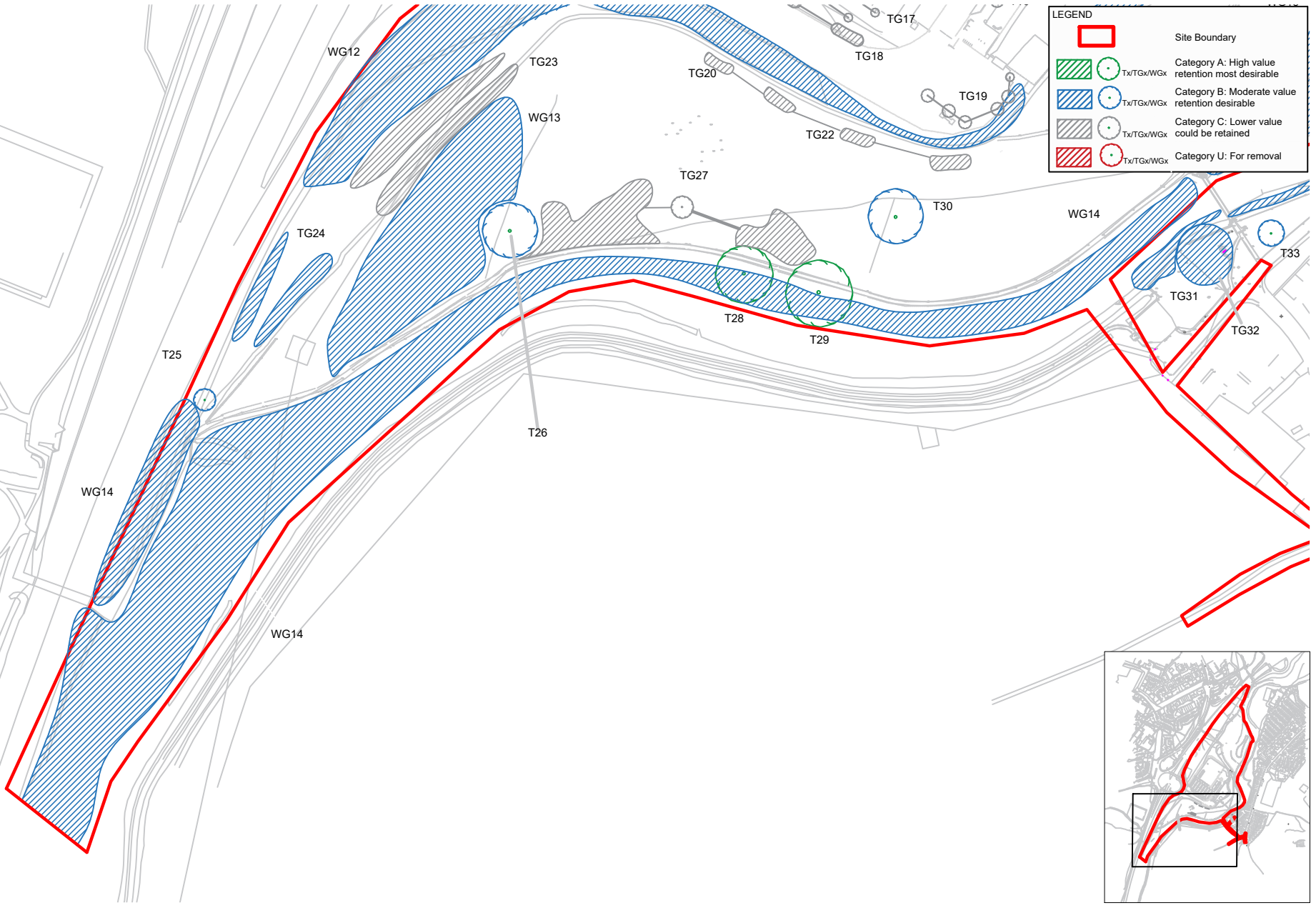


Site Plan Provided by Client





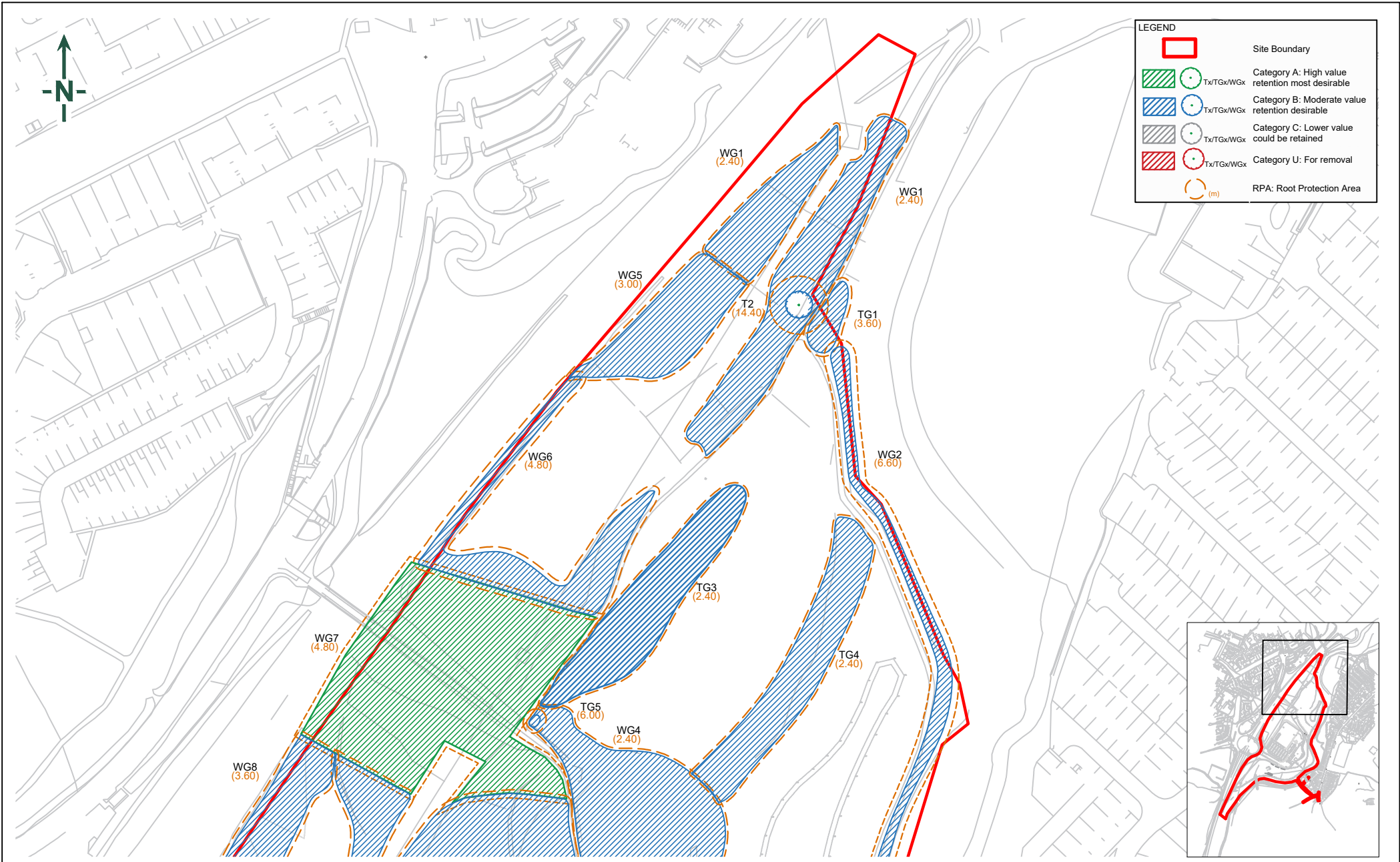
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 	Category U: For removal



