CARLTON GARDENS

TREE REPLACEMENT AND GARDEN BED PLAN 2024 – 2034

andrea proctor landscapes for City of Melbourne

Title
Carlton Gardens Tree Replacement Strategy and Garden Bed Plan 2024 – 2034
for City of Melbourne

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Cover Image
Platanus × *acerifolia*, Avenue 12 in Carlton Gardens North, apl April 2023

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Executive Summary

Carlton Gardens are one of the most significant gardens in Australia, and as a setting for the Royal Exhibition Buildings are the only garden the country to be granted World Heritage Status. In the lead up to the 1880 international exhibition, the Gardens were selected as an appropriate setting for the construction of the Royal Exhibition Building, emanating the original 1851 location in London's Hyde Park. A second international exhibition was hosted in 1888, and the site was also home to the opening of Australia's first federal parliament in 1901 and the seat of Victoria's State parliament from 1901 to 1927. The site is also of deep cultural significance to Australia's Traditional Owners and First Peoples, as a site of community gathering on the closure of Aboriginal missions and reserves.[1]

Given the heritage value of the Carlton Gardens a cautious approach needs to be taken regarding any change. However, with gardens in particular, change cannot be entirely avoided. Indeed, as trees and plantings establish, grow, age and senesce, active management and change is required in order for the gardens' character to stay the same.

City of Melbourne has long been managing the Carlton Gardens site with these principals in mind, however this document has been produced to formalise these practices and provide a 10 year plan for tree replacement and garden bed establishment on the site. This is in response to the recent review of the World Heritage Management Plan, the launch of the Carlton Gardens Master Plan 2022 and the necessity of meeting Heritage Victoria permit requirements.

The *Carlton Gardens Tree Replacement Strategy and Garden Bed Plan 2024 – 2034* was produced in collaboration with the City of Melbourne and Heritage Victoria and guided by the latest best practice and scientific research in urban forestry and climate change response. It aims to address the complex issues that arise with tree management in heritage landscapes, especially preserving the heritage values of the place while responding to the difficulties in climate change tolerance and establishing new trees in existing gardens. This was done by carrying out a heritage assessment of all trees and avenues on site and comparing this with management priorities and arboricultural and climate data to identify the next 10 years of tree planting on site. This was coupled with a historic review into past garden bed plantings. The result was recommendations focusing on:

- Priorities for Avenue replacement, especially Avenues 6 and 9 which are failing and due for replacement
- Locations and species lists for specimen tree replacement
- Providing long term guidance for the management of existing avenues and specimen tree planting on site
- Improving garden bed planting around the two lakes in Carlton Gardens South
- Reintroducing framing planting at entrances and along pathways within Carlton Gardens South

Avenue selection for the site is particularly complex, and as part of the project a rubric system was developed to assess the relative merits of potential avenue species from a heritage, climate and practicalities perspective. This rubric has potential for application in other heritage sites within City of Melbourne.

The *Carlton Gardens Tree Replacement Strategy and Garden Bed Plan 2024 – 2034* provides for the planting and management of the site over the next 10 years, providing a strategic approach to the protection and long term management of this significant landscape and popular local park.

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1 Introduction

The Carlton Gardens Tree Replacement Strategy and Garden Bed plan has been prepared to guide tree planting and new garden bed construction in Carlton Gardens for the next ten years. Royal Exhibition Building and Carlton Gardens are one of the most significant post-contact sites in Australia and are World Heritage listed for their role in in the international exhibitions of 1880 and 1888.[2] While much of the inscribed Assessment of Significance focuses on the building and the influence of the exhibition movement, the gardens are considered to be "*an integral part of the overall site design and also characteristic of exhibition buildings of this period.*"[3]

Even without this wider interest, the buildings and gardens are significant at a National level, as the site of the first Federal Australian parliament in 1901, and at a State level as one of Melbourne's ring of historic 19th century gardens and the seat of the Victorian parliament from 1901 to 1927.[4] Architecturally, historically and botanically the Carlton Gardens are a fine example of 19th century landscape planning, and are perhaps unique in Australia as the only major city public gardens with a classically derived design.

Central to the aesthetic and social value of the Carlton Gardens is its tree canopy. Like many 19th century gardens, Carlton Gardens are experiencing maintenance and management complexities that come from having a single age canopy, difficulties with finding suitable sites for replanting, and a changing macro and microclimate. Species once used are now no longer suitable, and trees that continue to thrive provide challenges to establishing new garden beds and planting the next generation of trees.

This plan addresses these complexities, by undertaking an assessment of the relative significance of all trees in Carlton Gardens and making recommendations on management, the removal process and replanting for the next 10 years, so that Carlton Gardens can continue to be the beautiful, history filled garden people know and love.

Figure 1: The Royal Exhibition Building in Carlton Gardens

1.1 Scope

The scope of the report is for tree planting and garden bed establishment for the next 10 years (up to 2034) within portions of Carlton Gardens managed by the City of Melbourne. Carlton Gardens, bounded by Nicholson Street on the east, Victoria Parade to the South, Rathdowne Street on the west and Carlton Street to the north, is made up of three parts:

- Carlton Gardens South, managed by City of Melbourne and extending to the edge of the sealed Royal Exhibition Building south terrace.
- Carlton Gardens North, managed by City of Melbourne and extending northwards from a line drawn approximately along the northern wall of the Melbourne Museum.
- The Royal Exhibitions Building and Melbourne Museum, including surrounding landscaping. This portion is managed by Museums Victoria and not subject to this report. However, best practice would be to apply a consistent management approach for trees within this area (especially applicable to trees that frame the Royal Exhibition Building).[i]

This report identifies locations and species for new tree planting to replace trees and avenues already lost, and to allow for 10 years of anticipated removals. Anticipated removals have been identified based on trees assessed by an arborist as having a Useful Life Expectancy (ULE) of under 10 years,[5] and trees and shrubs identified as intrusive to the heritage significance of the place.

In addition to the above detailed recommendations, general recommendations have been made for the ongoing management of the entire tree canopy, with particular focus on the significant avenue plantings. Avenues are particularly complex to manage as they are made up of individual trees, but biologically and aesthetically function as a single entity, and all trees, no matter how healthy, have a finite life span. Forward planning for both avenues and the specimen tree collection is critical to the long-term management of the Carlton Gardens.

This report also addresses the location, general design and species composition of new garden bed plantings in Carlton Gardens South. Historically, Carlton Gardens South was more densely planted than the open site known today. However, changing fashions, management requirements and a growing tree canopy mean most have been lost. Recent work by City of Melbourne has successfully re-established garden beds around the Royal Exhibition Building and near the entrance at Victoria Parade and Rathdowne Street, and this work is to be continued with the establishment of new garden beds through the rest of Carlton Gardens South.

This report is part of the implementation process for the Carlton Gardens Master Plan 2022 and is informed by the work previously undertaken by Meredith Gould Architects (2006) and by the World Heritage Management Plan (2022). The process and recommendations are based on the heritage principal of *reconstruction*.[ii] It was developed following the Burra Charter process of understanding the place's significance, identifying practical management constraints and developing a workable management approach which retains the cultural significance of the place. Given the significance of Carlton Gardens a very cautious approach was taken to management, and recommendations in this report are based on historical precedents, modified as needed to address the practical challenges of the site.

[i] Trees which frame the building are listed in groups "Eastern Framing" and "Western Framing" and are of Outstanding Significance to the Carlton Gardens site. These groups also include trees within the Melbourne Museum reserve which were not assessed as part of this report.

[ii] Returning a place to a known earlier state… by the introduction of new material (Burra Charter 2013, p 2)

1.2 Structure

The *Carlton Gardens Tree Replacement Strategy and Garden Bed Plan 2024 – 2034* is broken into three parts:

- Outcomes of the tree heritage assessment, provided in an excel (.xls) spreadsheet format and linked to the City of Melbourne asset number for each tree. The spreadsheet has three pages, the assessment results, descriptors and taxa list
- This report which provides policy recommendations, methodology, actions and explanatory detail
- Maps and plans for the site showing existing conditions, outcomes of the heritage assessment, historical research and recommendations

Of particular importance is the detail provided in the spreadsheet. This includes detailed notes on the heritage value of every tree within Carlton Gardens North and South, including notes on a recommended replacement approach if and when this is required. The spreadsheet ***must*** be consulted when implementing any recommendations made in this report.

1.3 Methodology

The following outlines the process undertaken to develop of the *Carlton Garden Tree Replacement Strategy and Garden Bed Plan 2024-2034*:

- andrea proctor landscapes (apl) was appointed in February 2023 to produce the new Tree Replacement Strategy and Garden Bed Plan for Carlton Gardens
- A Project Working Group was established to steer the project and provide input and direction throughout the development of the Plan. This group included:
    - City of Melbourne:
        - Tim Burt, Senior Open Space Planner
        - Angela Hill, Principle Open Space Planner
        - Dylan Nickelson, Senior Urban Forester
        - Jessica Peeler, Asset Management Officer
    - With additional consultation with:
        - Jessica Hood, Heritage Victoria
        - City of Melbourne Urban Forest Team
- Initial consultation with the Working Group took place in March 2023, including the provision of past Council documents, as well as historical records, plans, and photographs.
- apl undertook a review of the history of the site. This included the documents provided by the City of Melbourne, as well as additional research in the archives of State Library Victoria, Museums Victoria and Trove. Of particular use were the *Carlton Gardens: Tree Conservation Strategy* (2006) by Meredith Gould Architects Pty Ltd and the *Royal Exhibition Building & Carlton Gardens World Heritage Management Plan* (Lovell Chen, 2022). From this research a timeline of the evolution of Carlton Gardens relating to the 1880 and 1888 Exhibitions was developed and a detailed photographic essay from 1879 to 1949. Where there was conflicting evidence the primary point of reference for all recommendations was the WHMP and photographic evidence.
- Assessment criteria were developed for the assessment of all trees on site, based on the Assessment of Significance provided in the WHMP. Over a number of site visits all trees within the study area were assessed for their age, condition and relative significance with this mapped against their City of Melbourne Asset ID and logged in a spreadsheet.
- The trees of Carlton Gardens were assessed for their Heritage significance over the course of several visits. This assessment considered their current condition and contribution in the overall design.

