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i-Tree Eco Inventory Report for Barnard Park

London borough of Islington

Barnard Park
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Islington
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1 EXECUTIVE SUMMARY

1.1 Following a full tree inventory survey carried out in April 2021, London borough of Islington have commissioned a report on the data gathered. This report focuses on the many benefits that the trees within Barnard Park currently provide, balanced against trees proposed to be removed to facilitate development. It was possible to also view comparative benefits to 2036 based on growth estimates, with the development or with no development on site.

1.2 This will include:

- air pollution removal;
- carbon storage;
- carbon sequestration;
- avoided run-off;
- replacement cost; and
- CAVAT value

1.3 The above values are known collectively as ecosystem services, which are direct contributions of ecosystems to human well-being. The aim of this report is to quantify the ecosystem services of the trees in Barnard Park so that they can be assessed as part of the developmental proposal.[1]

1.4 In order to produce values for some of the benefits provided by Barnard Park trees, i-Tree Eco v6 (referred to as 'eco' throughout the report) was used.

1.5 A complete inventory of trees affected by the development were assessed based on a survey of the individual trees on the site. This enabled a detailed look within eco of each tree and the trees as a population.

1.6 Islington's trees within public parks play a pivotal role in the sense of place and as part of the wider urban forest.

1.7 The study has suggested that the development will impact ecosystem services on site, whilst mitigation will improve some those services, it does not improve all in the short term. However, the park improvements are likely to attract a greater number of residents to the park resulting in increased biophilic benefits.

1 - Forestry Commission. (2019) Understanding the role of urban tree management on ecosystem services

2 PROPOSALS

Introduction

2.1 The proposed development at Barnard park, within the area administrated by London Borough of Islington, is described as follows (hereafter referred to as the 'proposed development'):

2.2 *Major improvements to Barnard Park to create a more useable, green, and attractive space for local people. There will be improved pathways to make it easier to move around and clearer routes through the park. New biodiversity features and native planting will add to the parks existing natural value. Fitness equipment marked running routes and more seating for families will make the park more appealing for users. A large level grass area will provide a new informal space for leisure activities and informal sport. There will be a new 3G sports pitch for both football and rugby and where 9v9 matches, 5 a side and training sessions can take place. At the centre of the park there will also be a new Community Hub building with a multi-use community space which will provide for the existing one o'clock club. The new building will have accessible changing rooms and toilets, and the Park Keeper's office*.

2.3 As a result of the proposed development, there are associated impacts on trees. Whilst the majority will be retained, some will be removed to facilitate alterations on site. This impact will be thoroughly assessed using i-Tree to demonstrate the effects the proposed development will have to the value of trees on the site.

3 I-TREE ECO

3.1 i-Tree is a suite of open source, peer-reviewed and continuously improved software tools developed by the USDA (United States Department of Agriculture) Forest Service and collaborators, to help urban foresters and planners assess and manage urban tree populations and the benefits they can provide. i-Tree Eco ('eco' hereafter) is one of the tools in the i-Tree suite.

3.2 Eco is designed to use complete or sample plot inventories from a study area along with other local environmental data to characterise the structure of the tree population, quantify some of the environmental functions it performs in relation to air quality improvement, carbon dioxide reduction and storm-water control. Eco is also used to assess the value of the annual benefits derived from these functions, as well as the estimated value of benefits for each tree as it exists in the landscape.

3.3 Eco is adaptable to multiple scales from a single tree to area-wide assessments. It has been used to analyse tree populations on areas such as the whole of London borough of Islington, Sheffield, Newcastle and, Edinburgh. For more information see www.itreetools.org.

4 TERMINOLOGY

4.1 **Tree canopy cover/Leaf area:** the amount of surface area (one side) of leaves on a tree (not to be confused with Leaf Area Index (LAI) which is defined as its leaf area per unit of ground area).

4.2 **Pollution removal:** pollution removal value is a calculation based on the model of gaseous exchange and particulate matter interception by tree.

4.3 **Carbon storage:** the amount of carbon bound up in the above-ground and below-ground parts of a tree.

4.4 **Carbon sequestration:** the annual removal of carbon dioxide from the air by plants.

4.5 **Avoided runoff:** based on the amount of water held in the tree canopy and re-evaporated after the rainfall event. The value is based on an average volumetric charge of 1.20 per cubic metre and includes the cost of the avoided energy, and associated greenhouse gas emissions, in treating the water.

4.6 **Replacement cost:** Known as structural value in i-Tree, is based on the trunk formula method of the Council of Tree and Landscape Appraisers (CTLA 1992).: Known as structural value in i-Tree, is based on the trunk formula method of the Council of Tree and Landscape Appraisers (CTLA 1992).

4.7 **Capital asset value for amenity trees (CAVAT):** a valuation method with developed in the UK to express a tree's relative contribution to public amenity and its prominence in the urban landscape.

5 METHODOLOGY

5.1 The data used in this report focuses on the trees in Barnard Park within the supplied boundary. A tree inventory which was collected on site, was exported to .xls file format. It was then re-formatted and uploaded into i-Tree Eco version 6 by TMA in May 2021 and was analysed as a complete inventory. The Eco software requires data to be loaded in a format with values greater than 0 for the structural data of each tree. 144 records were supplied from the MyTrees database, with all 144 being suitable for use with Eco, this number decreases to 131 when trees removed are analysed, all 131 being suitable, and then the number was increased to 182 to calculate the future value of mitigation of planting, with 182 trees being suitable.

5.2 The minimum data required by the Eco system is tree species and stem diameter, however the survey data collected enabled input of further data fields to retrieve greater detail and reliability in the results within the study. This included percentage of crown dieback, height to live growth, height to crown base, crown light exposure, percentage of crown missing values and accurate spreads to cardinal points.[2] Once data is uploaded correctly it is submitted to i-Tree for processing.

5.3 While assessing current trees is based on the survey undertaken, trees proposed for removal require their data to be removed for each removal proposed, this equates to a line of data being removed for 13 trees. The data are then re-submitted and calculated to provide a comparative data set.

5.4 Additionally, it was requested that a projection of the trees value within i-Tree was undertaken for 15 years' time (2036). This has been provided by estimating the growth of stems on newly planted proposed trees and those that were in situ and expected to continue growing.

5.5 The method of tree growth was based on a study published in 'Urban Forestry & Urban Greening' entitled *Growth rates of common urban trees in five cities in Great Britain: A dendrochronological evaluation with an emphasis on the impact of climate (2017).*[3] This paper provides a method for estimating tree growth, as well as giving projections of tree growth across four species in five U.K cities. Using data provided in table 4 of this paper it was estimated that trees stem diameters should increase, on average, by 0.92 cm per year. This amount was then multiplied by 15 to create the 2036 projection of growth for each tree that was on balance considered to grow at that rate based on their current size and applied to all planned tree plantings provided.

5.6 The use of eco and its value output is greatly enhanced with more data fed into it. However, for the 2036 projections it is only suitable to use the data for species and DBH, as this is the only data that could be practically estimated.

