



REPORT

Urban Forest Plan
Tree Planting Prioritisation and Opportunity
Mapping

CLIENT

Greater London Authority
On behalf of London Tree Partnership

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Executive Summary

Introduction

The Mayor of London's [Environment Strategy](#) includes a target to increase the area of London's land area under tree canopy cover by 10% of current levels by 2050 (from ~21% to ~23%). An Urban Forest Plan (UFP) is currently being prepared by the Mayor in collaboration with the Forestry Commission and the [London Tree Partnership](#) to provide further detail on how to run a major programme of tree planting, and to determine activities required to help meet this objective. This report sets out a 2-step approach to help realise the target.

Firstly, by analysing the existing tree canopy cover data, in conjunction with a range of socio-economic, political, health and environmental datasets, priority wards for increasing canopy cover are identified. Secondly, by analysing existing canopy and land-use data, an approach to identifying potential planting opportunities on the ground, in openspace and pavements, is put forward. 3D visualisations of new street tree planting are provided to demonstrate the benefit of planting new street trees in low canopy wards.

Identifying priority wards for tree planting

Priority wards for increasing canopy cover are identified by calculating the average levels of the following factors within each London ward:

- Tree Canopy Cover (Canopy Curio data)
- Index of Multiple Deprivation (ONS data from 2011 census)
- Urban heat island (Mean night-time temperature during the summer of 2011)
- Green Blue cover (NDVI assessment of open water and greenspace)
- Air pollution (LAEI air quality data for NO2 and PM2.5)
- Sites of Importance for Nature conservation (% of SINC in Ward)

Wards were ranked based on levels of the above datasets and deciles are created. The overall approach outlined creates a 'decision support tool' and the full results are provided in an accompanying Spreadsheet. This allows the user to filter for the various factors above to:

- decide on which (combination of) factors are most important in their area of interest and
- decide on appropriate (local) thresholds for their chosen factors.

Identifying potential planting opportunities

The following datasets were used to map potential 'plantable' areas within a sample of low-canopy wards in inner and outer London:

- Land-use data (Verisk Geo-information Group UKmap)
- Tree Canopy Cover (Canopy Curio data)

UKmap land-use categories were selected as having potential for tree planting. These excluded, for instance, private gardens and playing fields but included a range of other open spaces (see Appendix 1 for full list). The area outside the current canopy was identified and the increase in canopy that would be possible by planting on these areas was calculated. This was based on Forestry Commission guidance that a maximum of 80% of the site could be planted, to allow for clearings in the canopy. In reality 80% wouldn't be appropriate on the majority of sites where tree planting needs to be balanced with other uses.

Outside of open spaces, the other major opportunity to plant new trees is on streets. To accommodate a tree-pit and provide adequate space for wheelchairs and pushchairs only pavements greater than 2m wide were considered suitable for planting. Those areas of pavements that were wide enough and not already under canopy were identified and the length of available pavement was estimated. To estimate maximum potential increase in canopy a spacing of 14.6m (required for trees of average 7.3m radius canopy size) was assumed. In reality local circumstances, like parking and underground utilities, will mean that not all of the pavement identified can be planted.

Within the inner and outer London sample wards many potential opportunities for new planting are identified. These need to be assessed for practicality at the local level (e.g. underground utilities) but the Major's targets for increasing canopy cover certainly appear very achievable.

Accompanying outputs

This report is provided in conjunction with:

- Spreadsheet and Shapefile data ward scores of prioritisation factors. Plus 7 x A3 PDF maps of London wards showing scores.
- Spreadsheet and Shapefiles data on potential increase in canopy cover in sample wards. Plus 24 x A3 PDF maps of sample wards showing potential planting locations
- A 3D model, fly-through animation and before-and-after photos of streets in New Cross ward.

Introduction

The Mayor of London's [Environment Strategy](#) includes a target to increase the area of London's land area under tree canopy cover by 10% of current levels by 2050 (from ~21% to ~23%). An Urban Forest Plan (UFP) is currently being prepared by the Mayor in collaboration with the Forestry Commission and the [London Tree Partnership](#) to provide further detail on how to run a major programme of tree planting, and to determine activities required to help meet this objective.

Alongside the policy developments, 2 new datasets had been created by the GLA and there was a desire to see how these might be used to target tree planting. The new datasets are:

- A high-resolution map of tree canopy cover for Greater London produced by Breadboard Labs in collaboration with the Greater London Authority as part of a Breadboard Lab's European Space Agency funded project, Curio Canopy.
- An accurate estimate of the extent of the London's green cover - the city's parks, gardens, trees, green spaces, rivers and wetlands, and features such as green roofs. The 'green-blue' cover layer was created by the GLA by combining classified near-infrared aerial imagery (NDVI) with land use datasets and resulted in a green cover estimate for London.

This report sets out a 2-step experimental methodology:

- Firstly, by analysing the new tree canopy cover data, in conjunction with a range of socio-economic, political, health and environmental datasets, priority wards for increasing canopy cover are identified.
- Secondly, by analysing existing canopy and land-use data, an approach to identifying potential planting opportunities on the ground, in openspace and pavements, is put forward. 3D visualisations of new street tree planting are provided to demonstrate the benefit of planting new street trees in low canopy wards.

Methodology

The methodology is in 2 parts. Firstly, to create an approach to identifying wards that could be considered priorities for new tree planting. Secondly, to identify possible opportunities for planting new trees in a sample of wards. The process of creating 3D model to show streets before and after tree planting is also described.

IDENTIFYING PRIORITY WARDS

Collating and formatting data

To identify priority wards for increasing canopy cover the datasets below were gathered and added to QGIS for appraisal and preparation. Where necessary the datasets were converted to appropriate GIS format (e.g. SHP) and re-projected to standardise on, and conduct analysis in, British National Grid EPSG 27700 projection. Attributes were inspected for completeness and appropriateness for analysis.

The following datasets form the basis for the analysis:

- London 2018 ward boundaries: <https://data.london.gov.uk/dataset/statistical-gis-boundary-files-london>
- Tree canopy cover: <https://data.london.gov.uk/dataset/curio-canopy>
- Green infrastructure: <https://maps.london.gov.uk/green-cover/>
- Street Tree data (as .csv): <https://data.london.gov.uk/dataset/local-authority-maintained-trees>
- Air Quality: <https://data.london.gov.uk/dataset/london-atmospheric-emissions-inventory-2013>
- Index of multiple deprivation: <https://www.gov.uk/government/statistics/english-indices-of-deprivation-2015>
- Lower Super Output Area boundaries: <https://data.gov.uk/dataset/fa883558-22fb-4a1a-8529-cffdee47d500/lower-layer-super-output-area-isoa-boundaries>
- Urban heat island: <https://data.london.gov.uk/dataset/london-s-urban-heat-island---average-summer>
- Areas of deficiency in access to public open space: <https://data.london.gov.uk/dataset/access-public-open-space-and-nature-ward>
- Ordnance Survey Mastermap (provided by GLA): <https://www.ordnancesurvey.co.uk/business-and-government/products/topography-layer.html>
- Verisk Geoinformation Group (provided by GLA) <https://www.geoinformationgroup.co.uk/ukmap>
- Sites of Importance for Nature conservation (provided by GIGL CIC): <https://www.gigl.org.uk/designated-sites/non-statutory-sincs/>

- Environment Agency Water Quality of London's Rivers and Other Waterbodies: <https://data.london.gov.uk/dataset/water-quality-london-rivers-other-waterbodies>
- Environment Agency flood risk zones: <https://data.london.gov.uk/dataset/flood-risk-zones>
- Surface water flooding and water quality: <https://data.london.gov.uk/dataset/flood-risk-zones>
- Environment Agency LiDAR DSM 2m: <https://environment.data.gov.uk/DefraDataDownload/?Mode=survey>
- 3D tree data: <https://www.lands-design.com/features/plant-database/>

Integrating data

To identify low canopy cover wards which also have a combination of factors, such as socio-economic deprivation and high levels of air pollution, that would make them potential priorities for tree planting, the above datasets were related to the ward boundaries.

- **Ward boundaries**

- The most up to date (2018) Ward boundaries were used as the basis for the analysis as these are the most useful for policy makers. The 2018 ward dataset with City of London wards merged was used so that ward size was comparable with others. All datasets were related to these boundaries.
- A total of 91 Wards (in Bexley, Croydon, Redbridge, Southwark boroughs) had been allocated new ward ID due to changes in some of the ward boundaries in those boroughs. These changes have not yet been reflected in some of the above datasets, which are based on 2014 ward ID's. This meant that it was not possible to join (append) some statistics based on Ward ID.
- To join Curio canopy cover to the 2018 Wards, the maximum overlapping 2014 Ward was used. For the majority of the 91 wards this was close to 100% but for c. 10 wards it was less than 50%, meaning the data is less reliable in these areas and should be updated when statistics for the 2018 wards is area available.
- To join IMD data (which is mapped using 2011 Census LSOA boundaries) a different approach was needed. LSOAs should in theory 'nest' under Ward boundaries but in many cases no longer do in London, due to Ward boundary changes in 2014 and 2018. It was decided that to relate data from LSOAs to Ward a LSOA had to be at least 66.7% within the Ward. IMD statistics should be updated when the boundaries and brought into line with the new Ward boundaries and new statistics are available.

- **Tree Canopy Cover**

- Canopy Curio ward statistics were joined to ward 2018 boundaries using the 2018 or 2014 ward IDs as described above from GLA-wards-canopy-cover.kml

- **Index of Multiple Deprivation**
 - This was joined to LSOA data and then to 2018 ward boundaries as described above.
 - The overall Index of Multiple Deprivation (IMD) Decile (where 1 is most deprived 10% of LSOAs) was appended to the attribute table
- **Urban heat island**
 - This data was provided by GLA as a CSV. The point data was intersected with the ward 2018 boundaries and mean night-time temperature during the summer of 2011 was appended to the attribute table. This was the same data as used in the GLA's Green Infrastructure focus map.
- **Green Blue cover**
 - Updated statistics for 2018 wards were provided by GLA and the 0.05 NDVI data was appended to the ward attribute table as this was considered the most reliable.
- **Air pollution**
 - The LAEI air quality data for NO2 and PM2.5 was provided as a CSV and intersected with 2018 ward boundaries to calculate average concentration for the wards.
 - It should be noted that air pollution occurs in highly localised areas within wards and the figures presented interpreted accordingly.
- **Sites of Importance for Nature conservation (SINCs)**
 - GiGL SINC data was intersected with ward 2018 boundaries and overall % of SINC in Ward was calculated.
- **Surface water flooding**
 - A subset of RoFRS_London data was created where risk was medium or high and intersected with ward 2018 boundaries. A column updated with Yes or No.
 - It should be noted that surface water flooding occurs in highly localised areas within wards and the figures presented interpreted accordingly.
- **Water quality**
 - The WFD data was intersected with ward 2018 boundaries and OV_CLASS - Overall Water Body Class appended
 - It should be noted that water quality is in highly localised areas within wards and the figures presented should be interpreted accordingly.

Ranking wards

It was agreed that rather than being prescriptive over which wards are considered priorities for new planting, the overall approach to identifying priority wards would be to create a 'decision support tool'. By calculating relative levels of the various factors above, and assigning Rank and Decile to each ward, the data will not only be useful on this project but would will allow users to:

- decide on which (combination of) factors are most important in their area of interest
- decide on appropriate thresholds for their chosen factors

The full results are provided in an accompanying Spreadsheet which allows the user to filter for the various factor as she sees fit.

IDENTIFYING PLANTING OPPORTUNITIES

Having identified the wards that could be considered the priorities for new tree planting the next step was to create a methodology to identify potential locations within a sample of the wards that have some of the lowest current levels of canopy cover.

It was decided that Openspace and Pavement represent the main opportunities for tree planting in London and that the methodology would attempt to identify areas of these land-uses in sample wards that could potentially be planted. It should be noted at the outset that the data-driven approach taken calculates a maximum potential plantable area and acts as a guide to inform decisions. In reality, local conditions (e.g. utilities, use of green space, conservation designations and existing habitat) would always need to be taken into account and would restrict where planting would be possible.

To calculate and map potential 'plantable' areas within each sample ward it was necessary to choose a base dataset. A comparison of Ordnance survey Mastermap and Verisk Geo-information Group UKmap data was undertaken to decide which would provide the basis for the analysis. The UKmap dataset was chosen as it provided a more detailed land-use characterisation.

Create sample of wards

In collaboration with Jude Hassall, the GLA Environment Team and the Forestry Commission London Manager a sub-set of the wards was created, that would be subject to further analysis to assess their tree planting potential.

- 2 wards were chosen from Ealing; Lady Margaret and Southall Broadway, as work had been undertaken by the Borough Tree officer and Trees for Cities to identify priority areas, and they indicated that they were willing to 'ground-truth' outputs.
- The 2 lowest canopy cover wards were chosen from outer London; Slade Green and Northend, Bexley and Broad Green, Croydon. These were considered sensible selections as one is high green cover and the other low green cover.
- 2 low-canopy wards were chosen from inner London; Lansbury (Tower Hamlets) – who were known to have been undertaking mapping to assess planting potential, and New Cross (Southwark).

Defining criteria

In order to be able to interpret the UKmap data (identify openspace and pavement, make estimates of tree planting and increase in canopy cover) it was necessary to agree certain criteria and thresholds. Effectively these are assumptions and clearly local circumstances will dictate whether, for instance,

the openspace/ pavement is or isn't suitable and the number and species of tree that could be planted in a given location.

An overview of the opportunities and constraints for new tree planting are set out in Table 1, below. See Appendix 1 for full list of land-uses that were included (considered suitable) or excluded (considered unsuitable).

Location	Ground type	Constraints (no planting)	Area estimate	Trees estimate	Cost/ tree
A range of openspaces (e.g. parks and verges) were considered suitable*	Soft	Buildings and structures, Playing Fields, Land alongside Railways etc**	80% cover of openspace	1280/ha	Dependent on local circumstances
Street trees	Hard	< 2m width	Number of trees x 167.243m ² (the canopy area of tree with 7.3m radius)**	Length pavement / (2 x average tree radius of 7.3m)**	£700**

Table 1: Opportunities for new planting (*see Appendix 1 for full list of land-uses that were included/excluded, **see tables below for further information)

Constraints for new planting

There are many constraints to planting trees in urban areas and to ensure the analysis was as realistic as possible consideration was given as to which land-uses should be included (considered suitable) or excluded (considered unsuitable). See Appendix 1 for a full list. The overall approach was to consider:

- the physical possibility of planting (buildings, water and man-made structures were excluded)
- the likelihood of planting (playing fields and rail-side land were excluded)

Table 2, below, outlines some of the main constraints for planting that were taken into account.

Land use	Details
Playing fields	May sometimes be possible to plant but considered to be very contentious and dependent on local situation so were excluded from planting estimates.
Land alongside railways	These areas are not appropriate for planting and were excluded.
Areas close to buildings	<p>Root protection area in British Standard 5837 "is calculated by multiplying the diameter of the tree at breast height in meters by 12 but is capped as an area with a radius of 15m", see https://www.woodlandtrust.org.uk/blog/2017/09/root-protection-order/</p> <p>It is not possible to establish a set distance from a building based on roots as would depend on the tree (a small tree could be much closer to a building and is likely to be a more appropriate choice for street planting). For this reason, areas close to buildings were included and an indication provided where buildings are within 5m of a suitable pavement.</p>
Pavement width	The GLA advised that best practice is based on making sure the pavement remains accessible (e.g. for wheelchair users and pushchairs). It was agreed that the analysis should be based on minimum of 2m pavement width to accommodate a tree pit. This is in line with a recent TDAG report (see http://www.tdag.org.uk/trees-in-hard-landscapes.html and Figure 1, below).
Underground utilities	Data was not available to map these.

Table 2: Some key constraints on new planting

Pavement requirements

A recent TDAG report 'Trees in hard landscape' does not specify width of pavement for pedestrians so a 2m minimum width was agreed with GLA to assure usability when a tree pit is present. See Figure 1 below and <http://www.tdag.org.uk/trees-in-hard-landscapes.html>.

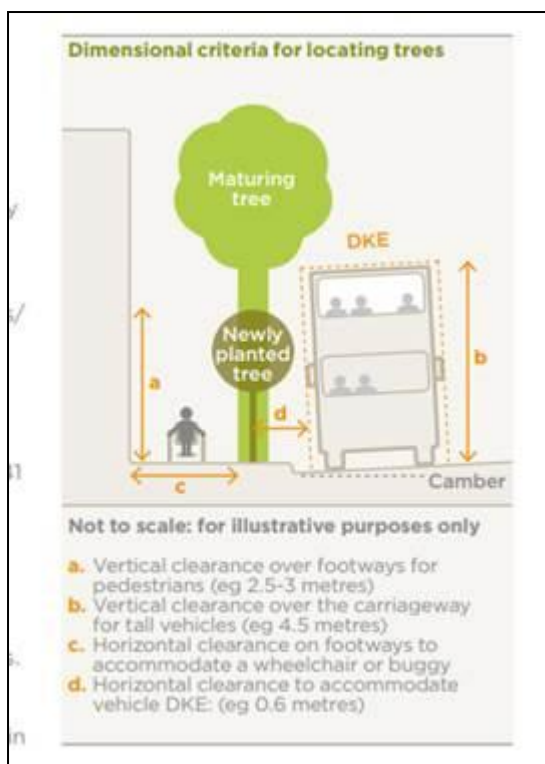


Figure 1: TDAG Pavement requirements

Financial cost estimates

The following cost estimates were provided by GLA and Forestry Commission for planting new trees.

Location	Details	Cost/ tree
Open spaces (i.e. soft surfaces like parks, roadside verges and amenity green space)	Guide cost for GLA grant scheme including 3 years maintenance and planting costs is £265/tree but will depend on many factors.	Depends on local circumstances and type of planting
Street trees	Cost including 3 years maintenance and planting costs (based on standard costs being offered in current Defra funding for street trees)	£700

Table 3: Cost estimates for planting trees (based on advice from GLA and Forestry Commission)

Stocking estimates

The following stocking estimates were provided by the Forestry Commission for planting new trees.

Description	Stocking density (stems/ha)
Minimum stocking density (3m x 3m planting)	1100
Grant scheme application year 2016	1,754
Grant scheme application year 2017	1,497
Grant scheme application year 2018	1,733
Average for most schemes to stock at	1600
Other considerations: The amount of open space in a woodland creation scheme is 20% of area, so a 1ha scheme there could be 0.2ha of open ground and 0.8ha of tree planting	1280/stems/ha.
FINAL estimate	1280

Table 4: Stocking estimates (provided by Forestry Commission)

Growth rates

It was not possible to account for growth rates as it will depend on species, local situation and whether a whip or sapling etc is planted and whether tree is, for instance, subsequently pollarded.

Crown spread

To estimate canopy gains from street tree planting, an analysis of the TfL/ borough street tree data was conducted. This revealed that the trees in Table 5, below, were the most common in London.

