Canopy Analysis of new developments
(Clackmannanshire, Falkirk and Stirling)

March 2025

A partnership project with:

- **Forth Climate Forest**
- **Green Action Trust**
- **Future Woodlands Scotland**

Forth Climate Forest
Communities - Canopy - Connectivity - Carbon

Green Action Trust

Future Woodlands Scotland

Contents

Introduction

The study provides details on the tree canopy cover proposed within six housing developments in Clackmannanshire, Falkirk and Stirling Councils at both the planning and implementation stages.

The “Threes Rule for Trees” was launched in 2021 as evidence-based guidance for urban planning. This sets a minimum standard of 30% canopy cover within urban neighbourhoods. This report makes recommendations on how planning for increased tree planting could achieve the minimum acceptable standard of 20%, or 30% canopy cover.

Trees within development boundaries were assessed for their ecosystem services to show the value of “consented” trees (that were proposed within Landscape drawings from development plans), and tree planting as surveyed from completed developments, as well as aspirational tree planting to achieve desired canopy cover levels.

These findings can be used to make recommendations on how future housing proposals might achieve more acceptable tree canopy levels, at the planning stage, as well as during the delivery phase.

The six sites are shown below with two housing development in each Local Authority area. In each area, one of the developments is complete, with the other awaiting build.

Site details:

Site	Name	Planning Details
Clackmannanshire		
1	Lower Mill Street Tillicoultry	20/00204/FULL 74 house units
2	Former Forth Valley College, Branshill Road, Sauchie	19/00214/FULL 149 house units
Falkirk		
3	Rosebank, Dunipace	P/17/0786/FUL 113 house / flat units
4	Crawfield Road, Bo'Ness	P/22/0009/FUL 227 house units
Stirling		
5	Newpark Farm	15/00669/FUL 185 house units
6	Cambusbarron South	19/00462/MSC 265 house units

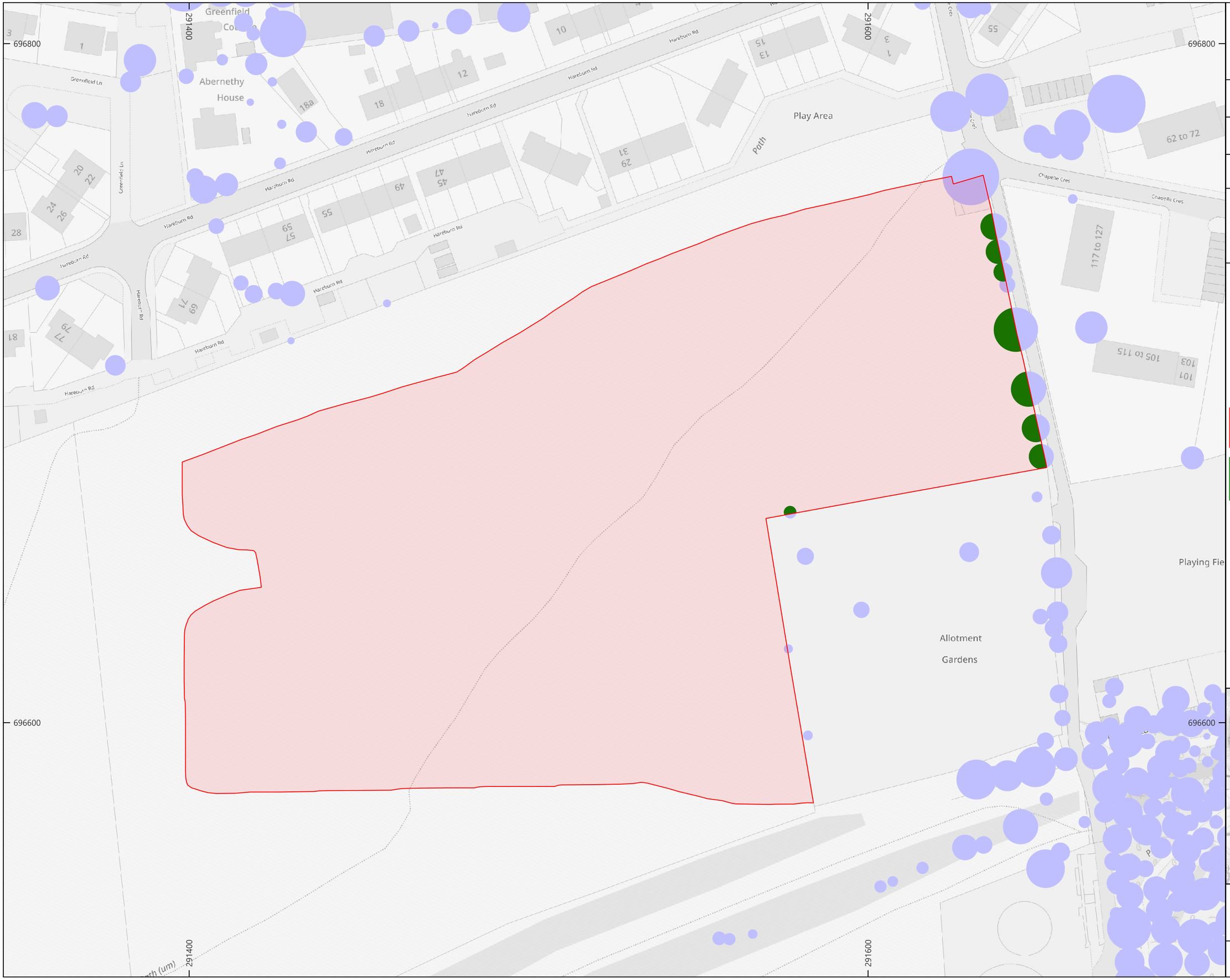
1: Desk based analysis of development proposals

For all six sites, pre-development tree cover was accessed from the National Tree Map, accessed from BlueSky. The results of this can be seen on the following pages. It should be noted that tree cover before development was generally very low due to the previous agricultural use of the sites. Construction work removed any existing trees, essentially giving a start point of zero canopy cover for all development sites.

Development proposals were manually digitised from the 6 site plans including site boundaries, and depending on information available, consented tree locations and their canopies as indicated by landscape drawings. The following maps and table below show these results:

Existing canopy cover pre-development:

Site number	Site name	Area of site (sq. m)	Area of existing canopy cover (sq. m)	% of site that is existing canopy cover
1	Lower Mill Street Tillicoultry (Clacks)	29,239.44	244.91	0.84
2	Former Forth Valley College (Clacks)	54,535.04	68.52	0.13
3	Rosebank, Dunipace (Falkirk)	48,915.09	34.87	0.07
4	Crawfield Road, Bo'Ness (Falkirk)	120,475.03	153.04	0.13
5	Newpark Farm (Stirling)	82,460.49	127.27	0.15
6	Cambusbarron South (Stirling)	139,166.00	6,292.87	4.52



Green Action Trust

Site 1
Pre-development tree cover

Drawn Date: 12/02/2025

Revision No: 1

Job/project name:

OP24ST0018
FCF Canopy Cover

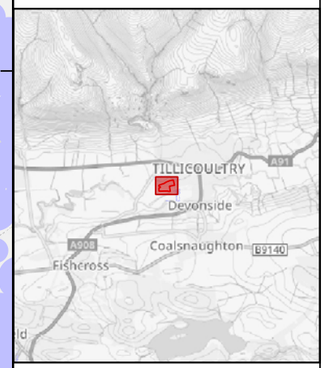
Legend:

- Site boundary
- National Tree Map data - within site area
- National Tree Map data - outside site area

Site area:
29239.44 m²

NTM within site:
244.91 m² 0.84 %

Plan Location:



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Green Action Trust

Site 2b
Pre-development tree cover

Drawn Date: 12/02/2025

Revision No: 1

Job/project name:

OP24ST0018
FCF Canopy Cover

Legend:

- Site boundary
- National Tree Map data - within site area
- National Tree Map data - outside site area

Site area:
54535.04 m²

NTM within site:
68.52 m² 0.13 %

Plan Location:

0 10 20 30 m N

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Green Action Trust

Site 3
Pre-development tree cover

Drawn Date: 12/02/2025

Revision No: 1

Job/project name:

OP24ST0018
FCF Canopy Cover

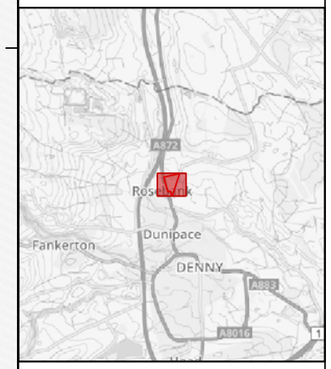
Legend:

- Site boundary
- National Tree Map data - within site area
- National Tree Map data - outside site area

Site area:
48915.09 m²

NTM within site:
34.87 m² 0.07 %

Plan Location:



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Green Action Trust

Site 4
Pre-development tree cover

Drawn Date: 12/02/2025

Revision No: 1

Job/project name:

OP24ST0018
FCF Canopy Cover

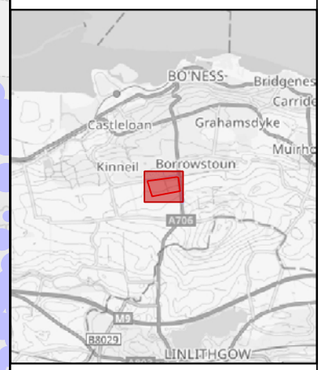
Legend:

- Site boundary
- National Tree Map data - within site area
- National Tree Map data - outside site area

Site area:
120475.03 m²

NTM within site:
153.04 m² 0.13 %

Plan Location:



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Green Action Trust

Site 5
Pre-development tree cover

Drawn Date: 12/02/2025

Revision No: 1

Job/project name:

OP24ST0018
FCF Canopy Cover

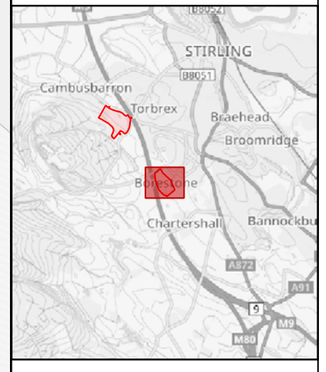
Legend:

- Site boundary
- National Tree Map data - within site area
- National Tree Map data - outside site area

Site area:
82460.49 m²

NTM within site:
127.27 m² 0.15 %

Plan Location:



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Green Action Trust

Site 6
Pre-development tree cover

Drawn Date: 12/02/2025

Revision No: 1

Job/project name:

OP24ST0018
FCF Canopy Cover

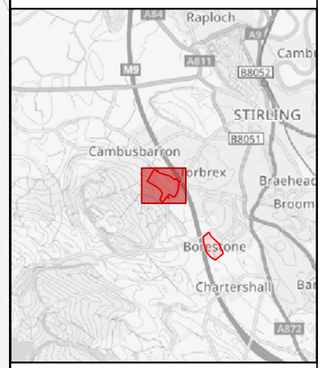
Legend:

- Site boundary
- National Tree Map data - within site area
- National Tree Map data - outside site area

Site area:
139166.00 m²

NTM within site:
6292.87 m² 4.52 %

Plan Location:



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Canopy cover was mapped for the consented trees to demonstrate the canopy cover that would be created, were the trees to grow to maturity. All trees shown have been assigned a canopy cover of 70m^2 to represent an achievable average based on mature tree dimensions for species and growing conditions in the UK.

Data and equations used for tree allometries are taken from the Handbook of UK Urban Tree Allometric Equations and Size Characteristics (Version 1.4, December 2024).[1]

Development proposals show the following number of trees to be planted per site. Landscape drawings demonstrate a canopy size, which has been shown below for information. Maps on the following pages show the potential size of these trees were they to meet maturity as described above:

Site number	Area of consented canopy cover (sq. m) (from landscape drawings)	% of site that is consented canopy cover (from landscape drawings)	Area of consented canopy cover (assuming mature tree size)	% of site that is consented canopy cover (assuming mature tree size)	Number of trees
1	1492.20	5.10	7017.57	24.00	164
2	1263.33	2.32	8437.57	15.47	180
3	2490.14	5.09	5020.77	10.26	93
4	5988.94	4.97	24859.47	20.63	217
5	8791.30	10.66	18992.86	23.03	419
6	8876.80	6.38	25203.33	18.11	351

[1] www.researchgate.net/publication/387253353_Handbook_of_UK_Urban_Tree_Allometric_Equations_and_Size_Characteristics_Version_14

Green Action Trust

Site 1
Proposed larger tree cover

Drawn Date: 05/03/2025

Revision No: 1

Job/project name:

OP24ST0018
FCF Canopy Cover

Legend:

- Site boundary
- Proposed larger trees

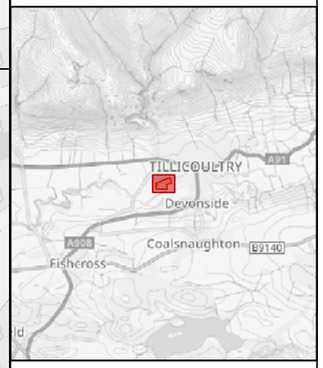
Site area:
29239.44 m²

Proposed trees canopy cover:
7017.57 m² 24.00 %

Shortfall to make up to 20 %:
0.00 m² 0.00 %

Shortfall to make up to 30 %:
1754.26 m² 6.00 %

Plan Location:



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Green Action Trust

Site 2b
Proposed larger tree cover

Drawn Date: 05/03/2025

Revision No: 1

Job/project name:

OP24ST0018
FCF Canopy Cover

Legend:

- Site boundary
- Proposed larger trees

Site area:
54535.04 m²

Proposed trees canopy cover:
8437.57 m² 15.47 %

Shortfall to make up to 20 %:
2469.44 m² 4.53 %

Shortfall to make up to 30 %:
7922.94 m² 14.53 %

Plan Location:

0 10 20 30 m N

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288800 289000 693800

Green Action Trust

Site 3
Proposed larger tree cover

Drawn Date: 05/03/2025

Revision No: 1

Job/project name:

OP24ST0018
FCF Canopy Cover

Legend:

- Site boundary
- Proposed larger trees

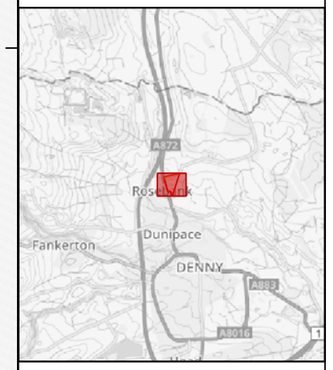
Site area:
48915.09 m²

Proposed trees canopy cover:
5020.77 m² 10.26 %

Shortfall to make up to 20 %:
4762.25 m² 9.74%

Shortfall to make up to 30 %:
9653.76 m² 19.74 %

Plan Location:



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Site 4
Proposed larger tree cover

Drawn Date: 05/03/2025

Revision No: 1

Job/project name:

OP24ST0018
FCF Canopy Cover

Legend:

- Site boundary
- Proposed larger trees

Site area:
120475.03 m²

Proposed trees canopy cover:
24859.47 m² 20.63 %

Shortfall to make up to 20 %:
0.00 m² 0.00 %

Shortfall to make up to 30 %:
11283.04 m² 9.37 %

Plan Location:

0 20 40 60 m N

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680100
679800
299400
299700
Fire Station
Gas Gov
Play Area
Liddle Dr
Pennelton Pl
Borrowstoun Hams Rd
Crawfield Rd
Shelter
LB
Drain
A706
LINLITHGOW RD (A706)
Issues
108.3m

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Site 5
Proposed larger tree cover

Drawn Date: 05/03/2025

Revision No: 1

Job/project name:

OP24ST0018
FCF Canopy Cover

Legend:

- Site boundary
- Proposed larger trees

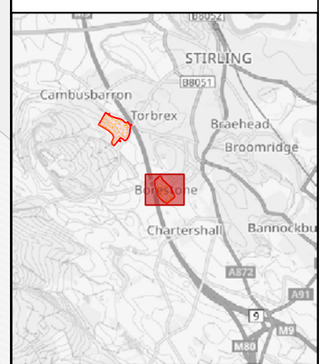
Site area:
82460.49 m²

Proposed trees canopy cover:
18992.86 m² 23.03 %

Shortfall to make up to 20 %:
0.00 m² 0.00 %

Shortfall to make up to 30 %:
5745.29 m² 6.97 %

Plan Location:



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278700 279000

690900

Green Action Trust

Site 6
Proposed larger tree cover

Drawn Date: 05/03/2025

Revision No: 1

Job/project name:

OP24ST0018
FCF Canopy Cover

Legend:

- Site boundary
- Proposed larger trees

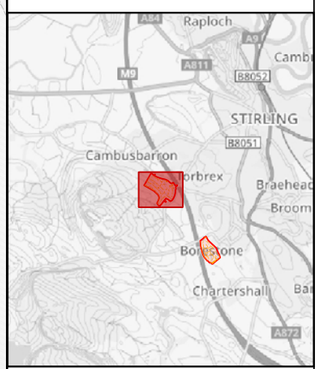
Site area:
139166.00 m²

Proposed trees canopy cover:
25203.33 m² 18.11 %

Shortfall to make up to 20 %:
2629.87 m² 1.89 %

Shortfall to make up to 30 %:
16546.47 m² 11.89 %

Plan Location:



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278000 278500 692000

2: Achieving 20% and 30% canopy cover

As shown in section 1, developments are very mixed in terms of their tree planting proposals and resultant canopy cover. The tables below show the sites with reference to meeting the 20% or 30% threshold for canopy cover from development proposals. The following tables show the required number of trees for each site to meet this requirement, with the 9.4m canopy sized tree representing the 70 m^2 canopy area discussed in section 1. This larger tree size has been used as a standard in the remainder of the processes and calculations within this report.