5.7 As previously stated, datasets were formatted into .xls format based on the estimates and species to include and inputted two further times into i-Tree to give is values to compare 2021 and 2036.

5.8 Once all tree data has been processed through eco the values are exported to an .xls format, and values for current, removals and mitigation are compared within a table of values, which a selection of the charts and graphs are based on.

2 - The measured characteristics are used to derive secondary structural variables and estimate various ecosystem services. The secondary structural variables derived in i-Tree are leaf area, leaf biomass, leaf area index, and total tree biomass. Subsequently, the directly measured characteristics and derived variables are used to estimate ecosystem services.

3 - M.V. Monteiro, T. Levancic, K. J. Doick. (2017) Growth rates of common urban trees in five cities in Great Britain: A dendrochronological evaluation with an emphasis on the impact of climate.

6 TREE POPULATION ANALYSIS

Tree population

6.1 Maintaining and increasing the number and diversity of trees is part of the overall process in creating a sustainable ecosystem that provides for the current populations, future generations, and the natural environment.[4]

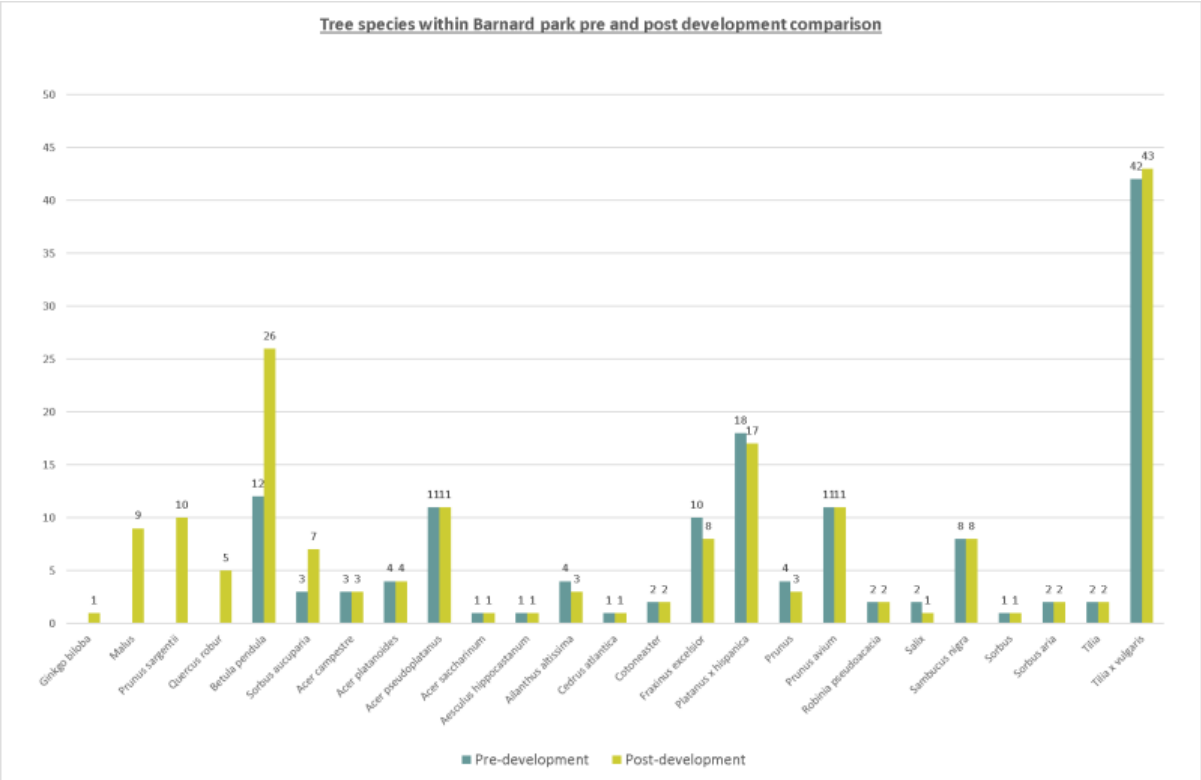
6.2 A total of 144 trees were surveyed as part of this work. There are 13 removals resulting in 131 trees retained. Due to this loss of trees, it has been proposed that the replanting of 51 trees is included in this scheme to mitigate the impact of the proposal, thus improving tree population and resilience in the future.

Tree species

6.3 In order to conserve the contribution that trees make to the urban environment, a tree population should be managed for sustainability over the long term. The Forestry Commission has highlighted the need for diversity in the urban tree population.

6.4 Diversity in the urban forest refers to:

- Age class diversity the need to maintain a balanced population of trees of all ages to ensure that when older trees need to be removed, there is a growing population of trees to take their place;
- Species diversity – a balanced range of species to avoid the devastating effects of species-specific pests and diseases which threaten to reduce the value of or remove some species. Recent examples have been Dutch elm disease and ash dieback.
- Genetic diversity – the need to plant trees grown from seed where possible. Many amenity trees are now produced from cuttings (vegetative reproduction) which makes them genetically identical.[5] Trees grown from seed will have greater genetic diversity and a greater variation in their response to factors which threaten the urban forest.



Tree species at Barnard park: chart showing the various species of trees currently (pre-development) and post development with removals and planting accounted for.