Most common species (TfL/Borough tree data)	Currently planted	TDAG Diameter information*	Radius for Canopy estimate (m)
Plane (Platanus x hispanica)	Yes	A globular to ovoid crown form. Capable of becoming very wide, up to 25m+	12.5
Ash (Fraxinus excelsior)	No	Not relevant	
Oak (Quercus robur)	No	Not relevant	
Maple (Acer pseudoplatanus)	Yes	Not listed	
Maple (Acer platanoides)	Yes	Ovoid to globular crown A dense crown form. Crown spread can become over 20m	10
Cherry (Prunus avium)	Yes	An obovoid crown to 5m wide	2.5
Birch (Betula pendula)	Yes	Columnar, often rather an open crown irregular with a weeping (pendulous) branches at Maturity 6-8m wide.	4
Lime (Tilia x europaea)	Yes	A broad ovoid to globular crown that can become at least 15m wide	7.5
Average for canopy estimates			7.3m radius 167.42m² canopy 14.6m spacing

Table 4: Canopy spread estimates *from TDAG report 'Tree species selection for green infrastructure - a guide for specifiers' Dr Andrew Hirons and Dr Henrik Sjöman

GIS METHODOLOGY

Data preparation

- UKmap data for the sample wards was provided by GLA in SHP format and relevant land-uses were selected
- Relevant tiles of Canopy Curio data for the sample wards were identified and downloaded (in kml format) from the GLA Datastore
 - These tiles were merged into a single SHP layer and saved in 27700 projection

- An Intersect query was used to identify the Curio canopy polygons in the sample (and exclude other areas in the tiles)

Mapping potential plantable Openspace

- In collaboration with the GLA and Forestry Commission, the UKmap categories in Appendix 1 were selected as having potential for tree planting. In so doing, areas considered unsuitable for tree planting were excluded.
 - These polygons selected in QGIS and a new UKmap 'Openspace' dataset created
 - The scope of the analysis did not allow for a full exploration constraints on where trees can be planted (many of these factors will vary at a local level). However, SINC data was displayed on the Ward opportunity maps to show where the might be a constraint on planting.
- A difference query was used to identify areas of UKmap openspace not under canopy
- A selection of UKmap buildings was made by attribute query and this was buffered 5m
 - Intersect query used to identify openspaces that were within 5m of building and attribute updated to indicate
- NNjoin QGIS plug-in was used to calculate the distance from the polygons of openspace not under canopy to the nearest Curio canopy polygons and an attribute updated
- A spatial join was used to append priority ward data to the Openspace polygons
- A group by query was used to calculate total plantable areas in each ward

Mapping potential plantable pavement

- A UKmap 'pavement' dataset was created using attribute query
- A difference query was used to identify areas of UKmap pavement not under canopy
- A negative buffer of -1m was applied to identify pavements >2m wide (suitable) that were not already under canopy
- The perimeter of the pavement fragments was calculated and divided by 2 to calculate an approximate pavement length
 - This was divided by 14.6m (spacing required for trees of average canopy size) to estimate number of trees that could be planted
- Intersect query used to identify pavement that were within 5m of building and attribute updated to indicate
- NNjoin QGIS plug-in was used to calculate the distance from the polygons of pavement not under canopy to the nearest Curio canopy polygons and an attribute updated

- A spatial join was used to append priority ward data to the pavement polygons
- A group by query was used to calculate total plantable pavement in each ward

CREATING 3D MODEL

In order to demonstrate the benefit of planting trees in low canopy streets a 3D model was created, with a fly-through animation and before and after photos.

- Identifying location
 - Streets with potential for planting in the New Cross sample ward (with very low canopy cover) were identified by viewing satellite images and Curio canopy data in QGIS.
 - The streets were visited and photographed from strategic locations
 - Approximate GPS co-ordinates were taken (accurate to c.3m) with app on mobile phone
- Preparing data
 - The best available LiDAR for the area was identified and downloaded (tq3577_DSM_2M.asc)
 - A subset of UKmap data (of buildings and pavements) was created for the area of interest
 - Lands Design software to generate specific tree species and age models
- Processing data
 - Using the data available for the project a masterfile was created with all the datasets combined and accurately positioned relative to one another in the 3D CAD software.
 - Extrude the building bases to the height of the Lidar reference data and 3D model the different shapes of the rooves that are visible.
 - Place reference points in the 3D file referencing the approximate coordinates in the photography meta data. Raise the point to 1.6m to approximate the height of the lens.
 - Import the photography as a backplate image in the 3D software and match the lens length from the metadata. Then rotate the scene in 3D to further improve the match of the 3D model to the photographic features e.g. roads and buildings.
 - Array trees down the street using Lands Design. The species Acer Platanoides was chosen and the software was set to place a tree at a 14.6m interval with a 50% variation in the tree geometry while not exceeding a roughly 6m crown diameter.
 - Using the Sun feature in Rhino the light source was placed at the correct position for the date and time the photos were taken.

- All geometry not in the view was roughly extruded with reference to the Lidar so that accurate shadows would be cast in rendering. The geometry was also materialised so accurate secondary light bounces with reflect the correct colour temperature.
- The renders were then taken using the same resolution as the photography and matched to the images in Photoshop.

Results

Priority ward statistics

This report is provided in conjunction with a spreadsheet and shapefile of ward scores, ranks and deciles for the various prioritisation factors. These can be filtered by the user as required, for instance to select the wards with the lowest 10% canopy cover that are also in the most 20% IMD deprived wards. Table 5, below, is a simplified sub-set of this spreadsheet showing the decile scores for the 6 x sample wards where opportunity areas for planting were identified.

Ward	Borough	Location	Size of ward	Canopy Cover	Canopy decile	Blue-Green decile	IMD decile	Urban heat island decile	NO2 decile	PM2.5 decile	SINC decile	High or Medium flood risk	Poor water quality
			ha	%	1 = 10% lowest canopy levels	1 = 10% lowest greenspace/ open water	1 = 10% most deprived wards	1 = 10% warmest wards	1 = 10% highest average NO2	1 = 10% highest average PM2.5	1 = lowest 10% levels of SINC in ward	Yes/No	Yes/No
Lady Margaret	Ealing	Outer London	154.18	9.82	2	4	6	7	7	7	2	N	N
New Cross	Lewisham	Inner London	181.11	8.85	1	2	1	2	3	3	6	Y	N
Broad Green	Croydon	Outer London	195.22	4.85	1	1	2	5	6	5	1	Y	N
Southall Broadway	Ealing	Outer London	161.72	7.23	1	1	2	5	5	5	3	N	N
Slade Green & Northend	Bexley	Outer London	554.26	2.8	1	10	3	10	10	10	10	Y	N
Lansbury	Tower Hamlets	Outer London	131.56	8.14	1	2	1	1	2	2	3	Y	Y

Table 5: Prioritisation deciles for the 6 sample wards

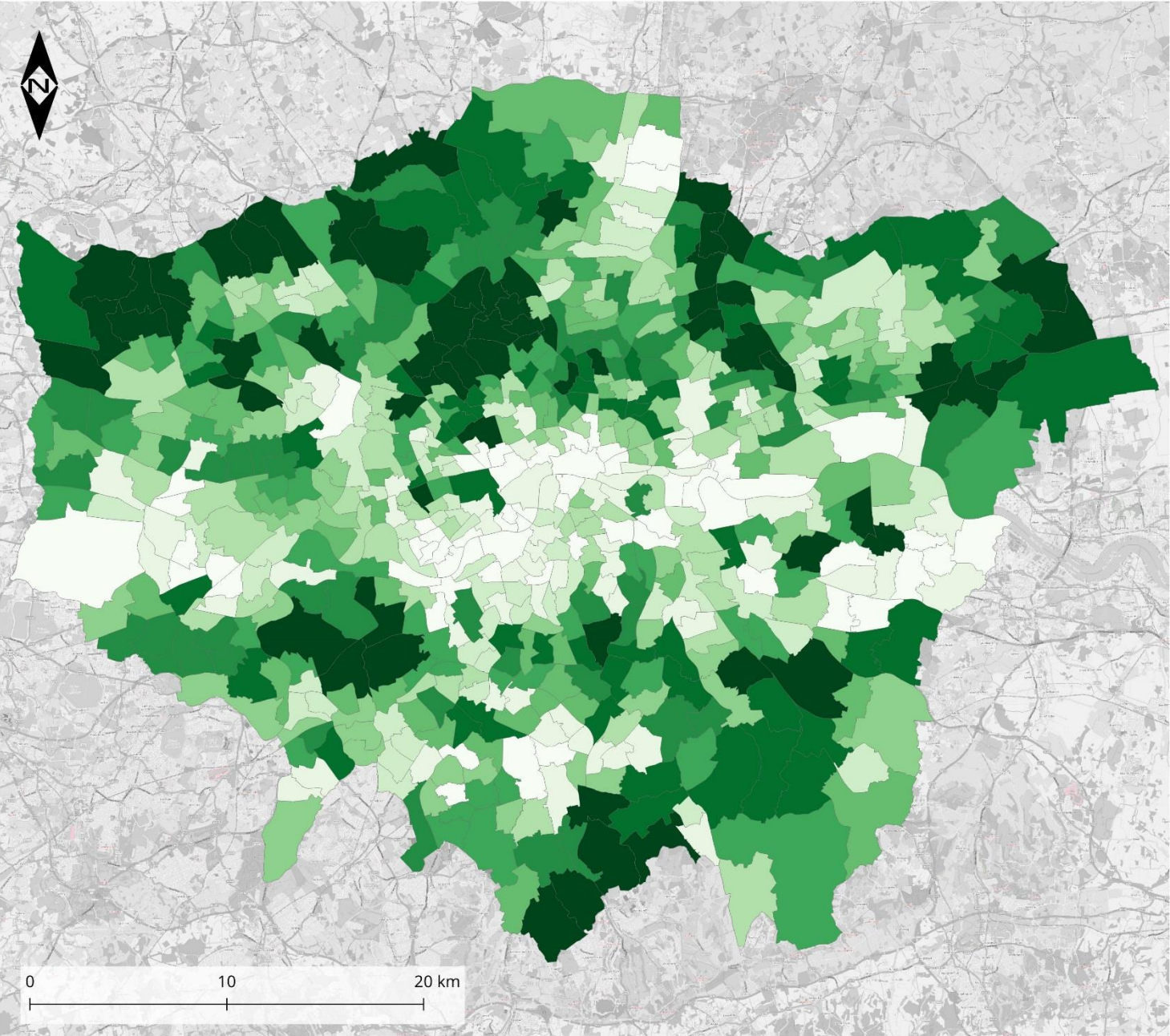
Priority ward maps

The following pages show maps of the 7 prioritisation factors for wards across London.

Identifying priority wards for tree planting: Current Canopy

Percentage of ward currently under tree canopy

Curio Canopy ward rank deciles (1 low)



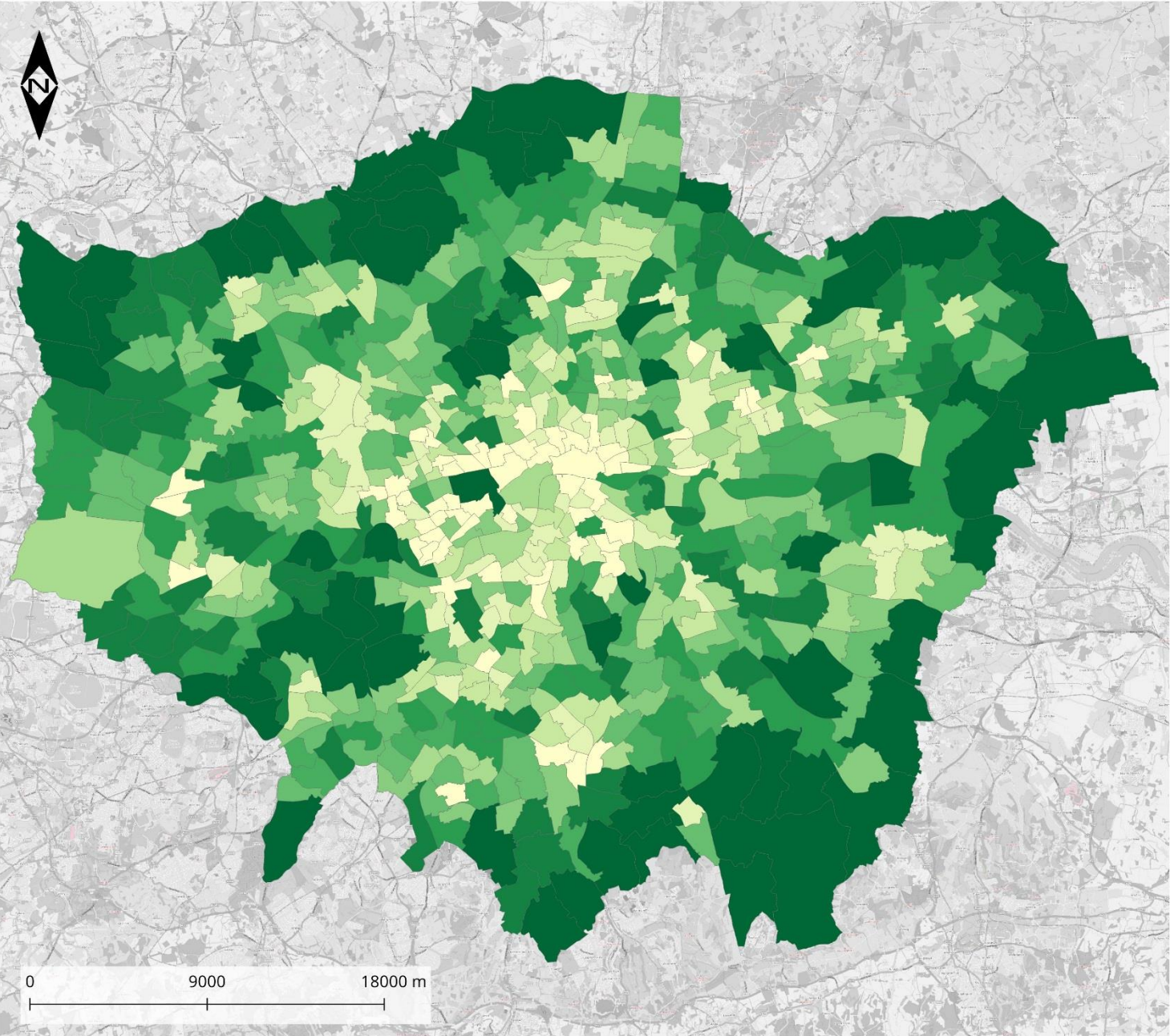
Map design: Maplango. Foreground data: Contains National Statistics data (Ward boundaries) © Crown copyright and database right 2018 and Curio Canopy - London Tree Canopy Cover data (Breadboard Labs, Creative Commons Attribution Share-Alike License). Background map © OpenStreetMap contributors.



Identifying priority wards for tree planting: Current Blue/ Green cover

Percentage of ward that is green cover or open water

Blue Green ward rank deciles (1 low)



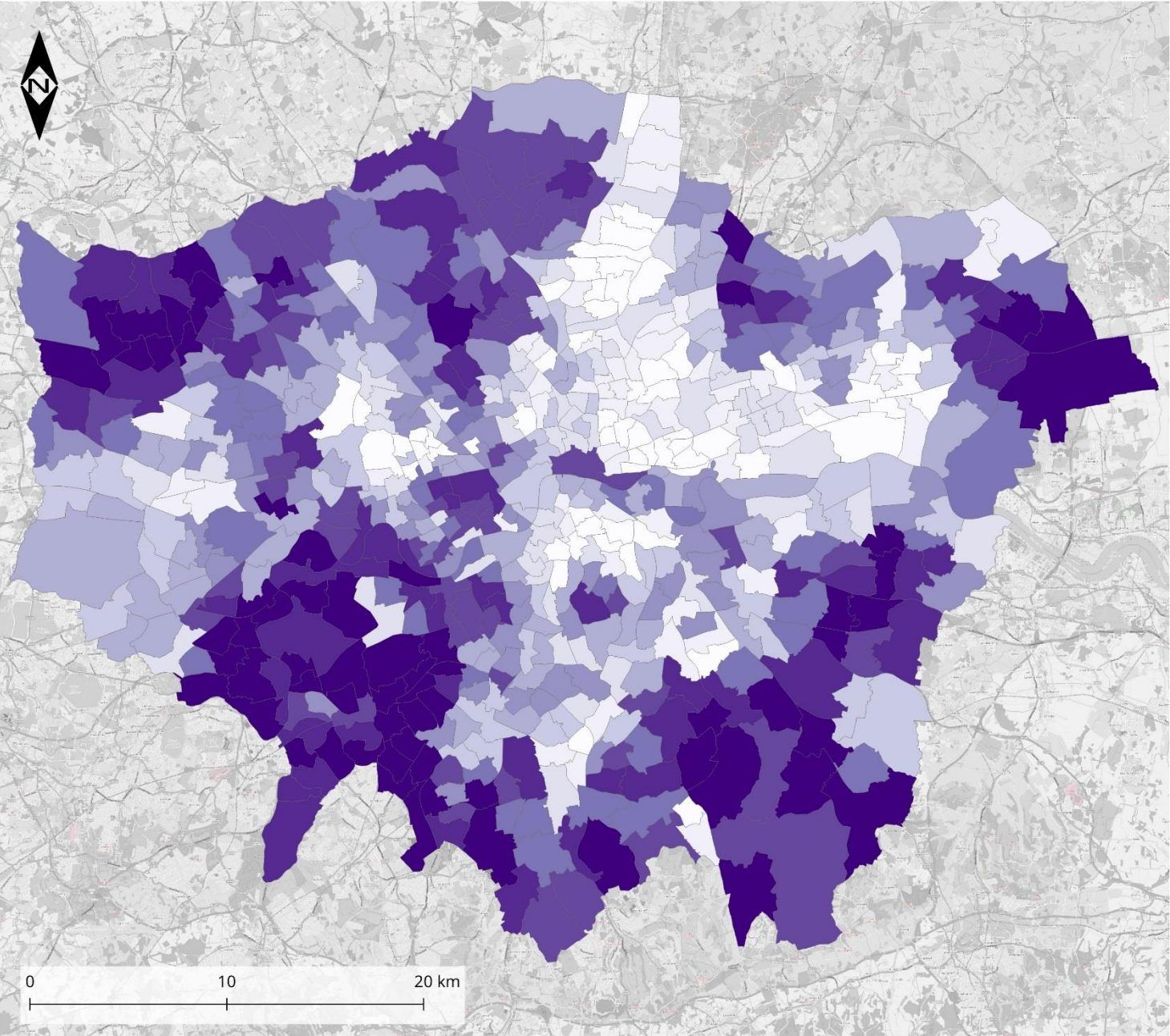
Map design: Maplango. Foreground data: Contains National Statistics data (Ward boundaries) © Crown copyright and database right 2018 and Blue/Green cover from UKMap © Verisk Analytics Geoinformation Group. Background map © OpenStreetMap contributors.



Identifying priority wards for tree planting: Index of Multiple Deprivation

Average IMD scores for ward

IMD ward rank deciles (1 = high deprivation)

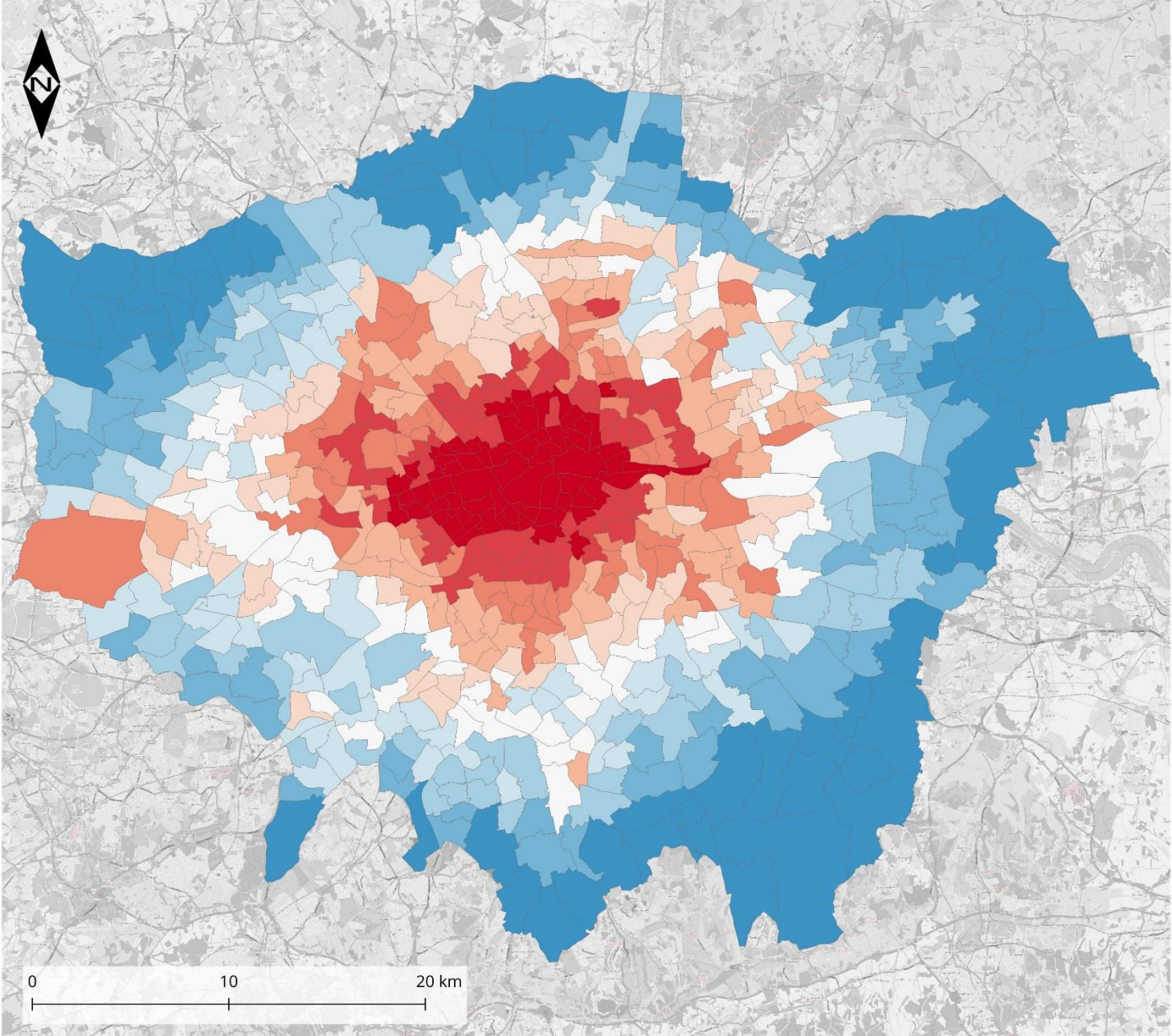


Map design: Maplango. Foreground data: Contains National Statistics data (Ward boundaries and Index of Multiple deprivation) © Crown copyright and database right 2018. Background map © OpenStreetMap contributors.