To increase canopy cover to 20% of site:

Site number	Area needed	% needed	No. of 3m wide canopy trees needed	No. of 4m wide canopy trees needed	No. of 5m wide canopy trees needed	No. of 9.4m wide canopy trees needed
1	0	0	0	0	0	0
2	2469.44	4.53	349.35	196.51	125.77	35.28
3	4762.25	9.74	673.72	378.97	242.54	68.03
4	0	0	0	0	0	0
5	0	0	0	0	0	0
6	2629.87	1.89	372.05	209.28	133.94	37.57

To increase canopy cover to 30% of site:

Site number	Area needed	% needed	No. of 3m wide canopy trees needed	No. of 4m wide canopy trees needed	No. of 5m wide canopy trees needed	No. of 9.4m wide canopy trees needed
1	1754.26	6.00	248.18	139.60	89.34	25.06
2	7922.94	14.53	1120.87	630.49	403.51	113.18
3	9653.76	19.74	1365.73	768.22	491.66	137.91
4	11283.04	9.37	1596.22	897.88	574.64	161.19
5	5745.29	6.97	812.79	457.20	292.61	82.08
6	16546.47	11.89	2340.85	1316.73	842.70	236.38

A variety of canopy sizes are shown to illustrate the number of trees required depending on species selected. Sites 1, 4 and 5 would meet the 20% canopy cover threshold, assuming the consented trees reached 70 m^2 canopy area. The figures show the land needed, and variety of tree sizes required to bring the developments to 20% and 30% canopy cover for each site.

Methodology to add trees to sites.

QGIS was used to generate random tree location, in two phases. The first phase placed tree locations in available greenspace, the second phase placed additional tree locations in available private garden space.

The land types for all sites were digitally captured either from Ordnance Survey data (for already built sites) or direct from landscape plans (for the sites yet to be built). The land types were needed for constraints layers to define where trees could be planted and where they could not be planted. Land types were defined as:

- Greenspace
- Water
- Private garden
- Buildings
- Road/pavement
- Other hardstanding

For the first phase, to randomly allocate trees to greenspace, a constraints layer was created that only included greenspace land use. This layer was then clipped using a 4.72 m buffer applied to: the site boundary; the consented/surveyed tree canopy; and all other land types not to be planted on. The clip was necessary to avoid canopy overshoot into areas where trees would not be planted. A random point generating algorithm was then used to create the maximum number of tree points possible with a 9.44 m spacing. This spacing avoided canopy overlap with the randomly generated trees. The algorithm ran 3 times with 1000 iterations for each pass to optimise point create, and attempt to generate the maximum number of possible tree points. The tree points were then buffered by 4.72 m to create individual tree canopies on greenspace of 70 m^2.

For the second phase, to randomly allocate trees to private gardens, a similar workflow was used. The constraints layer used was the private gardens land type. This layer was then clipped using a 4.72 m buffer applied to the site boundary, the consented/surveyed tree canopy, the random greenspace canopy cover and all other land types not to be planted on. The clip was again necessary to avoid canopy overshoot into areas where trees would not be planted. The same random point generating algorithm was used with the same calibration and buffer settings as the first phase.

Maps on the following pages show potential locations for the shortfall in trees using this methodology, based on tree planting proposals from development plans. There are two maps per site showing:

1. Trees added to greenspaces only
2. Trees added to greenspaces and private gardens

The following tables show the canopy cover for the site from the development proposals, with the addition of trees using the above methodology.

	% of site			
Site number	**Consented canopy cover**	**Greenspace trees cover**	**Garden trees cover**	**Total**
1	24.00	0.48	4.55	29.02
2	15.47	1.67	10.52	27.66
3	10.26	1.00	6.29	17.56
4	20.63	4.12	6.04	30.80
5	23.03	1.02	9.50	33.55
6	18.11	8.44	8.75	35.30

If all the trees consented during development planning were planted and grew to maturity as described, sites 4, 5 and 6 would meet the threshold for 20% and 30% canopy cover. Sites 1 and 2 only meet 20% cover, and site 3 would not meet either criterion.

	No. of 9.4m wide trees		
Site number	**Consented, random and garden**	**Shortfall for 20%**	**Shortfall for 30%**
1	21	None needed	5
2	95	None needed	19
3	51	18	87
4	175	None needed	None needed
5	124	None needed	None needed
6	341	None needed	None needed

Green Action Trust

Site 1 - Consented and greenspace tree cover

Drawn Date: 30/04/2025

Revision No: 1

Job/project name:

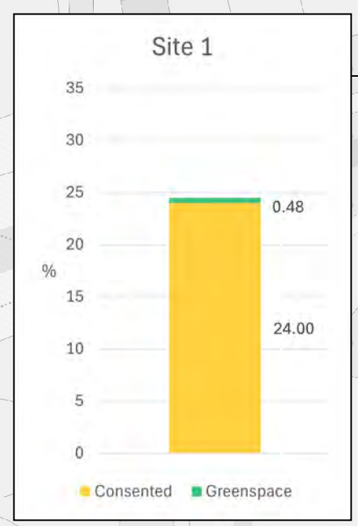
OP24ST0018
FCF Canopy Cover

Legend:

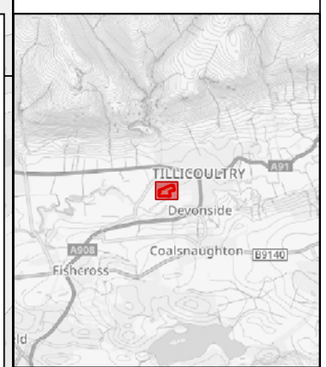
- Site boundary
- Included greenspace areas
- Consented trees
- Random greenspace trees

Consented trees canopy cover: 7017.57 m² 24.00 %

Greenspace canopy cover: 139.91 m² 0.48 %



Plan Location:



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Green Action Trust

Site 1 - Additional garden tree cover

Drawn Date: 30/04/2025

Revision No: 1

Job/project name:

OP24ST0018
FCF Canopy Cover

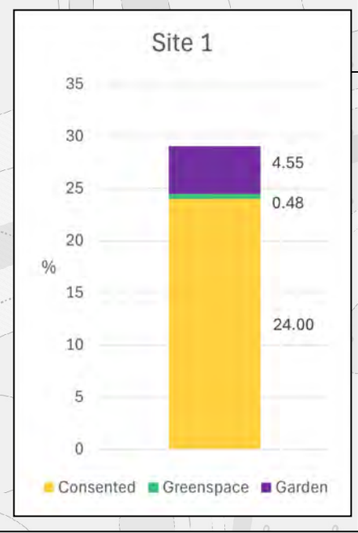
Legend:

- Site boundary
- Included garden areas
- Consented trees
- Random greenspace trees
- Random garden trees

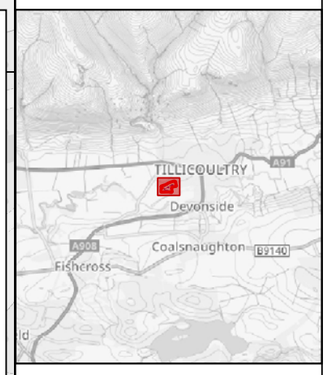
Consented trees canopy cover: 7017.57 m² 24.00 %

Greenspace canopy cover: 139.91 m² 0.48 %

Garden canopy cover: 1329.11 m² 4.55 %



Plan Location:



0 10 20 30 m N

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Green Action Trust

Site 2b - Consented and greenspace tree cover

Drawn Date: 30/04/2025

Revision No: 1

Job/project name:

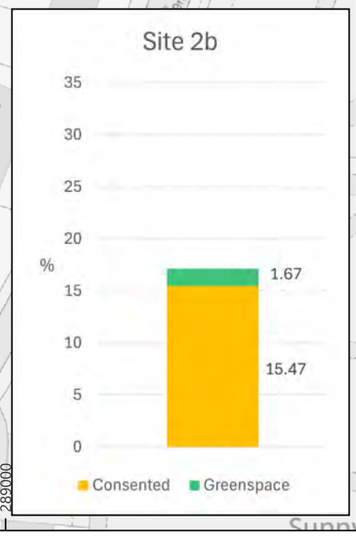
OP24ST0018
FCF Canopy Cover

Legend:

- Site boundary
- Included greenspace areas
- Consented trees
- Random greenspace trees

Consented trees canopy cover: 8437.57 m² 15.47 %

Greenspace canopy cover: 909.38 m² 1.67 %



Plan Location:

0 15 30 45 m N

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Green Action Trust

Site 2b - Additional garden tree cover

Drawn Date: 30/04/2025

Revision No: 1

Job/project name:

OP24ST0018
FCF Canopy Cover

Legend:

- Site boundary
- Included garden areas
- Consented trees
- Random greenspace trees
- Random garden trees

Consented trees canopy cover: 8437.57 m² 15.47 %

Greenspace canopy cover: 909.38 m² 1.67 %

Garden canopy cover: 5736.09 m² 10.52 %

Plan Location:

0 15 30 45 m N

Page Size: A3 Scale: 1:1,250

Green Action Trust

Site 3 - Consented and greenspace tree cover

Drawn Date: 30/04/2025

Revision No: 1

Job/project name:

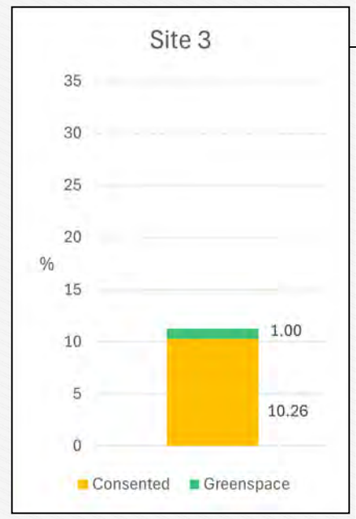
OP24ST0018
FCF Canopy Cover

Legend:

- Site boundary
- Included greenspace areas
- Consented trees
- Random greenspace trees

Consented trees canopy cover: 5020.77 m² 10.26 %

Greenspace canopy cover: 489.64 m² 1.00 %



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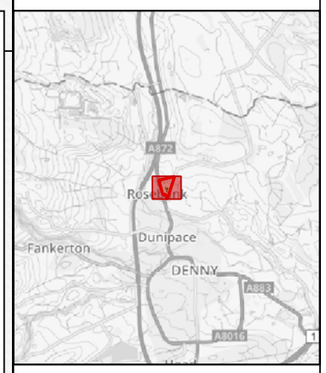

0 10 20 30 40 m N

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Green Action Trust

Site 3 - Additional garden tree cover

Drawn Date: 30/04/2025

Revision No: 1

Job/project name:

OP24ST0018
FCF Canopy Cover

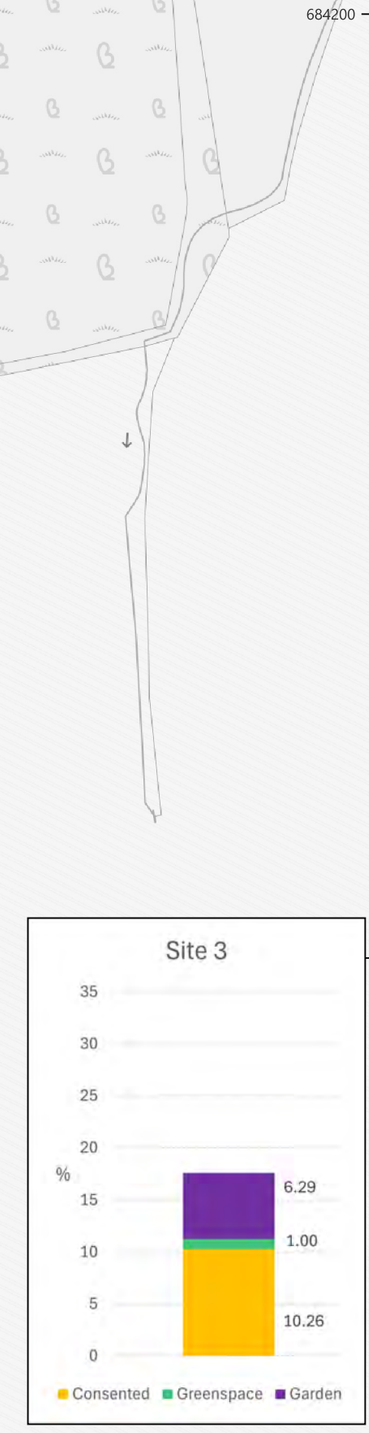
Legend:

- Site boundary
- Included garden areas
- Consented trees
- Random greenspace trees
- Random garden trees

Consented trees canopy cover: 5020.77 m² 10.26 %

Greenspace canopy cover: 489.64 m² 1.00 %

Garden canopy cover: 3077.76 m² 6.29 %



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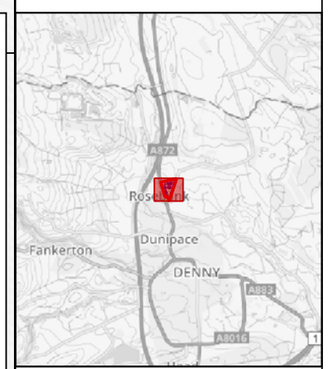


0 10 20 30 40 m

N

Page Size: A3 Scale: 1:1,300

Green Action Trust

Site 4 - Consented and greenspace tree cover

Drawn Date: 30/04/2025

Revision No: 1

Job/project name:

OP24ST0018
FCF Canopy Cover

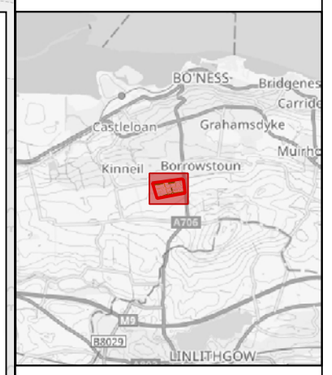
Legend:

- Site boundary
- Included greenspace areas
- Consented trees
- Random greenspace trees

Consented trees canopy cover: 24859.47 m² 20.63 %

Greenspace canopy cover: 4966.89 m² 4.12 %

Plan Location:



0 20 40 60 m N

Page Size: A3 Scale: 1:1,750

Green Action Trust

Site 4 - Additional garden tree cover

Drawn Date: 30/04/2025

Revision No: 1

Job/project name:

OP24ST0018
FCF Canopy Cover

Legend:

- Site boundary
- Included garden areas
- Consented trees
- Random greenspace trees
- Random garden trees

Consented trees canopy cover: 24859.47 m² 20.63 %

Greenspace canopy cover: 4966.89 m² 4.12 %

Garden canopy cover: 7275.44 m² 6.04 %

Plan Location:

0 20 40 60 m N

Page Size: A3 Scale: 1:1,750

Green Action Trust

Site 5 - Consented and greenspace tree cover

Drawn Date: 30/04/2025

Revision No: 1

Job/project name:

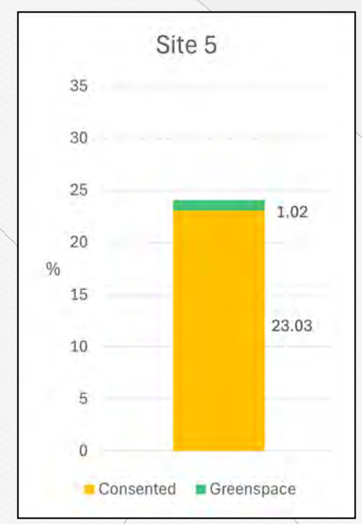
OP24ST0018
FCF Canopy Cover

Legend:

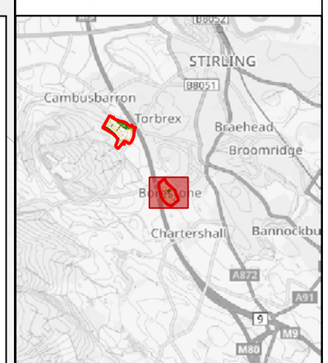
- Site boundary
- Included greenspace areas
- Consented trees
- Random greenspace trees

Consented trees canopy cover: 18992.86 m² 23.03 %

Greenspace canopy cover: 839.38 m² 1.02 %



Plan Location:



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Green Action Trust

Site 5 - Additional garden tree cover

Drawn Date: 30/04/2025

Revision No: 1

Job/project name:

OP24ST0018
FCF Canopy Cover

Legend:

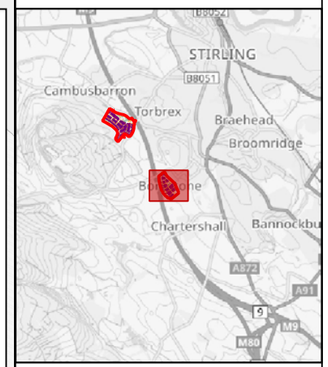
- Site boundary
- Included garden areas
- Consented trees
- Random greenspace trees
- Random garden trees

Consented trees canopy cover: 18992.86 m² 23.03 %

Greenspace canopy cover: 839.38 m² 1.02 %

Garden canopy cover: 7834.21 m² 9.50 %

Plan Location:



0 20 40 60 m N

Page Size: A3 Scale: 1:1,750

Green Action Trust

Site 6 - Consented and greenspace tree cover

Drawn Date: 30/04/2025

Revision No: 1

Job/project name:

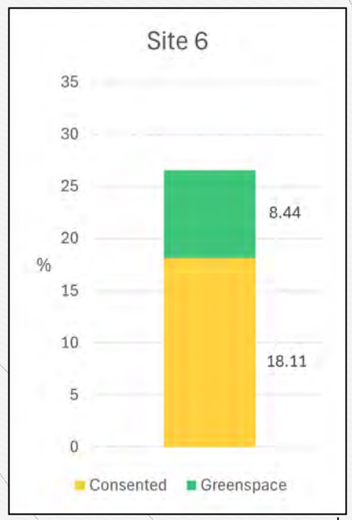
OP24ST0018
FCF Canopy Cover

Legend:

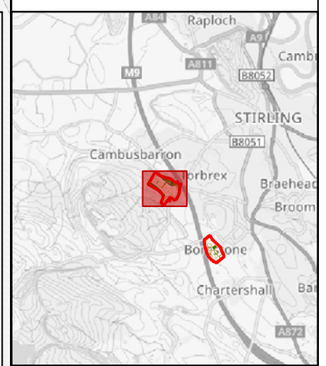
- Site boundary
- Included greenspace areas
- Consented trees
- Random greenspace trees

Consented trees canopy cover: 11751.27 m² 8.44 %

Greenspace canopy cover: 12170.96 m² 8.75 %



Plan Location:



0 20 40 60 m N

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Green Action Trust

Site 6 - Additional garden tree cover

Drawn Date: 30/04/2025

Revision No: 1

Job/project name:

OP24ST0018
FCF Canopy Cover

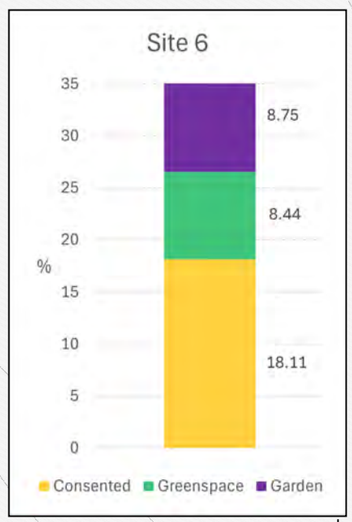
Legend:

- Site boundary
- Included garden areas
- Consented trees
- Random greenspace trees
- Random garden trees

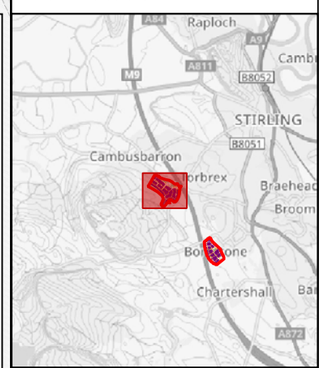
Consented trees canopy cover: 11751.27 m² 8.44 %

Greenspace canopy cover: 12170.96 m² 8.75 %

Garden canopy cover: 12170.96 m² 8.75 %



Plan Location:



0 20 40 60 m N

Page Size: A3 Scale: 1:2,000

3: Trees from site surveys

The three developed sites (sites 2, 3 and 5) were surveyed for existing trees, with the following information gathered:

- Species (to family or species)
- Diameter at breast height (DBH) (cm)
- Full height (m)
- DBH and height of additional stems
- Canopy dieback (%)

Trees were georeferenced using QGIS; dead trees were also recorded. Maps on the following pages show the locations of all trees on site, compared with the development proposals. As the maps on the following pages show, there is variety in how well delivery matches the original plans:

- Site 2: existing tree planting matches quite well with original plans, with a few proposals not met and changes to spacing. 2 dead trees were noted.
- Site 3: existing tree planting matches fairly well with original plans, with a few proposals not met and changes to spacing. While more standard trees were planted than was consented, there is less planting around the SUDS area to the northwest of the site, with whip tree planting along the northern edge replacing some consented standard planting. 6 dead trees were noted, along with 2 which had been cut to head height presumably to prevent shading of the adjacent garden.
- Site 5: existing tree planting matches poorly with original plans. A significant number of trees consented during through the planning application were not planted, mostly street trees at the edges of gardens. 2 dead trees were noted.

The following table summarises the number of trees planted on each site, and their canopy cover (assuming they reach mature size):

Site number	Canopy cover (sq. m)	Canopy cover (%)	Number of trees
2	6884.90	12.62	146
3	7524.25	15.38	121
5	6195.39	7.51	115

The table below shows the number of trees consented from planning applications, compared to the actual trees planted on site. Note that for site 5 this includes an area of dense, whip tree planting that had not been delivered at the time of site survey.

Site number	No. of trees consented	No. of trees planted
2	180	146
3	93	121
5	419	115

Green Action Trust

Site 2b - Consented and surveyed trees

Drawn Date: 30/04/2025

Revision No: 2

Job/project name:

OP24ST0018
FCF Canopy Cover

Legend:

- Site boundary
- Consented trees

Site assessment:

- Birch sp
- Cherry sp
- Dead
- Dead / Missing
- Hornbeam sp
- Lime
- Maple sp.
- Oak sp
- Rowan

Plan Location:

0 10 20 30 m N

Page Size: A3 Scale: 1:1,000

Green Action Trust

Site 3 - Consented and surveyed trees

Drawn Date: 30/04/2025

Revision No: 2

Job/project name:

OP24ST0018
FCF Canopy Cover

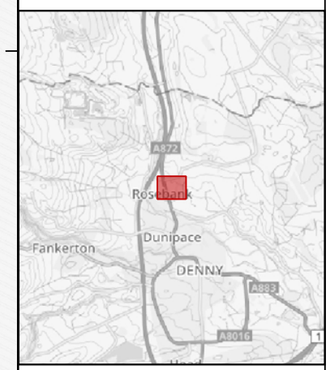
Legend:

- Site boundary
- Consented trees

Site assessment:

- Alder
- Beech
- Birch
- Cherry
- Dead
- Dogwood
- Hornbeam
- Maple
- Whitebeam
- fcf_whip_trees

Plan Location:



0 10 20 30 40 m

N

Page Size: A3 Scale: 1:1,300

Green Action Trust

Site 5 - Consented and surveyed trees

Drawn Date: 30/04/2025

Revision No: 2

Job/project name:

OP24ST0018
FCF Canopy Cover

Legend:

- Site boundary
- Consented trees

Site assessment:

- Alder
- Alnus incana
- Birch/Birch sp.
- Cherry/Cherry sp.
- Common Whitebeam (Sorbus aria)
- Crataegus pruniflora
- Dead/Dead (Alder)
- Horse Chestnut
- Lime
- Norway Maple (Acer platanoides drummond)
- Sorbus aucuparia streetwise
- Sorbus sp
- Upright Hornbeam (Carpinus betulus fastigiata)

Plan Location:

0 20 40 60 m N

Page Size: A3 Scale: 1:1,750

The potential to add new tree planting to the development was assessed, with the number of trees required shown below and mapped on the following pages. As with previous data, this assumes existing and new trees reaching a mature standard size.

	For 20% canopy cover			For 30% canopy cover		
Site number	Area needed	% needed	No. trees	Area needed	% needed	No. of trees
2	4022.11	7.38	57.46	9475.61	17.38	135.37
3	2258.77	4.62	32.29	7150.277	14.61	102.15
5	10296.71	12.49	147.10	18542.76	22.49	264.90

Maps on the following pages show potential location for the shortfall in trees, based on actual tree planting as surveyed. There are three maps per site showing:

1. Existing trees (at maturity)
2. Trees retrofitted to greenspaces only
3. Trees retrofitted to greenspaces and private gardens

The following tables shows the canopy cover of the site of the trees planted, with potential additional cover using the methodology previously described.