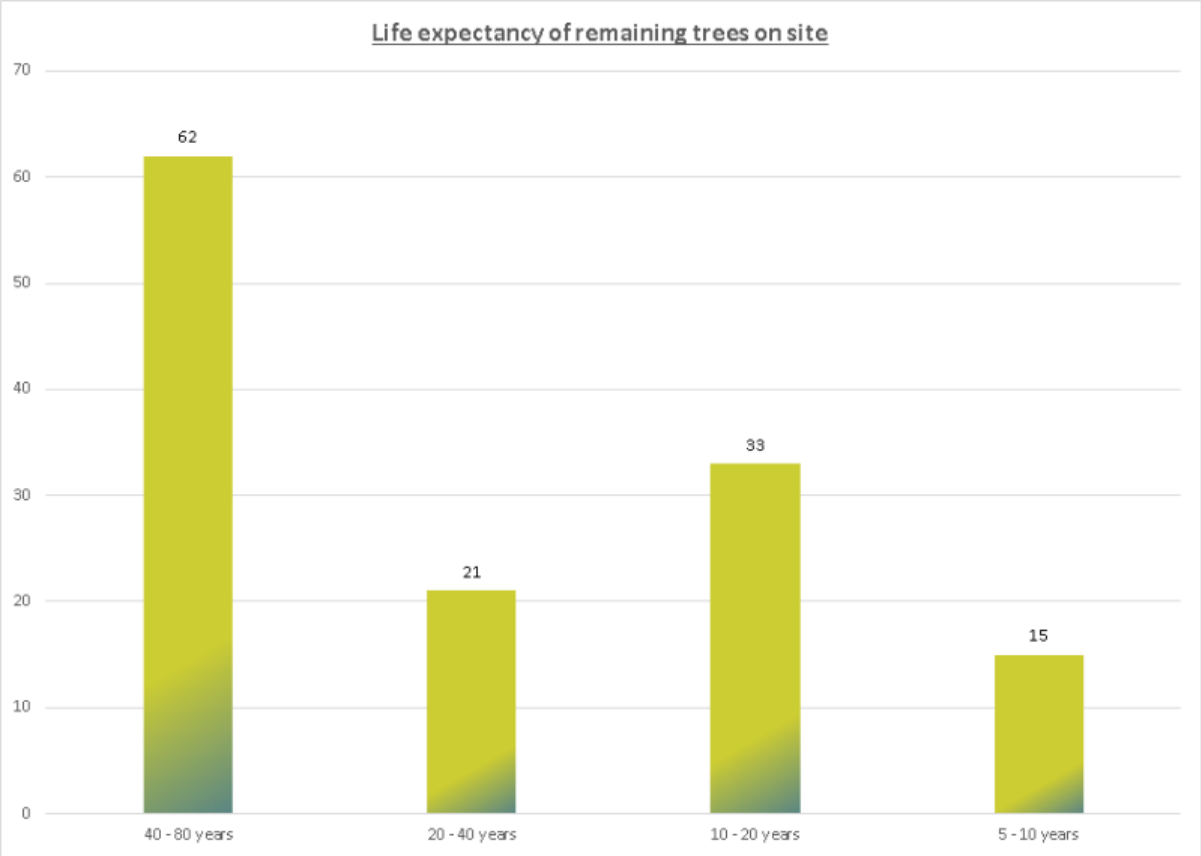
6.5 There are 22 different species of tree at present, with the mitigation planting there will be 26 in total in Barnard Park which shows a fair diversity in the population. However there is a high likelihood that many of the trees on site which include species like *Tilia, Platanus, Prunus* and *Betula* are clonally produced, rather than through seed. This means diversity within the genus is low.

6.6 It is not easy to source trees grown from seed, whereas trees grown from cuttings which are likely cloned from a parent plant are a more stable method of production for many growers. It should be encouraged that when sourcing trees, that the provenance is requested so a record of genetic diversity is known.

6.7 The results from this site in species mix echo similarities seen in the conclusions of the eco report for the London Borough of Islington concluded in March 2019 by Treeconomics.[6]

6.8 There is no mitigating planting of species that already represent a significant proportion of the wider London Borough of Islington tree population e.g. London plane, sycamore and, ash which make up 20 % of borough's tree population.

Tree condition



Life expectancy: of trees on site according to assessment during site visit only. Based on tree species, age, condition, and experience of surveyor. This is not a complete and accurate estimate based on all exact variables due to lack of available data.

6.9 The condition of the trees within Barnard Park has been determined as good overall. There are only a few examples of trees which are in a poor condition overall. This is important as trees in poor condition will have limited ecosystem services in comparison.[7]

6.10 This would suggest that there is little concern over the short term future of trees on the whole with only 15 trees potentially in short term risk of removal. Such trees would form part of further mitigation planting in future, and such estimations may help inform a planting policy on this site.

6.11 The majority of retained trees on site are expected to live beyond 20 years, and the rest are estimated to live up to that 20 year limit. These estimations are made on site during the survey based on the trees current condition in relation to its species type in the most part, as well as estimated age of the tree and experience of surveyor.

4 - Forestry Commission. (2015) Our vision for a resilient urban forest
5 - Forestry Commission. (2018) The urban tree manual.
6 - Treeconomics. (2019) Islington Borough Council: i-Tree Eco Inventory Report Public Trees
7 - David J. Nowak; Daniel E. Crane; Jack C. Stevens; Robert E. Hoehn; Jeffrey T. Walton; Jerry Bond (2008) A ground-based method of assessing urban forest structure and ecosystem services.

7 SUSTAINABILITY

Tree diversity

7.1 Tree diversity is essential for the continuity of the tree population. Diversity decreases the dependence on individual species and gives enhanced resilience to environmental stress, including pests and disease. This diversity is not just down to the differences between species. Genetic diversity also plays a big part in increasing sustainability.[8]

7.2 The tree survey has underlined that, there is an overreliance on Tilia species (Lime) trees to provide most of the canopy cover and ecosystem services. This over reliance may prove pivotal in the long term, as all Tilia species are mature examples. As and when they deteriorate diversity in replanting must be considered.

7.3 Promoting increased species, age and, genetic diversity in their tree stock to build in greater resilience to the current threats and those that may arise in the future, will increase resilience and sustainability of the urban forest.

7.4 When deciding on planting new trees, good nursery stock should be sourced from suppliers who can demonstrate reliable bio-security measures.

Ecology

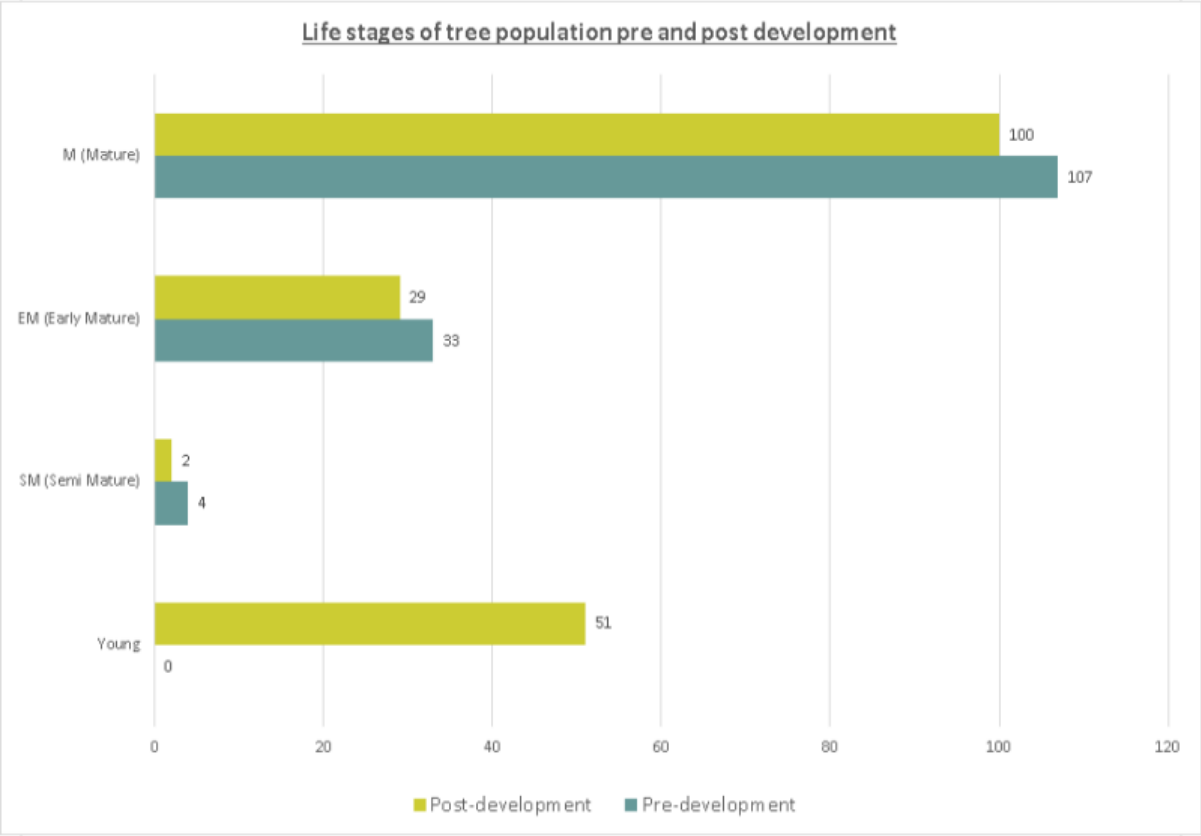
7.5 Tree planting across the site has been designed in collaboration between arboriculturists, landscape architects and ecologists. The tree species selected will provide a high diversity of native tree species to attract and support native wildlife, particularly invertebrates.