- Historic garden bed locations were reviewed on site to determine the suitability or otherwise of re-instatement and any practical requirements to be addressed.
- Landscape character traits for the tree canopy were assessed on site and mapped to inform future tree planting. Sites suitable for new tree planting were identified based on locations with sufficient space, gaps suitable for infilling and the identified character traits of the area.
- Initial findings were presented to the City of Melbourne Working Group in April 2023, including recommended heritage approach, draft significance assessments, potential areas for future planting and the results of the historic research and site assessments.
- Following feedback from the Working Group, the above information was presented to Heritage Victoria in April 2023. Findings and approach received broad approval, with a request made for detailed explanations to be included in the final report.
- Taxa not suitable for continued use were identified and a long list of suggested replacements developed by apl, and workshopped with the City of Melbourne Urban Forest Team to develop the final list of recommended taxa.
- Findings were documented by apl in this report, accompanying plans and tree spreadsheet, and submitted to the Working Group for comment
- Comments were received and adjustments made as appropriate. The most substantial of these was introducing a more formal assessment matrix for the review of potential avenue species. There was also some modification to garden bed layouts
- Portions of the document relating to climate assessments were peer reviewed by Dr Dave Kendell
- The final report was presented to Heritage Victoria and the City of Melbourne Environment Team with modifications made as needed

2 Heritage Context

2.1 Background

The Royal Exhibition Building and Carlton Gardens is one of the most significant post contact cultural sites in Australia, with recognised heritage value at a Local, State, National and International level. In 2004 it was the first cultural site in Australia to be granted World Heritage Status and one of only a handful of gardens listed on the National Heritage List.[iii]

The heritage significance for the site is identified and managed through the World Heritage Management Plan (WHMP). The WHMP was subject to review in the first half of 2023, and a document by GML is publicly available in draft form. The Tree Replacement and Garden Bed Plan was primarily informed by the current endorsed version of the document, produced by Lovell Chen and dated 2013, in particular the Assessment of Significance from pages 125 to 156 which covers significance from Local to World level. The revised WHMP was formally adopted after publication and while this Tree Replacement and Garden Bed Plan was being produced.

The heritage values of the site are complex and multi-layered and it is not appropriate to reproduce them within this report, and the WHMP should be referred to when further detail is required. However, section 2.3 provides a summary of how the broader values of the site were interpreted for the assessment of the tree canopy and ground level plantings.

[iii] Noting that the National Heritage Listing is relatively new and still under active development

A possible weakness of the 2023 WHMP is a lack of detail regarding the significance of trees within the site. The detailed assessment undertaken as part of this work has identified many more trees as meeting heritage thresholds. It also provides greater detail on *how* individual trees, avenues and rows are significant – information which will be used to inform long term management and replacement works.

2.2 Nomenclature: Avenues, Rows and Specimen Trees

Not all trees are of individual significance, with the majority of the significant trees within Carlton Gardens being important as part of an avenue, row or group. Trees and groups were assessed as follows:

- Avenues and rows were assessed as a single item, as their significance lies in their aesthetic and historic value as a complete entity, not as individual trees. For clarity, Avenue and row numbers were directly adopted from those used in the *Carlton Gardens: Tree Conservation Strategy* (2006) by Meredith Gould Architects Pty Ltd
- Bosquets and deliberate pairings were assessed as a single item, as their significance lies in their aesthetic value as a complete entity, not as individual trees. Groups were given names as part of the current assessment
- Trees which are part of an informal group were assessed as a single item, as their significance is related to others in the group (e.g. the 3 Moreton Bay Figs of importance to the Traditional Custodians). Grouping these trees together assists with understanding their role and heritage value within Carlton Gardens. Groups were given names as part of the current assessment
- The remaining trees were individually assessed specimen trees within lawn areas. The numbering system for lawn areas was directly adopted from those used in the *Carlton Gardens: Tree Conservation Strategy* (2006) by Meredith Gould Architects Pty Ltd. Tree numbers are the City of Melbourne asset IDs

2.3 Assessment Criteria: State, National and World Conventions

The following outlines how trees and other plantings were assessed against the significance inscribed by various conventions and legislated listings. For this assessment each tree and group is listed with its highest ranking (World, National or State) with detailed assessments against AHC criteria undertaken using the Victorian (State) criteria. Trees were not assessed for local level significance.

The assessment of heritage values was informed by the following:

- New research undertaken for this assessment, in particular detailed analysis of early photographs
- Site assessment, including professional experience in determining condition, botanical rarity and likely age of trees
- The *Royal Exhibition Building and Carlton Gardens Heritage Management Plan* (Lovell Chen 2022)
- The *Carlton Gardens: Tree Conservation Strategy*, Meredith Gould Architects Pty Ltd (2006)

2.3.1 State Values

The criteria defined by the *Heritage Act 2017* (Victoria) was used to establish the heritage value of trees and groups to inform tree replacement recommendations. The State level criteria were selected as they provide the most detail, and are the major legislative control effecting the daily heritage management of the site[iv].

[iv] The National Heritage List is legislative, but, unlike the Victorian heritage legislation, the permit process is only triggered when major change is proposed

All trees identified as having significance at either a State, National or World level were assessed against the following 9 criteria in order to determine *how* they are significant. As like-for-like replacement is often not appropriate or possible for trees, due to changes in the micro- and macroclimates and immediate surroundings, this assessment provides an understanding of not only the importance of the tree, but how it is significant and what characteristics replacement specimens need to meet.

The criteria were adapted for use in the Carlton Gardens Assessment is as follows:

Criterion (a): Importance to the course, or pattern, of Victoria's cultural history ('*Historic*')

Criterion (b): Possession of uncommon, rare or endangered aspects of Victoria's cultural history. This includes botanical rarity ('*Botanic / Scientific*' or '*Rarity*').

Criterion (d): Importance in demonstrating the principal characteristics of a class of cultural places and objects ('*Principal characteristics*')

Criterion (e): Importance in exhibiting particular aesthetic characteristics ('*Aesthetic*')

Criterion (f): Importance in demonstrating a high degree of creative or technical achievement at a particular period ('*Creative or technical achievement*')

Criterion (g): Strong or special association with a particular present-day community or cultural group for social, cultural or spiritual reasons ('*Social value*')

Criterion (i): The place has heritage value to Victoria because of the place's importance as part of Indigenous traditions. (*Indigenous tradition*)

In addition to the above, no trees, avenues or groups were found to meet the following criteria:

Criterion (c): Potential to yield information that will contribute to an understanding of Victoria's cultural history ('*Research*')

Criterion (h): Special association with the life or works of a person, or group of persons, of importance in Victoria's history ('*Significant people*')

2.3.2 National Heritage List

The Statement of Significance for the National Heritage List provided by the World Heritage Management Plan[6] identifies the Royal Exhibition Building and Carlton Gardens as meeting the following criteria. The relevance of these to the plantings is provided as a summary in italics, with the full text in the World Heritage Management Plan referred to if further detail is required:

a) outstanding heritage value to the nation because of the place's importance in the course, or pattern, of Australia's natural or cultural history (*relating specifically to its role in Federation and as the seat of the nation's first Parliament and its role in the exhibition movement*)

b) the place has outstanding heritage value to the nation because of the places' possession of uncommon, rare or endangered aspects of Australia's natural or cultural history (*relating to being purpose built as a precinct/complex for the international exhibitions AND for the Gardens, being a rare example of classical design in an Australian public landscape with earlier Gardenesque features overlaid with a classical layout of formal paths, parterres, the Hochgürtel Fountain, avenues, bosquets, ponds and 19th century specimen trees)*

d) the place has outstanding heritage value to the nation because of the place's importance in demonstrating the particular characteristics of:

   i a class of Australia's natural or cultural places

   ii a class of Australia's natural or cultural environments

   (As a unique style of public garden in which an earlier public, Gardenesque style landscape was overlaid with a classical design. The citation specifically mentions the items listed under criteria b) as well as the

surviving trees from Bateman's plan and those planted by Sangster c1879-1880 and during the north garden restoration in 1890. As well as for its continuity of use as an exhibition space)

e) the place has outstanding value to the nation because of the place's importance in exhibiting particular aesthetic characteristics valued by a community or cultural group (*for the 19th century classically modified Gardenesque design and as a source of inspiration as an architectural/landscape ensemble)*

f) the place has outstanding heritage value to the nation because of the place's importance in demonstrating a high degree of creative or technical achievement at a particular period (*relating to the Building and its garden setting, based on an axial Beaux-Arts scheme with the building as a palace and gardens designed to create a palatial garden setting AND the classical and Gardenesque listed under criteria b). Of particular importance is that the "Gardenesque and classical elements are integral to the original 1880 design…and are a major feature of the place's outstanding national values"[7] and the important contribution of the "contrasting colours and forms"[8] of the varied tree canopy*).

For the purpose of this assessment, trees and groups were assessed as meeting the National Heritage List criteria when they **date from the period of significance of 1879-1901 and** meet one of the following criteria:

- **Reinforce the classical design of Carlton Gardens**
- **Contribute to the diversity and aesthetic values of the tree canopy**

All trees listed as National also meet State level thresholds.

2.3.3 World Heritage

The Royal Exhibition Building and Carlton Gardens was inscribed on the World Heritage List under one criterion only: "*Criterion ii: exhibit an important interchange of human values, over a span of time or within a cultural area of the world, on developments in architecture or technology, monumental arts, town-planning or landscape design*"[9] in particular "*The Royal Exhibition Building and the surrounding Carlton Gardens, as the main extant survivors of a Palace of Industry and its setting, together reflect the global influence of the international exhibition movement of the 19th and early 20th centuries. The movement showcased technological innovation and change, which helped promote a rapid increase in industrialisation and international trade through the exchange of knowledge and ideas.*" [10]

The site was also nominated for criteria iv and vi which deal with artistic merit and related ideas and achievements of universal significance. These criteria were rejected, and as such trees and plantings were only assessed based on their historical significance, and not their aesthetic qualities. Therefore, trees assessed as meeting the World Heritage threshold relate strongly to the design and layout of the Royal Exhibition Building and the classically derived landscape surrounding it and call back to the 'important exchange of human values' and 'developments in architecture or technology, monumental arts, town-planning or landscape design' related directly to the 1880 and 1888 exhibitions, as found in Part 1 of the World Heritage Management Plan 2023 (WHMP 2023) .