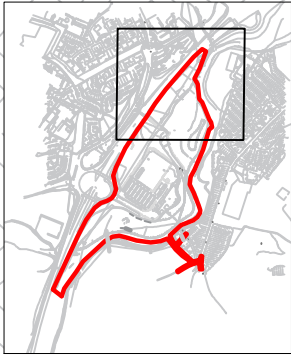
Site Plan Provided by Client

## Figure 3a-d – Tree Constraints Plan

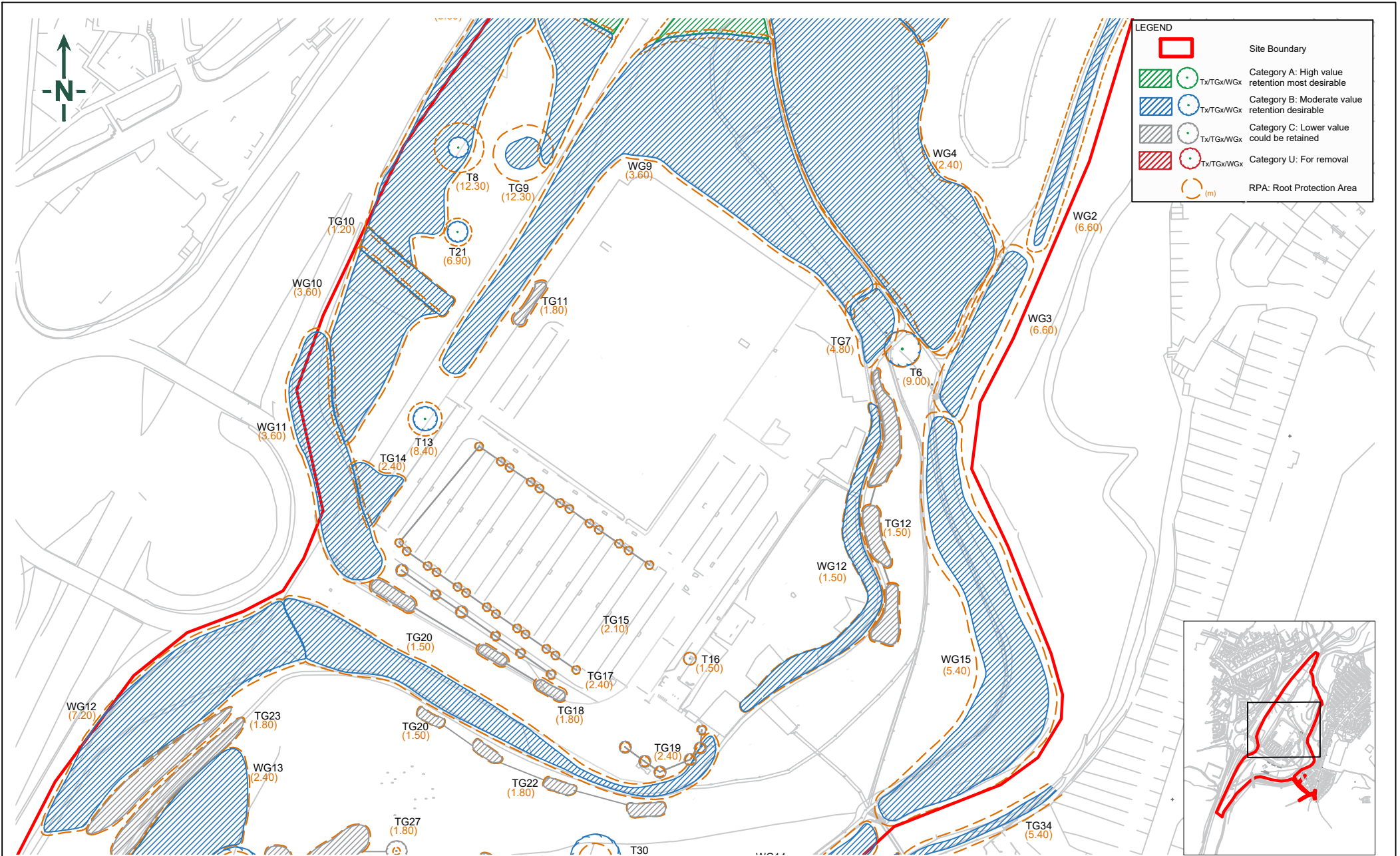




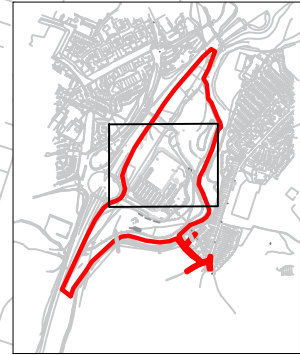
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	Category B: Moderate value retention desirable
	Category C: Lower value could be retained
	Category U: For removal
	RPA: Root Protection Area (m)