7.6 The tree planting proposals will increase tree canopy cover, including tree species that are appropriate for their location but also resilient to climate change and with consideration to incoming tree pests and diseases.

7.7 The proposed new traditional orchard is a stand-out ecological enhancement. Traditional orchard is a Priority Habitat and provides an excellent resource for pollinating invertebrates and food for birds.

7.8 The tree species proposed will provide a range of flowering and fruiting periods throughout the year. Tree planting proposals are designed to complement other ecological enhancements throughout the site including wildflower meadows and a new pond.

Age range and size distribution



Life stages at Barnard park: chart showing the difference in life stages in current (pre-development) tree population and the population once development is complete considering removals and planting (post-development).

7.9 It is important for a sustainable tree population to have enough young and maturing trees to replace older specimens to increase resilience[9]. The average lifetime of a tree differs according to its species, management, and environment.

7.10 The trees in the Barnard Park are mostly mature, and many are of a long-lived species, so have a considerable contribution still to make. However, this is not a guarantee when considering the effects that a changing climate along with pests and disease may have on the survival of the species found on site.

7.11 Trees with the largest DBH (stem diameter at breast height) and crown spreads are mostly London Plane. Improving size of tree and age range diversity would increase the overall resilience of the tree population.

7.12 The above chart shows that this development will allow a sudden injection of young trees, whilst reducing the other life stages minimally due to removals proposed. This represents an increase in age range diversity, compared to no work undertaken to plant trees.

Leaf area and population

7.13 The dominant species in terms of leaf area are *Tilia* species, which make up over 30 % of the population and 54 % of the total leaf area for Barnard Park. The total leaf area of a tree is linked directly to its photosynthetic ability and the larger the canopy the greater the ecosystem benefits.[10] This highlights the importance of planting larger species to benefit the sustainability and resilience of eco services.

8 - Forestry Commission. (2018) The urban tree manual.

9 - London Urban Forest Partnership. (2020) London Urban Forest Plan

10 - Leaf area of an individual open-grown, deciduous trees is calculated using a regression equation. Leaf area in an urban forest canopy is an important variable influencing estimates of biomass, air pollution removal, carbon storage and sequestration, and other ecosystem services.

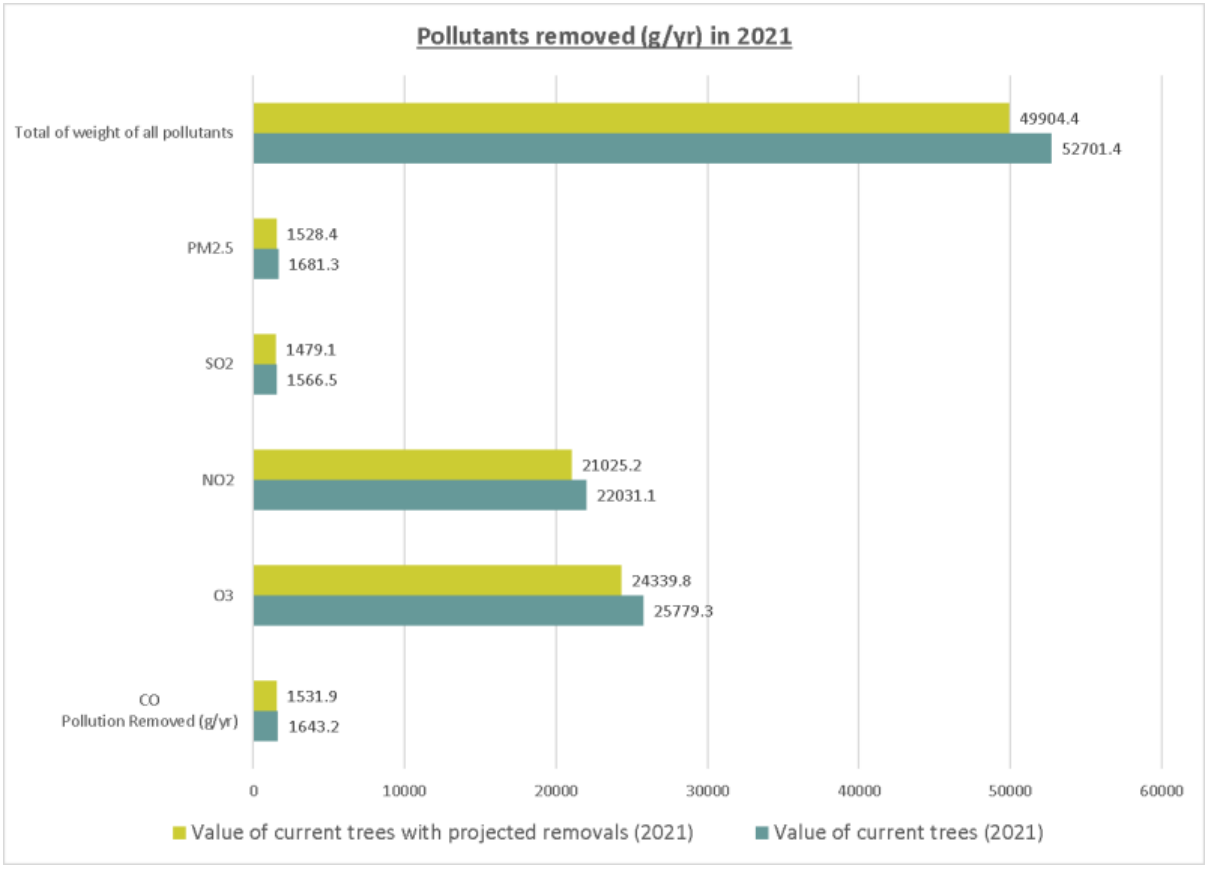
8 ECOSYSTEM SERVICES

8.1 Urban forests (trees in the urban landscape) are an important source of ecosystem services in towns and cities.[11] They improve local air quality, offer shade, and cool the air, capture carbon, reduce flooding, have important biophilic benefits and provide food and habitat for wildlife. Valuing ecosystem services helps landowners to manage urban trees and provides a guide to where trees can be planted for the maximum benefit.[12]