	% of site			
Site number	Surveyed canopy cover	Greenspace trees cover	Garden trees cover	Total tree cover
2	12.62	1.67	10.01	24.30
3	15.38	0.72	5.29	21.39
5	7.51	4.84	9.10	21.45

As the following information shows, if all planted trees reached the maturity level ascribed, all developed sites would meet 20% canopy cover. None of the sites would attain 30% cover, with the number of trees required shown:

	No. of 9.4m wide trees		
Site number	Surveyed, greenspace and garden	Shortfall for 20%	Shortfall for 30%
2	88	None needed	47
3	42	None needed	60
5	166	None needed	99

Green Action Trust

Site 2b
Surveyed larger tree cover

Drawn Date: 19/03/2025

Revision No: 1

Job/project name:

OP24ST0018
FCF Canopy Cover

Legend:

- Site boundary
- Surveyed larger trees

Site area:
54535.04 m²

Surveyed trees canopy cover:
6884.90 m² 12.62 %

Shortfall to make up to 20 %:
4022.11 m² 7.38 %

Shortfall to make up to 30 %:
4022.11 m² 7.38 %

Plan Location:

0 15 30 45 m N

Page Size: A3 Scale: 1:1,250

Green Action Trust

Site 2b - Surveyed and greenspace tree cover

Drawn Date: 20/03/2025

Revision No: 1

Job/project name:

OP24ST0018
FCF Canopy Cover

Legend:

- Site boundary
- Included greenspace areas
- Surveyed trees
- Random greenspace trees

Surveyed trees canopy cover:
6884.90 m² 12.62 %

Greenspace canopy cover:
909.38 m² 1.67 %

Plan Location:

0 15 30 45 m

Page Size: A3 Scale: 1:1,250

694000 288800 289000 693800

Green Action Trust

Site 2b - Surveyed additional garden tree cover

Drawn Date: 20/03/2025

Revision No: 1

Job/project name:

OP24ST0018
FCF Canopy Cover

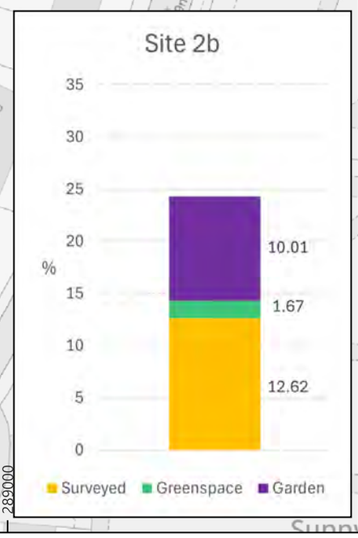
Legend:

- Site boundary
- Included garden areas
- Surveyed trees
- Random greenspace trees
- Random garden trees

Surveyed trees canopy cover:
6884.90 m² 12.62 %

Greenspace canopy cover:
909.38 m² 1.67 %

Garden canopy cover:
5456.28 m² 10.01 %



Plan Location:

0 15 30 45 m N

Page Size: A3 Scale: 1:1,250

Green Action Trust

Site 3
Surveyed larger tree cover

Drawn Date: 19/03/2025

Revision No: 1

Job/project name:

OP24ST0018
FCF Canopy Cover

Legend:

- Site boundary
- Surveyed larger trees

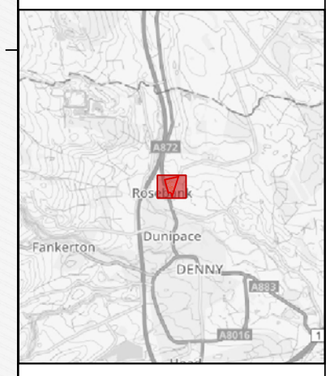
Site area:
48915.09 m²

Surveyed trees canopy cover:
7524.25 m² 15.38 %

Shortfall to make up to 20 %:
2258.77 m² 4.62 %

Shortfall to make up to 30 %:
7150.28 m² 14.62 %

Plan Location:



0 10 20 30 40 m

N

Page Size: A3 Scale: 1:1,300

Green Action Trust

Site 3 - Surveyed and greenspace tree cover

Drawn Date: 20/03/2025

Revision No: 1

Job/project name:

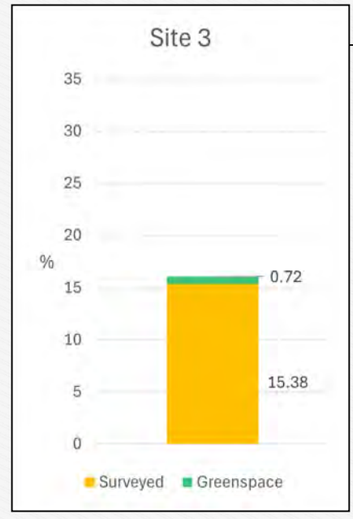
OP24ST0018
FCF Canopy Cover

Legend:

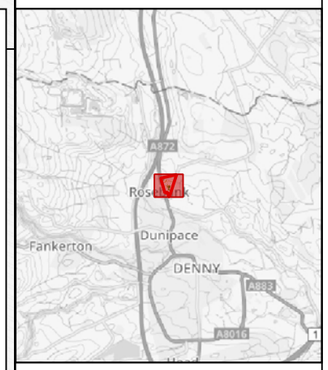
- Site boundary
- Included greenspace areas
- Surveyed trees
- Random greenspace trees

Surveyed trees canopy cover:
7524.25 m² 15.38 %

Greenspace canopy cover:
349.75 m² 0.72 %



Plan Location:



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Page Size: A3 Scale: 1:1,300

Green Action Trust

Site 3 - Surveyed additional garden tree cover

Drawn Date: 20/03/2025

Revision No: 1

Job/project name:

OP24ST0018
FCF Canopy Cover

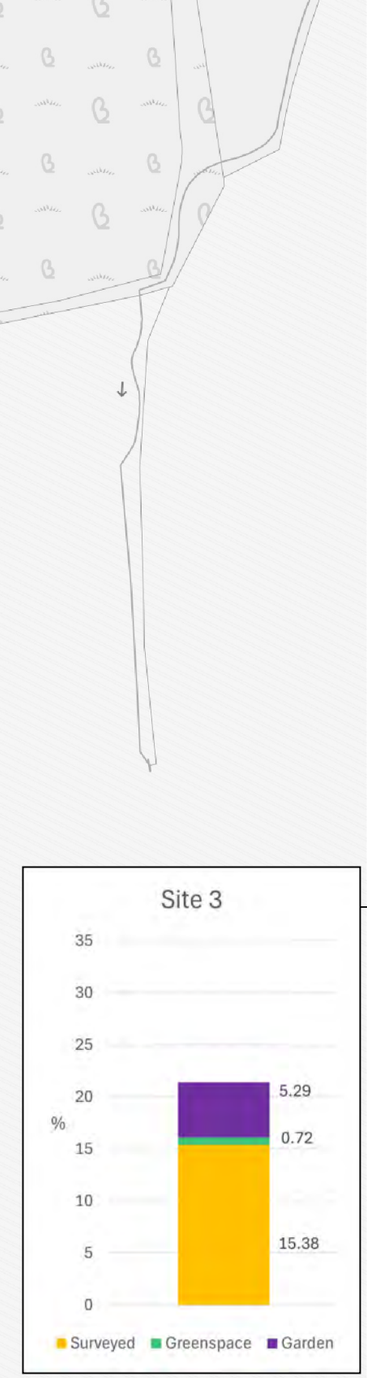
Legend:

- Site boundary
- Included garden areas
- Surveyed trees
- Random greenspace trees
- Random garden trees

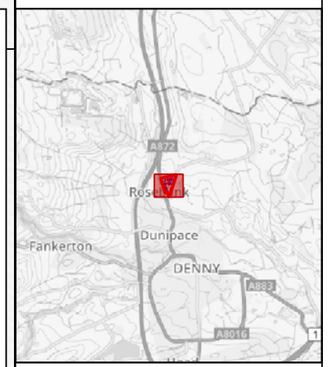
Surveyed trees canopy cover:
7524.25 m² 15.38 %

Greenspace canopy cover:
349.75 m² 0.72 %

Garden canopy cover:
2588.12 m² 5.29 %



Plan Location:



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Page Size: A3 Scale: 1:1,300

Green Action Trust

Site 5
Surveyed larger tree cover

Drawn Date: 19/03/2025

Revision No: 1

Job/project name:

OP24ST0018
FCF Canopy Cover

Legend:

- Site boundary
- Surveyed larger trees

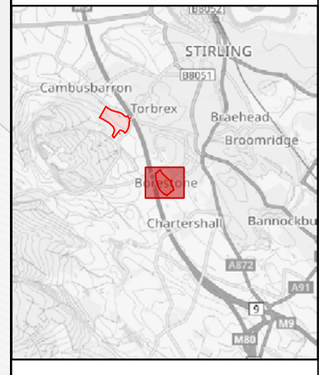
Site area:
82460.49 m²

Surveyed trees canopy cover:
6195.39 m² 7.51 %

Shortfall to make up to 20 %:
10296.71 m² 12.49 %

Shortfall to make up to 30 %:
18542.76 m² 22.49 %

Plan Location:



0 20 40 60 m N

Page Size: A3 Scale: 1:1,750

278700 279000 690900

Green Action Trust

Site 5 - Surveyed and greenspace tree cover

Drawn Date: 20/03/2025

Revision No: 1

Job/project name:

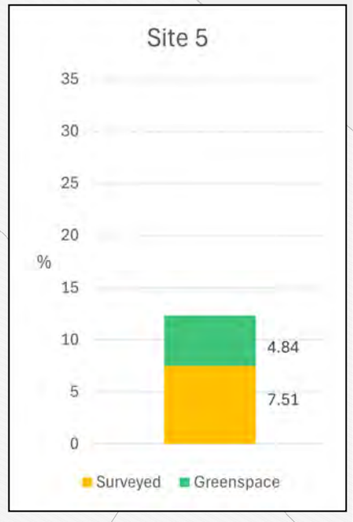
OP24ST0018
FCF Canopy Cover

Legend:

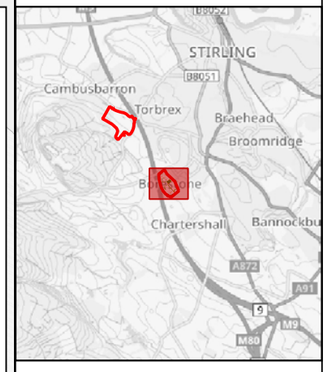
- Site boundary
- Included greenspace areas
- Surveyed trees
- Random greenspace trees

Surveyed trees canopy cover:
6195.39 m² 7.51 %

Greenspace canopy cover:
3987.06 m² 4.84 %



Plan Location:



0 20 40 60 m N

Page Size: A3 Scale: 1:1,750

Green Action Trust

Site 5 - Surveyed aditional garden tree cover

Drawn Date: 20/03/2025

Revision No: 1

Job/project name:

OP24ST0018
FCF Canopy Cover

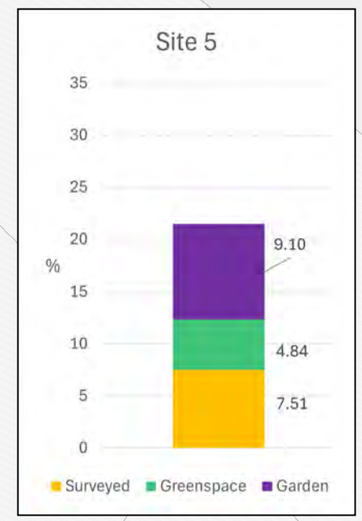
Legend:

- Site boundary
- Included garden areas
- Surveyed trees
- Random greenspace trees
- Random garden trees

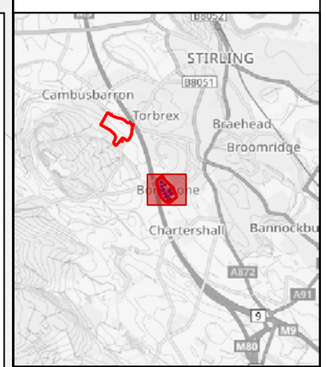
Surveyed trees canopy cover:
6195.39 m² 7.51 %

Greenspace canopy cover:
3987.06 m² 4.84 %

Garden canopy cover:
7507.29 m² 9.10 %



Plan Location:



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4: Value analysis

i-Tree Eco (v6) was used to evaluate ecosystem value of the trees within the 3 developed sites. This tool is used worldwide to standardise quantifying the benefits of trees including the removal of pollutants from the air, and absorption of carbon dioxide. The Eco tool is designed to be used with data collected from the field, with v6 adapted for international use, including in the UK.

The Arboricultural Association[2] provides information on interpreting the results of i-Tree anaylsis, including the following statement:

> *Replacement Cost: This is the cost of the trees based on the physical resource itself (e.g. the cost of having to replace a tree with a similar tree). The value is determined within i-Tree Eco according to the Council of Tree and Landscape Appraisers method.*

Data was entered into the tool and used to understand the value of services including carbon storage and pollution reduction. This tool was run on data from:

- Trees consented from the development plan proposals
- Existing trees, in their current state
- Trees to meet canopy cover at 20%
- Trees to meet canopy cover at 30%

The following conditions are assumed / were selected by the i-Tree tool:

- "The estimated 2025 Social Cost of Carbon for the monetary value of carbon storage and sequestration is set at $130 / metric ton of CO^2 (or $477 / metric ton of carbon). The value represents the midpoint of the 2.5 % discount rate estimates for 2020 and 2030, respectively. This is an update of the previous Social Cost of Carbon value used in i-Tree which was $51.27 / metric ton of CO^2."
- The programme requires assigning nearby stations for pollutants, weather and precipitation, all to the same date. The same monitoring stations were used for each site / process:
    - Closest weather station; 27 km (16miles) from site 3 (near Edinburgh)
    - Closet pollution station: 704 km (437 miles) from site 3 (Netherlands)

Trees consented from development plans

The following points should be noted:

- Where the selected species was not known or available in iTree, the closest/native/commonly used species was selected for the tool.
- The trees were not georeferenced to individual locations (a central location of each site was used).
- DBH and height were estimated from the Handbook of UK Urban Tree Allometric Equations and Size Characteristics (Version 1.4, December 2024), which often required matching the ornamental versions of trees to its closest native species.
- Canopy health was set to a default of 87 %
- Areas of "woodland structure planting" or whip trees were not assessed using the i-Tree tool as they were not large enough to take measurements; only standard sized trees were assessed to allow for comparability between sites.

[2] https://www.trees.org.uk/Help-Advice/Public/i-Tree-en

Ecosystem service analysis:

	Site 2	Site 3	Site 5
Replacement Value (in) (£)	241,064	225,813	192,050
Carbon Storage (lb)	257,328	252,440	182,444
Carbon Storage (£)	29,531	28,970	20,937
Gross Carbon Sequestration (lb/yr)	6,082	5,480	7,076
Gross Carbon Sequestration (£/yr)	698	629	812
Avoided Runoff (£/yr)	0	0	0
Avoided Runoff (gal/yr)	0	0	0
Pollution Removal (oz/yr)	2,506	2,291	2,246
Pollution Removal (£/yr)	139	153	87
Oxygen Production (lb/yr)	16,218	14,614	18,870
Total Annual Benefits (£/yr)	**£837**	**£782**	**£899**

Ton: short ton (U.S.) (2,000 lbs)
Monetary values £ are reported in Pound Sterlings throughout the report except where noted.
Ecosystem service estimates are reported for trees.
With Complete Inventory Projects, oxygen production is estimated from gross carbon sequestration and does not account for decomposition.

Avoided runoff value is calculated by the price £0.006/gal. The user-designated weather station reported 0.0 inches of total annual precipitation. Eco will always use the hourly measurements that have the greatest total rainfall or user-submitted rainfall if provided.

Existing trees within developments, in their current state

The following points should be noted:

- It was not assumed that trees planted matched the landscape proposals from the development plan. The species selected to run through i-Tree were either matched to the field surveyor's identification, or the closest approximation to a native species. Due to time of year and young age growth forms, it was not always possible to ascertain species of each tree. Family was known, and the species chosen for analysis was the most common/native match.
- i-Tree does not provide data for every species, particularly for ornamental varieties; the closest native or commonly used species was selected in this case e.g. at site 5 some trees retained species labels including *Carpinus betulus "fastigiate"* which is a slimmer growth form than the *C. betulus* selected for data processing.
- i-Tree would not accept some small multi-stemmed data; these were removed from the data (trees 8, 52 and 54 at site 2)
- Only standard tree planting was processed; areas of denser/whip tree planting were not included.

Ecosystem service analysis:

	Site 2	Site 3	Site 5
Replacement Value (in) (£)	4,314	5,157	4,302
Carbon Storage (lb)	2,319	7,729	1,480
Carbon Storage (£)	266	887	170
Gross Carbon Sequestration (lb/yr)	604	810	346
Gross Carbon Sequestration (£/yr)	69	93	40

	Site 2	Site 3	Site 5
Avoided Runoff (£/yr)	0	0	0
Avoided Runoff (gal/yr)	0	0	0
Pollution Removal (oz/yr)	152	201	103
Pollution Removal (£/yr)	8	12	4
Oxygen Production (lb/yr)	1,611	2,160	922
Total Annual Benefits (£/yr)	**£77**	**£105**	**£43**

Mature trees to meet canopy cover levels

The following points should be noted:

- A mix of species used in development proposals were allocated for this assessment; native species were chosen and data from the Handbook of UK Urban Tree Allometric Equations and Size Characteristics (Version 1.4, December 2024) was used to calculate assumed statistics as shown below.
- The trees were not allocated specific locations; a central latitude and longitude for each site was used.

Tree species	Canopy area	Crown radius	DBH predicted by crown radius (cm)	Height predicted by crown radius (m)
Betula pendula	70	4.720348719	33.74889314	13.00122973
Acer campestre	70	4.720348719	37.58686394	9.228032988
Alnus glutinosa	70	4.720348719	37.00279744	11.10026532
Carpinus betulus	70	4.720348719	34.9024788	11.25323612
Prunus avium	70	4.720348719	38.10233624	8.157091683
Quercus robur	70	4.720348719	44.17978405	11.3714209
Sorbus aucuparia	70	4.720348719	30.04505067	7.888784771
Tilia cordata	70	4.720348719	39.84195699	12.26747524

This gives the following number of trees at each built site, to achieve required canopy cover levels. The number of trees was split evenly between each species above, with any additional numbers allocated to field maple, which was a common and abundant choice in the development proposals.