Carlton Gardens North was entirely covered with buildings during the second exhibition of 1888, and subsequently all trees date from the 1890 post-exhibition reconstruction works or later, except for the Elms along Carlton Street which predate both exhibitions. As such, **no trees in Carlton Gardens North** are considered sufficiently connected to the international exhibition movement to **meet the criteria for World Heritage significance.**

Carlton Gardens South was redesigned for the original 1880 exhibition, explicitly along Free classical lines designed to maximise vistas to the Royal Exhibition Building and Hochgürtel Fountain.[11] The park setting was an important factor in the selection of the site, following the precedent set by the first exhibition held in 1851 in the Crystal Palace constructed within London's Hyde Park. Indeed, despite the early intentions and classical *patte d'oie* layout, Carlton Gardens' grand promenades framed by London Planes and open lawns scattered with specimen trees, is more reflective in character of London's parks than French classical garden design.

Trees within **Carlton Gardens South which frame and anchor the monumental Royal Exhibition Building** are considered to relate directly to the site's role in the international exhibition building and have been assessed as **meeting the criteria for World Heritage significance**. While only a limited number of trees meet this threshold, the Gardens as a whole are fundamental to our understanding of the place and provide an important setting for the building. All trees listed as World also meet National and State level thresholds.

2.4 Relative Significance within Carlton Gardens

In addition to the above assessment, the report identified the relative significance of each tree, avenue or row in Carlton Gardens following standard heritage conventions. While the above assessments influence replacement recommendations, these assessments guide the long term management of the individual tree or group:

Outstanding Significance: Tree or group is in good condition, intact, and makes a critical contribution to our understanding of Carlton Gardens as setting for the last remaining, continuously active Hall of Industry from the Exhibition movement. Tree or group relates strongly to the Exhibition Building and its classical design and is substantially intact (in good condition).

Primary Significance: Tree or group is in good condition, intact, and makes a primary contribution to our understanding of Carlton Gardens as setting for the last remaining, continuously active Hall of Industry from the Exhibition movement and/or as an important 19th century public garden. Tree or group makes an important contribution to the classical design of the landscape, recognised as being of historic and aesthetic significance at a National level. Also includes trees or groups that relate strongly to the Royal Exhibition Building layout but are replacements or no-longer intact.

Contributory Significance: Tree or group makes some contribution to our understanding of Carlton Gardens as setting for the last remaining, continuously active Hall of Industry from the Exhibition movement and/or as an important 19th century public garden, but is not vital to the understanding of the place or is in poor condition/degraded or is from after the period of significance.

Not Significant: Tree or group does not add any particular value to our understanding of the Carlton Gardens as setting for the last remaining, continuously active Hall of Industry from the Exhibition movement and/or as an important 19th century public garden.

The World Heritage Management Plan for the Royal Exhibition Building and Carlton Gardens[12] only provides primary and contributory ranks of significance for trees. The additional rank of 'outstanding' has been added for trees which are clearly a level above Primary, and refers specifically to trees related to the 1888 exhibition works, the design of the building and its relationship with the surrounding Carlton Gardens. These trees contribute directly to the World Heritage values of the site.

2.5 Assessment of Significance

The following is a summary list of all significant trees and groups. For full citations, including replacement recommendations and assessment against AHC criteria, refer to the accompanying spreadsheet.

Carlton Gardens South Avenues

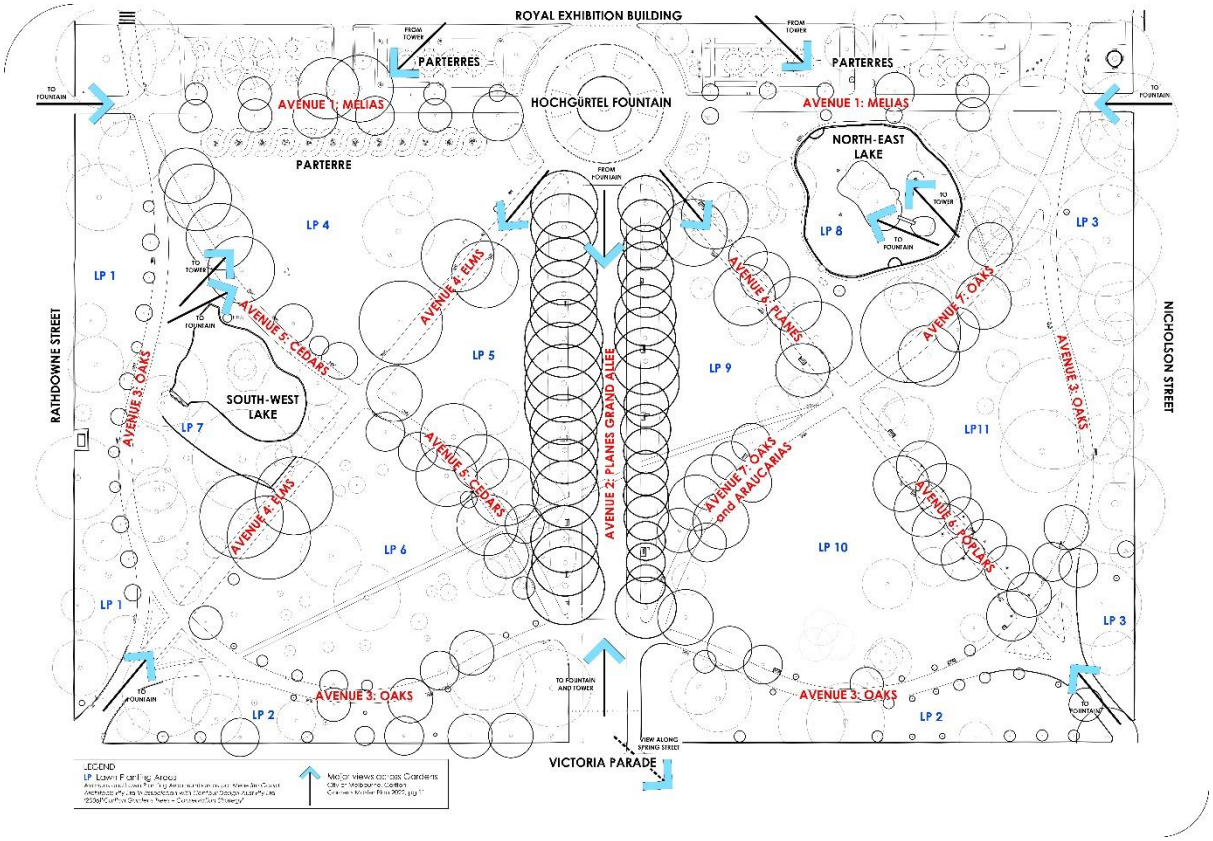

Figure 2: Map of Avenues and Lawn Plantings, Carlton Gardens South

Avenue / Row	Assessment	Asset Numbers
Avenue 1 Melias *Melia azedarach*	Primary	1036937, 1036940, 1036941, 1037188, 1037189, 1037190, 1037191, 1037192, 1037193, 1037196, 1037197, 1286901, 1440714, 1440715, 1441187, 1441681, 1441682, 1533865, 1564762
Avenue 2 Grand Allée *Platanus* x *acerifolia*	Outstanding	1036981, 1037000, 1037001, 1037002, 1037003, 1037004, 1037005, 1037006, 1037007, 1037008, 1037009, 1037010, 1037011, 1037012, 1037013, 1037014, 1037015, 1037016, 1037017, 1037018, 1037019, 1037020, 1037021, 1037022, 1037023, 1037024, 1037025, 1037026, 1037027, 1037028, 1037029, 1037030, 1037031, 1037033, 1037034, 1037035

Avenue / Row	Assessment	Asset Numbers
Avenue 3 Curving Oaks Predominantly *Quercus robur*	Contributory	1036870, 1036887, 1036893, 1037055, 1037063, 1037064, 1037076, 1037078, 1037079, 1037096, 1037100, 1037103, 1037104, 1037151, 1286904, 1286905, 1286913, 1286915, 1288406, 1288411, 1288413, 1288415, 1288416, 1288417, 1455940, 1455943, 1492591, 1492592, 1492593, 1533856, 1533859, 1533860, 1533868, 1533869, 1533870, 1533871, 1556487, 1564759, 1565078, 1565090, 1570961, 1580525, 1605237, 1613578, 1663825, 1769083
Avenue 4 Informal Elms Predominantly *Ulmus procera*	Contributory	1037146, 1037147, 1037165, 1037167, 1037170, 1037267, 1457039, 1605789
Avenue 5 Conifers Mix of *Cedrus deodara* and *Araucaria cunninghamii*	Primary	1037137, 1037140, 1037141, 1037142, 1037143, 1037152, 1037154, 1037155, 1037156, 1037173, 1037174, 1037175, 1037177, 1037178, 1037180, 1037181
Avenue 6 Poplars *Populus alba*	Contributory	1036894, 1036907, 1036908, 1036909, 1036910, 1036911, 1037038, 1037039, 1037040, 1037041, 1037043
Avenue 6 Informal Planes Predominantly *Platanus x acerifolia*	Contributory	1036954, 1036956, 1036961, 1036962, 1036963, 1036966, 1036982, 1036985, 1036986, 1036988
Avenue 7 Oak and Bunya Mixed *Quercus sp.* and *Aracuaria bidwillii*	Primary	1036926, 1036991, 1036992, 1036993, 1036994, 1036995, 1036997, 1036998, 1036999