Site Plan Provided by Client

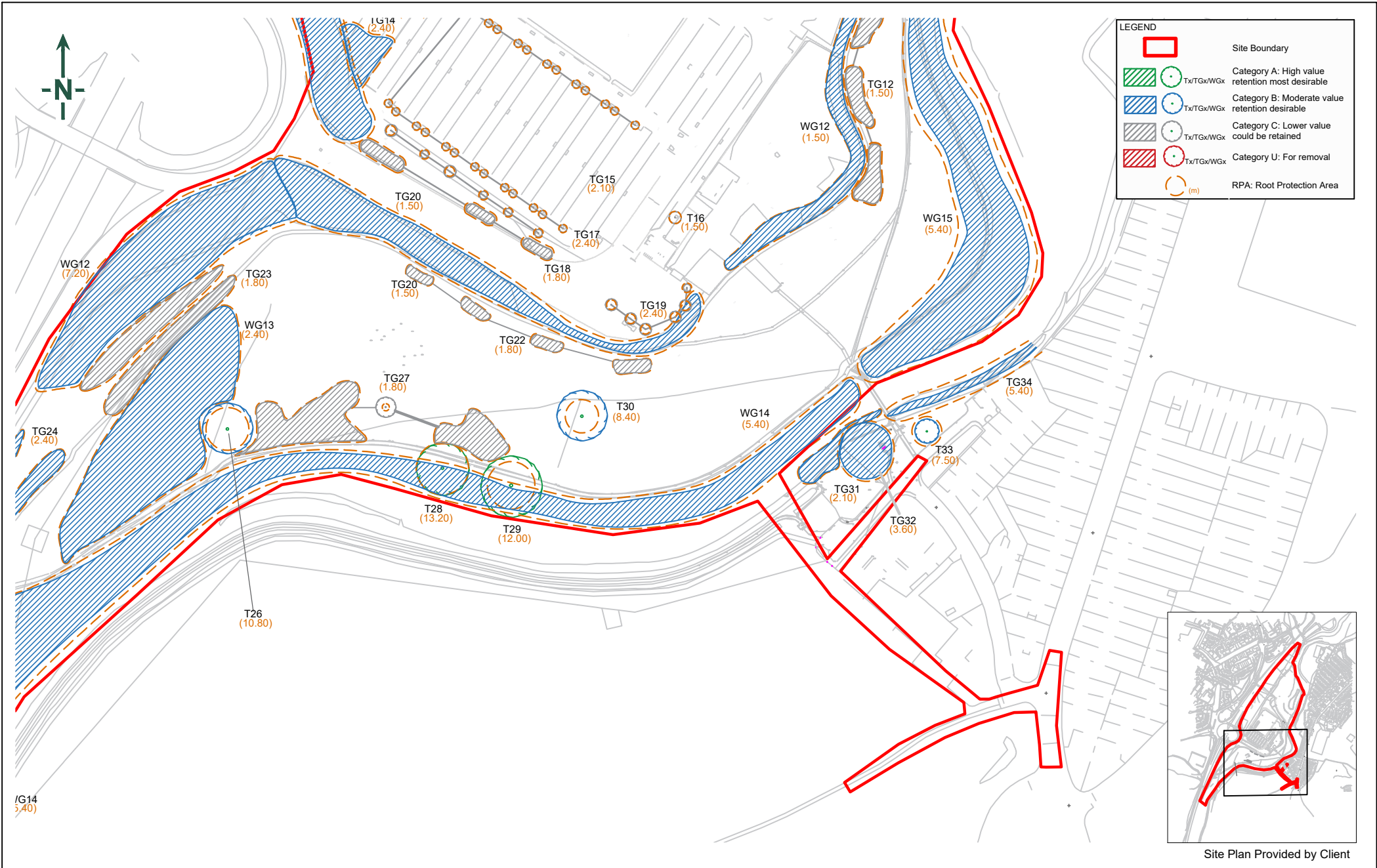


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	Category B: Moderate value retention desirable
	Category C: Lower value could be retained
	Category U: For removal
	RPA: Root Protection Area (m)