Identifying priority wards for tree planting: Nitrogen Dioxide

Average concentrations of NO2 in ward

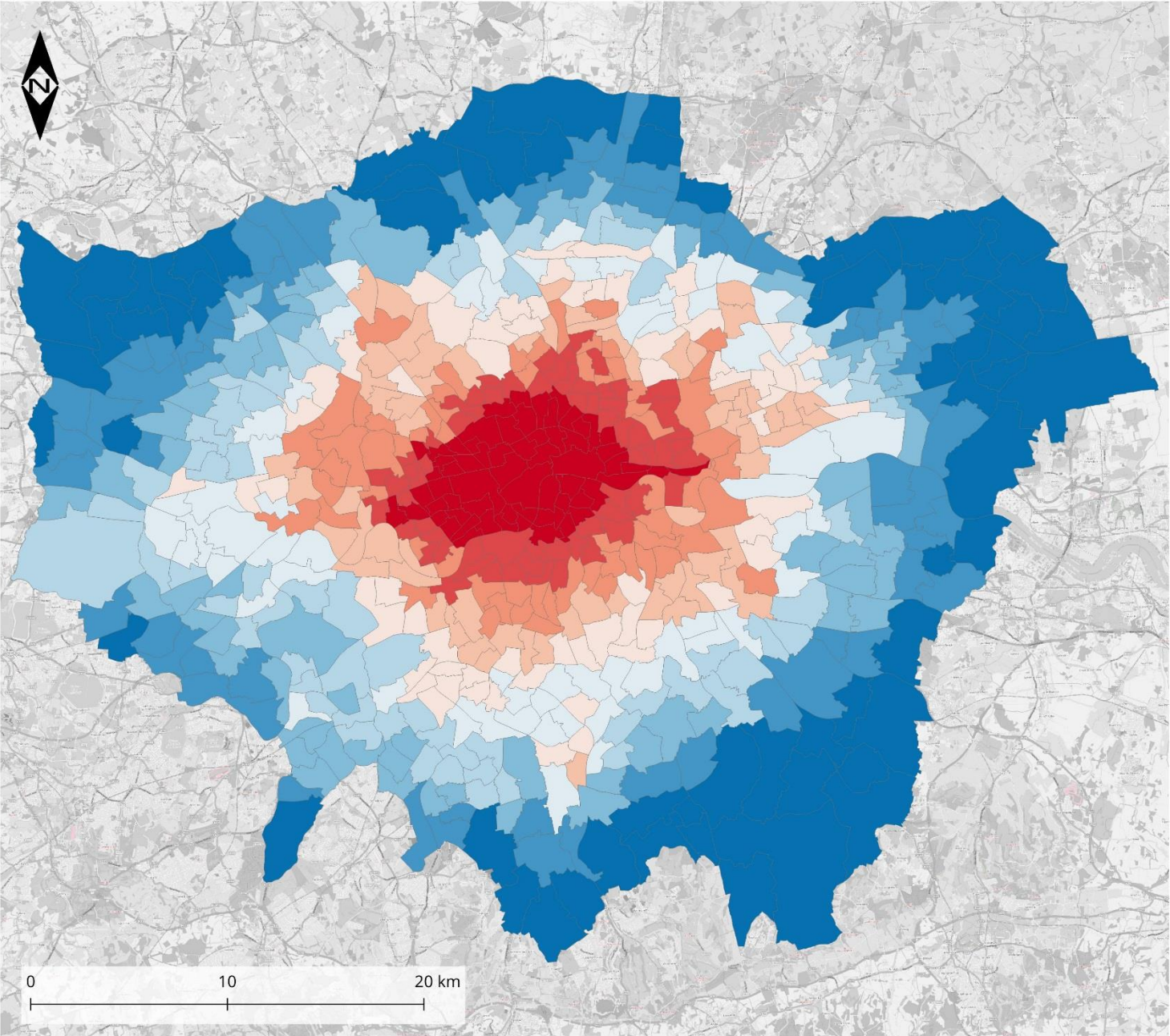
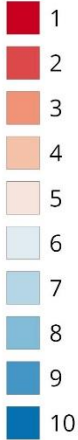


Map design: Maplango. Foreground data: Contains National Statistics data (Ward boundaries) © Crown copyright and database right 2018 and London Atmospheric Emissions Inventory (LAEI) 2013 data licensed under the Open Government Licence v3.0. Background map © OpenStreetMap contributors.

Identifying priority wards for tree planting: Particulate matter 2.5

Average concentrations of PM2.5 in ward

PM2.5 ward rank deciles (1 high)



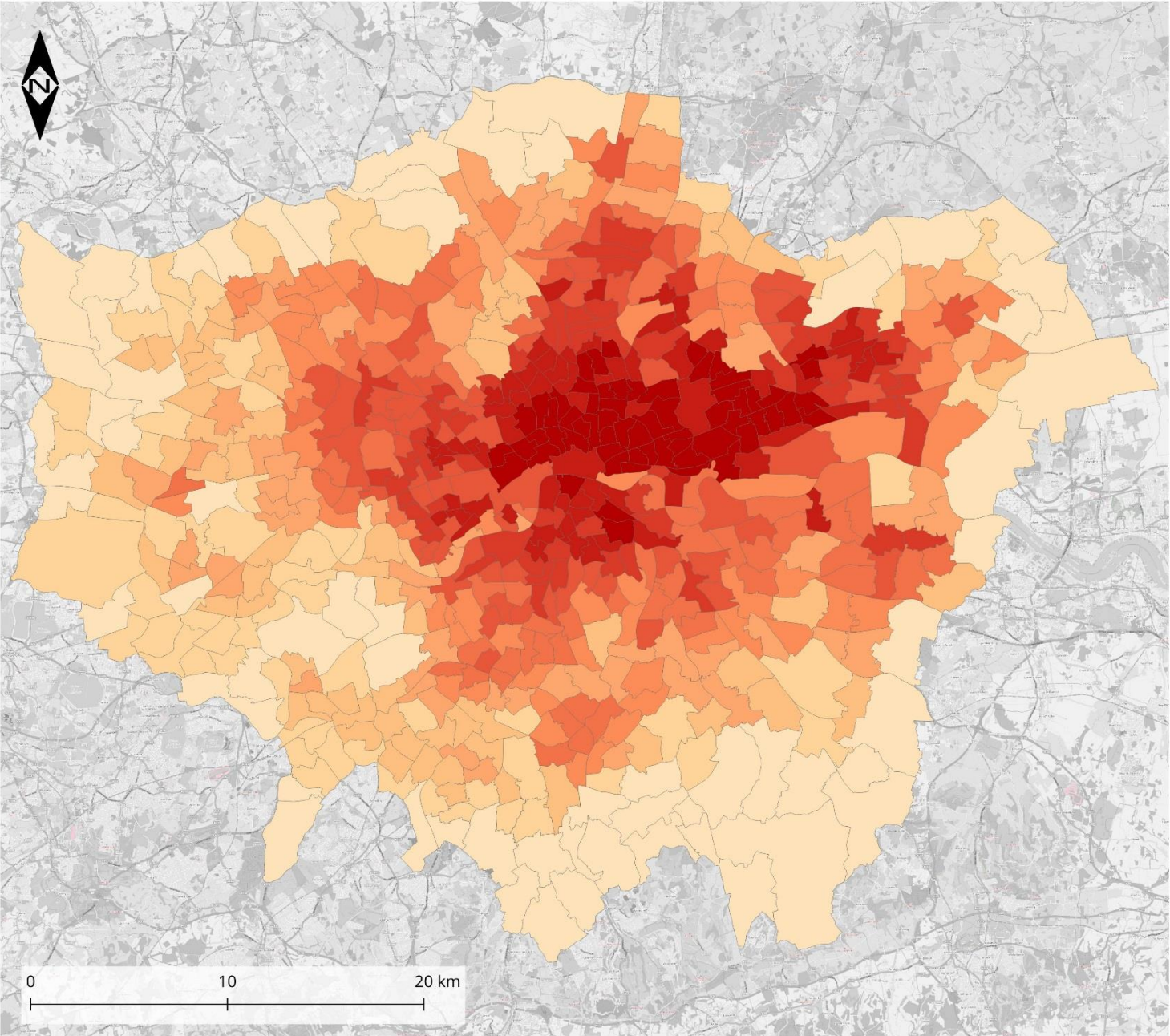
Map design: Maplango. Foreground data: Contains National Statistics data (Ward boundaries) © Crown copyright and database right 2018 and London Atmospheric Emissions Inventory (LAEI) 2013 data licensed under the Open Government Licence v3.0. Background map © OpenStreetMap contributors.



Identifying priority wards for tree planting: Urban Heat Island

Average midnight temperature for ward during a typical summer

UHI ward rank deciles (1 high)



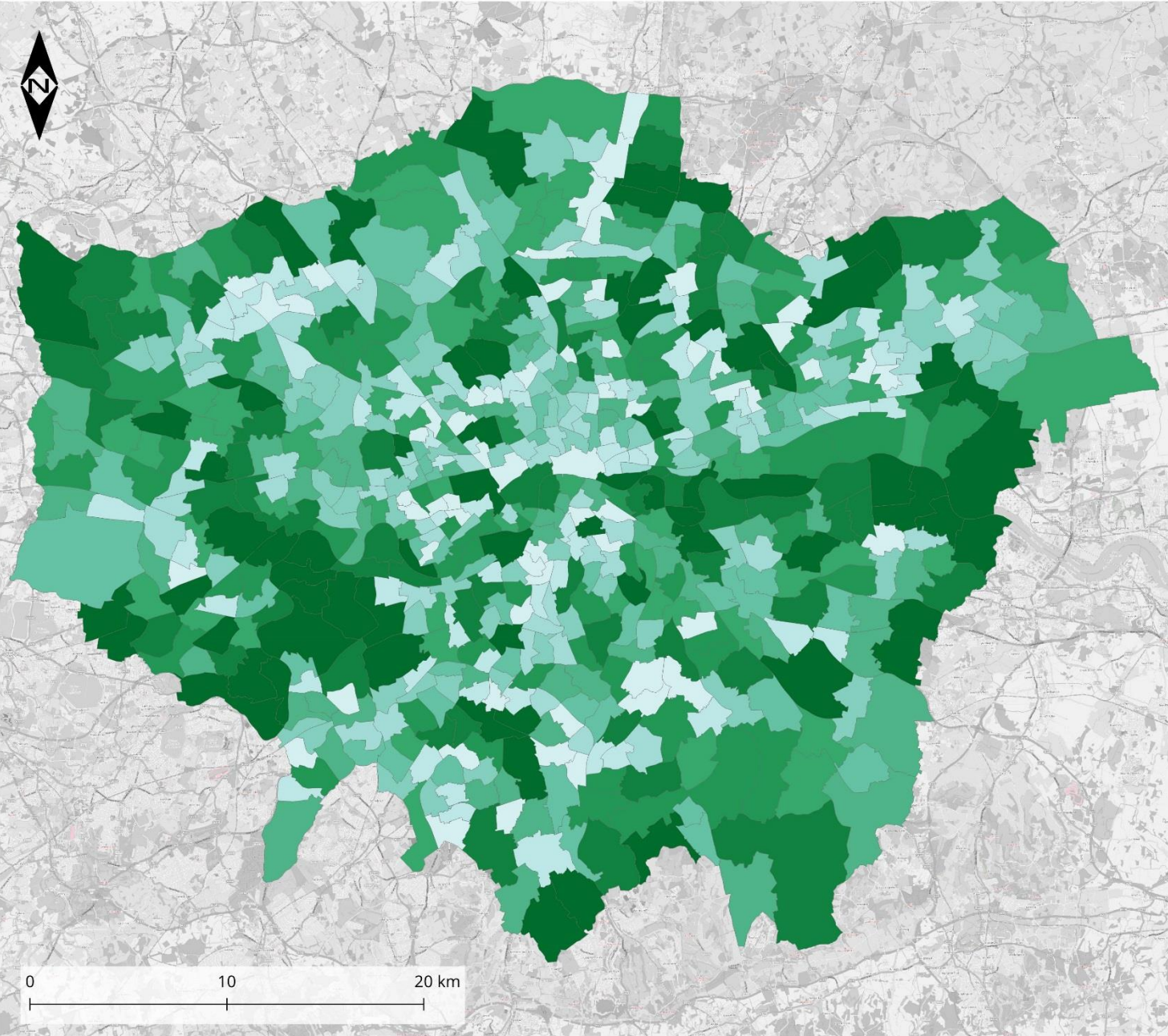
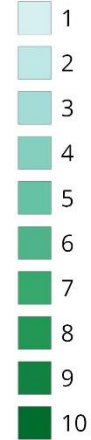
Map design: Maplango. Foreground data: Contains National Statistics data (Ward boundaries) © Crown copyright and database right 2018 and UrbClim climate model data licensed under the Open Government Licence v3.0. Background map © OpenStreetMap contributors.



Identifying priority wards for tree planting: Sites of Importance for Nature Conservation

Percentage of ward designated as a SINC

SINC ward rank deciles (1 low)



Map design: Maplango. Foreground data: Contains National Statistics data (Ward boundaries) © Crown copyright and database right 2018 and SINC data © GIGL CIC. Background map © OpenStreetMap contributors.

PLANTING OPPORTUNITIES

Planting Statistics

The tables below provide an overview of the planting opportunity statistics in the 6 sample wards.

Ward	Borough	Ward area	Current Canopy Ward	Possible new greenspace canopy	Possible new greenspace canopy	Length all pavement	Length potential pavement	Possible number new pavement trees	Potential new street tree canopy	Potential new street tree canopy	Total possible canopy increase (openspace + street tree area)	Total possible canopy increase (openspace + street tree)
		ha	%	ha	%	km	km	count	ha	%	ha	%
Broad Green	Croydon	195.22	4.85	3.34	1.71	52.36	39.30	2692	45.07	23.09	48.41	24.80
Lady Margaret	Ealing	154.18	9.82	6.56	4.26	37.10	23.29	1595	26.71	17.32	33.27	21.58
Lansbury	Tower Hamlets	131.56	8.14	4.96	3.77	34.03	22.55	1545	25.86	19.66	30.83	23.43
New Cross	Lewisham	181.11	8.85	7.59	4.19	42.22	23.58	1615	27.04	14.93	34.63	19.12
Slade Green & Northend ¹	Bexley	554.26	2.8	151.05	27.25	41.96	16.67	1142	19.12	3.45	170.17	30.70
Southall Broadway	Ealing	161.72	7.23	6.87	4.25	32.27	22.79	1561	26.13	16.16	33.00	20.40

Table 6: Summary of planting opportunities in the sample wards

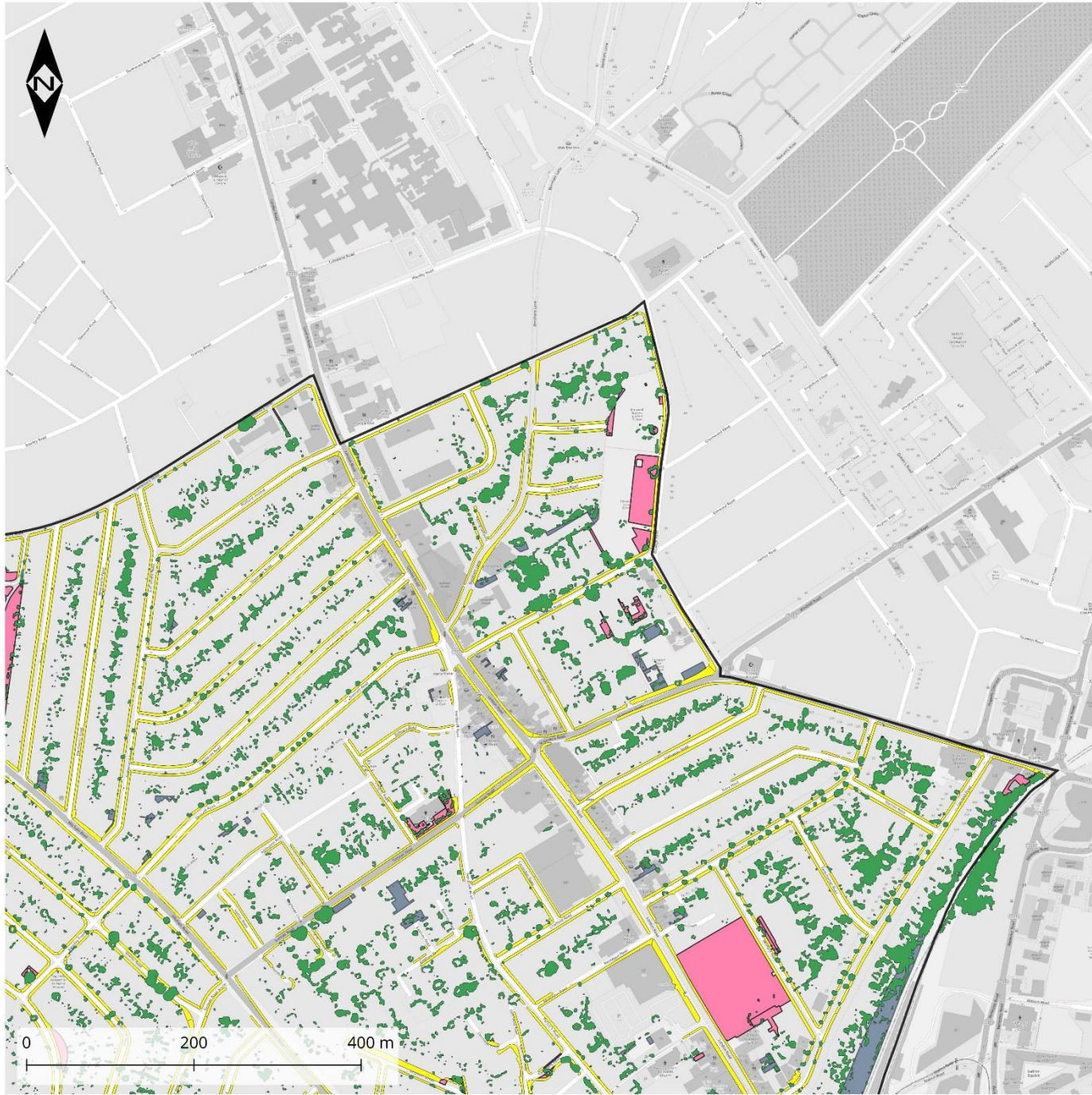
¹ NB: the total possible new canopy for Slade Green & Northend ward includes areas that are identified as having tree planting potential using the methodology employed, but are unlikely to be suitable for significant tree planting due to their conservation designation. Please see discussion below.