Carlton Gardens North Avenues

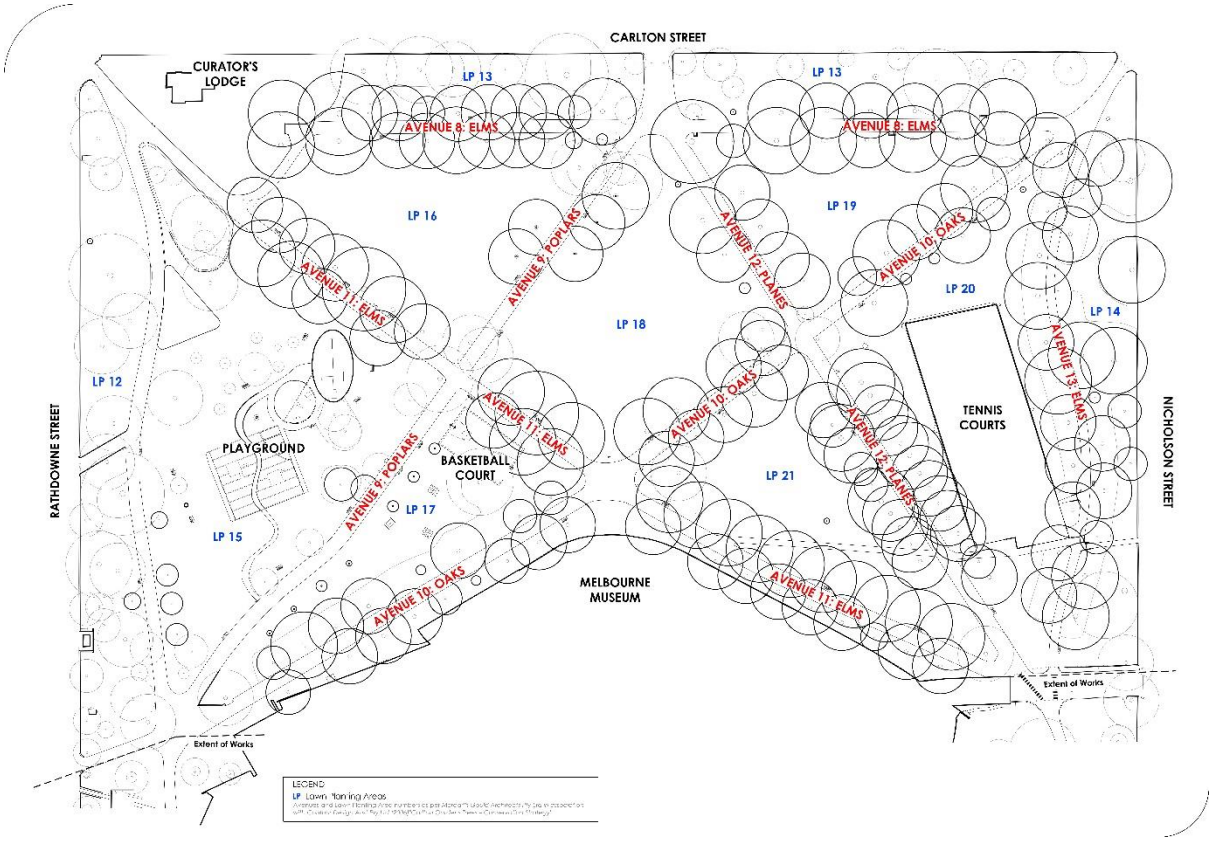

Figure 3: Map of Avenues and Lawn Plantings, Carlton Gardens North

Avenue / Row	Assessment	Asset Numbers
Avenue 8 Carlton Street Elms Predominantly *Ulmus procera*	Primary	1036548, 1036561, 1036562, 1036563, 1036564, 1036565, 1036566, 1036567, 1036568, 1036569, 1036570, 1036571, 1036572, 1036573, 1036574, 1036588, 1036589, 1036590, 1036595, 1036596, 1036597, 1036598, 1036599, 1036600, 1036601, 1036603, 1036604, 1036671, 1036673, 1036674, 1036675, 1036676, 1036677, 1036678, 1036679, 1036680, 1285699, 1454956
Avenue 9 Poplars *Populus alba*	Contributory	1036685, 1036686, 1036708, 1036709, 1036710, 1456952, 1456955, 1456956, 1493123, 1493125, 1510206, 1510208
Avenue 10 Oaks Predominantly *Quercus castaneifolia*	Primary	1036504, 1036505, 1036506, 1036507, 1036508, 1036554, 1036555, 1036556, 1036557, 1036558, 1036715, 1036716, 1036718, 1036719, 1036728, 1036729, 1036730, 1036731, 1036732, 1036756, 1036757, 1036758, 1036763, 1036765, 1036767, 1036768, 1036769, 1036770, 1036771, 1036772, 1036775, 1068805, 1763402, 1763403, 1793372

Avenue / Row	Assessment	Asset Numbers
Avenue 11 Elms *Ulumus procera*	Primary	1036605, 1036690, 1036691, 1036692, 1036693, 1036694, 1036695, 1036697, 1036698, 1036699, 1036701, 1036720, 1036721, 1036722, 1036723, 1036724, 1036725, 1036735, 1036736, 1036737, 1036738, 1036739, 1036740, 1036741, 1036742, 1036743, 1036744, 1036745, 1036746, 1036747, 1036748, 1036749, 1036750, 1036752, 1036753, 1036754
Avenue 12 Planes *Platanus* x *acerifolia*	Primary	1036513, 1036514, 1036515, 1036516, 1036517, 1036518, 1036519, 1036520, 1036521, 1036522, 1036523, 1036524, 1036525, 1036526, 1036531, 1036532, 1036533, 1036534, 1036535, 1036536, 1036537, 1036538, 1036539, 1036540, 1036541, 1036545, 1036546, 1036549, 1036550, 1036551
Avenue 13 Elms Mixed *Ulmus sp.*	Primary	1036473, 1036474, 1036476, 1036477, 1036478, 1036479, 1036480, 1036481, 1036482, 1036483, 1036486, 1036487, 1036489, 1036490, 1036492, 1036494, 1036497, 1036498, 1036499, 1036500, 1036501

Carlton Gardens South Specimen Trees and Lawn Plantings

Specimen / Group	Assessment	Asset Number(s)
Partial Araucaria Bosquet	Contributory	1037134, 1037135
Pinus Bosquet	Primary	1037051, 1037052, 1063872
Eastern Carpark Platanus	Outstanding	1036967, 1036968
Eastern Ficus Group	Primary	1036863, 1036880, 1036930
Eastern Oaks by Eastern Lake	Primary	1036916, 1036917, 1036919, 1036923
Ficus – Aboriginal Heritage	Outstanding	1036852, 1036853, 1036933
Liquidambar	Contributory	1036895, 1036896
Near Eastern Lake Specimens	Contributory	1036951, 1036957, 1036958, 1036959, 1036960
SE Boundary Elms	Primary	1037066, 1037067, 1037084, 1037085
SW Boundary Elms	Primary	1037111, 1037115
Cupressus funebris Bookend	Outstanding	1037194, 1037195
Corymbia calophylla Pair	Contributory	1037139, 1037160
Araucaria bidwillii	Contributory	1036855
Grevillea robusta	Contributory	1036857 , 1036874, 1037235
Ulmus procera	Contributory	1036860, 1036885, 1036886, 1037171, 1037227
Cedrus deodara	Contributory	1036861, 1036866, 1037257,
Cedrus deodara	Outstanding	1037215
Populus alba	Contributory	1036868
Cupressus torulosa	Contributory	1036871, 1037218, 1037274
Ficus macrophylla	Contributory	1036872, 1036912
Ficus macrophylla	Primary	1037091, 1037268
Ficus macrophylla	Outstanding	1037217

Specimen / Group	Assessment	Asset Number(s)
Ficus platypoda	Primary	1036920
Araucaria cunninghamii	Contributory	1036875, 1036881, 1036983, 1037046, 1037219, 1037229
Araucaria cunninghamii	Primary	1037082
Araucaria cunninghamii	Outstanding	1037216
Salix babylonica var. *pekinensis*	Contributory	1036935
Magnolia grandiflora	Primary	1037199
Magnolia grandiflora	Contributory	1036970
Erythrina crista-galli	Contributory	1036978
Quercus canariensis	Contributory	1037130
Quercus canariensis	Primary	1037090
Pinus canariensis	Contributory	1037117
Melaleuca styphelioides	Contributory	1037179
Corymbia citriodora	Contributory	1037185
Pinus canariensis	Contributory	1037229
Quercus robur	Contributory	1037237
Quercus robur	Primary	1037054
Washingtonia filifera	Contributory	1037250
Corymbia maculata	Contributory	1037258
Stenocarpus sinuatus	Contributory	1037266
Cupressus torulosa	Contributory	1037274
Pinus halepensis	Contributory	1063871
Harpephyllym caffrum	Contributory	1582850
Taxodium distichum	Primary	1037256

Carlton Gardens North Specimen Trees and Lawn Plantings

Specimen / Group	Assessment	Asset Number(s)
Rathdowne Street Row	Primary	1036488, 1036495, 1036496
Carlton Street Boundary	Primary	1036591, 1036593, 1036594, 1036602
Phoenix canariensis	Contributory	1036475
Schinus molle	Contributory	1036578
Syzygium paniculatum	Contributory	1036585
Pinus canariensis	Contributory	1036689, 1036704, 1036796, 1036797, 1036806
Ficus platypoda	Contributory	1036734
Ficus platypoda	Primary	1036759, 1036842
Eucalyptus botryoides	Contributory	1036776, 1036843
Celtis australis	Contributory	1036817
Populus alba 'Pyramidalis'	Contributory	1036827
Quercus ilex	Contributory	1036838
Grevillea robusta	Contributory	1036844
Araucaria heterophylla	Contributory	1036850
Eucalyptus camaldulensis	Primary	1036703
Angophora floribunda	Primary	1036832
Corymbia citriodora	Primary	1036834, 1036502
Eucalyptus sp.	Contributory	1357265

3 Tree Management and Replacement Plan

3.1 History and Contemporary Layout

The following is a brief history of the plantings within Carlton Gardens as it relates to the recommendations made in this report. For further information regarding the specific history of an avenue or lawn planting, please refer to the *Tree Conservation Strategy* 2006 and *World Heritage Management Plan* 2023.