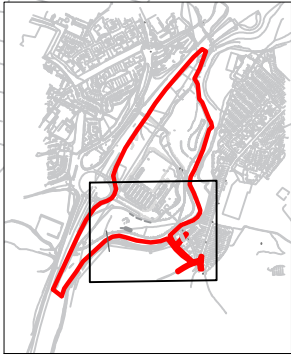


Site Plan Provided by Client





LEGEND	
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	Category B: Moderate value retention desirable
	Category C: Lower value could be retained
	Category U: For removal
	RPA: Root Protection Area (m)

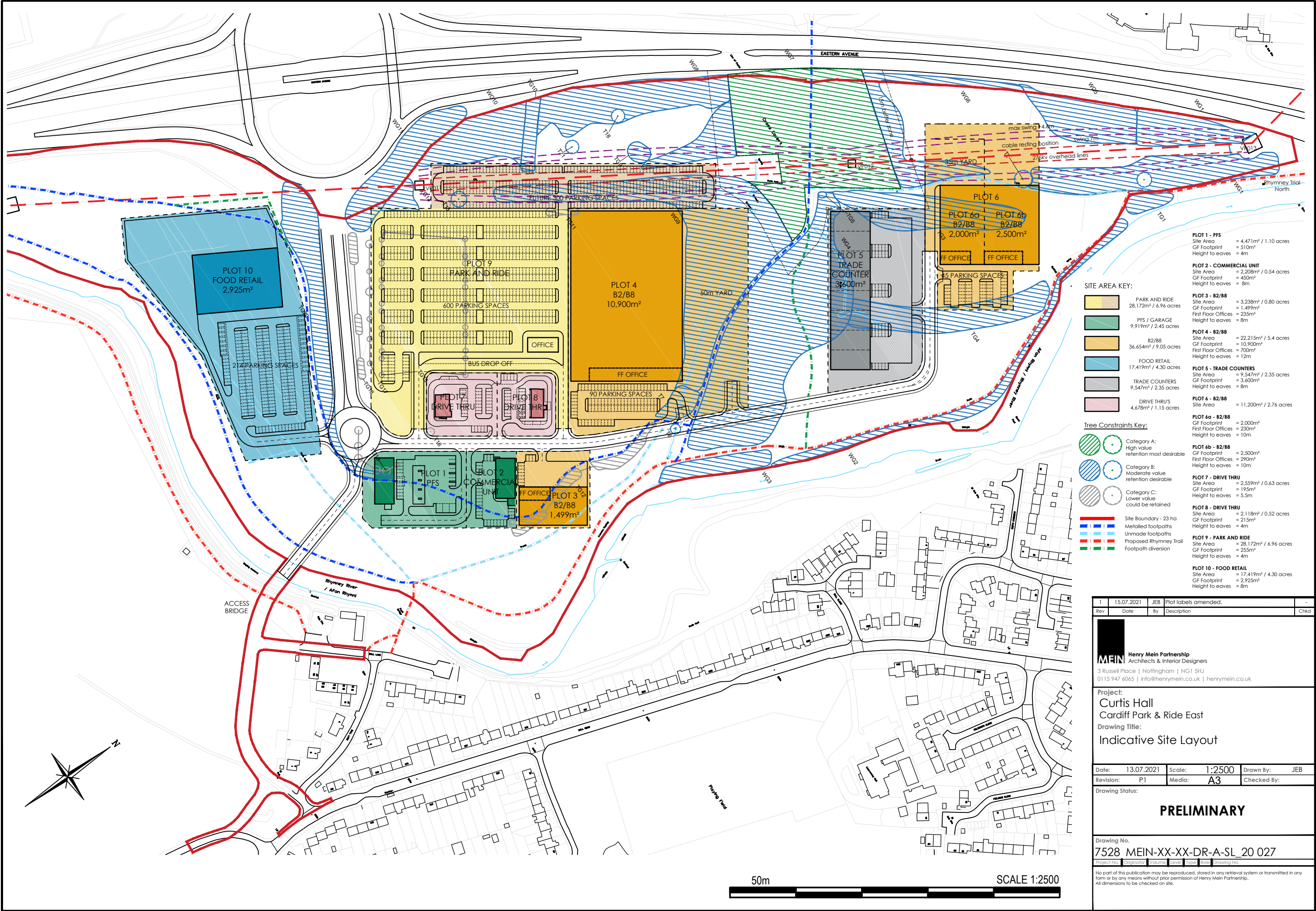


Site Plan Provided by Client



# Drawing 1 – Proposed Development Plan





Plot	Use	Site Area	GF Footprint	Height to eaves
PLOT 1	PFS	4.47m <sup>2</sup> / 1.10 acres	510m <sup>2</sup>	4m
PLOT 2	COMMERCIAL UNIT	2.208m <sup>2</sup> / 0.54 acres	450m <sup>2</sup>	8m
PLOT 3	B2/B8	3.238m <sup>2</sup> / 0.80 acres	1,499m <sup>2</sup>	8m
PLOT 4	B2/B8	22.215m <sup>2</sup> / 5.4 acres	10,900m <sup>2</sup>	12m
PLOT 5	TRADE COUNTERS	9.547m <sup>2</sup> / 2.35 acres	3,400m <sup>2</sup>	8m
PLOT 6	B2/B8	11.200m <sup>2</sup> / 2.76 acres	2,000m <sup>2</sup>	10m
PLOT 6a	B2/B8	2.000m <sup>2</sup>	230m <sup>2</sup>	10m
PLOT 6b	B2/B8	2.500m <sup>2</sup>	290m <sup>2</sup>	10m
PLOT 7	DRIVE THRU	2.559m <sup>2</sup> / 0.63 acres	195m <sup>2</sup>	5.5m
PLOT 8	DRIVE THRU	2.118m <sup>2</sup> / 0.52 acres	215m <sup>2</sup>	4m
PLOT 9	PARK AND RIDE	28.172m <sup>2</sup> / 6.96 acres	255m <sup>2</sup>	4m
PLOT 10	FOOD RETAIL	17.419m <sup>2</sup> / 4.30 acres	2,925m <sup>2</sup>	8m

Category	Value	Retention
Category A	High value	retention most desirable
