Tree Health & Vitality Diagnostic Assessment

Site:

Victoria Tower Gardens
Millbank
Westminster, London
SW1P 3JA

Prepared for:

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Bartlett Project Reference:

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Table of Contents

1.0   SCOPE OF REPORT

1.1   Survey Brief

To undertake a scientifically backed health and vitality assessment of twenty (20) London Plane (*Platanus x hispanica*) trees, located within the grounds of Victoria Tower Gardens, Millbank, Westminster, London, using the Arbor Check® system. The individual trees are itemised in Section 2.0 below.

To provide a report with considerations as to what affect, if any, that proposed development and associated root pruning within the notional root protection of these trees may have on their long-term health and vigour, following the outcome of the assessment – where such conclusions can be reached.

To provide any recommendations, in accordance with current arboricultural practice and modern tree health care techniques, where applicable, following the conclusion of the diagnostic and interpretation of results.

1.2   Report Background

Development of the United Kingdom Holocaust Memorial and Learning Centre has been proposed within Victoria Tower Gardens. This planning application is referenced 19/00114/FULL and has been submitted to Westminster City Council for determination.

The footprint of proposed development is within the notional root protection area of the subject London Plane trees, with the requirement of root pruning to facilitate the proposed development.

1.3   Report References

The Arborcheck® system was developed by Hansatech Instruments, working in collaboration with Bartlett Tree Experts and Barcham Trees PLC, Cambridgeshire, following extensive research over a number of years and scientific papers published. A selection of these include:

· Banks, J.M. (2017). *Continuous Excitation Chlorophyll Fluorescence Parameters: A Review for Practitioners* Tree Physiology, 37(8):1128–1136. (Access: here)
· Kalaji, M. H., V. N. Goltsev, K. Żuk-Gołaszewska, M. Zivcak, and M. Brestic (2017) *Applications of Chlorophyll Fluorescence in Understanding Plant Performance.* CRC Press, Florida.
· Percival, G.C. (2004). *Evaluation of Physiological Tests as Predictors of Young Tree Establishment.* Journal of Arboriculture 30(2): 80-92.
· Percival, G. and Banks, J. (2014) *Evaluation of Nursery Stock Tree Vitality.* Bartlett Tree Experts
· Percival, G. and Holmes, S. (2014) *Answering a Few Practical Questions about Chlorophyll Fluorescence*
· Percival, G.C., Keary, I., & Noviss, K. (2008) *The Potential of a Chlorophyll Content SPAD Meter to Quantify Nutrient Stress in Foliar Tissue of Sycamore, English Oak and European Beech.* Arboriculture and Urban Forestry 34(2):89-100. ISA.

1.0   SCOPE OF REPORT (continued…)

1.4   Report Limitations & Methodologies

Of the twenty (20) trees subject of the diagnostic assessment, eighteen (18) have been identified for root pruning to facilitate development with two (02) control trees included in the assessment for comparison before and after any approved development.

This report is restricted to those trees shown on the attached Tree Location Plan and described in the tree vitality assessment table. The statements, findings and recommendations made within the report do not take into account any effects of extreme climate and weather incidences, vandalism, changes in the natural and/or built environment around the trees after the date of this report or any damage whether physical, chemical or otherwise.

This report contains information about the analytical tree health and stress diagnostics. The results are not absolute and are comparative and relative in nature. There can also be variations in the results as they are dependent upon the time period of the growing season when the testing was undertaken: for example testing conducted during periods of drought vs. testing conducted in the spring may return different results for the same tree.

Bartlett Consulting and Bartlett Tree Experts cannot accept any liability in connection with the above factors nor where recommended tree management is not carried out in accordance with modern tree health care techniques, within the timelines proposed and specification provided. The contents of this report remain valid for one year.

1.5   Fluorescence Testing

One of the main roles of leaves is to gather energy from the sun and convert it to a different form of energy; in this case, complex carbohydrates that the tree may use for nutritional value. This is the main principle of photosynthesis. Stressors (biotic or abiotic) will have an effect on the photosynthetic capacity of a tree which is reflected in the intensity and dynamics of the chlorophyll fluorescence measurement. Chlorophyll fluorescence is the re-emitted light as a result of energy overflow within photosystem II.