Prior to European colonisation, the Melbourne area and the land of the Royal Exhibition Building and Carlton Gardens was well established as a place at which the five tribes of the Kulin confederacy would meet in the warmer months. As noted in Part 2 of the WHMP 2023, the swamps around Birrarung (the Yarra River) were favoured fishing spots and regularly used as meeting places for the local tribes.

The arrival of British settlers and colonisation of the Melbourne area began in 1835. As the township of Melbourne was established and grew, so the Aboriginal people were displaced from the land and its resources. The urban development of the land removed the existing forest and water way, and erased the original form entirely.

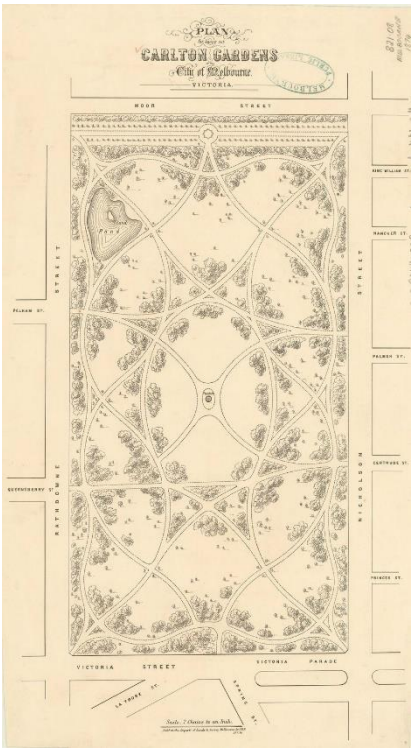

Figure 4: Edward La Trobe Bateman's original 1856 design as updated in 1874 by Clement Hodgkinson.

Source: State Library of Victoria

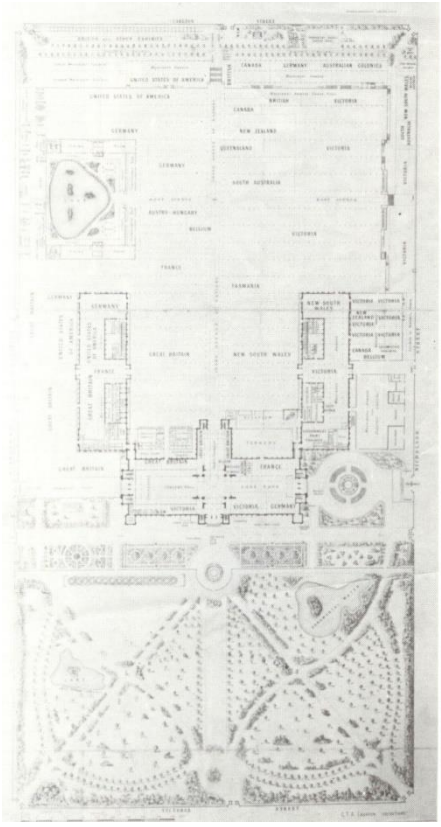

Figure 5: Reed The Reed and Barnes 1879 design as altered for the 1888 International Exhibition. Note the covering of Carlton Gardens North with exhibition spaces.

Carlton Gardens was originally a public park, established for the recreation of the people of Melbourne. The first design for the park was by prominent designer Edward La Trobe Bateman in 1856. Bateman's plan was not implemented at the time, but was adapted by Clement Hodgkinson in his 1874 plan, and remains the basis of the Garden's southern portion design to this day.

The first exhibition in Hyde Park, London, revealed the requirements of an exhibition site – a park setting, close to the city and of adequate size.[13] The selection of the site to host the 1880 exhibition led to a rejuvenation of the grounds. The architectural firm of Reed and Barnes designed the Royal Exhibition Building to be a great hall and Palace of Industry, with the resulting building being ostentatious and reminiscent of the grand palaces of Europe. The Gardens were redesigned to suit such a majestic building. This included the straightening of La Trobe Bateman's winding paths in Carlton Gardens South into a more formal *patte d'oie* - being a crow or goose foot typical of classical French garden design – and the creation of the Grand Alleé on the central axis. These amendments created sightlines into the Gardens from the

south-west and south-east entrances, and framed a majestic view of the Hochgürtel Fountain and Royal Exhibition Building up the Grand Alleé. The focus at this time was Carlton Gardens South, as the northern gardens were to be covered in tents, temporary buildings and exhibition spaces.

As stated in Part 1 of the WHMP 2023 pg 27, *"By World War One, Carlton Gardens was in poor condition, a situation exacerbated by staff shortages and a lack of funding and adequate resources. However, the REB and CG continued to be used for a variety of purposes into the twentieth century. It served as a principal venue in Melbourne for a range of regular and one-off exhibitions, including industrial fairs, motor shows, home shows, baby shows, bicycle races, pole sitting competitions, concerts and musical shows."*

3.1.1 Carlton Gardens South

Even with alterations to the design, Carlton Gardens South retained the symmetry of La Trobe Bateman and Hodgkinson's initial designs. The Grand Alleé defined the mirroring of this layout, and the offset placement of the ornamental lakes provided a refreshing contrast. Respected Horticulturist William Sangster was engaged to conduct the planting of the Gardens, and it is widely believed his personal preferences were at odds with the grand formality of the design[14]. Although the *patte d'oie* and Grand Alleé indicated formality, Sangster softened the surrounding landscape with casual avenue plantings and Gardenesque garden beds containing a melange of shrubs and forbs.

The two lakes were a necessary source of firefighting water and provide juxtaposition to the symmetry whilst simultaneously retaining it, alternating along the vertical axis in a north and south position. While the shape and size of the north-east lake has changed over time, it has always retained a framed view of the Royal Exhibition Building, with the reflection of the dome mirrored in the water. The south-west lake has similarly reduced in size and become slightly truncated in form.

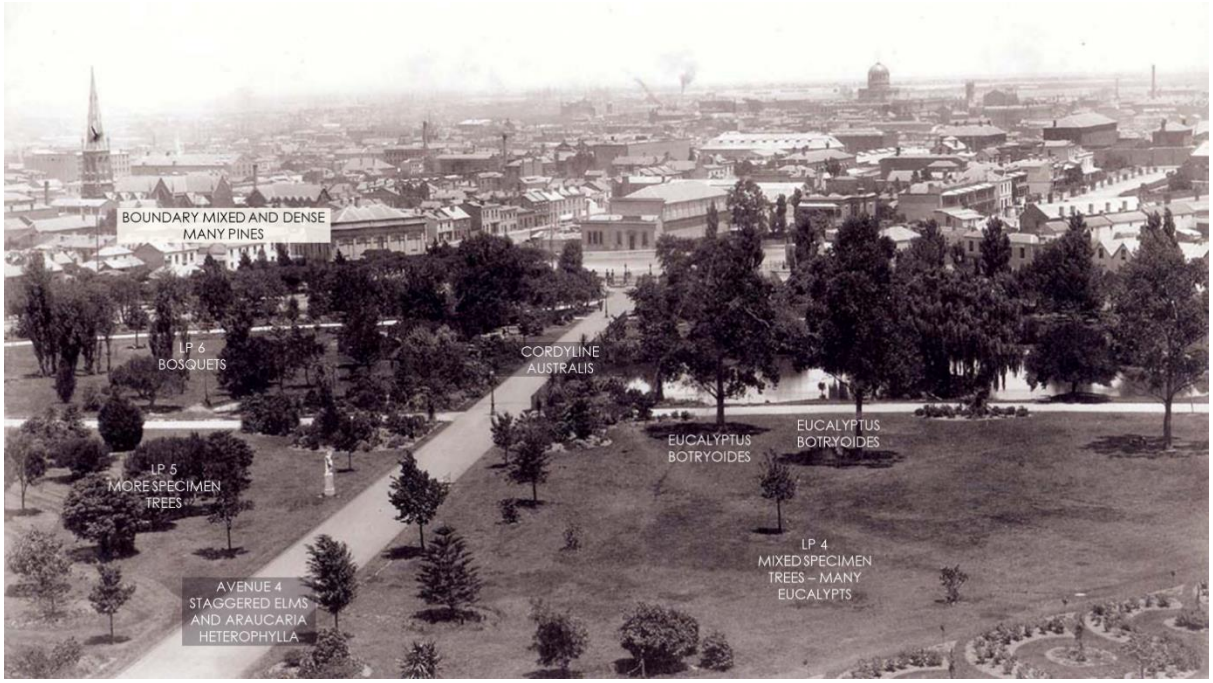

Figure 6: Carlton Gardens South in 1883 with explanatory notes. View looks along Avenue 4 to the corner of Victoria Parade and Rathdowne Street. (Nettleton, Charles. (1883) View of Melbourne (West) from the terrace of the Exhibition Building, Carlton Gardens. H848. State Library Victoria. Melbourne, Australia)

Generally speaking, planting in Carlton Gardens was sedate, with common species chosen. The exception was the area around the two lakes, which host a range of species not found elsewhere in Carlton Gardens and in some cases are rare in Victoria. The *Taxodium distichum* by the south-west lake is a particularly beautiful specimen, and the *Harpephyllum caffrum* by the north-east lake is rare in cultivation. These lawn plantings are, and appear to have always been, of botanic interest, and provide necessary contrast to the mass plantings of the avenues and rows.

All other internal lawn areas have featured varying numbers of specimen trees, as visible in both historic and modern photographs. Photographs from the 1880-1890s (Figure 6 and Figure 7 in particular) show a density of lawn specimens, many of which are eucalypts, which is not true of the Gardens today, with some of the lawn areas now being markedly open. While it is not always possible to identify individual species, pines and Eucalypts are generally distinguishable to genus level and *Cordyline australis* and *Araucaria heterophylla* are easily identified in early photos but are now uncommon in the Gardens. Both species appear to have been widely planted during Sangster's time.