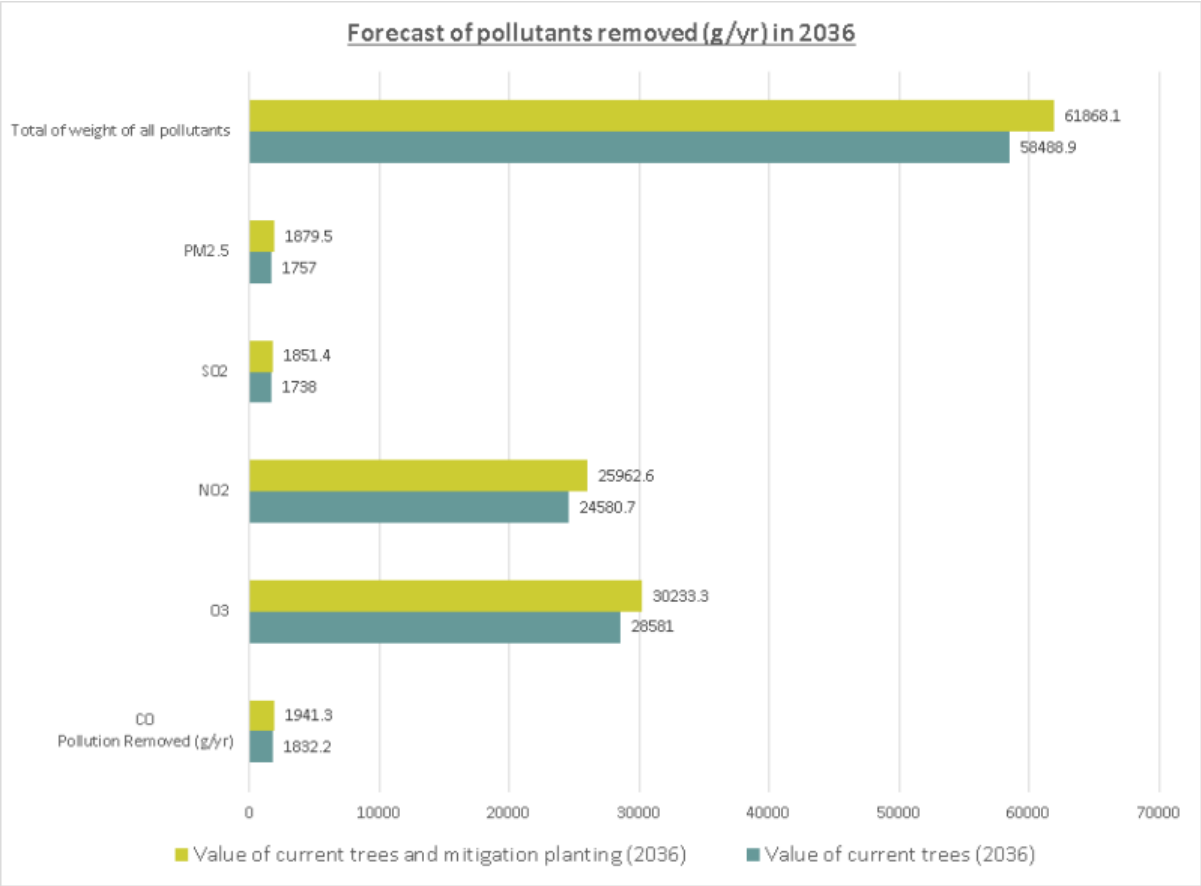
8.2 The quality of the urban landscapes increases public appreciation and usage, whilst encouraging further understanding to the wider biosphere that surrounds us day to day.[13]

8.3 Using the data collected analysis shows the directs effects trees can have on this ecosystem and gives a value to the range of benefits that they provide. This has been undertaken within four scenarios for comparison, they include tree population at current levels, with tree removals, with removals and mitigation planting forecasted into 2036 and with current trees and no removals forecasted into 2036.

Air pollution removal



Pollutant removal with 2021 dataset: showing the compounds removed from the atmosphere due to the trees present on site.



Pollutant removal with 2036 dataset: showing the compounds removed from the atmosphere due to the trees present on site.

8.4 Pollution in urban landscapes is recognised as a serious problem[14], with effects ranging from human health impacts to damage to buildings. Air quality is especially important in London, with trees playing a pivotal role in helping to reduce the pollutants within cities by intercepting particulate pollution and reducing air temperature.

8.5 Pollution removal value includes carbon monoxide (CO), ozone (O3), nitrogen dioxide (NO2), sulphur dioxide (SO2), and fine particulate matter (PM 2.5).[15]

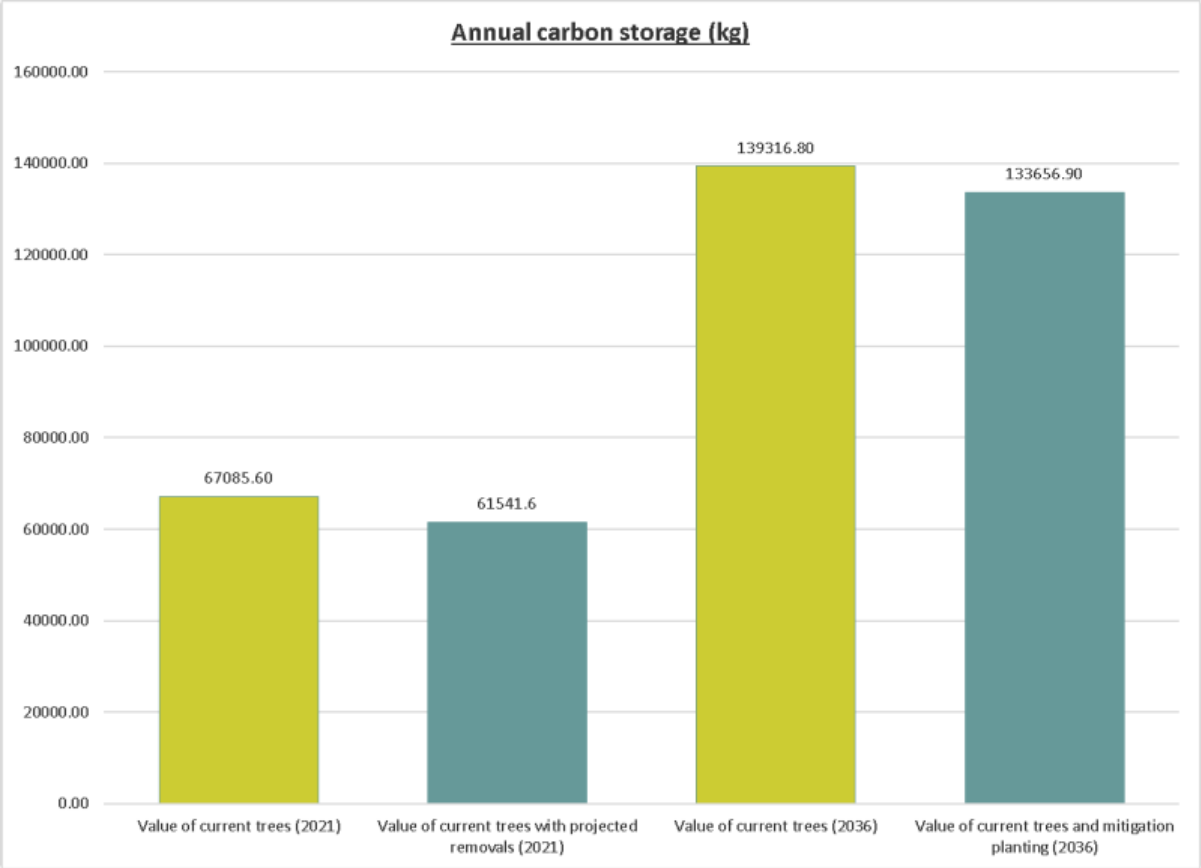
8.6 Trees not only reduce air pollution from traffic, but they also reduce the noise caused by traffic, the heat produced by traffic and provide shade and opportunities recreation in a densely populated area.