During an Arborcheck® test, representative leaves are left to adapt to darkness, using a clip system, allowing them to reach a stable baseline state. During a one second flash of light the device measures changes in the fluorescence emission from the leaf, from a zero to maximum state. The test evaluates the quantity and efficiency of chlorophyll in leaves and the efficiency of photosynthesis within the leaf (and tree as a whole).

An Arborcheck® test allows for quick and effective evaluation of plant physiological condition, providing an empirical measurement, widely considered a useful indicator of plant physiological activity. Therefore, it is instrumental in making plant vitality based decisions.

The Arborcheck® system uses a nursery benchmark database which was compiled over 5 years, using the data from over 15,000 samples, taken from over 350 tree species, growing in optimum conditions. It is against this database that each sample is compared against its species or cultivar specific counterpart and presented as the number of standard deviations away from the nursery database value (NDB).

1.6   Leaf Sampling Methodology

A random sample of ten (10) leaves was collected from each of the previously identified London Plane trees within Victoria Tower Gardens. The leaves were collected from various heights and locations within each tree canopy using Felco secateurs and a MEWP.

2.0   VITALITY ASSESSMENT RESULTS

The table below shows the fluorescence and chlorophyll content results for each London Plane tree analysed within Victoria Tower Gardens. The table uses a traffic light colour coding system for each of the referenced values and test categories, to better highlight differences and variation.

Tree ID	T/C	Efficiency	Chlorophyll	SI1	SI2	SI3	SI4	Interpretation
70006E	Test	0.4	-0.3	0.2	-0.8	-0.3	-0.5	· Healthy · No stress identified
70008E	Test	-0.4	-0.5	-0.2	-0.3	-0.7	-0.9	· Healthy · No stress identified
70009E	Test	0.0	0.0	-0.1	-0.8	-0.9	-0.5	· Healthy · No stress identified
70010E	Test	0.1	-0.7	0.0	-0.8	-0.8	-0.6	· Healthy · No stress identified
70011E	Test	-0.1	0	-0.2	-0.5	-0.7	-0.8	· Healthy · No stress identified
70012E	Test	0.4	-0.5	0.2	-0.9	-0.4	-0.4	· Healthy · No stress identified
70013E	Test	0.2	-0.1	0	-0.7	-0.5	-0.4	· Healthy · No stress identified
70014E	Test	-0.2	-0.3	-0.2	-0.7	-1	-0.7	· Healthy · No stress identified
70015E	Test	0.1	-0.2	0	-0.8	-0.6	-0.7	· Healthy · No stress identified
70016E	Control	0.5	-0.2	0.3	-0.9	-0.3	-0.4	· Healthy · No stress identified
71009W	Control	0.1	0.1	0	-0.4	-0.3	-0.5	· Healthy · No stress identified
71011W	Test	0.3	-0.1	0.1	-1	-0.7	-0.3	· Healthy · No stress identified
71012W	Test	-1.0	-1.6	-0.5	-0.5	-1.5	-1.5	· Reduced vitality · Mild to Moderate physiological stress
71013W	Test	-0.7	-0.5	-0.5	-0.5	-1.3	-1	· Healthy · Mild to Moderate physiological stress
71014W	Test	0.0	-0.1	-0.1	-0.8	-0.9	-0.5	· Healthy · No stress identified
71015W	Test	-0.5	0.1	-0.4	-0.2	-0.9	-0.8	· Healthy · No stress identified
71016W	Test	-0.1	0	-0.1	-0.5	-0.6	-0.7	· Healthy · No stress identified
71017W	Test	-1.6	-0.6	-0.9	0	-1.8	-1.3	· Healthy · Mild to Moderate physiological stress
71018W	Test	-0.5	-0.5	-0.3	-0.6	-1.1	-0.8	· Healthy · Mild to Moderate physiological stress
71019W	Test	-0.1	-0.7	-0.1	-0.4	-0.5	-0.9	· Healthy · No stress identified

NOTE ON TREE NUMBERS: Some London Plane trees along the eastern and western site boundaries have the same tree tag number. Therefore the numbering above has an "E" or "W" suffix denoting the tree along the eastern or western site boundary.

2.0   VITALITY ASSESSMENT RESULTS (continued…)

2.1   Tree Vitality

Efficiency: this is the ability of the leaf to convert light from the sun into energy and complex carbohydrates, and the overall photosynthetic capability and function of the leaf and tree system. Each number in the table above is the level of deviation from the benchmark value for the particular tree species. For example, ≤2 deviations return an amber colour whilst ≤4 deviations returns a red (warning) colour.