The majority of canopy cover in the south is tied to the paths and boundaries and is dominated by deciduous species. Evergreen elements are largely confined to the conifers of Avenues 5 and 7, as well as scattered specimen trees, especially *Ficus* sp. and later plantings of *Grevillea robusta*.

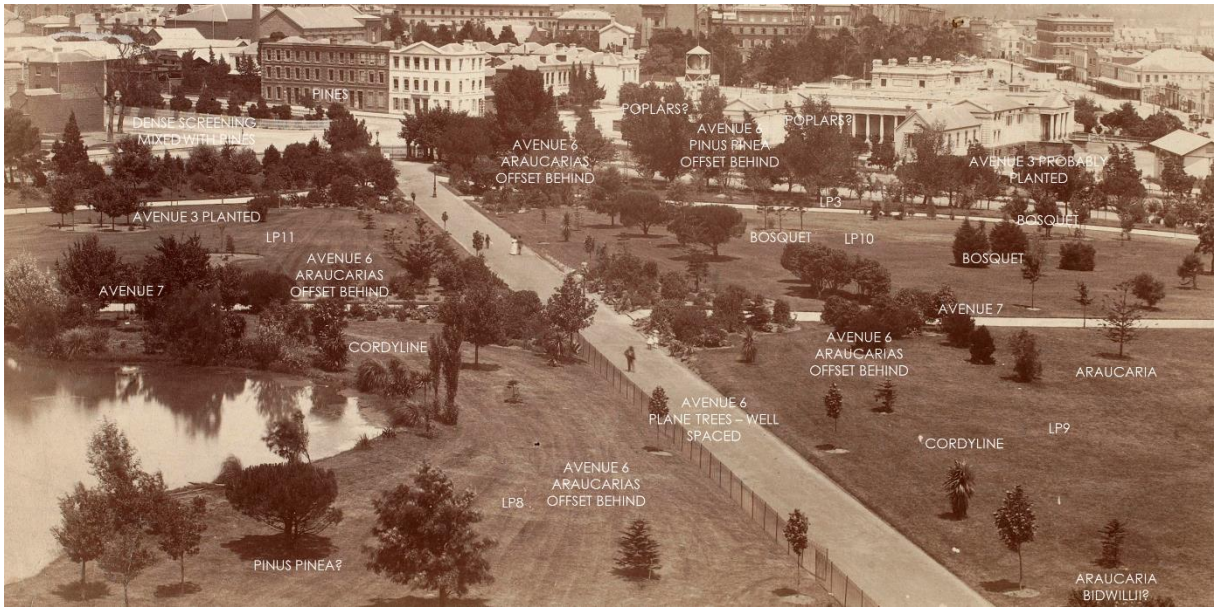

Figure 7: Carlton Gardens South in 1879 with explanatory notes. View looks along Avenue 6 to the corner of Victoria Parade and Nicholson Street. (Unattributed. (1879) [Melbourne from the Carlton Gardens] [picture]. H4512. State Library Victoria. Melbourne, Australia.)

The Grand Alleé (*Platanus* x *acerifolia*) was designed and planted with the intention of recalling the majesty and regal splendour of the palace of Versailles. From its initial planting this avenue has remained largely unchanged and undisturbed through the decades, and these now mature and statuesque trees have more than achieved their intended purpose. The view to the Hochgürtel Fountain is beautifully framed all the way from Victoria Parade, the trees creating a soaring canopy which cannot be compared to any other avenue in Australia.

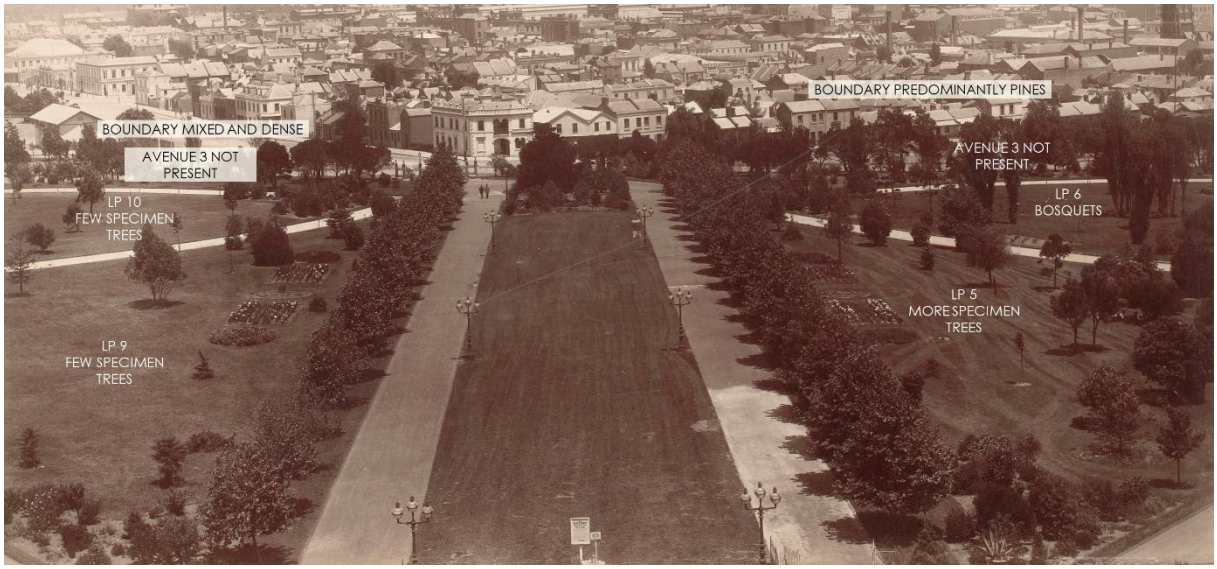

Figure 8: Carlton Gardens South in 1888 with explanatory notes. View from the dome looks along Grand Alleé and shows the new garden beds proposed near the Victoria Parade entrance. (Nettleton, Charles. (1883) View of Melbourne (South West) from the terrace of the Exhibition Building, Carlton Gardens [picture] H845. State Library Victoria. Melbourne, Australia.)

Avenues 4 (Elms) and 6 (Planes and Poplars), which make up the rest of the patte d'oie, were not marked for avenue planting in the initial Reed and Barnes 1879 design, nor the version altered for the 1888 International Exhibition. The 'unofficial' avenue plantings along these paths are thought to be the work of Sangster. Older elms planted along Avenue 4 appear to have been positioned in opposite pairs, but with a much wider spacing than that of the Grand Alleé. Early photos from 1880 (see Figure 7, Figure 48 and others) indicate that the Avenue was original alternated with Araucaria heterophylla, set back as a second row. It is noted in Appendix 2, Part 3 of the WHMP 2023 that the southern half of Avenue 4 appears to be a later planting, however given the stature of the elms in question, this does not appear to be the case. With all the Norfolk Island Pines and individual elms now gone, this openness grants the avenue a far more casual feel and in no way competes with the Grand Alleé. It would appear that this was always intended to be the case, with the Grand Alleé intended to be the dominant avenue in Carlton Gardens south, with all others subservient to it.

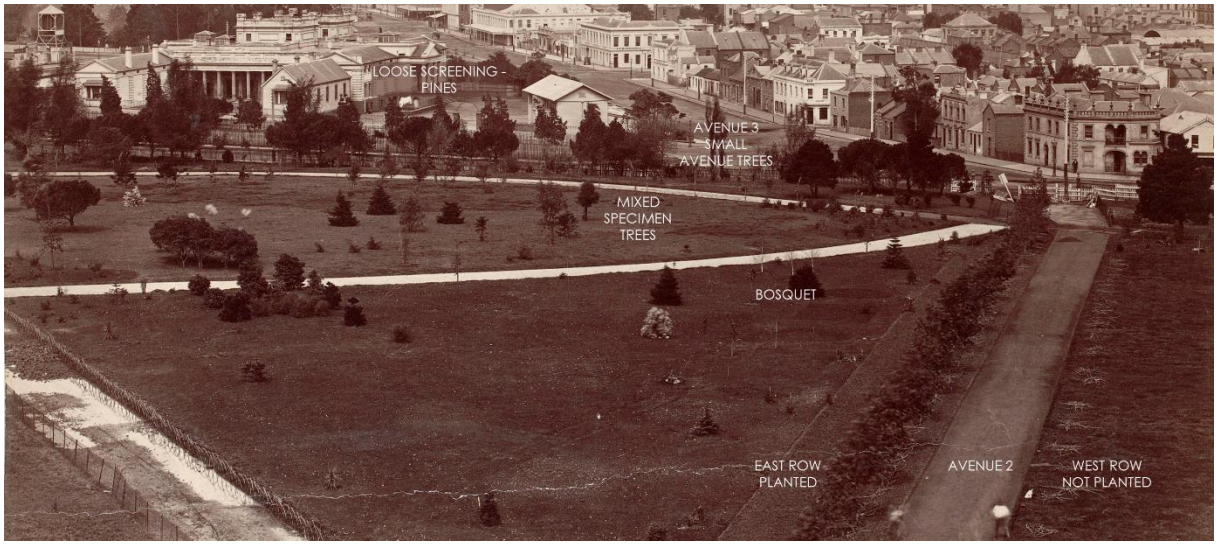

Figure 9: Carlton Gardens South in 1879 with explanatory notes. View shows the Grand Alleé in the foreground, Avenue 6 in the middle ground and Avenue 4 to the rear. Note the lack of avenue planting on Avenue 4 and only a few small avenue trees on Avenue 3. (Unattributed. (1879) [Melbourne from the Carlton Gardens looking south] [picture]. H4543. State Library Victoria. Melbourne, Australia.)

Avenue 6 is a more curious affair, with its plantings divided between the north and south. The north consists of paired plane trees, which muddle in with the Grand Alleé by the Hochgürtel Fountain. This avenue is further diluted by what appear to be early 20th century additions of unusual, albeit perhaps misplaced, specimen trees of various contrasting species.