8.7 As shown in the chart, the trees currently at Barnard Park remove 53 kg of air pollution per year, with the proposed tree removals and no mitigation planting it is 50 kg.

8.8 If existing trees are retained with growth projected it is forecasted that the pollutant removal in 2036 will be 58 kg, and with removals and mitigation planting it is forecast to be 62 kg per year.

8.9 The values show that there is an expected gain in the removals of pollutants from the atmosphere of 9 kg, if the development goes ahead as planned and all trees, including new planting, grow to the expected size.

Carbon storage



Annual carbon storage: amount of carbon stored in kilograms per year.

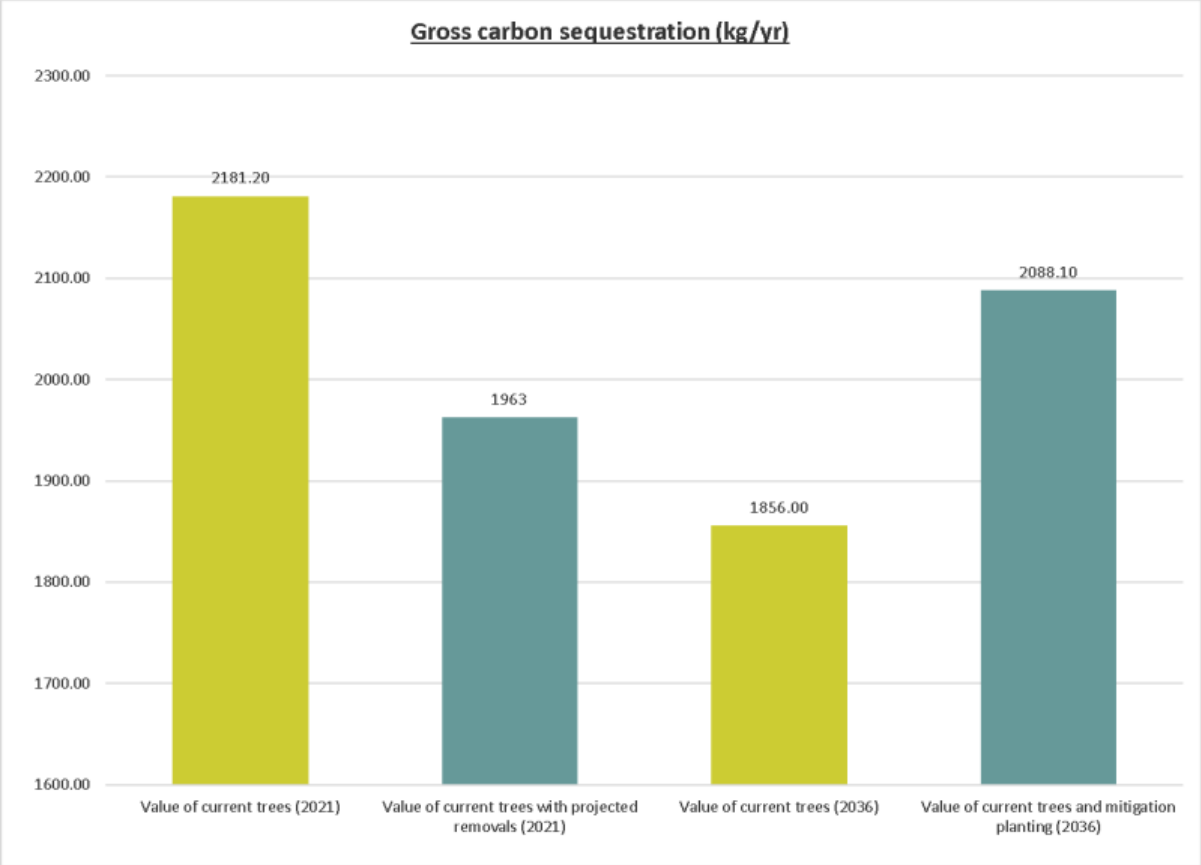
8.10 Over the lifetime of a large tree, several tonnes of atmospheric carbon dioxide can be absorbed and stored in the tree as wood. This is enabled through photosynthesis. Therefore, it is important to highlight not only the need of replanting felled trees, but to find the space to plant new trees in new locations. When planting new species for diversity, the carbon efficiency of a species should be a consideration for selection criteria to maximise the trees benefits to the ecosystem.

8.11 As shown in the chart, trees within the study at Barnard Park have a carbon storage value of 67.1 metric tonnes. The figures show that at present *Tilia* species and *Platanus x hispanica* trees provide the greatest amount of carbon storage. With trees removed this figure is 61.5 metric tonnes.

8.12 Using growth projections, it is forecast that the carbon storage on site with trees retained as is to be 139.3 metric tonnes, whereas with mitigation planting it is forecast to be 133.6 metric tonnes.

8.13 This highlights that retaining the current trees would be more beneficial to carbon storage in the medium term. This is likely due to the actual size of trees on site expected in 2036, although many more trees are planted their size is not sufficient in comparison at that stage of growth. Over a longer time period it would be expected that value of the mitigation planting to exceed the forecast values. This is if tree get larger at an expected rate. It takes time for trees to become carbon neutral or beneficial as there is of course carbon used in the production and supply of trees when planting occurs.

Carbon sequestration



Gross carbon sequestration: amount of carbon sequestered in kilograms per year.

8.14 Carbon sequestration is calculated from the predicted growth of the trees based on field measurements, climate data and genera specific growth rates within i-Tree Eco which provides an annualised volume of tree growth. This volume is then converted into tonnes of carbon based on species specific conversion factors[16]

8.15 The annual value with the existing trees on the site is that they sequester around 2.2 metric tonnes. With trees removed it equals 1.9 metric tonnes.