All of the London Plane trees showed good efficiency and photosynthetic capability, returning and assessment of "healthy" and "good vitality". It should be noted however, that two trees along the western boundary of Victoria Tower Gardens had deviations of -1.0 and -1.6.

Chlorophyll: this is the amount of chlorophyll available for photosynthesis, or an index of leaf "greenness". This value can be correlated with soil nitrogen levels, with the measurement having a similar analysis of deviation from the benchmark value as detailed above.

London Plane T71012 was the only tree to return a reduction in chlorophyll content, recorded at -1.6. It is notable that this tree also has a reduction in efficiency. Leaf yellowing, evidence of low chlorophyll content, can be seen visually in the photograph below.

2.2   Tree Stress

The vitality assessment also records four stress indices (SI) based on the fluorescence results. These stress markers are processed using four, detailed, scientific calculations. A deviation of 1.0 – 2.5 from a stress parameter returns an amber colour whilst anything beyond 2.5 returns a red (warning) colour.

All of the London Plane trees subject to the vitality assessment indicated some minor stress, with one of the four stress indices recording a negative value. However only trees T71012, T71013, T7107 and T71018 (all along the western site boundary) returned a value beyond -1.0, indicating that these trees are under a mild – moderate level of physiological stress at the present time.

Figure 1: Image Showing Trees T71012 and T71013 Along Western Site Boundary

3.0   DISCUSSION

At the conclusion of the vitality assessment, only four (04) of the twenty (20) London Plane trees subject to the diagnostic analysis returned notable markers of physiological stress and reduced efficiency / vitality. These trees are all situated along the western site boundary of Victoria Tower Gardens with Millbank and in fairly close proximity to one another.

All four trees had a marked variation in SI3. A low SI3 can indicate two possible events: a reduction of energy following the photosynthetic process due to heat dissipation for example; or photosynthesis is not fully functioning due to some level of damage within the leaves increasing fluorescence.

With regards to SI3, this variation has not affected overall chlorophyll content or overall tree vitally, but an indicator of stress within the tree, which is why trees T71013, T71017 and T71018 are currently considered "healthy" in the table above.

T71012 is the only tree which has been identified with both reduced vitality and stress indicators. When comparing this tree with the other three (especially T71017 with a comparable reduction in efficiency) it is the reduction in both chlorophyll content and efficiency which has led to T71012 being considered of "reduced vitality".

The proposed United Kingdom Holocaust Memorial and Learning Centre will necessitate root pruning of eighteen (18) of the London Plane trees subject to this assessment. However, the proposals within the notional root protection area of these trees have been modified in design and layout as much as possible to reduce potentially harmful impacts.

As per the scope of this report and previously highlighted in the Arboricultural Impact Assessment, proposed development operations within the notional root protection area of these trees might further impact overall tree health and vitality. Whilst we cannot scientifically quantify the level of impact (for example SI3 from -1.5 to -2.0 following root pruning) it would be reasonable to presume healthy trees may experience a reduction in vitality; and the stress level of trees with "mild to moderate" stress may increase to "moderate".

Proposed within the Arboricultural Impact Assessment which accompanied the planning application, a proactive programme of tree and soil health care will help ensure that all the London Plane trees are in "peak" health prior to any approved development. A reactive programme of tree health care identified for both during and after approved development has also been proposed, to address root pruning and any other potential causes of physiological stress and tree health, to maintain current tree health.

4.0   CONCLUSIONS

At the conclusion of the diagnostic and analytical assessment, only four (04) of the twenty (20) London Plane trees tested returned a notable reduction in vitality and any corresponding stress indicators.

This information indicates that at the present time, as a whole, the London Plane trees within Victoria Tower Gardens are at a physiological condition to best tolerate, and be resilient to, the impacts of proposed development.

We trust that the analysis and discussions contained within this report were informative, easy to understand and helpful to you with regards to the London Plane trees and planning application. Should you have any further questions or concerns, please do not hesitate to contact us again.

REPORT CLASSIFICATION: Tree Health & Vitality Diagnostic Report

REPORT STATUS: Final

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SIGNATURE: **DATE: 25/08/2020**

REPORT REVIEWED BY: Dr. Jon Banks *PhD*
Researcher and Research Lab Manager

SIGNATURE: **DATE: 19/08/2020**