Site	No. of 9.4m wide canopy trees needed (20% canopy)	No. of trees of each species per site	No. of 9.4m wide canopy trees needed (30% canopy)	No. of trees of each species per site
2	138	17	216	27
3	105	13	175	21
5	111	13	228	28

Canopy cover at 20 %

Ecosystem service analysis:

	Site 2	Site 3	Site 5
Replacement Value (in) (£)	124,837	95,023	100,016
Carbon Storage (lb)	127,119	96,701	102,454
Carbon Storage (£)	14,588	11,097	11,758
Gross Carbon Sequestration (lb/yr)	3,889	2,738	2,760
Gross Carbon Sequestration (£/yr)	446	314	317
Avoided Runoff (£/yr)	0	0	0
Avoided Runoff (gal/yr)	0	0	0
Pollution Removal (oz/yr)	1,699	1,233	1,307
Pollution Removal (£/yr)	96	82	53
Oxygen Production (lb/yr)	10,370	7,301	7,361
Total Annual Benefits (£/yr)	**£542**	**£396**	**£370**

Canopy cover at 30 %

Ecosystem service analysis:

	Site 2	Site 3	Site 5
Replacement Value (in) (£)	193,325	157,980	206,202
Carbon Storage (lb)	197,878	161,373	210,049
Carbon Storage (£)	22,708	18,519	24,105
Gross Carbon Sequestration (lb/yr)	6,118	4,485	5,819
Gross Carbon Sequestration (£/yr)	702	515	668
Avoided Runoff (£/yr)	0	0	0
Avoided Runoff (gal/yr)	0	0	0
Pollution Removal (oz/yr)	2,644	2,054	2,684
Pollution Removal (£/yr)	149	137	109
Oxygen Production (lb/yr)	16,314	11,960	15,518
Total Annual Benefits (£/yr)	**£851**	**£651**	**£776**

Comparison of ecosystem services

In the table below, all ecosystem services are compared with 30% canopy as a benchmark. Positive number show that 30% canopy cover on that site provides higher benefit; negative number show where the compared option is favourable:

	20% canopy cover			Planted trees			Consented trees		
	Site 2	Site 3	Site 5	Site 2	Site 3	Site 5	Site 2	Site 3	Site 5
Replacement Value (in) (£)	68,488	62,957	106,186	189,011	152,823	201,900	-47,739	-67,833	14,152
Carbon Storage (lb)	70,759	64,672	107,595	195,559	153,644	208,569	-59,450	-91,067	27,605
Carbon Storage (£)	8,120	7,422	12,347	22,442	17,632	23,935	-6,823	-10,451	3,168

	20% canopy cover			Planted trees			Consented trees		
	Site 2	Site 3	Site 5	Site 2	Site 3	Site 5	Site 2	Site 3	Site 5
Gross Carbon Sequestration (lb/yr)	2,229	1,747	3,059	5,514	3,675	5,473	36	-995	-1,257
Gross Carbon Sequestration (£/yr)	256	201	351	633	422	628	4	-114	-144
Pollution Removal (oz/yr)	945	821	1,377	2,492	1,853	2,581	138	-237	438
Pollution Removal (£/yr)	53	55	56	141	125	105	10	-16	22
Oxygen Production (lb/yr)	5,944	4,659	8,157	14,703	9,800	14,596	96	-2,654	-3,352
Total Annual Benefits (£/yr)	**309**	**255**	**406**	**774**	**546**	**733**	**14**	**-131**	**-123**

Allocation of land to shortfall

As described above, the geoprocessing tools used to allocate standard trees to the development greenspace and gardens, resulted in a shortfall of trees for canopy cover at 30%:

Site number	Shortfall for 30%	No. of housing units at site
2	47	149
3	60	113
5	99	185

As the mapping for these proposals show, the only way to meet this additional tree planting would be through loss of housing units, and in general, this would be one housing unit per tree which represents a substantial land loss to housing.

The iterative process of this tool is perhaps a limit for this use, as well as highlighting the need to allocate tree canopy cover at the start of development rather than retrospectively.

5: Key findings

If trees consented within development applications were planted, and grew to a standard canopy size as described, three out of six sites would meet 20% canopy cover within the site boundary. No sites would reach 30% canopy cover.

Spatial analysis of the potential to add trees to sites to make up the shortfall demonstrates that retro-fitting trees to both greenspaces and gardens is the only way to achieve cover. Three sites could reach 30% cover in this way; two sites can reach 20%, and one site meets neither. This demonstrates the difficulting with attempting to increase tree planting post-development; it is also very unlikely that any substantial canopy cover could be achieved within private gardens to meet these levels.

Site surveys noted that the consented number of trees were not planted in any development, though more trees were delivered in site 3 than originally planned. There were also changes to the area of whip tree planting proposed that would eventually result in denser canopy cover in some areas. With the addition of trees in greenspaces and gardens all three sites could attain 20% canopy cover, bur none would reach 30% and the space required to do so is substantial.

As can be seen from value analysis, planting trees to result in 30% canopy cover in developments provides better ecosystem services and natural capital benefits than a lower canopy cover, and from the planted trees in their current state. However, were consented trees planted and reached assumed canopy size, they would generally provide higher ecosystem value than other options.

However, the proposals from development were not generally met, and it could be assumed that planted trees would not reach a full, mature canopy level either due to the ornamental forms selected, or removal/pruning to limit growth. This is a potential risk for all trees planted within development sites, particularly those near to and within gardens or residences.

6: Recommendations

National Planning Framework 4 support development proposals that are sited and designed to adapt to current and future risks from climate change (Policy 2: Climate mitigation and adaptation), enhance biodiversity, (Policy 3: Biodiversity) and enhance, expand and improve woodland and tree cover (Policy 6: Forestry, woodland and trees).

A minimum standard of 30% canopy cover within urban neighbourhoods clearly accords with these requirements.

The following recommendations have been identified, to enable future development to deliver for increased urban canopy cover:

- Determine desired canopy cover level pre-design in agreement between developers and Planning Authority, through Local Development Plans and supporting guidance. There should be consideration of political context and national/local forest and woodland strategies, and there is potential to work across Local Authority boundaries to standardise guidance on a regional level.
- Require development proposals to include information on potential mature canopy cover (visually and through GIS) that will be achieved during development.
- Provide clear and easy to use guidance to developers for all scales of development to encourage increased canopy cover; this could potentially be tied in with biodiversity net gain and/or tree loss mitigation measures from development.
- Require Landscape proposals that include tree planting to georeference trees by species and include their potential canopy size within drawings
- Retain existing trees / woodland during construction; treat existing trees as infrastructure, especially those with higher biodiversity value e.g. longer living species, older, and larger trees.
- Habitat connectivity and nature networks should be considered with the wider landscape to ensure tree planting helps provide habitat or stepping stones in the form of hedges and trees selected for their biodiversity value.
- Consider the wider environment and what additional benefits can be delivered alongside tree planting e.g. species rich grassland
- Identify the area(s) of land needed within the development to meet agreed canopy cover level. Implement site checks or evidence of delivery to ensure adherence to proposals/conditions of development.
- Plan around areas designated for tree planting, considering ground works, proximity of trees to buildings and other infrastructure and services locations. Understand the environmental conditions – evaluate soil conditions, climate, exposure etc, know that planting conditions often poor and if interventions are required (e.g. drainage).
- Consider the objectives of the greenspace and individual trees: recommend tree species to be planted to give desired cover e.g. favour those that provide high levels of ecosystem services[3], for example, trees with ability to filter/absorb pollutants may be selected to buffer roads.
- In order to maximise the climate benefits of trees within developments, including shading and water inception, trees require to be located throughout development rather than as dense plantation within one area.

[3] https://www.forestresearch.gov.uk/research/quantification-and-valuation-of-benefits-provided-by-urban-trees/selecting-urban-trees-for-ecosystem-service-provision/

- Work with house buyers to ensure buy-in for garden and neighbourhood trees potentially though an element of choice/options e.g. fruit trees
- Ensure an adequate specification for planting and protection is in place for individual as well as groups of trees.
- Put in place a robust maintenance plan for ongoing management and consider who will be undertaking this across the development e.g. individual homeowners, the local authority, or developer.

Existing guidance provides information of integrating trees within new development, including "First Steps in Trees and New Developments" [4] (Trees and Design Action Group, 2022). This short guide provides principles of good practice for tree planting in developments on, for example, tree retention and tree planting and provides advice for developers and local planning authorities:

Focuses on retaining trees on new developments through three principles: 'understand', 'retain' and 'enhance'. It outlines the actions required by different stakeholders and the best time frame for their implementation, ultimately to integrate existing trees into new developments in order to achieve multiple benefits.

[4] http://epapers.bham.ac.uk/4109/1/TDAG_TreesAndNewDevelopment.pdf