Ward	Land-use types for tree planting
Broad Green, Croydon	Car park - street level, Children's playground, Club meeting place, Community centre, Green verges, Old people's home, Places of worship, Primary schools, Recreational open space, Scrub land
Lady Margaret, Ealing	Allotment gardens, Cemetery, Children's playground, Community centre, Green verges, Park, Parking area, Places of worship, Primary schools, Recreational open space, Secondary schools, Unused formerly developed land
Lansbury, Tower Hamlets	Children's playground, Club meeting place, College of further education, Community centre, Green verges, Park, Places of worship, Primary schools, Recreational open space, Secondary schools
New Cross, Lewisham	Allotment gardens, Car park - street level, Children's playground, Club meeting place, College of further education, Community centre, Gardens (not private), Green verges, Middle school, Museum, Park, Places of worship, Primary schools, Recreational open space, Scrub land, Secondary schools, University teaching establishment, Woodland and scrub
Slade Green & Northend, Bexley	College of further education, Community centre, Green verges, Park, Permanent pasture, Places of worship, Primary schools, Recreational open space, Rough grazing, Scrub land
Southall Broadway, Ealing	Allotment gardens, Car park - street level, Children's playground, Community centre, Green verges, Health care places, Park, Places of worship, Primary schools, Recreational open space, Secondary schools, Woodland and scrub

Table 7: Summary of land-use types for open-space planting in the sample wards

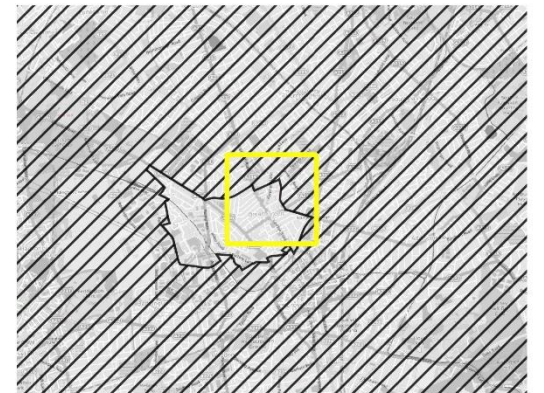
Planting opportunity maps

The following pages contain maps of sample wards showing potential planting locations (4 per ward).



Tree planting opportunity areas: Broad Green - NE

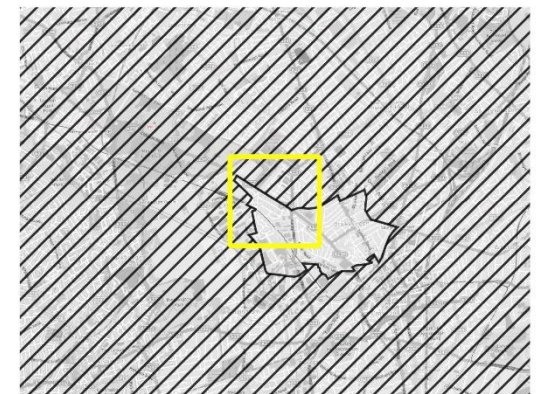
- Current Canopy
- Pavement - potential for planting
- Greenspace - potential for planting
- Greenspace - other

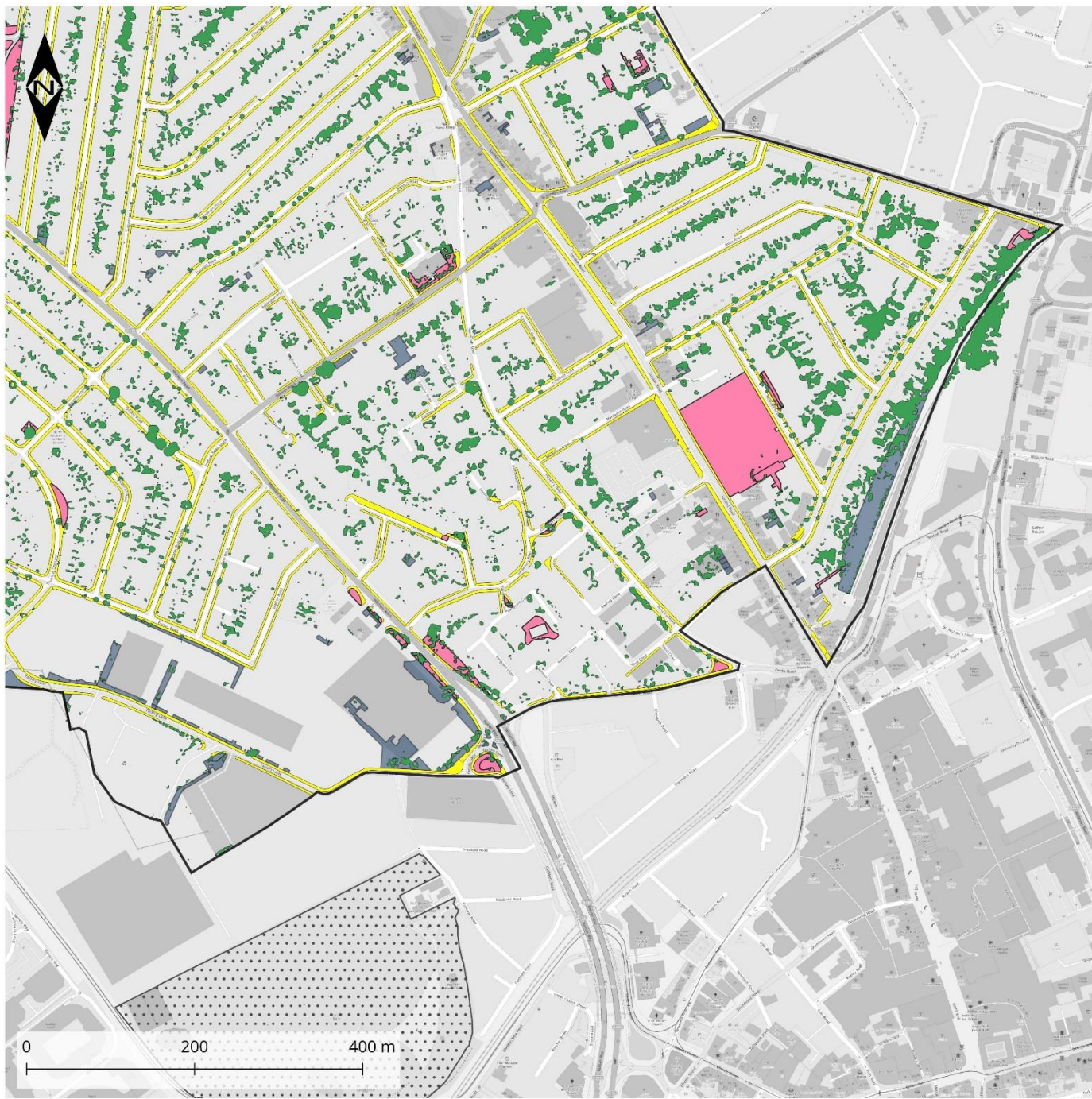


Tree planting opportunity areas: Broad Green - NW



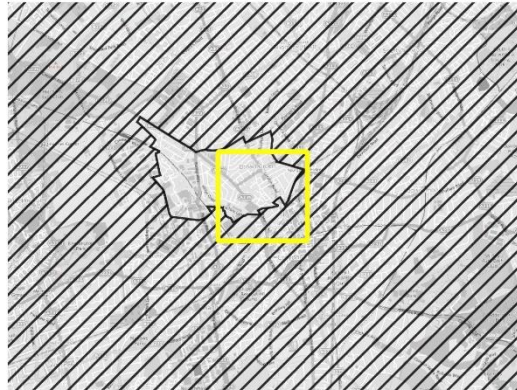
- Current Canopy
- Pavement - potential for planting
- Greenspace - potential for planting
- Greenspace - other
- SINC



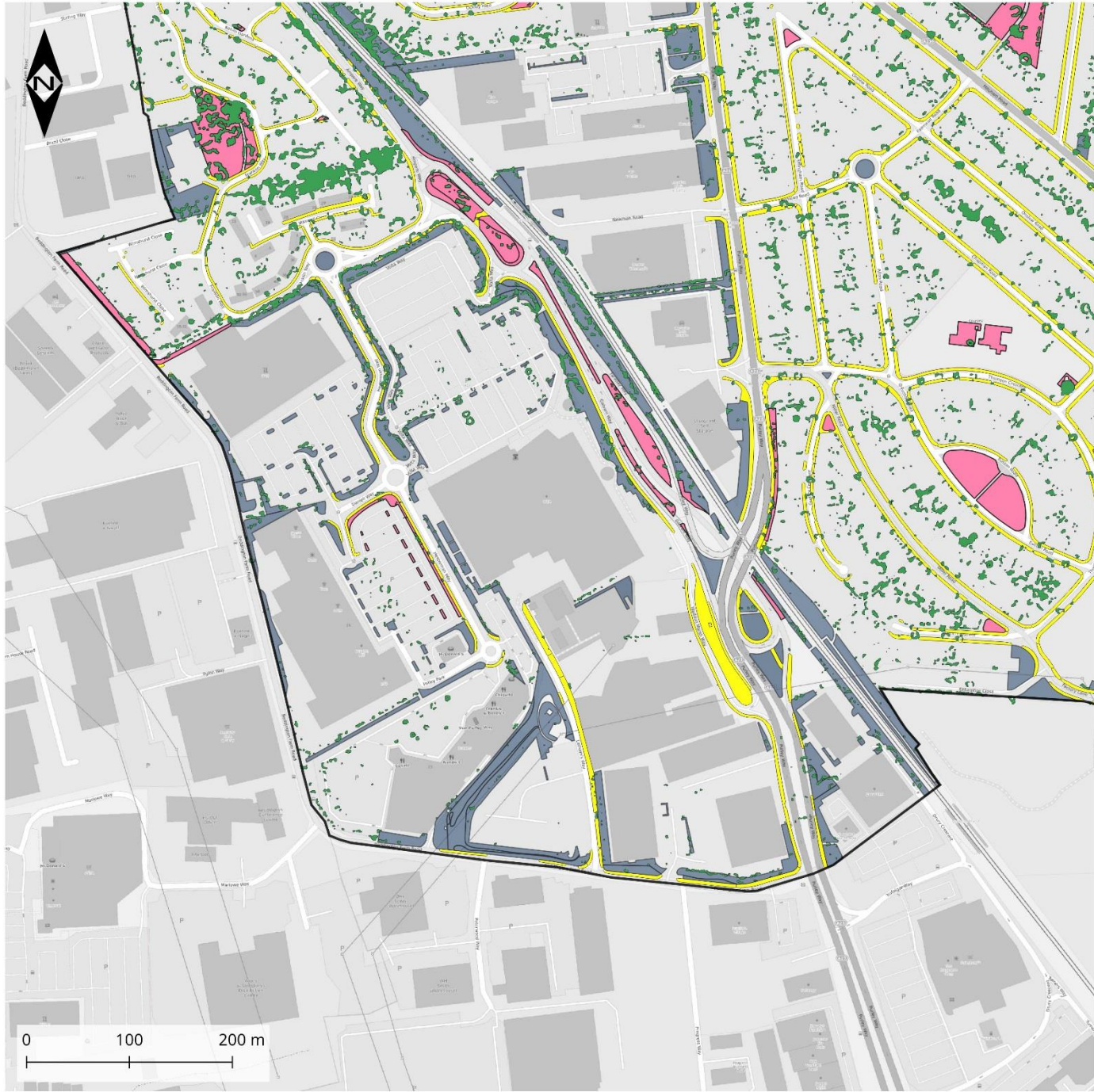


Tree planting opportunity areas: Broad Green - SE

- Current Canopy
- Pavement - potential for planting
- Greenspace - potential for planting
- Greenspace - other
- SINC

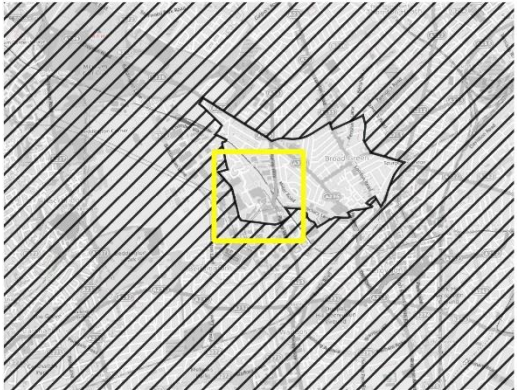


Map design: Maplango. Foreground data © Verisk/GeoInformation Group UKmap. Background map © OpenStreetMap contributors.



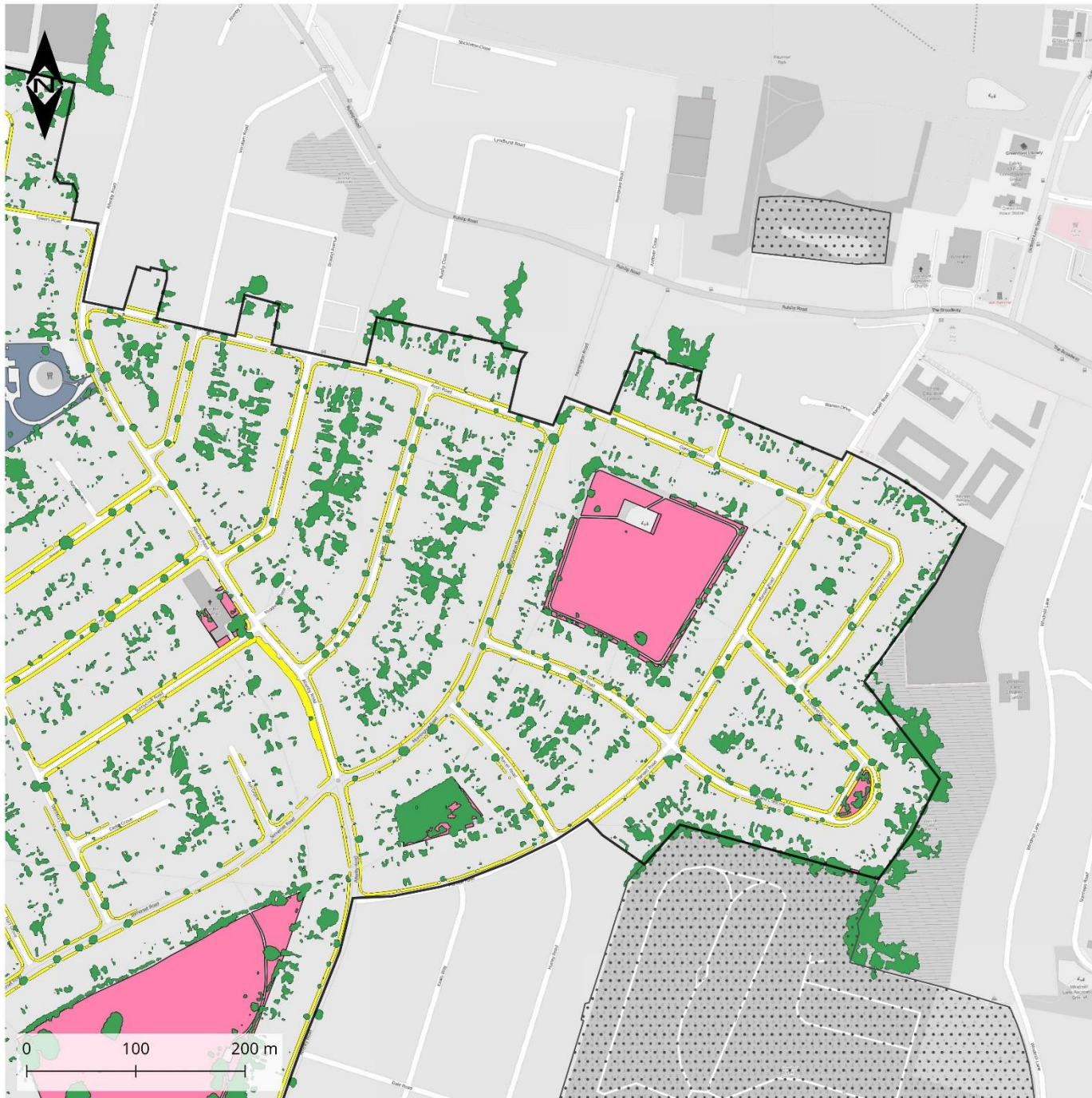
Tree planting opportunity areas: Broad Green - SW

- Current Canopy
- Pavement - potential for planting
- Greenspace - potential for planting
- Greenspace - other

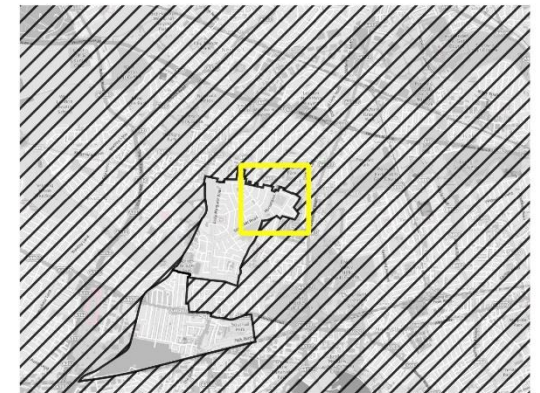


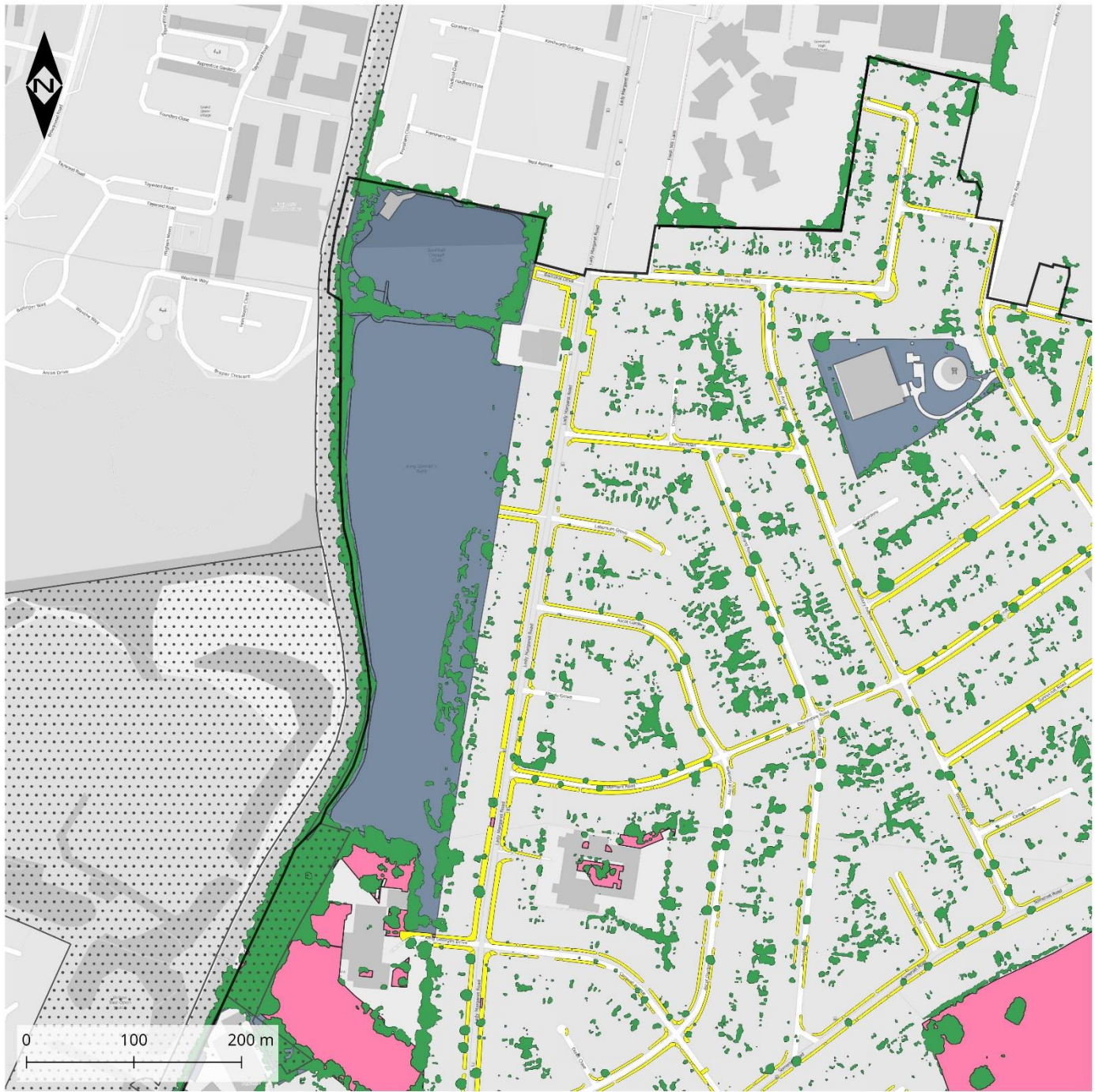
Map design: Maplango. Foreground data © Verisk/GeoInformation Group UKmap. Background map © OpenStreetMap contributors.