The southern section of Avenue 6 consists of paired plantings of *Populus alba*. The selected species works well to contrast with the Grand Alleé without detracting from it, as the poplars provide contrasting foliage, texture and colour, and remain smaller in stature than the planes. This appears to be a later avenue planting, with an analysis of historic photographs indicating that the trees date from the late 19th or early twentieth century[15] (see 3.12.1).

Avenue 3, now comprised of oaks, which winds along the eastern, southern, and western border of the south, was only marked for avenue planting in the altered version of the Reed and Barnes 1879 plan intended for the 1888 exhibition, however, as many other elements of that plan were not implemented, it is unknown if this was actually undertaken. Photographic evidence indicates an avenue of an unknown species in 1879, though this may not be the same avenue as is currently present (see 3.12.2). Some older specimens of *Quercus robur* remain in the south-east corner. These trees are in poor condition, and given they lack the size expected for the age, have likely under-performed for the majority of their years. Infilling to recreate this avenue has recently taken place with *Q. robur* being planted along both the southern and western sections of Avenue 3. The majority of these replantings are likewise in poor condition.

Figure 10: Carlton Gardens South in 1880 with explanatory notes. View shows corner of Avenue 3 and Avenue 5 near Rathdowne Street with the parterres in the foreground. (Nettleton, Charles (?). (1880) [View from the roof of the Exhibition Building, Carlton Gardens] [picture]. H141261. State Library Victoria. Melbourne, Australia.)

Avenues 5 (cedar mix) and 7 (oak mix), which run in Gardenesque curves from the outer north down to the southern end of the Grand Alleé, are similar to Avenues 4 and 6 in that early plans do not indicate avenue plantings and it is likely they originate from Sangster. Planting to both avenues is somewhat informal. Avenue 5 is unusual in Carlton Gardens as a strong evergreen element. Historic photographic evidence shows conifers in this area, although as a mixed planting and not an avenue.[16] The current plantings of *Cedrus*

deodara and *Araucaria cunninghamii* were both typical of the era and for Sangster. The transformation into an avenue appears to have been an organic one, taking place over the years. Some recent infill plantings have taken place. Plantings around the western lake and specimen trees around the south-eastern section of the avenue interfere with the uniformity of presentation of the avenue, and together with its mixed species add to the informality.

Avenue 7 is divided north/south by the intersection with Avenue 6. The southern section is a neat and well formed avenue of alternating *Araucaria bidwillii* and *Quercus* sp. in opposite pairs. All appear to date from the 1880-1890s. The northern section comprises of a variety of *Quercus* sp. which run alongside the lake. The presence of specimen trees around the lake and immense *Ficus macrophylla* bookending this short avenue muddles its visual presence, to the point that its identity as an avenue is only really apparent when standing within it. Being as these oak trees are not *Q. robur*, they are in good condition with fine form and canopy formation.

The final significant avenue in Carlton Gardens south is Avenue 1, comprised of Melias running east-west in front of the Royal Exhibition Building. This avenue was an early selection of small trees thought to be designed to create an avenue effect without impacting on views to the building[17]. Over time individual trees failed, but the wide spacings allowed infill planting to easily take place. Today a second generation of trees is performing well, with 4 original specimens still present.

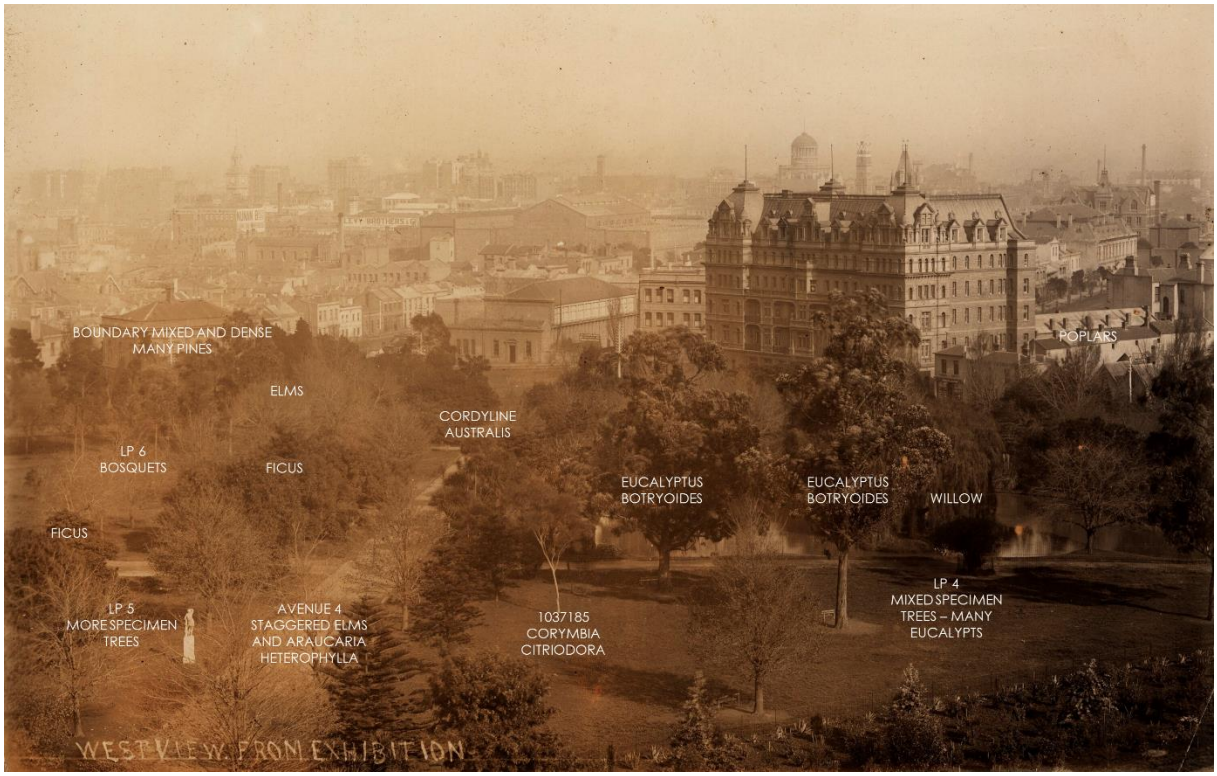

Figure 11: Carlton Gardens South in 1890 with explanatory notes. Specimen trees are now established. View looks down Avenue 4, likely from the Royal Exhibition Building dome and shows a similar view to Figure 6 taken 7 years earlier. (Nettleton and Arnest. (1890) Photograph - Carlton Gardens & Queen's Coffee Palace, Melbourne, circa 1890. MM 109787. Museums Victoria Collection, Melbourne Victoria.)

In addition to the Avenues Carlton Gardens South has a significant number of specimen trees, the majority of which are trace remainders of earlier planting schemes. The focus of specimen tree plantings are the boundaries, especially Nicholson Street and Rathdowne Street where early planting schemes had dense

tree planting, with garden beds beneath – similar in style to what still surrounds the Royal Botanic Gardens Melbourne. This planting has gradually thinned over time until only mixed specimen trees remain, but still remains an important characteristic of the site providing respite from the surrounding streets.

Specimen trees at the southern end of Carlton Gardens include an interesting feature – referred to in the Meredith Gould report somewhat inaccurately as "Bosquets" (bosk-ques)[v]. The history of this planting scheme is unknown – and the feature of three trees of the same species planted in a tight cluster is certainly unusual and may have been a whim of Sangster. Alternatively, this approach is sometimes used where arboriculture and forestry meet, with the intention being to plant three trees, allowing managers to select the dominant specimen after a few years and remove the other two. Due to gardeners' reluctance to remove trees this thinning does not always take place. The Bosquets are clearly visible in early photographs of the site (Figure 7 and Figure 9), and there is one remaining bosquet in Carlton Gardens South and a pair of Araucarias which may be remnants. There is no evidence of this planting scheme taking place in Carlton Gardens North.

3.1.2 Carlton Gardens North

Temporary buildings for the exhibitions occupied much of the north during the period of significance. The only avenue or lawn undisturbed by these buildings was Avenue 8 *(Ulmus procera),* running parallel to Carlton Street at the far north of the site. Apart from this avenue, all paths and avenues rise from the reconstruction of the north gardens after conclusion of the 1888 International Exhibition, with works completed in 1890. The layout installed at this time remains largely intact to this day, with the exception of one avenue[vi], which originally ran from the intersection of Avenues 9 (*Populus alba)* and Avenue 12 (*Platanus x acerifolia)* south to what is now the Melbourne Museum. This avenue has since been removed and its reinstatement would be inappropriate given the change in Carlton Gardens' layout and the way the Melbourne Museum now cuts through what would have been the termination this avenue.

Avenue 8 is in remarkable condition. These elms are among the oldest trees in the entirety of Carlton Gardens, with the majority dating from pre 1880. Six of the trees have been replanted – like-for-like and likely in 1940s-50s and are now indistinguishable from the main avenue (see Figure 64 which shows four of these trees at a good size). Some recent infill plantings are likely to struggle due to competition from the older surrounding trees.

Avenue 11 (elms), running diagonally from the north-west to the south-east, is likewise comprised of elms and remarkably intact. This avenue – and all other avenues in Carlton Gardens North – was planted as part of the 1890 reconstruction after the removal of the temporary buildings. Replacements have been minimal, and would be difficult due to the relatively tight planting, and as a result some gaps remain.

Avenue 10, running through the site from the north-east to the south-west, is comprised of oaks, primarily *Quercus castaneifolia*, with several recent *Quercus castaneifolia* and one *Quercus robur* replacements. *Q. castaneifolia* is performing far better than the specimens of *Q. robur* in the south gardens, and the mature specimens are in good condition and form. The north-eastern section of this avenue is more intact than the south-western section, although replacements have been planted in both. The south side trees of both

[v] The original Versaille "Bosquets" were thickets of trees planted in a formal arrangement – the grouping of three does not appear in literature on historic French garden design

[vi] This avenue is referred to as Avenue 14 in the Meridith Gould report, but as it is no longer appropriate it has been left off current plans to avoid confusion

Avenues 10 and 11 are extremely close to the wall of the Melbourne Museum, and it is likely that roots were damaged during construction. While replacement of these trees is not required in the short term, any future replacement works will be compromised by the proximity of the building.