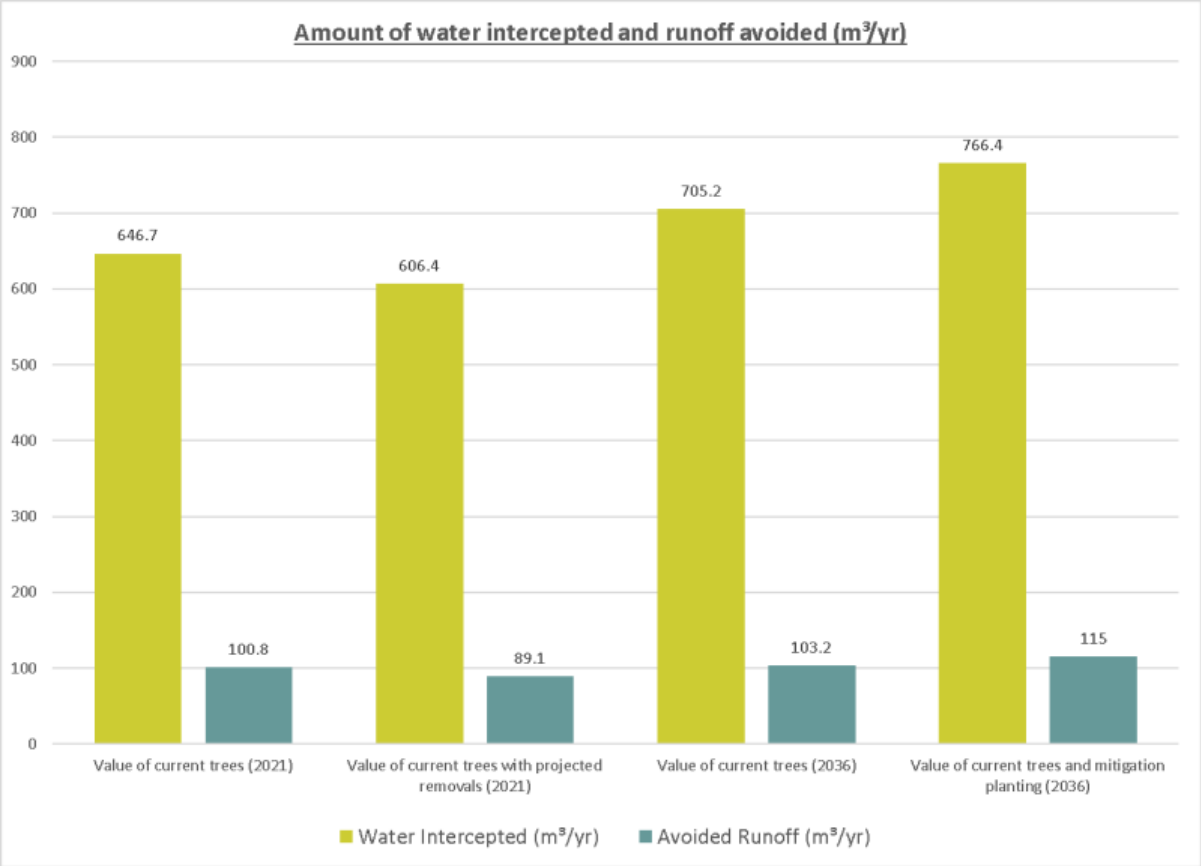
8.16 With projections of growth in 15 years, it was forecast with the site unchanged, and the entire tree population surviving in good health, that the value of carbon sequestration

to be 1.9 metric tonnes, this value becomes 2.1 metric tonnes if trees are removed, and the mitigation planting grows at the expected rate.

8.17 This shows that the development will potentially impact on the carbon sequestration of the site in the short term by around 93 kg compared to value of current trees.

8.18 These figures do not take account of any carbon emissions generated in the nursery or in the transport, planting, and maintenance of newly planted trees.

Avoided run-off



Water interception with avoided run-off: showing data of m3 per year.

8.19 Tree crowns intercept up to 30% of the rainfall which lands on the crown of the tree annually. This is water is either absorbed or evaporates without reaching the ground. In addition, trees absorb water from the soil which provides greater soil capacity to absorb rainfall as they provide necessary structure and capacity in soil profiles. For these reasons, trees provide benefits in avoiding water run-off and flooding.

8.20 The charts below show rainfall interception in the park in four different scenarios. Firstly, it shows that current tree populations intercept 647 m of rainwater per year, with an avoided run off of 101 m of rainwater per year. With trees removed this figure becomes 606 m³ intercepted with 89 m³ avoided run-off.

8.21 Inclusion of the projected growth rates for trees retained to 2036, this becomes 705 m^3 intercepted and 103 m^3 avoided run-off, with the removals and mitigation planting the effects amount to 766 m^3 intercepted and 115 m^3 avoided run-off.

8.22 This demonstrates that the development will potentially have a positive impact on the hydrology of the site.

11 - Public Health England. (2020) Improving access to greenspace.
12 - Robert W. Miller, Richard J. Hauer, Les P. Werner. (2015) Urban Forestry: Planning and Managing Urban Greenscapes - Third Edition.
13 - London Urban Forest Partnership. (2020) London Urban Forest Plan
14 - David Dajnak, Dimitris Evangelopoulos, Nutthida Kitwiroon, Sean Beevers and Heather Walton (2021) London Health Burden of Current Air Pollution and Future Health Benefits of Mayoral Air Quality Policies.
15 - Air pollution removal estimates are based on modelling of gas exchange and particulate matter interception by trees, shrubs, and grass for carbon monoxide (CO), nitrogen dioxide (NO2), ozone (O3), particulate matter less than 10 microns (PM10), particulate matter less than 2.5 microns (PM2.5), and sulphur dioxide (SO2).
16 - Carbon dioxide (CO2) in the atmosphere is necessary for plants and trees to grow. Trees absorb carbon dioxide during photosynthesis, storing carbon and producing oxygen as a by-product of photosynthesis. Carbon sequestration is the process of removing carbon from the atmosphere and storing it in a physical element (e.g., a tree). i-Tree Eco estimates carbon storage in trees, annual carbon sequestration, and emission of carbon via tree decomposition.

9 TREE VALUE

Replacement cost

9.1 Eco provides a figure based on the trees included within a study termed *structural value*.[17] In the UK this is known as the replacement cost. This replacement cost helps to show the cost to a landowner in replacing any or all of the trees. Replacing a tree may be necessary to facilitate development, due to pests and/or diseases, natural decline, or damage to a tree.

9.2 The total replacement value for the trees included is £203, 801 With removal of trees on site, this value is £189, 150 and with the estimations of growth on current trees and mitigation planting the value is £325, 540 and £338, 877, respectively.

9.3 The population replacement value will increase substantially if estimates of growth are realised, and that with the proposed new trees planted it will be of more value to the London Borough of Islington to ensure trees establish successfully.