Tree planting opportunity areas: Lady Margaret - NE



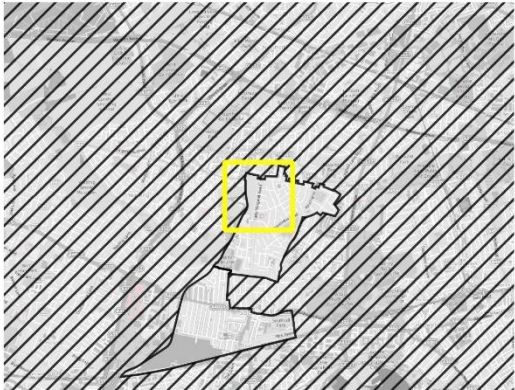
- Current Canopy
- Pavement - potential for planting
- Greenspace - potential for planting
- Greenspace - other
- SINC





Tree planting opportunity areas: Lady Margaret - NW

- Current Canopy
- Pavement - potential for planting
- Greenspace - potential for planting
- Greenspace - other
- SINC

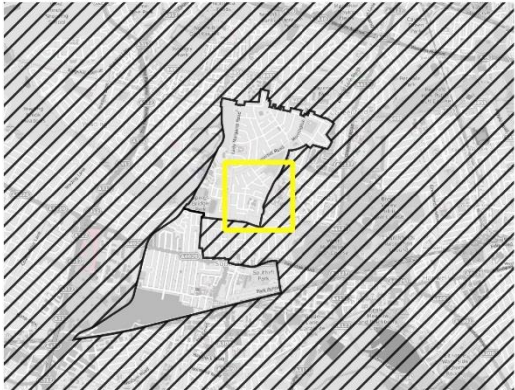


Map design: Maplango. Foreground data © Verisk/GeoInformation Group UKmap. Background map © OpenStreetMap contributors.

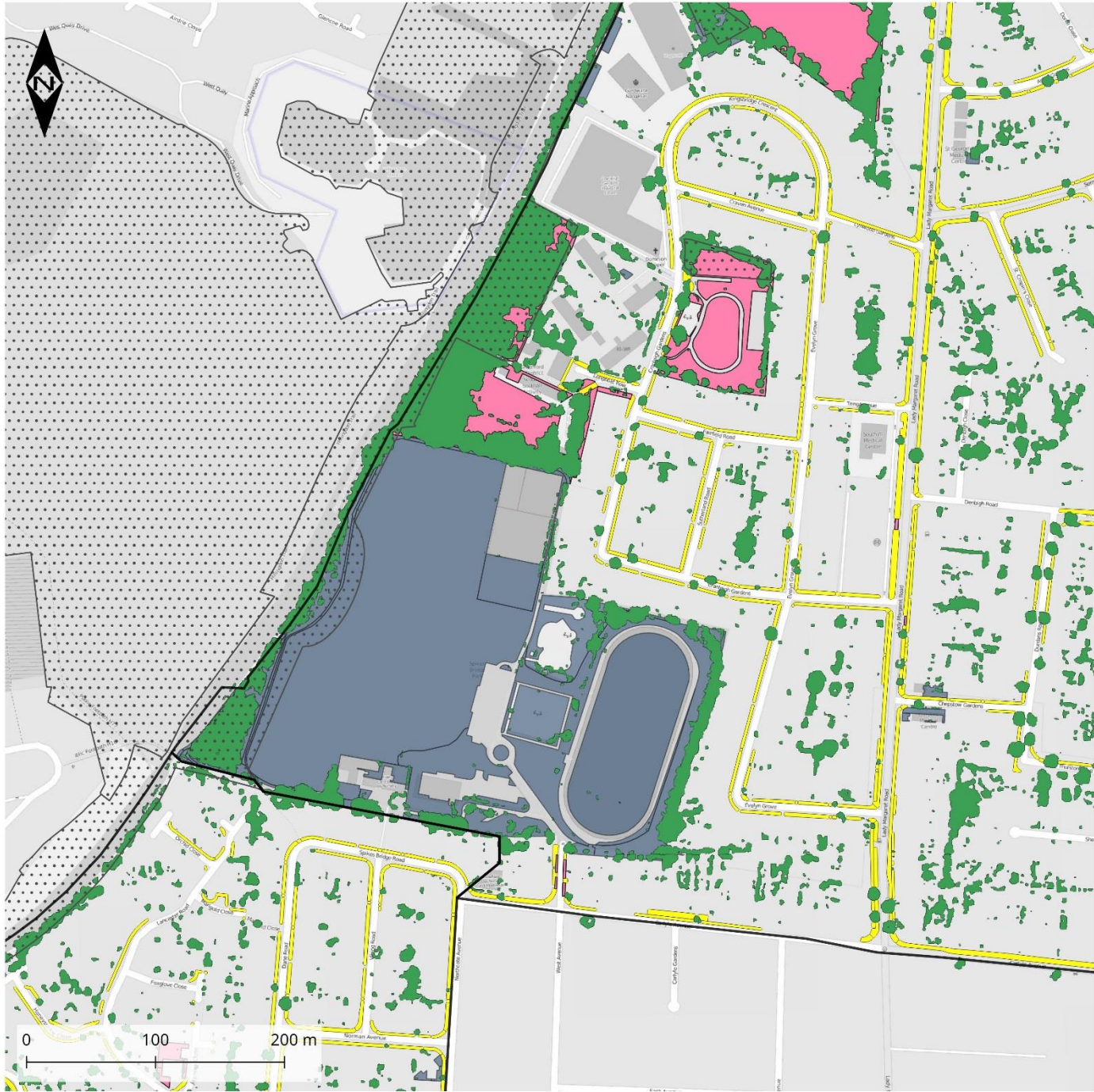


Tree planting opportunity areas: Lady Margaret - SE

- Current Canopy
- Pavement - potential for planting
- Greenspace - potential for planting
- Greenspace - other



Map design: Maplango. Foreground data © Verisk/GeoInformation Group UKmap. Background map © OpenStreetMap contributors.

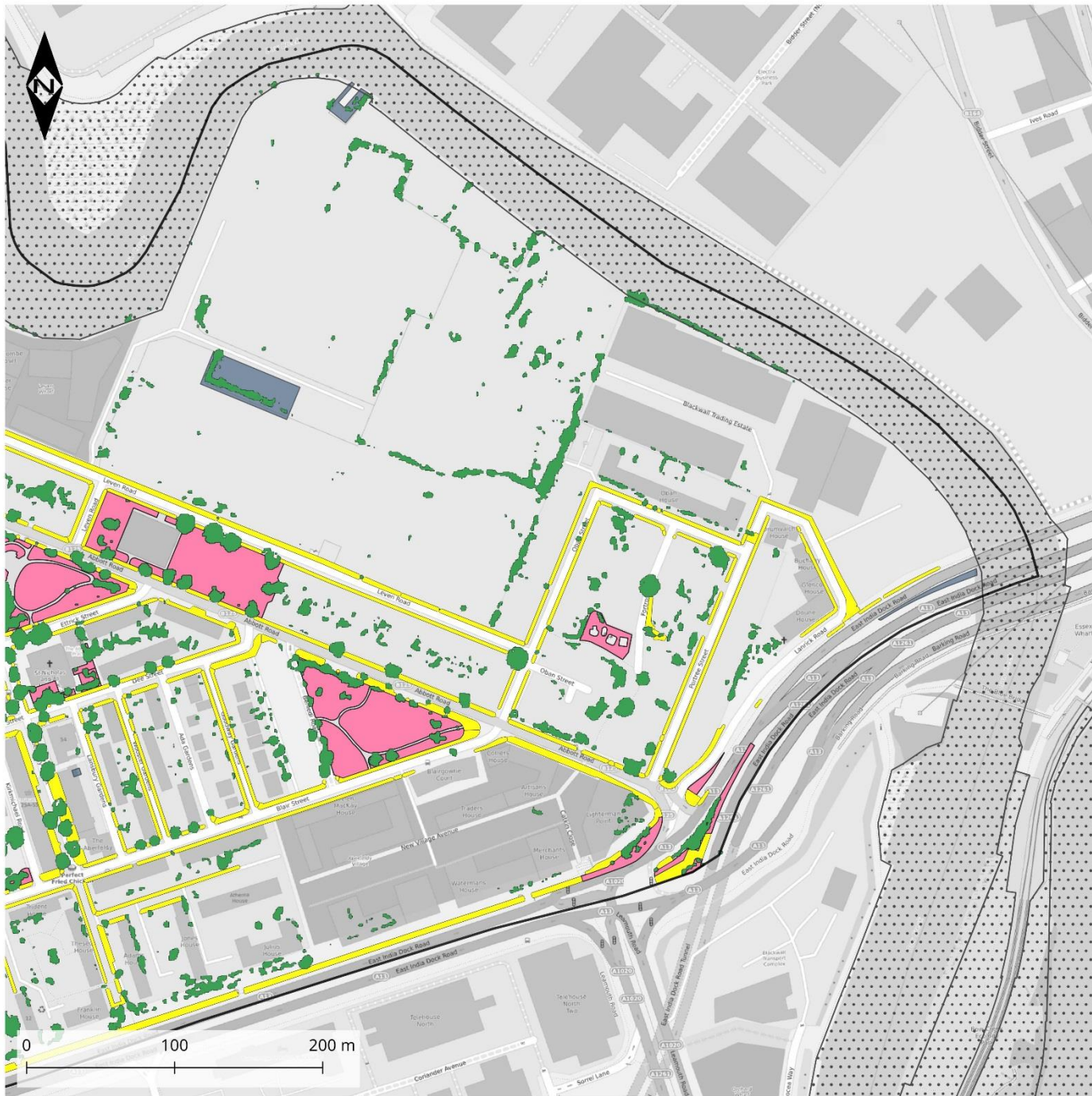


Tree planting opportunity areas: Lady Margaret - SW

- Current Canopy
- Pavement - potential for planting
- Greenspace - potential for planting
- Greenspace - other
- SINC



Map design: Maplango. Foreground data © Verisk/GeoInformation Group UKmap. Background map © OpenStreetMap contributors.



Tree planting opportunity areas: Lansbury - E

- Current Canopy
- Pavement - potential for planting
- Greenspace - potential for planting
- Greenspace - other
- SINC

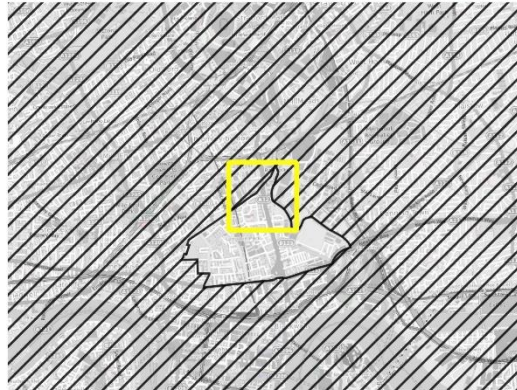


Map design: Maplango. Foreground data © Verisk/GeoInformation Group UKmap. Background map © OpenStreetMap contributors.



Tree planting opportunity areas: Lansbury - N

- Current Canopy
- Pavement - potential for planting
- Greenspace - potential for planting
- Greenspace - other
- SINC

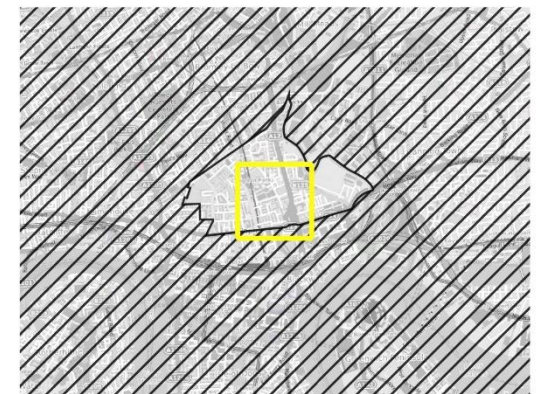


Map design: Maplango. Foreground data © Verisk/GeoInformation Group UKmap. Background map © OpenStreetMap contributors.

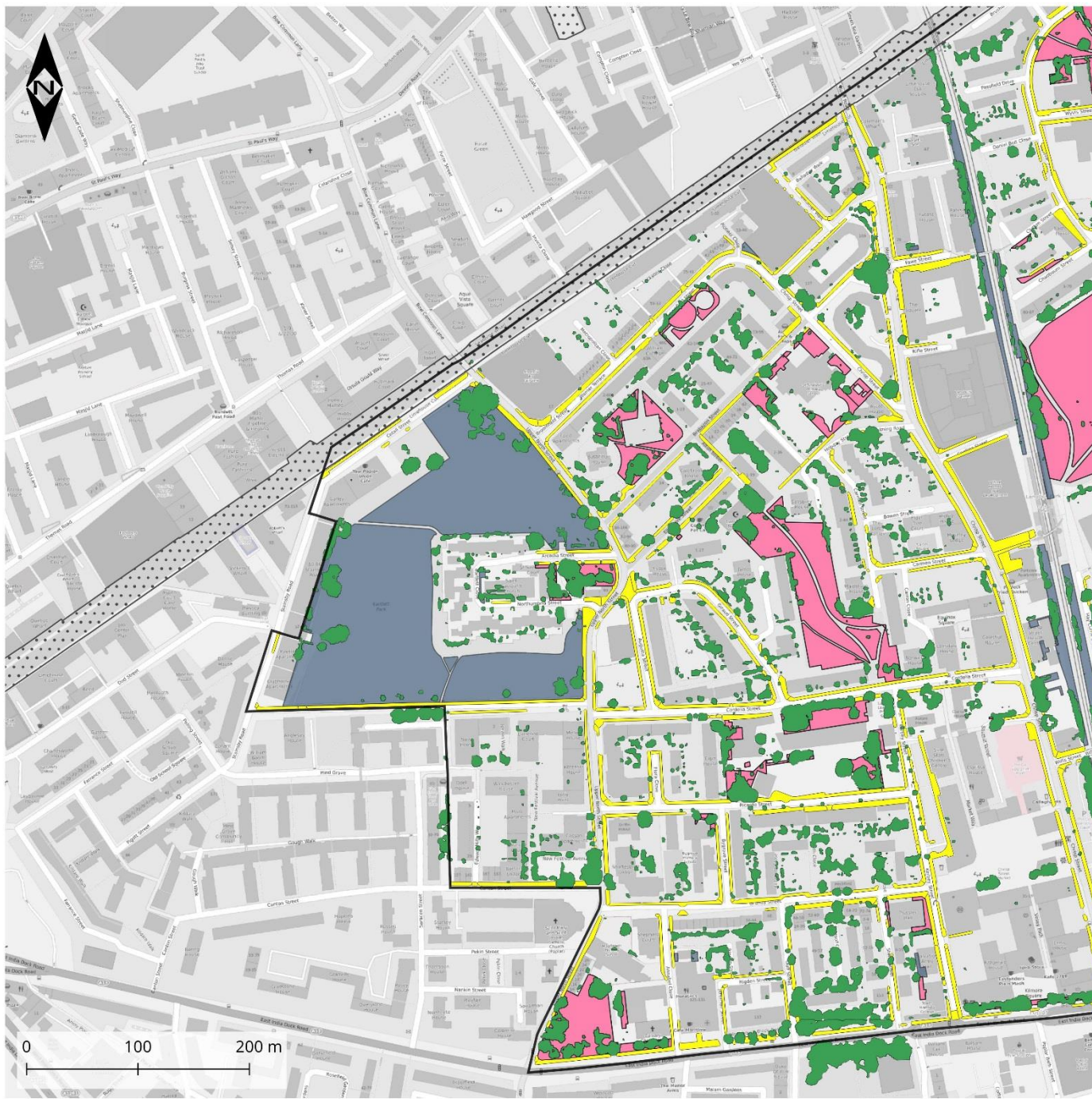
Tree planting opportunity areas: Lansbury - S



- Current Canopy
- Pavement - potential for planting
- Greenspace - potential for planting
- Greenspace - other
- SINC

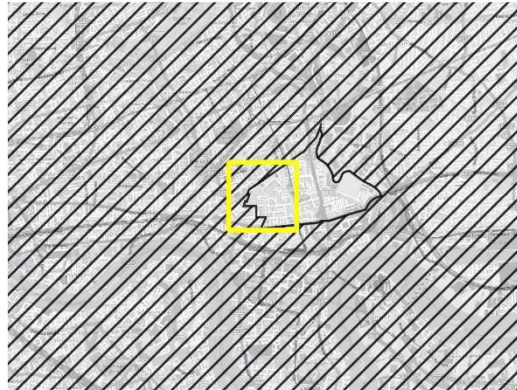


Map design: Maplango. Foreground data © Verisk/GeoInformation Group UKmap. Background map © OpenStreetMap contributors.