Category B	Moderate value	retention desirable
Category C	Lower value	could be retained

Line Style	Description
Red dashed	Site Boundary - 23 ha
Blue dashed	Metallo footpaths
Black dashed	Unmade footpaths
Red dashed	Proposed Rhymney Trail
Green dashed	Footpath diversion

1	15.07.2021	JEB	Plot labels amended.	-
Rev	Date	By	Description	Chkd

**MEIN** Henry Mein Partnership  
Architects & Interior Designers  
3 Russell Place | Nottingham | NG1 5HJ  
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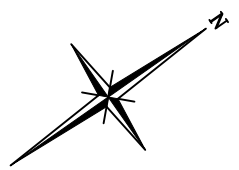
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**Curtis Hall**  
Cardiff Park & Ride East  
Drawing Title:  
**Indicative Site Layout**

Date:	13.07.2021	Scale:	1:2500	Drawn By:	JEB
Revision:	P1	Media:	A3	Checked By:	

Drawing Status:  
**PRELIMINARY**

Drawing No.  
**7528 MEIN-XX-XX-DR-A-SL\_20 027**

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All dimensions to be checked on site.





## Appendix A – References

## References

BSI Publication BS 5837:2012 Trees in Relation to Design, Demolition and Construction – Recommendations.

BSI Publication BS 5837:2005 Trees in Relation to Construction - Recommendations.

Stace, C. (2010). *New Flora of the British Isles 3<sup>rd</sup> edition*. University Press, Cambridge.

Cardiff City Council. (Nov 2017) Cardiff Green Infrastructure SPG - Trees and Development Technical Guidance Note (TGN).