CAVAT - The amenity value of trees

9.4 CAVAT (Capital Asset Value for Amenity Trees) recognises trees as environmental assets in monetary terms, rather than liabilities and constraints. Trees are assigned a monetary value using this system, based on the number of people who may benefit from a tree considering its location, size, condition and potential longevity. With the value of a tree established, a strong case can be made for the allocation of resources to properly manage the asset, as well as determining appropriate compensation for damage to or loss of a tree.

9.5 The 'Quick Method' methodology[18] has been used for this survey which provides an estimation of value based on crown functionality, stem diameter and estimated remaining life expectancy. Further information is available at - .https://ltoa.org.uk/resources/cavat

9.6 The CAVAT value of the total tree population currently is £2,125,136. With trees removed it is £1,984,967.

9.7 There is no estimated CAVAT value for the 2036 growth projections as the figure is reliant on a until value factor which changes regularly, and there is no projected unit value factor for 2036.

17 - Structural valuation/replacement cost is based on four tree/site characteristics: trunk area (cross-sectional area at d.b.h.), species, condition, and location. Trunk area and species are used to determine the basic value, which is then multiplied by condition (0-1) and location ratings (0-1) to determine the final tree structural value. This replacement cost is the average replacement cost and cost per square inch for trees with a maximum replacement size of 10 cm (4 inches) d.b.h. is based on an average of all species with values within broadleaved and coniferous categories for the UK.
18 - London Tree Officers Association. (2009) CAVAT: Quick method

10 VULNERABILITIES

Pest and disease

10.1 Urban trees are susceptible to increasing impacts from pests and diseases. Climate change, plant importation and the use of timber packaging materials are increasing the rate at which new pests and diseases are arriving in the UK and being transmitted within established tree populations.[19] The impact of any pest or disease is dependent on the trees condition, however some pests can prove significant to healthy trees.

10.2 Considering the species composition of those trees surveyed and those to be planted the following pests and disease may have an impact on the health and management of the trees.

10.3 These include;

- Asian longhorn beetle - invasive non-native pest which affects a range of broadleaved tree species. Larvae feed on living tissues of a tree and can bore through many layers of a tree stem meaning a severe infestation can kill.
- Gypsy moth - The caterpillars of this moth can cause severe defoliation of trees decreasing the photosynthetic abilities of a tree, weakening it on a yearly basis which can eventually lead to tree death.
- Oak processionary moth (OPM) - Established within London, are not necessarily a concern or the tree itself but for the public and animals using a site where it may be present. The caterpillars have tiny hairs which can when in contact which skin, eyes or throat can cause significant allergic reactions and potential breathing issues.
- Ash dieback - A significant disease to the population of ash, which is able to kill of young and coppiced growth which impacts regeneration of the species. It blackens and causes leaves to wilt, with dieback in crowns becoming a more common site. Although mature specimens are thought to be more resistant, it can still impact their longevity if afflicted.

Climate change

10.4 While climate change provides opportunities to plant new tree species, the pace of this change means that some established species are likely to be significantly adversely affected before the end of their natural lifespan.

10.5 Changes in the climate can have several impacts on tree health including water stress, excessively high temperatures and the proliferation of insect pests which are favoured by the conditions. Drought stress can also increase the severity of fungal and bacterial

pathogens including Armillaria species and some stem and branch cankers, which may be of importance to horse trees and other species.

10.6 Adapting the tree population for changes in climate is key to securing the future of the ecosystem services provided by trees.

10.7 Climate change predictions suggest that there will be both more severe droughts and more intense rainfall events during summer months, and generally wetter conditions through winter months.[20]

19 - DEFRA. (2018) Tree Health Resilience Strategy - building the resilience of our trees, woods and forests to pests and diseases.
20 - Met Office. (2021) Climate change in the UK - https://www.metoffice.gov.uk/weather/climate-change/climate-change-in-the-uk

11 CONCLUSION

Impacts and mitigation

11.1 There are a total of 13 trees proposed to be removed to facilitate the development of the park, which means it is expected 131 will be retained and contribute to the site post development. There are a planned 51 trees to be planted as part of the wider redesigned landscaping on site.

11.2 This development will impact on ecosystem services, however given suitable time to establish, and with continued maintenance undertaken it would be expected that ecosystem services will increase in the long term.

11.3 Although the site has a small population of trees within a much larger ecosystem, it is shown that they provide a significant benefit to the environment and for the local community.

11.4 With the removals of 13 trees and the planting of 51, the carbon capture values (carbon storage & sequestration) will not attain their current value in 15 years. This is on the face of it a negative outcome, however, to expand on this point it could be expected for those values to catch up with current values given more than 15 years. This is due to the fact carbon capture values do rely on the mass of a tree which would be expected to be greater in a timeframe of 30 years for example.

11.5 Whilst not part of the calculations in this report, carbon usage in the nursery, transportation, planting, and maintenance will also have a negative impact on the carbon budget.

Opportunities

11.6 As stated within this council's core strategy, Islington has the second lowest amount of green space per person of all local authorities in England.[21] This development presents a chance to highlight their importance to the local area, and increase peoples contact with nature by attracting more local people to this green space.

11.7 The success of this development for the council can set an example for the improvement of other green spaces within the borough.

11.8 As stated within the London environment strategy, residents in London should be able to enjoy the very best parks, trees, and wildlife.[22]

Recommendations

11.9 The planned development will need to commit to its tree planting plan as set out currently and include further trees if feasible on site post development as part of a

further tree planting strategy on site in the longer term. This is necessary not only to increase where possible tree numbers but also to account for the potential losses of trees that may occur naturally over time.

11.10 All mitigation planting must be properly cared for and maintained for a suitable length of time to make certain that the establishment of the 51 proposed trees is successful and therefore does account for the loss of the 13 trees needing removal. If a new tree fails, it should be replaced. Adherence to British Standard 8545:2014[23] is recommended as best practice in this regard.

11.11 Maintenance should include operations like adjusting stakes and ties, correct irrigation according to species, weather and size of tree, protection of tree bases from mower/strimmer strikes or negotiating mulching or no-mow areas near the planted trees.

11.12 Minor pruning works to planted trees of a formative manner[24] to encourage good form and growth of the crowns would be recommended based on advice from appropriate arboricultural experts.

11.13 It is recommended that the trees are frequently surveyed post development in order to ensure establishment is occurring. This could also form part of an update of this study.

11.14 If mitigation planting fails, it should be replaced in the next planting season. Any replacement planting should consider alternative species to previous planted on site to increase diversity. When deciding on planting new trees, good nursery stock should be sourced from suppliers who can demonstrate reliable bio-security measures.

21 - London Borough of Islington (2011) Islington's Core Strategy
22 - Greater London Authority. (2018) London environment strategy
23 - BSI. (2014) BS 8545:2014 Trees: from nursery to independence in the landscape - Recommendations. UK: British Standards Institution.
24 - Edward F. Gilman (2012) An Illustrated Guide to Pruning - Third Edition

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