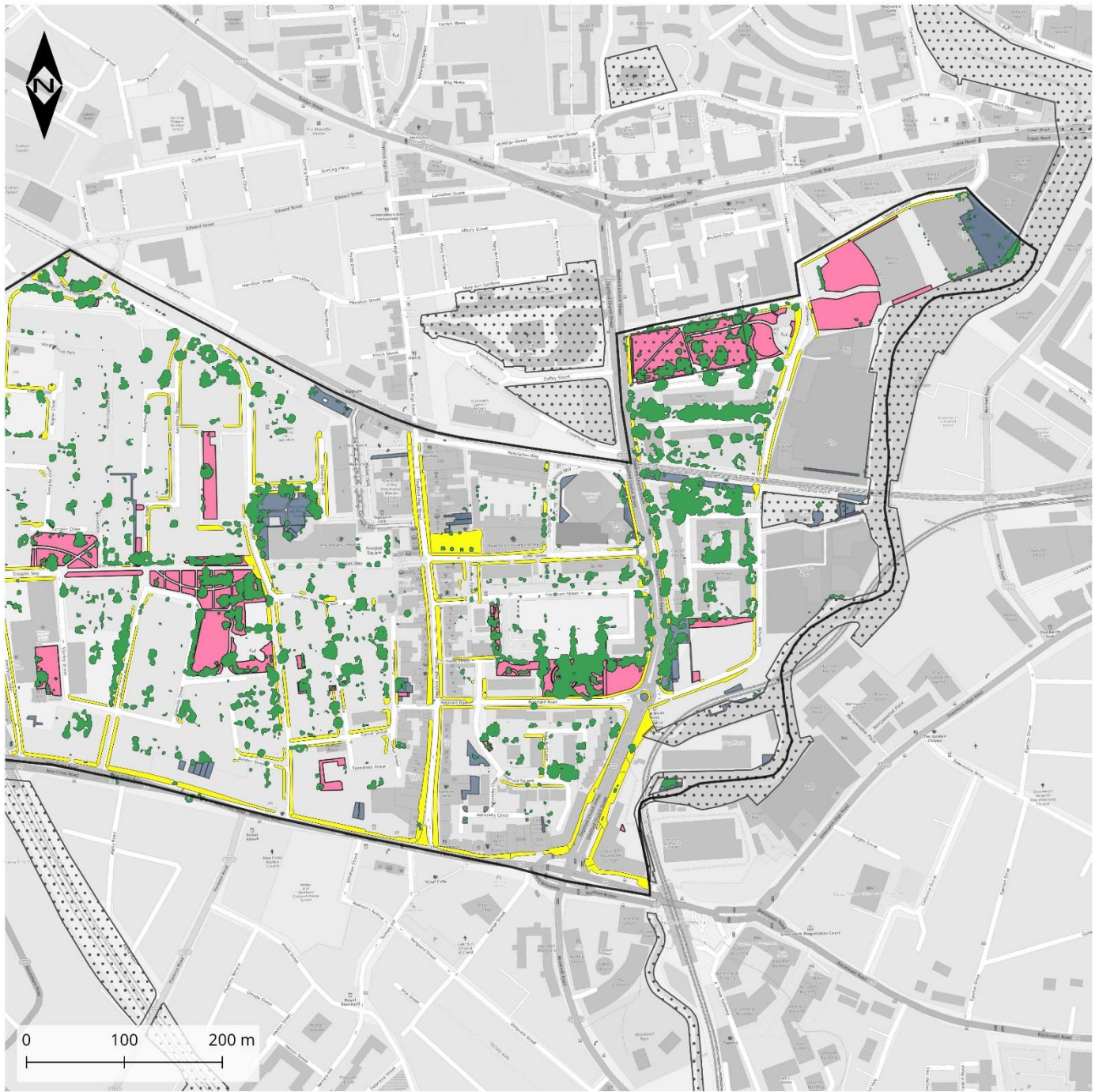


Tree planting opportunity areas: Lansbury - W

- Current Canopy
- Pavement - potential for planting
- Greenspace - potential for planting
- Greenspace - other
- SINC

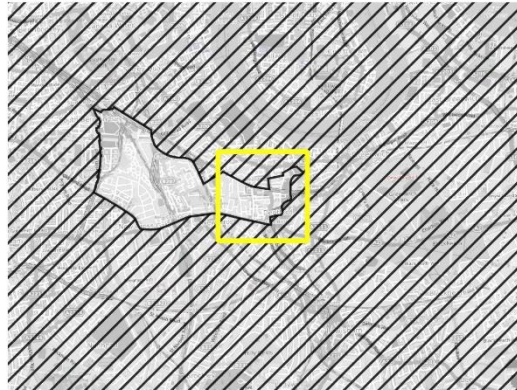


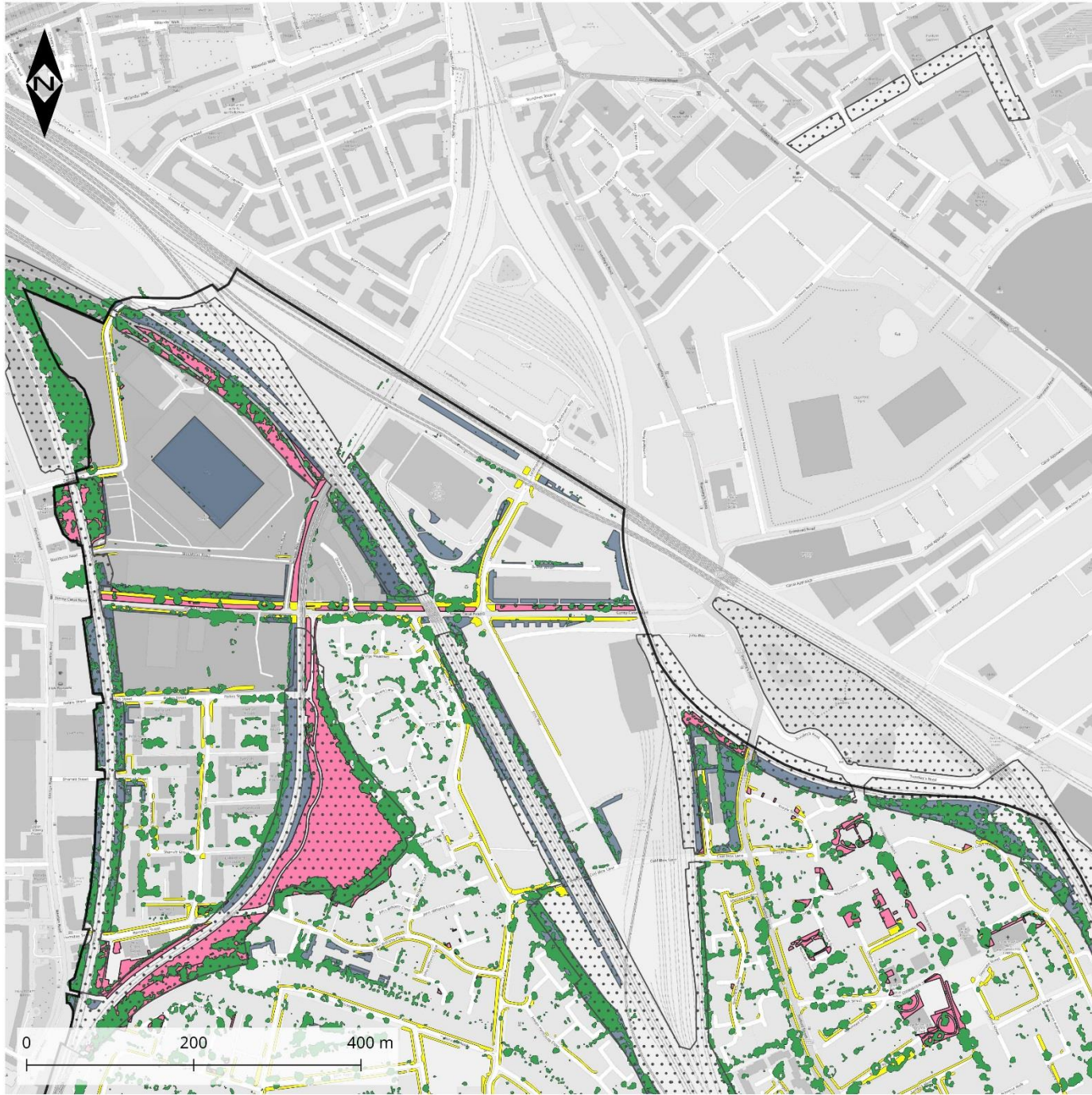
Map design: Maplango. Foreground data © Verisk/GeoInformation Group UKmap. Background map © OpenStreetMap contributors.



Tree planting opportunity areas: New Cross - E

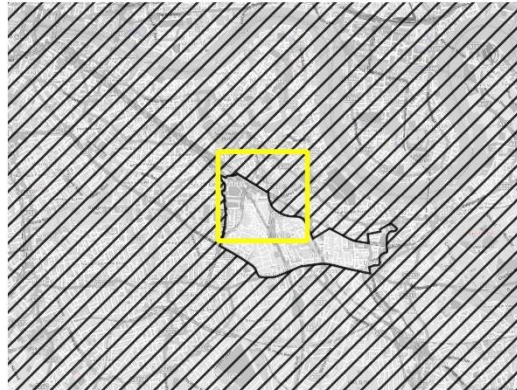
- Current Canopy
- Pavement - potential for planting
- Greenspace - potential for planting
- Greenspace - other
- SINC



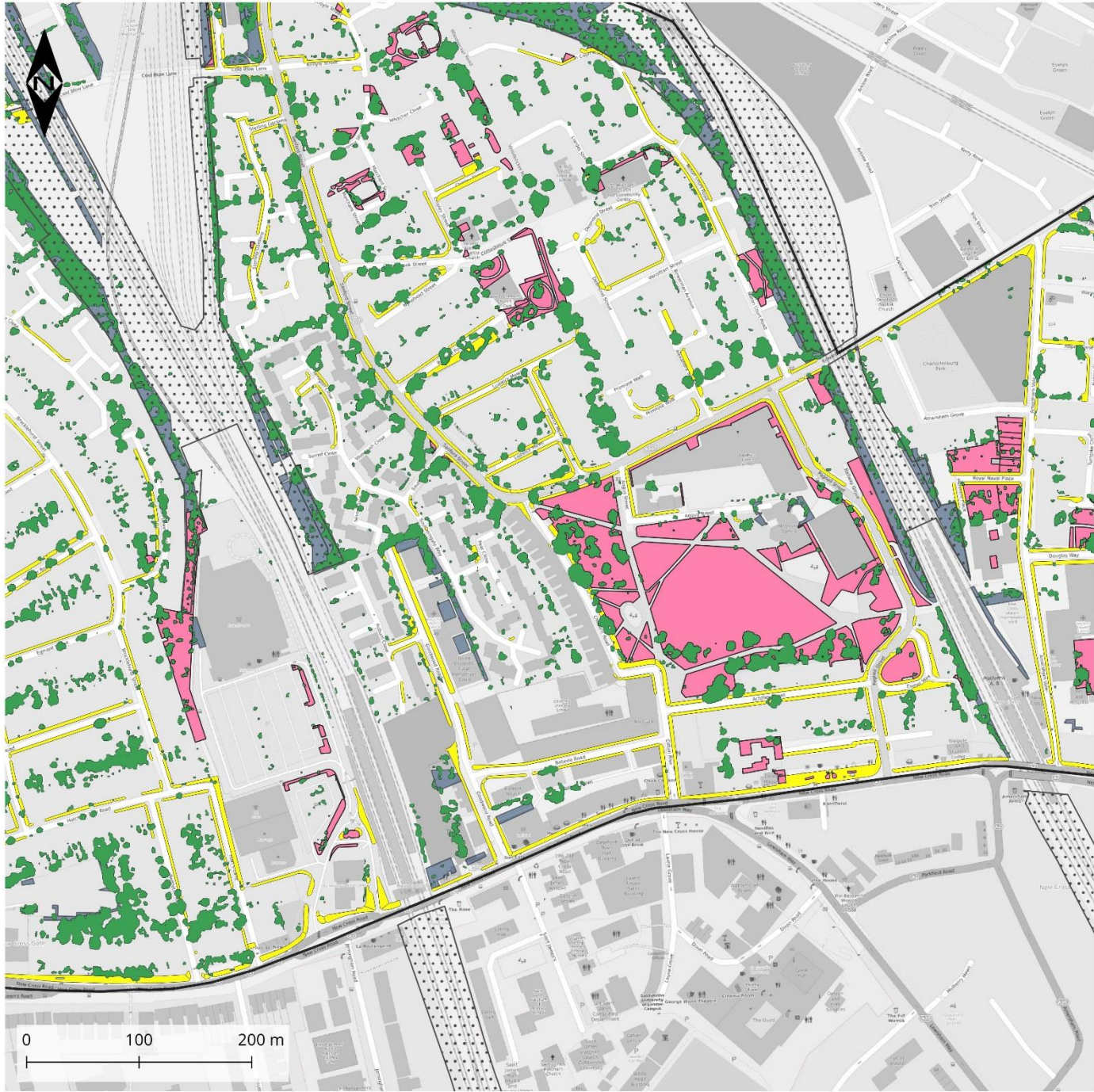


Tree planting opportunity areas: New Cross - N

- Current Canopy
- Pavement - potential for planting
- Greenspace - potential for planting
- Greenspace - other
- SINC

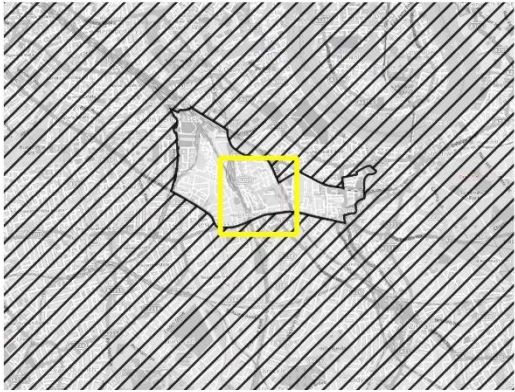


Map design: Maplango. Foreground data © Verisk/GeoInformation Group UKmap. Background map © OpenStreetMap contributors.

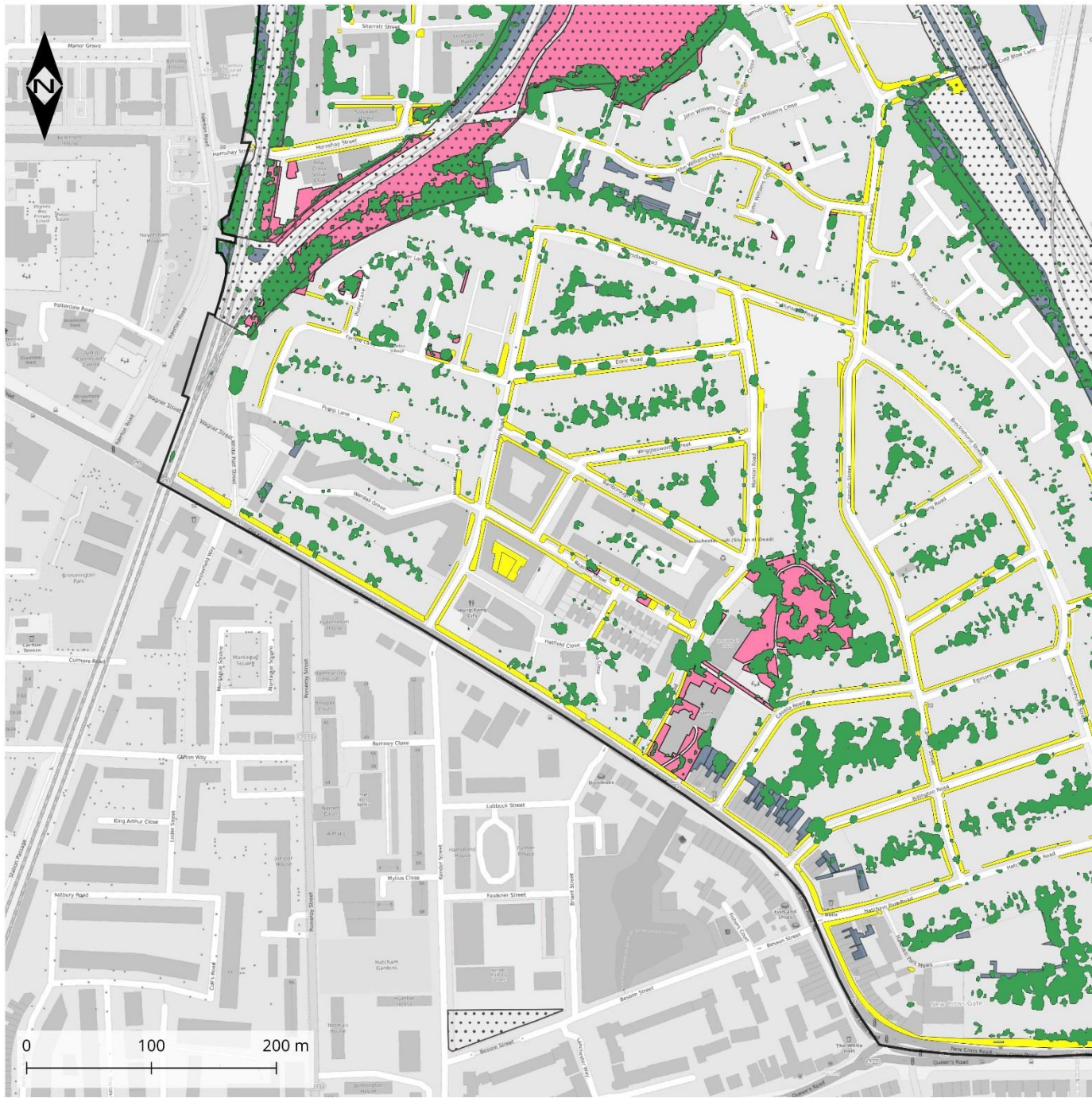


Tree planting opportunity areas: New Cross - S

- Current Canopy
- Pavement - potential for planting
- Greenspace - potential for planting
- Greenspace - other
- SINC

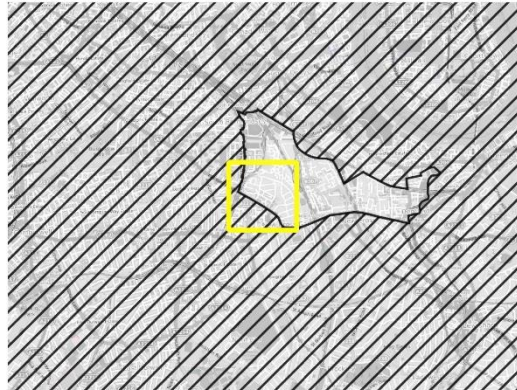


Map design: Maplango. Foreground data © Verisk/GeoInformation Group UKmap. Background map © OpenStreetMap contributors.

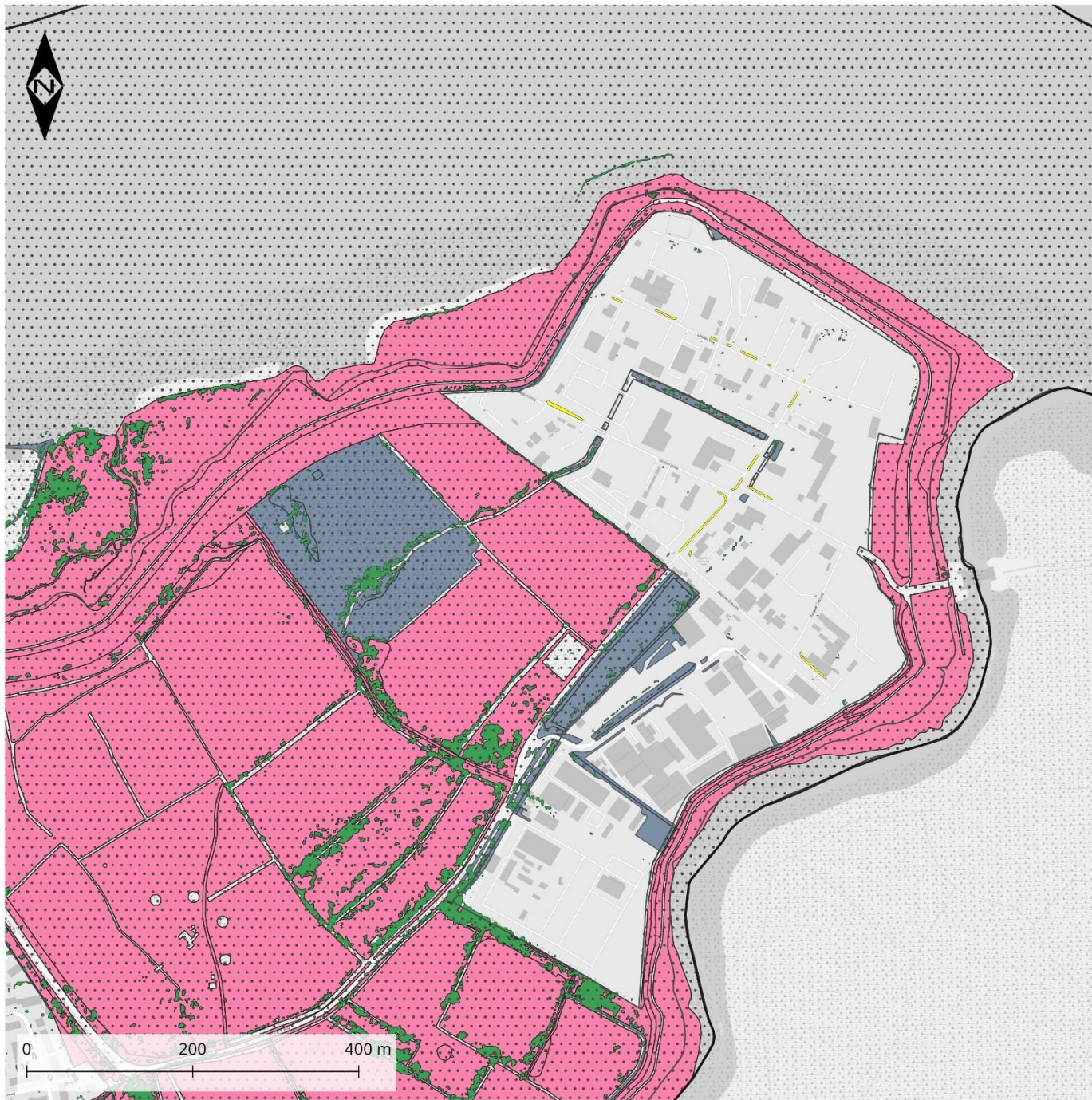


Tree planting opportunity areas: New Cross - W

- Current Canopy
- Pavement - potential for planting
- Greenspace - potential for planting
- Greenspace - other
- SINC