## Appendix B – Guidance on Assessing the Potential Suitability of Development Sites to Support Bats

# Guidance on Assessing the Potential Suitability of Development Sites to Support Bats

(adapted from Collins, J. (ed)).

Suitability	Description	
	Roosting	Commuting and Foraging
Negligible	<p>An inspected structure or tree which is considered to have no features of importance for roosting bats.</p> <p>No further constraints apply to the method or timing of proposed works.</p>	<p>Negligible habitat features on-Site to support commuting or foraging bats</p>
Low	<p>A structure with at least one or more features suitable to support opportunistic individual bats. However, inadequate space, shelter, protection and conditions, and the low suitability of surrounding habitats means that it is unlikely to be used as a maternity or hibernation roost site.</p> <p>A tree of adequate age and stature to support potential roosting features, however, either no features, or only features of limited potential recorded from the ground.</p>	<p>Habitat with potential to support low numbers of commuting bats due to its quality and connectivity. For example, a gappy hedgerow or unvegetated stream that is isolated from the surrounding landscape.</p> <p>Alternatively, suitable but isolated habitats suitable to support low numbers of foraging bats such as a lone tree or a patch of scrub.</p>
Moderate	<p>A structure or tree with one or more potential roost sites that are of adequate size, shelter and protection, with suitable conditions and surrounding habitat to support a bat roost not of high conservation status (with respect to roost type not individual species conservation status).</p>	<p>Linear habitat continuity connecting to the wider landscape offering potential to support commuting bats, such as rows of trees and scrub or linked back gardens.</p> <p>Habitat such as trees, scrub, grassland or a waterbody with connectivity to the wider landscape offering foraging opportunities for bats.</p>
High	<p>A structure or tree with one or more potential roost sites that are suitable for use by large numbers of bats on a regular basis and for long periods of time due to their size, shelter, protection, conditions and the surrounding habitat.</p>	<p>Continuous high-quality habitat with strong connectivity to the wider landscape that is likely to be used by commuting bats on a regular basis, such as flowing waterbodies, hedgerows, rows of trees and woodland edges.</p> <p>High quality habitat with strong connectivity to the wider landscape that is likely to be regularly used by foraging bats, such as broadleaved woodland, tree-lined watercourses and grazed parkland.</p> <p>Site is close to, and connected to, known roost sites</p>

## Appendix C – Site Photographs

## Site Photographs



**Photograph 1 – Tree Group (TG)1**



**Photograph 2 – T2**





**Photograph 3 – TG3**



**Photograph 4 – TG4**



**Photograph 5 – TG5**



**Photograph 6 – T6**





**Photograph 7 – TG7**



**Photograph 8 – T8**



**Photograph 9 – TG9**



**Photograph 10 – TG10**





**Photograph 11 – TG11**



**Photograph 12 – TG12**





**Photograph 13 – T13**



**Photograph 14 – TG14**



**Photograph 15 – TG15**



**Photograph 16 – T16**



**Photograph 17 – TG17**



**Photograph 18 – TG18**





**Photograph 19 – TG19**



**Photograph 20 – TG20**



**Photograph 21 – T21**



**Photograph 22 – TG22**





**Photograph 23 – TG23**



**Photograph 24 – TG24**





**Photograph 25 – T25**



**Photograph 26 – T26**



**Photograph 27 – TG27 (to the left)**



**Photograph 28 – T28**





**Photograph 29 – T30**



**Photograph 30 – TG31**



**Photograph 31 – TG32**



**Photograph 32 – T33**





**Photograph 33 – T34**



**Photograph 34 – WG1**





**Photograph 35 – WG2**



**Photograph 36 – WG3**



**Photograph 37 – WG4**



**Photograph 38 – WG5**



**Photograph 39 – WG6**



**Photograph 40 – WG7**





**Photograph 41 – WG8**



**Photograph 42 – WG9**



**Photograph 43 – WG10**



**Photograph 44 – WG11**





**Photograph 45 – WG12**



**Photograph 46 – WG13 (on the left)**





**Photograph 47 – WG14**



**Photograph 48 – WG15**