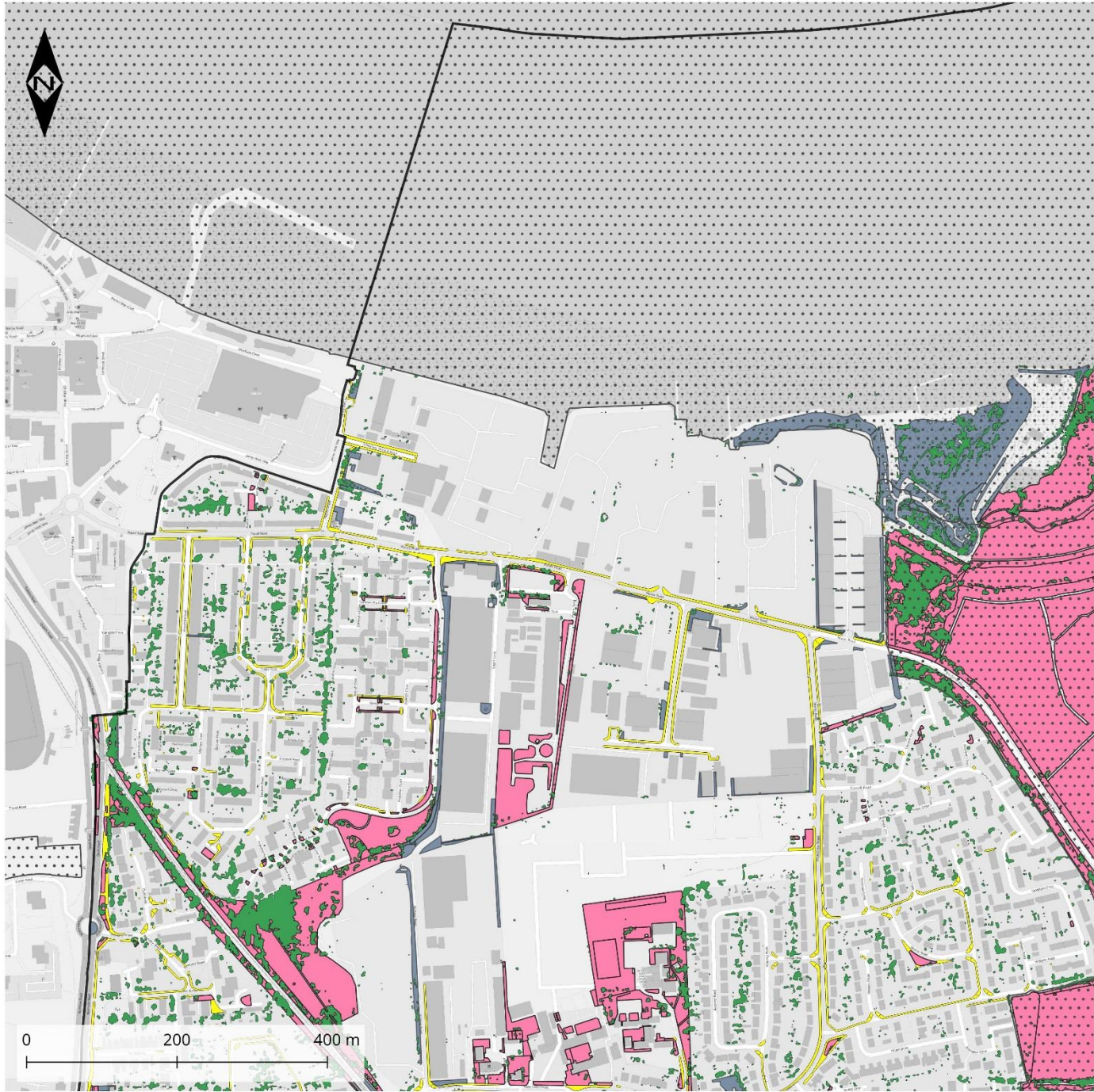
Map design: Maplango. Foreground data © Verisk/GeoInformation Group UKmap. Background map © OpenStreetMap contributors.



Tree planting opportunity areas: Slade Green & Northend - NE

- Current Canopy
- Pavement - potential for planting
- Greenspace - potential for planting
- Greenspace - other
- SINC



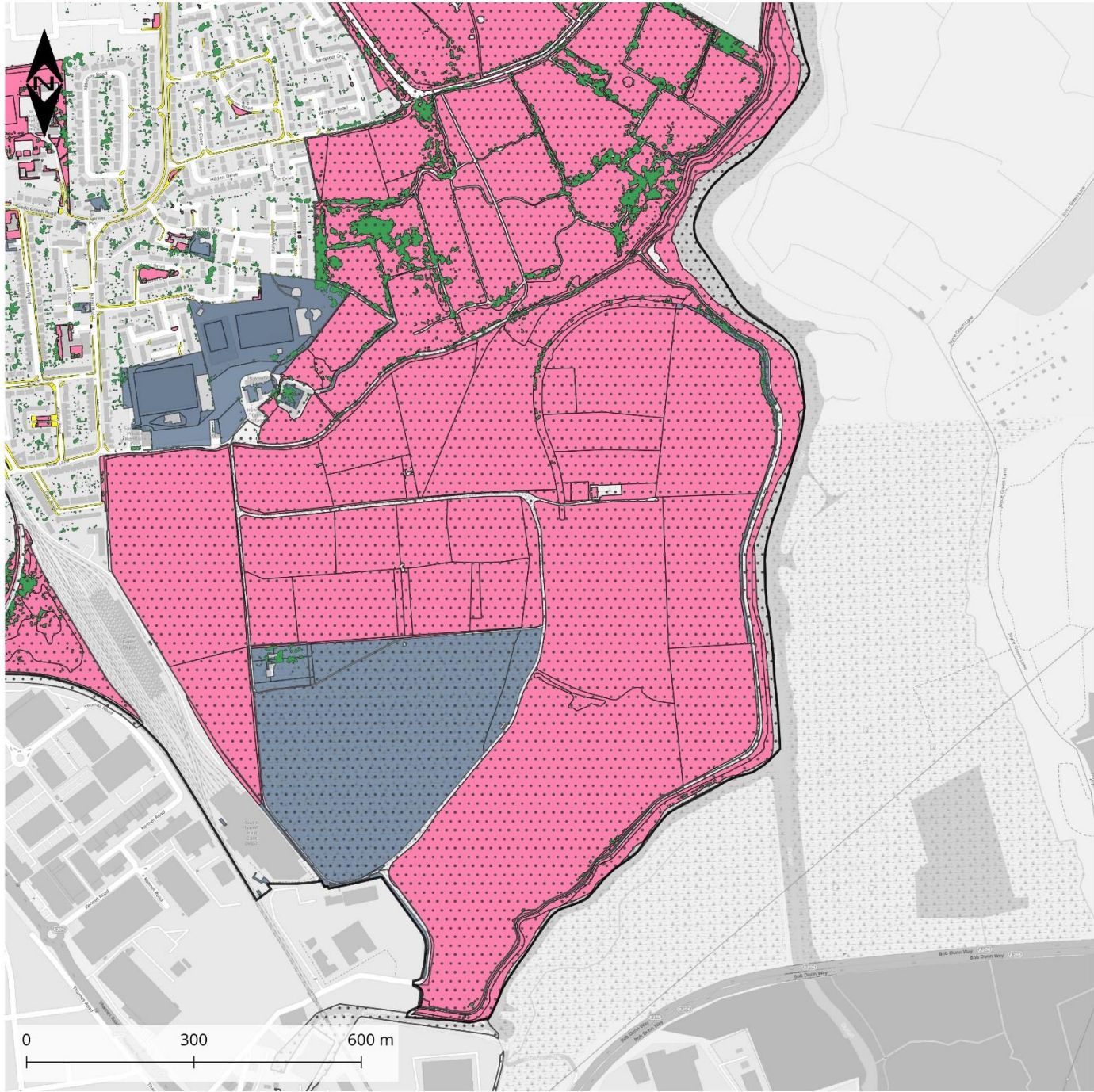


Tree planting opportunity areas: Slade Green & Northend - NW

- Current Canopy
- Pavement - potential for planting
- Greenspace - potential for planting
- Greenspace - other
- SINC



Map design: Maplango. Foreground data © Verisk/GeoInformation Group UKmap. Background map © OpenStreetMap contributors.

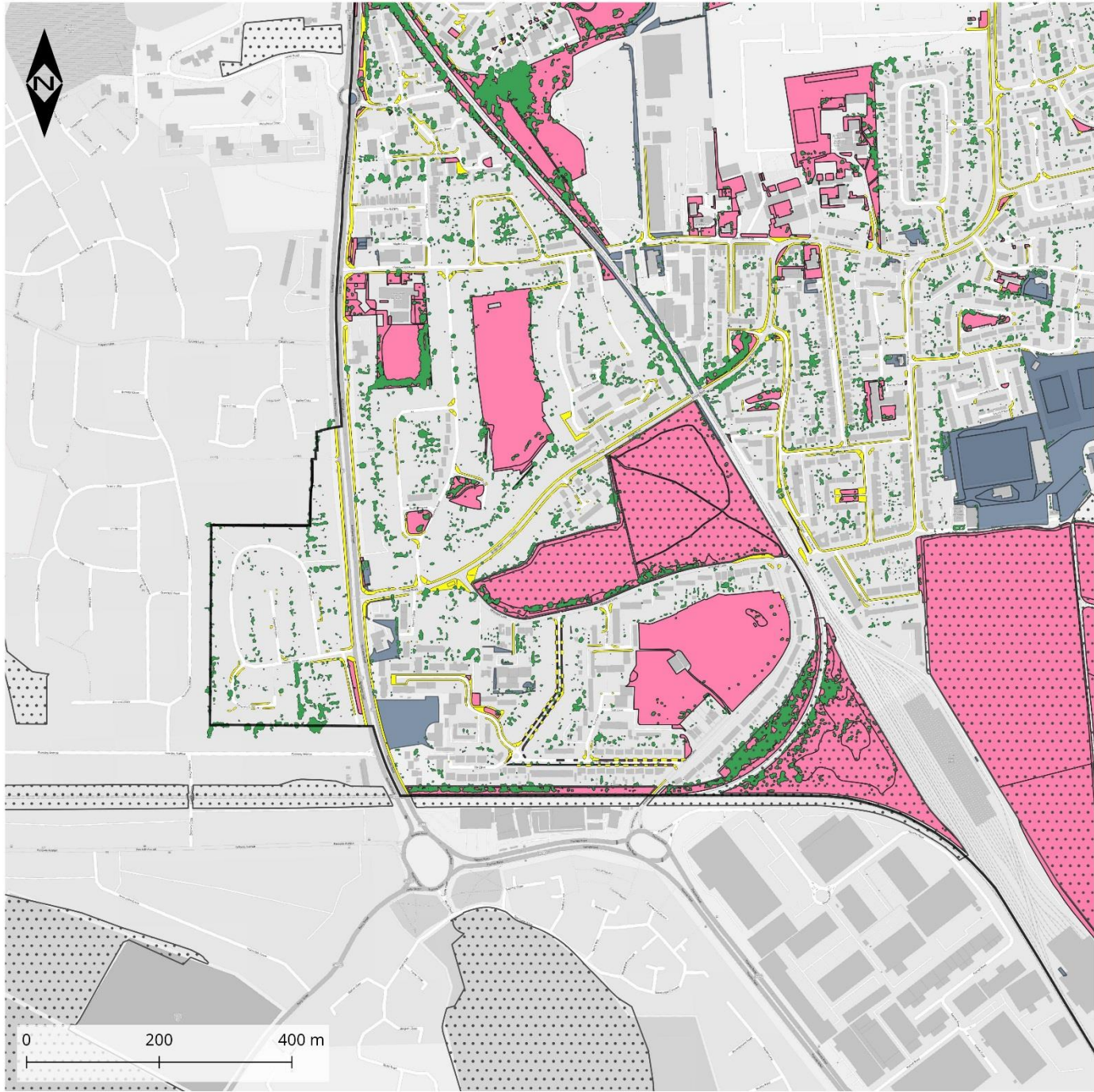


Tree planting opportunity areas: Slade Green & Northend - SE

- Current Canopy
- Pavement - potential for planting
- Greenspace - potential for planting
- Greenspace - other
- SINC



Map design: Maplango. Foreground data © Verisk/GeoInformation Group UKmap. Background map © OpenStreetMap contributors.



Tree planting opportunity areas: Slade Green & Northend - SW

- Current Canopy
- Pavement - potential for planting
- Greenspace - potential for planting
- Greenspace - other
- SINC



Map design: Maplango. Foreground data © Verisk/GeoInformation Group UKmap. Background map © OpenStreetMap contributors.



Tree planting opportunity areas: Southall Broadway - E

- Current Canopy
- Pavement - potential for planting
- Greenspace - potential for planting
- Greenspace - other
- SINC



Map design: Maplango. Foreground data © Verisk/GeoInformation Group UKmap. Background map © OpenStreetMap contributors.



Tree planting opportunity areas: Southall Broadway - N

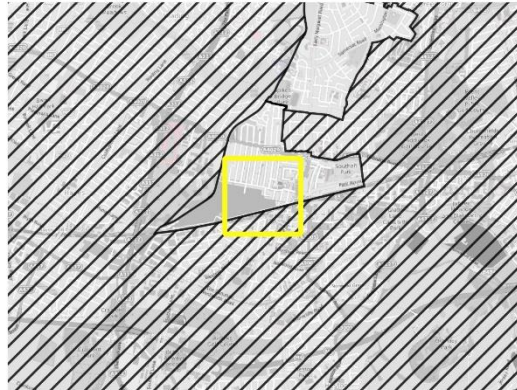
- Current Canopy
- Pavement - potential for planting
- Greenspace - potential for planting
- Greenspace - other
- SINC





Tree planting opportunity areas: Southall Broadway - S

- Current Canopy
- Pavement - potential for planting
- Greenspace - potential for planting
- Greenspace - other

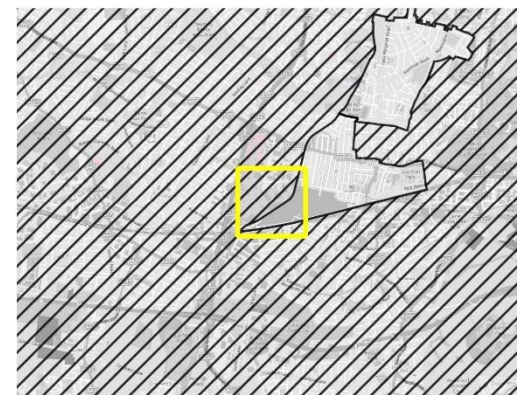


Map design: Maplango. Foreground data © Verisk/GeoInformation Group UKmap. Background map © OpenStreetMap contributors.



Tree planting opportunity areas: Southall Broadway - W

- Current Canopy
- Pavement - potential for planting
- Greenspace - potential for planting
- Greenspace - other
- SINC



3D MODEL

The 3D model of an area of the New Cross ward resulted in several outputs:

- the DWG file, which can be viewed in appropriate (3D) software
- an animation in MP4 format, which can be played in appropriate software
- Before and after photos (see below)

Still from Animation

Below is a still from the 3D fly through of a street in New Cross with new tree planting.



Figure 2: Still from 3D animation model

Before and after photos

The following pages show before and after photos that were created from the 3D model at 4 x viewpoints in the New Cross ward. The tree species is a 3D model (from Lands Design) of *Acer Platanoides* which was placed at 14.6m intervals with a c. 6m crown diameter. The sun/ light source for the 3D model was set to the date and time the photos were taken so that the images appear natural.



Figure 2: Viewpoint 1 - Billington Road from corner of Camplin Road, New Cross (51.476328° - 0.045393°)



Figure 3: Viewpoint 2 - Brocklehurst Road from corner Laylang Road (51.478492° -0.044729°)



Figure 4: Viewpoint 3 Camplin Road from corner Ventnor Road, New Cross (VP 3 51.477381° - 0.045677°)



Figure 5: Viewpoint 4 - Ventnor Road from corner Camplin Road, New Cross (51.477381° - 0.045677°)

ACCOMPANYING OUTPUTS

In addition to the maps and images in the sections above, the project resulted in the following additional/ accompanying outputs:

- A Spreadsheet and Shapefile that can be filtered by the user to identify priority wards, plus PDF maps for printing at A3 of the prioritisation ward maps shown above.
- A Spreadsheet of summary statistics and Shapefiles that show the potential plantable areas in the sample wards, plus PDF maps for printing at A3 of the opportunity areas as shown above.
- 3D model of an area of New Cross ward in DWG format, fly-through MP4 animation of a street in the same area, and before and after JGP photos.

Discussion

WARD PRIORITISATION

A review of the ward prioritisation decile maps above reveals some trends at a London scale but this data is presented in detail in an accompanying spreadsheet for interpretation of the various factors either individually or in combination, as desired. Some key observations and caveats are as follows.

- Tree Canopy Cover (Canopy Curio data)
 - Broadly the map above shows that canopy levels are higher in outer London wards although there are noticeable exceptions: in certain wards of the Lea Valley, Bexley, Croydon, near Heathrow and in pockets of NW London.
 - On close observation, the data appears to include areas of shrub and may over-estimate tree canopy cover.
- Green Blue cover (NDVI assessment of open water and greenspace)
 - Blue-green cover, or green and open water areas, is generally higher in the outer London wards as might be expected but there are many exceptions, perhaps reflecting the larger (Royal) parks and other large natural features in central wards.
- Index of Multiple Deprivation (ONS data from 2011 census)
 - IMD (which measures deprivation in Income, Employment, Education, Health and Disability, Crime, Housing and Services and Living Environment) is noticeably higher in north-east London, south central, and some parts on north-west London.
 - It should be noted that IMD data is mapped using LSOA boundaries for the 2011 census. Where ward boundaries have changed since this time, the LSOA boundaries did not 'nest' within wards. IMD estimates for these wards are therefore less reliable and should be updated when updated data is available.
- Urban heat island (Mean night-time temperature during the summer of 2011)
 - The wards most affected by higher summertime night-time temperatures are predominantly in central and north eastern wards. Broadly speaking, the wards with high levels of blue-green cover appear least affected by the urban heat island.
- Air pollution (LAEI air quality data for NO2 and PM2.5)
 - Of all the maps NO2 and PM2.5 most clearly demonstrate an inner-outer London differentiation, though there are nuances which will be important at the local level and exceptions, such as in central Croydon and near Heathrow.
 - Air quality varies considerably at a micro scale and are levels are not consistent across the whole ward. Estimates of air quality at the ward scale should be interpreted with care.
- Sites of Importance for Nature conservation (% of SINC in Ward)
 - There are noticeably high levels of land and water designated as SINC in south west London (Richmond park) and in the wards along the Thames estuary. However, % cover

of SINC appears to be much more heterogeneous than the other factors and perhaps reflects the efforts of the GLA and boroughs to ensure land is designated for conservation across London.

PLANTING OPPORTUNITY MAPPING

A review of the table and ward level maps above reveal some distinct differences between the sample wards, which suggest that the relative opportunities for planting trees in openspace and pavement vary considerably across wards in London. The estimates are based on available data and based on assumptions as set out in the methodology above. Key observations and caveats are:

- All sample wards currently contain <10% canopy cover, ranging from just 2.8% in Slade Green & Northend to 9.82% in Lady Margaret, though it should be noted that Slade Green & Northend is considerably larger than the other wards at 554.26ha, reflecting its location on the edge of London.
- With the exception of Slade Green & Northend the possible increase in canopy cover in each ward in suitable open space is <5%, ranging from 1.71% in Broad Green to 4.26% in Lady Margaret. In Slade Green & Northend it is much higher, at 27.25%, reflecting the large amount of openspace in the ward, particularly the considerable areas of Permanent pasture and Rough grazing, and some Scrub. It is also apparent that these areas are currently designated as SINC, highlighting the fact that while there may be some limited potential to plant trees in these areas, further discussions will be necessary at a local level to agree conservation priorities and assess feasibility.
- Conversely, the potential for new street trees planting in Slade Green & Northend is much lower (at 3.45%) than the other wards (which range from 14.93% in New Cross to 23.09% in Broad Green).
- When the openspace and street tree estimates are combined the overall possible increase in canopy ranges from 19.12% in New Cross to 30.70% in Slade Green & Northend. Whilst those estimates may seem high and very aspirational it would bring the canopy levels into line with many other wards. For comparison, the average (median) canopy cover is 17.99 % in Chapel End in Waltham Forest and the highest is Hampstead Town (58.66%).
- It should be noted that estimates of canopy gain for new trees are based on the categorisation of land-use in the UKmap data. The land-uses that were considered suitable for tree planting (Appendix 1) will not, in all cases, be suitable. While they operate as a guide, local level assessment will be needed as it is apparent that:
 - The land-use categorisation in the UKmap data does not identify all conservation designations or habitat types that may not be suitable for tree planting, such as the large areas of grazing marsh SINC in Slade Green & Northend. SINC's have been identified on the planting opportunity maps, and in all cases would need further assessment to identify whether they are suitable for tree planting.

- Some areas of landscaping around buildings, for example on housing estates, were classified in UKmap as private and were excluded, when perhaps they would actually be suitable for planting.
- Some areas were classified as playing fields and excluded and, conversely, some areas were included that appear to include some playing pitches.
- Grazing land was included but it may not be appropriate to convert this to woodland.
- It may be possible to plant trees in pavement which is less than 2m wide but this will require local assessment, and perhaps negotiations with borough highway departments on where residents park on pavement.
- The 3D visualisations, particularly the before and after photos, show how new trees would look in-situ and should help residents in low-canopy wards demonstrate the benefit of new planting and support campaigns at a local level. They should also be useful for organisations promoting tree planting in low canopy wards to demonstrate benefits to local residents and funders.

Conclusion and next steps

The project has been useful examination of the 2 new datasets that have been created by the GLA (the Canopy Curio and Blue-Green datasets), in the context of other datasets. It is particularly timely given the [new £10m fund to plant over 130,000 urban trees](#).

The data-driven approach taken here calculates a maximum potential 'plantable' area and acts as a guide to inform further discussion. The guidance set out is not prescriptive and while it might be possible to plant trees in the locations identified, in reality there are many local factors (e.g. utilities, use of green space, land ownership, car parking, conservation designation) that would need to be taken into account. These would restrict where planting would actually be possible.

The research set out here should help to inform discussions with stakeholders at both regional and local levels to make actionable plans to increase canopy cover in London. Whilst the methodology was necessarily experimental, the outputs and overall approach should help policy makers, borough tree officers and organisations promoting new tree planting:

- Target new planting in low canopy areas, while taking into account the wider environmental and socio-economic context.
- Identify possible opportunities for planting in openspace and pavement.
- Engage in discussions at the local level to agree conservation priorities and assess feasibility of planting

The approach taken could be adapted and improved, for instance:

- IMD and Canopy Curio statistics should be updated when the boundaries and brought into line with the new Ward boundaries and new statistics are available.
- Integrating habitat data to include/exclude areas that would not be suitable for planting (e.g. marsh).
- Integrating nature conservation designations including habitat classifications
 - to exclude areas that are designated for grassland or other habitat types and would not therefore be suitable for tree planting
 - to inform a discussion as to conservation priorities at the local level (e.g. to decide whether (parts of) sites currently designated as SINC could be planted with trees to increase canopy).
- Borough tree officers, especially those responsible for the sample wards, could 'ground-truth' outputs at a local level, to see if the potential planting opportunity areas are viable for planting, this may lead to:
 - refinements in the land-use categories used to identify opportunities for planting in openspace
 - confirmation or otherwise as to whether the identified pavements are actionable opportunities

- The opportunities for tree planting could be further analysed using borough street tree (pit) data.
- A [digital map of underground pipes and cables](#) is to be created and when this data is available it could help further refine the potential locations for new street trees.
- The approach could be adapted and implemented using, for instance, OS Mastermap data if UKmap data was not available

Further reading

- *'GLA – Green City: Assessing London's Tree Planting Potential on Local Authority Green Spaces'* The Mayhew Consultancy Ltd (2017)
- *'London Borough of Barking and Dagenham Tree Planting Strategy'* Jon Sheaff and Associates (2018)
- *'Trees in Hard Landscapes A Guide for Delivery'* Trees and Design Action Group (2014)
- *'Tree species selection for green infrastructure: A guide for specifiers'* Trees and Design Action Group (2014)

Appendix 1: UK map categories with tree planting potential

The table below provides a full list of UKmap land-use categories, with those used as the basis for identifying planting opportunities highlighted. Polygons with land-use as shown in the left-hand column (**FCC COD**) were selected EXCEPT where the **feature_type** indicated that planting would not be possible.

UKMap FCC COD (Yellow were included as having potential for planting)	feature_type (Red categories were excluded, orange were included as may be possible to plant, green included as have potential)
Access Road	Building
Address Point only	Man-made Surfaced Area
Advanced stop line	Vegetated
Advertising places	Scattered Trees
Agricultural buildings & farmyards	Dense Trees
Agricultural research	Man-made Structure (not a building)
Agricultural research establishment	Water
Air freight terminal	
Airport	
Allotment gardens	
Ambulance stations	
Amenity, amusement and show places	
Ancient monument	
Animal breeding places	
Animal living places	
Animal product processing places	
Animal service places	
Animal training and competing places	
Aquarium	
Aqueduct	
Aqueduct over canal	
Aqueduct over rail	
Aqueduct over river	
Aqueduct over road	
Arable farm places	
Archaeological site	
Art gallery	
Association football ground	
Athletic game courses	
Athletic games arenas	
Athletic ground	
Ball game courses	
Ball game greens and courts	

Ball game pitches and grounds	
Barracks	
BB	
Beach or sand dune	
Blood transfusion centre	
Boarding house	
Boating facilities	
Boatyard	
Borstal institution	
Botanical garden	
Bowling green	
Bridge - Rail bridge	
Bridge - Rail over canal	
Bridge - Rail over rail	
Bridge - Rail over river	
Bridge - Rail over road	
Bridge - Road bridge	
Bridge - Road over canal	
Bridge - Road over rail	
Bridge - Road over river	
Bridge - Road over river (duplicate code)	
Bridge - Road over road	
Bridges	
Bridleway	
Broadcasting, filming and sound recording studio	
Bulk material stores (Not retail)	
Bus depot	
Bus lane on road	
Bus station	
Bus stop	
Bus way	
Camping site	
Canal	
Car park - multi storey	
Car park - street level	
Car storage place	
CC	
Cemetery	
Central government administration office	
Children's home	
Children's playground	
Church hall	
Cinema - use RCC	
Civil Defence centre	
Cliff or natural outcrop	
Club meeting place	
Coach depot	
Coach station	

Coastguard station	
College of further education	
Commercial sites - general	
Communal homes	
Communication places	
Community centre	
Community protection services	
Concert/Event arena	
Coniferous forest	
Construction site	
Container depot	
Convalescent home	
Coppice	
Counselling places	
Country park	
Courts	
Crematorium	
Cricket ground	
Crop conditioning grading and storage places	
Crop processing places	
Cultivated places	
Customs depot	
Cycle lane on road	
Cycle track	
Cycle track on pavement	
Cycling circuit	
DD	
Dead bodies disposal places	
Dead bodies storage places	
Deciduous forest	
Defence establishments	
Defence training places	
Dentist's surgery and consulting room	
DESCRIPTION	
Designated travellers' site	
Detention places	
Disabled parking	
Do Not Use	
Docks	
Doctor's surgery and consulting room	
Dog racing track	
Dwellings	
Ear, nose and throat hospital	
Education places	
Electricity cableway	
Electricity distribution places	
Electricity production places 24020103 24 2 1 3 UKMap feature Solar farm 24020104 24 2 1 4 UKMap feature Wind farm	

Electricity supply places	
Electricity transformer station	
Eye hospital	
Family planning clinic	
Farm track	
Feature Type needs verification	
Field margin - grassland	
Field margin - hedgerow	
Field margin - hedgerow with trees	
Field margin - line of trees	
Field margin - undifferentiated	
Fire station	
Fish farm	
Flood Defence	
Footbridge	
Footpath	
Forensic medicine centre	
Forestry places	
Fun fair	
Function rooms (e.g. wedding venue)	
Galleries	
Gardens (not private)	
Gas production and storage places	
Gas supply places	
General hospital	
General offices	
Geriatric hospital	
Glass house	
Golf course	
Golf driving range	
Goods handling places	
Grass land	
Grazing places	
Green verges	
Group residences	
Gymnasium	
Handicapped and disabled people's home	
Hashed zone	
Health care places	
Heath and moorland	
Historic House (with/without garden)	
Holiday camp site	
Holiday camps	
Holiday caravan site	
Horse racing course	
Horse training area and stables	
Horticultural places	
Hospitals	

Hotel	
Hunting and shooting places	
Ice rink	
Industrial sites - general	
Isolation hospital	
Justice administration places	
Keep clear zone/No parking area	
Land sport places	
Land transport places	
Land transport tracks	
Law court	
Lending library	
Level crossing	
Level crossing (emergency vehicle access only)	
Libraries	
Libraries, museums and galleries	
Life boat station	
Light controlled road crossing	
Loading bay	
Local government administration office	
Lorry transhipment park	
Marina	
Material stores	
Maternity hospital	
Mechanical handling places	
Medical auxiliary service centres	
Medical diagnosis and treatment centres	
Medical research establishments	
Medical research laboratory	
Mental hospital	
Middle school	
Mineral extraction places	
Miniature golf course	
Mixed forest	
Monument	
Mooring	
Mortuary	
Motor vehicle racing track	
Museum	
Nature reserve	
Nature reserves and sanctuaries	
Night club - use RCC	
Non cultivated places	
Non medical care places	
Non medical homes	
Non-dwelling structures - garages, sheds	
Non-dwelling structures - swimming pools	

NOT FOR DISTRIBUTION TO THIRD PARTIES WITHOUT WRITTEN PERMISSION	
NOT FOR USE	
Observatory	
Offices	
Old people's home	
Orchard with grass	
Outdoor amenity places	
Park	
Parking area	
Parking bay - partially on pavement	
Passing place	
Pavement	
Pavement - covered	
Peat, bog, freshwater marsh and swamp	
Pedestrian crossing	
Pedestrian tunnel	
Pedestrian zone	
Permanent pasture	
Picnic site	
Pipeline	
Places of worship	
Police station	
Pond or lake	
Postal service places	
Postal service, signalling and telecommunications places	
Postal sorting depot	
Precinct	
Pre-primary schools	
Primary schools	
Prison	
Private Road	
Public convenience	
Radar beacon	
Radar places	
Radar station	
Radio and television mast	
Radio station	
Railway station	
Railway tunnel	
Railways	
Recreational open space	
Refuse disposal places	
Refuse disposal plant	
Refuse tip 24050103 24 5 1 3 UKMap feature	
Recycling centre	
Research establishments	

Research places	
Reservoir	
Residences	
Residential caravan site	
Restricted road	
Retail Centre	
Retail Centre - 1 floor	
Retail Centre - 1 floor - floor level 1	
Retail Centre - 1 floor - floor level -1	
Retail Centre - 1 floor - floor level 2	
Retail Centre - 1 floor - floor level -2	
Retail Centre - 1 floor - floor level 3	
Retail Centre - 1 floor - floor level -3	
Retail Centre - 1 floor - floor level 4	
Retail Centre - 1 floor - floor level G	
Retail Centre - 2 floors	
Retail Centre - 2 floors - floor level 1	
Retail Centre - 2 floors - floor level -1	
Retail Centre - 2 floors - floor level 2	
Retail Centre - 2 floors - floor level -2	
Retail Centre - 2 floors - floor level 3	
Retail Centre - 2 floors - floor level -3	
Retail Centre - 2 floors - floor level 4	
Retail Centre - 2 floors - floor level G	
Retail Centre - 3 floors	
Retail Centre - 3 floors - floor level 1	
Retail Centre - 3 floors - floor level -1	
Retail Centre - 3 floors - floor level 2	
Retail Centre - 3 floors - floor level -2	
Retail Centre - 3 floors - floor level 3	
Retail Centre - 3 floors - floor level -3	
Retail Centre - 3 floors - floor level 4	
Retail Centre - 3 floors - floor level G	
Retail Centre - 4 floors	
Retail Centre - 4 floors - floor level 1	
Retail Centre - 4 floors - floor level -1	
Retail Centre - 4 floors - floor level 2	
Retail Centre - 4 floors - floor level -2	
Retail Centre - 4 floors - floor level 3	
Retail Centre - 4 floors - floor level -3	
Retail Centre - 4 floors - floor level 4	
Retail Centre - 4 floors - floor level G	
Retail Centre - 5 floors	
Retail Centre - 5 floors - floor level 1	
Retail Centre - 5 floors - floor level -1	
Retail Centre - 5 floors - floor level 2	
Retail Centre - 5 floors - floor level -2	
Retail Centre - 5 floors - floor level 3	

Retail Centre - 5 floors - floor level -3	
Retail Centre - 5 floors - floor level 4	
Retail Centre - 5 floors - floor level G	
Retail distribution places	
River	
Road feature - undifferentiated	
Road marking - undifferentiated	
Road sign - undifferentiated	
Road tunnel	
Roads	
Rock climbing	
Rod/recreational fishing place	
Roller skating rink	
Rough grazing	
Rugby football ground	
Ruins	
Rural - narrow, single track	
Salt marsh (unused)	
Sanitation places	
Satellite communication station	
Scrap and waste dealer	
Scrub land	
Secondary schools	
Sewage disposal places	
Sewage draining places	
Sewage pumping station	
Sewage treatment places	
Sewage treatment works	
Ship passenger terminal	
Show places	
Single Tree	
Site of special scientific interest	
Sixth form college	
Skiing and tobogganing run	
Social meeting places	
SOURCE	
Special school 14010502 14 1 5 2 UKMap feature All-through school	
Specialised, higher & further education centres	
Specialist college/training centre	
Speed humps	
Squash court	
Station	
Storage places for vehicles	
Storage places for water craft	
Swimming and bathing	
Swimming baths	
Target shooting places	

Taxi rank/Taxi stand	
Teacher training college	
Telecoms mast	
Telephone exchange	
Television and radio broadcasting places	
Television station	
Ten pin bowling alley	
Tennis court	
Terminals and interchanges for goods	
Terminals and interchanges for people	
Text label point - Point of Interest	
Text label point - Road name	
Theatre - use RCC 15010408 15 1 4 8 UKMap feature Leisure Centre / gym	
Traffic island	
Tramway	
Tree nursery	
Tunnels	
Under development	
Underground Station entrance	
Underground Station entrance & subway	
University teaching establishment	
Unused buildings	
Unused formerly developed land	
Unused land in natural or semi natural state	
Unused water	
Veterinary hospital	
Veterinary surgery	
Walkway	
Warehousing - general (incl. self-storage)	
Water course	
Water distribution places	
Water pipeline	
Water pumping station	
Water recreation places	
Water sport places	
Water storage and treatment places	
Water supply places	
Water tower	
Water tracks	
Water transport places	
Water transport tracks	
Water treatment works	
Watercraft places	
Woodland and scrub	
Youth hostel	
Zebra crossing	
Zoological garden	

Appendix 2: Metadata ward ranking spreadsheet

Column	Description
NAME	Ward name
GSS_CODE	Ward code
DISTRICT	Ward District
InnerOuter	Inner or Outer London borough
LAGSSCODE	Local Authority code
HECTARES	Area of Ward (ha)
WardIn2014	WardIn2014 - Y = Ward (code) same as in 2014, N = Ward (code) has changed since 2014. Where N statistics are based on Max overlapping Ward
W14MaxGSS	Code of 2014 Maximum overlapping Ward
W14MaxOver	% overlap with Ward
LSOAccount	Count of LSOAs where overlap is >66.7%
LSOAmin67	Minimum % overlap of LSOA where over 66.7%
AvgIMD	Average IMD rank for Ward (1 most deprived)
IMDrank	IMD rank - 1 most deprived
IMDDec	IMD decile - 1 most deprived
CurioCover	% Curio Canopy cover for 2018 Wards
CurioRank	Curio rank - 1 lowest canopy cover
CurioDec	Curio decile - 1 lowest canopy cover
NDVI0_05bg	% Green-Blue cover of ward
BlGrRank	Blue green rank - 1 lowest blue green cover
BlGrDec	Blue green decile - 1 lowest blue- green cover
UHltempAvg	Average Mean night-time temperature during the summer of 2011 event
UHltempRank	Urban heat island rank - 1 most affected during heatwave
UHltempDec	Urban heat island decile - 1 most affected during heatwave
N02_LAEI13	Average level of NO2 in Ward
N02Rank	Air quality, NO2 rank - 1 highest levels NO2 in Ward
N02Dec	Air quality, NO2 decile - 1 highest levels NO2 in Ward
PM25LAEI13	Average level of PM25 in Ward
PM25Rank	Air quality, PM25 - 1 highest levels in Ward
PM25Dec	Air quality, PM25 - 1 highest levels in Ward
SINC	% SINC overlap with Ward, all SINC types
SINCRank	SINC rank - 1 lowest levels of SINC in Ward
SINCDec	SINC decile - 1 lowest levels of SINC in Ward
RoFRS_HiMd	Y/N if Ward intersects High or Medium Run-off categories
WFD_Poor	Y/N if Ward intersects WFD Poor or Bad categories

Appendix 3: Metadata planting opportunity spreadsheet

Totals	
Column	Example
NAME	Broad Green
Borough	Croydon
Ward area (ha)	195.22
Current Curio Canopy Ward %	4.85
Current Blue Green Ward %	18.1
Area Possible new greenspace canopy (ha, 80% canopy)	3.34
% of Ward possible new greenspace tree canopy	1.71
Length all pavement (km)	52.36
Length current pavement canopy (km)	27.52
Length potential pavement (km)	39.30
Number new pavement Trees (14.6m spacing)	2692
Potential canopy gain from new street trees (ha)	45.07
Potential canopy gain from street trees (% Ward)	23.09
Cost estimate (£700/tree)	1,884,301.23
Total possible canopy increase (ha) - openspace and street tree area combined	48.41
Total possible canopy increase (% of ward) - openspace and street tree area combined	24.80
Openspace Overview	
Column	Example
NAME	Broad Green
Borough	Croydon
Landuse	Agriculture and Fisheries
Landuse Group	Scrub land
Feature Type	Vegetated
Building within 5m?	No building within 5m
Floodrisk High/Med	No
Within 10m of a >0.1ha Wood?	No
Area Possible Woodland (m)	14.83
Number of (parts of) site	1
Ward area (ha)	195.22

Curio Borough %	4.85
Blue Green Borough	18.1
Area Possible Woodland (ha, 80% canopy)	0.0011864
% of Ward Possible Woodland	0.000607725
Pavements Overview	
Column	Example
NAME	Broad Green
Borough	Croydon
Landuse	Transport tracks and places
Landuse Group	Pavement
Feature Type	Man-made Surfaced Area
Building5m	No building within 5m
Floodrisk High/Med	No
Within 10m of a >0.1ha Wood	No
Length Suitable pavement (m)	2917.21
Ward area (ha)	195.22
Curio Borough %	4.85
Blue Green Borough %	18.10
Number Trees	200
Canopy gain (ha)	3.35
Canopy gain (% increase)	1.71
Cost estimate (£)	139866.23