Figure 12: Aerial photograph of Carlton Gardens North in 1949 with explanatory notes. There are remarkably few photographs of Carlton Gardens North, with the earliest dating from c.1931 and only showing part of the Gardens. (Unattributed. (1949) Aerial Photograph of Carlton Gardens North, City of Melbourne.)

Avenue 12 (*Platanus* x *acerifolia)* runs from the centre-north to the south-east, with tighter spacing in the southern section of the avenue. Apart from a couple of replacements, it is largely intact and in good condition, being a smaller and more intimate version of the Grand Alleé. Aesthetically, this is the finest avenue in Carlton Gardens North.

Avenue 12's mirror, Avenue 9 (*Populus alba)* on the west, is in poor condition. A handful of original poplars remain in the northern section, with attempted replacements planted in the southern section. These replacements appear to have suffered possum predation and are in very poor condition. The Avenue is spotty and inconsistent with its spacing. Apart from those mature specimens in the north, there is no canopy cover, and in fact no avenue of which to speak, partially due to repeated failures of attempted replacement replanting. While attempting to replace like-for-like was reasonable, the repeated failures mean a new approach is now warranted.

The eastern boundary of the garden is lined by Avenue 13. The avenue is comprised of mixed elms, including *Ulmus* x *hollandica* 'Vegeta', *Ulmus glabra*, *Ulmus minor* and *Ulmus* x *hollandica.* It is largely intact, in good condition, and a strong representation of the aesthetics of the era.

Figure 13: 1962 Aerial photograph showing carparking in Carlton Gardens north and a network of avenues with little specimen tree planting away from the western boundary. Source: Museums Victoria

Avenue 13's counterpart on the western boundary is undefined, with what appears to be the beginnings of an oak avenue recently planted at the southern end. There are no indications in previous plans or historic images that an avenue ever existed along this path and it is recommended that mixed, informal specimen planting be used for any future planting.

The lawn plantings along the western boundary contain some fine mixed specimens, including a *Ficus platypoda* which is an outstanding example of the species. Some of the species planted here are found nowhere else in Carlton Gardens. This is the only portion of Carlton Gardens North that has extensive specimen tree planting. A number of specimens here appear to be from post 1920, with earlier plantings likely to be a continuation in style from that found on the boundaries of Carlton Gardens South.

Where the playground is now located was previously a lake, a necessary source of firefighting water. Like its counterparts in the south, the shape of the lake shifted and changed over the years. It was first transformed from lake into a children's wading pond in the 1920s, and then a children's traffic school in the 1960s, until the installation of the current playground in 2000.[18] Trees in the lawn around the playground are of mixed diversity and quality, some performing better than others. Canopy around the playground is minimal, and the Carlton Gardens Master Plan identifies more shade as a high priority. The public preference is for deciduous trees around playgrounds, and given the extensive amount of change which has taken place in this area a more contemporary tree planting scheme would be appropriate. This is reflected in Part 4 of the WHMP 2023.

Only the boundary lawns have any specimen plantings to speak of, all interior lawns being left open and unplanted. The northern and eastern boundaries feature selected species which can be found in the south as well, in particular several pairings of *Ficus macrophylla* and *Schinus molle*, a couplet known to be in style during the period of significance. One unusual feature of Carlton Gardens North is the use of contrasting species at Avenue intersections. These trees are generally Eucalypts, often in poor condition, but the design feature does assist with maintaining the integrity of individual avenues without letting one dominate the other.

The more fragmented history of Carlton Gardens North and its impact on management is summed up in the World Heritage Management Plan as follows (part 3, pg 34) "*The recommended interpretive approach recognises the changes which occurred in the North Garden even during the 1880s, associated with the two exhibitions, and the fact that there is no fully authentic single or overriding design to use here to inform a new garden design. Consequently, the North Garden offers somewhat greater latitude in engaging with climate adaptation and other requirements with respect to tree selection and other landscape considerations, although congruency with the world, national and state heritage values and the c. 1880s character of Carlton Gardens will remain the primary basis for design and management of the North Gardens.*"

3.2 Tree Management Policies

The following policy recommendations relate to the arboricultural care and heritage management of the Carlton Gardens' tree canopy. The two requirements are interlinked, as heritage value is affected by the condition of the fabric. As living organisms, trees require a specific and more dynamic approach to management than buildings and hard landscaping. No matter the level of care, it is not possible to maintain trees forever and as stated in Part 4 of the WHMP 2023 active succession planning is required if the landscape character, and therefore heritage value, of a garden is to be maintained.

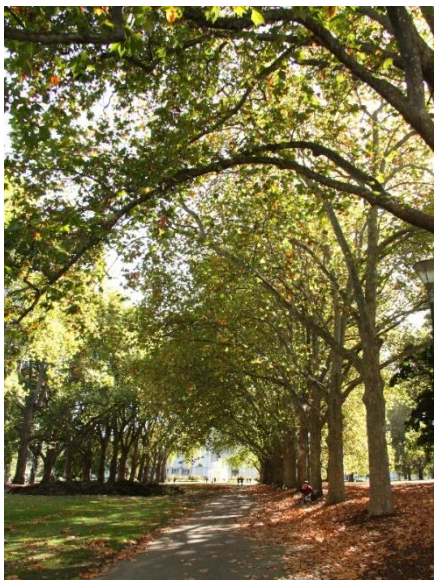

Figure 14: Avenue 2, the Grand Alleé contributes to the World Heritage values of the place and is of Outstanding Significance to the site

While succession planting (the early establishment of the next generation of trees) is highly desirable, there are many factors which make this difficult to achieve. A problem faced by all of Australia's 19th century gardens is that the tree canopy was generally established on a vacant site and within a relatively short 30-50 year period. This means that not only are the tree canopies largely single age, but the micro-climate of the site is now also completely different, with competition from mature trees not being conducive to the establishment of the next generation. Structural defects left by previous well-meaning but incorrect management practices such as lopping or cavity filling, a changing climate and previous poor species choice all contribute to landscapes that are complex and difficult to maintain. Once these factors are taken into consideration the only suitable sites left for tree planting are generally open lawn areas, which cannot be planted without seriously damaging the aesthetic value of the landscape by enclosing critical views and removing socially important lawn areas.

This is not to say that new tree planting cannot take place. It can, and it should. But it means that great care is required, and options are generally limited. The approach of not immediately replacing failed trees at Carlton Gardens over the last few years means that an integrated approach can now be implemented with greater chance of successfully establishing the next generation of heritage trees.

3.3 Management of Existing Trees and Replanting Approach

Discussion

All actions and recommendations in this document are focused on *reconstruction*. This approach honours the design as it relates to the period of significance (1879-1901) and reinterprets the original planting style within the limits of what is currently practical from both a maintenance and environmental perspective. It is a forensic and strategic response. Historic records have been analysed from a design and historic perspective to attempt to determine what Reed and Barnes, and Sangster, were trying to achieve.

Recommendations made below are based on the assessment of significance for each tree or group.

Policy Recommendations

Outstanding Significance

Trees which have been assigned a rank of Outstanding are of singular significance to the design of the site, and are significant as individual specimens and groups in their own right. All trees ranked as Outstanding have specific recommendations made in this report (see spreadsheet).

General recommendations for all specimens of Outstanding significance are as follows:

- Trees of Outstanding rank should be actively managed in order to prolong their lives. This may include carrying out extraordinary works such as public exclusion where appropriate (those avenues ranked as Outstanding being an exception to this).
- Outstanding trees must be retained and actively protected during any development works, including new garden bed establishment (as per AS 4970-2009)
- Where succession planting is able to be undertaken without impacting the heritage values of the site, this should occur and as soon as is practical.
- If succession planting cannot take place without impacting the values of the place (e.g. for the avenues) then planning for replacement should start approximately 15-20 years in advance of the trees' predicted end of life. This is especially relevant for the growing of replacement specimens offsite in order for them to be as advanced and mature as possible when the planting finally occurs.
- Outstanding trees with a life expectancy <20 years should be identified and replacement planting commenced (see 3.4). Specimen and Avenue tree replacements should ideally begin propagation 10-15 years before trees require removal to allow replacement with advanced nursery stock.
- Outstanding trees should be replaced like-for-like wherever climatically and arboriculturally appropriate. The appropriateness of like-for-like replanting has been noted in the spreadsheet for individual trees.
- If practical, replacement trees may be the progeny of the tree on site, however should only be pursued for trees with social significance (see 3.9 for further discussion).
- In instances where this is not possible or practical – eg, the micro and macroclimate of the site have or are projected to change – then the replacement species should reflect the stated significance of the tree, as stated in Part 4 of the WHMP 2023.

Primary Significance

Trees given a ranking of Primary significance play an important role to the overall design and history of the site. General recommendations for all specimens of Primary significance are as follows:

- Trees of Primary rank should be actively managed in order to prolong their lives. This may include carrying out extraordinary works such as public exclusion where appropriate (excluding avenues).
- Primary trees must be retained and actively protected during any developments (as per AS 4970-2009)
- Plans for the eventual replacement of Primary specimen trees with botanical and historic significance should be developed and in place, regardless of their current condition.
- Primary trees with a life expectancy <10 years have specific recommendations made in this report, allowing for the next 10 years of planting.
- Primary trees with a life expectancy <10 years should be identified and planning for replacement planting commenced (see 3.4). Specimen and Avenue tree replacements should ideally begin propagation 5-8 years before trees require removal to allow replacement with advanced nursery stock (noting that some species, especially evergreens, will not be suitable for advanced container production and will need to be planted as younger trees)

- Primary trees should be replaced like-for-like wherever horticulturally and arboriculturally appropriate. The appropriateness of like-for-like replanting has been noted in the spreadsheet for individual trees and avenues.
- In instances where this is not possible or practical – eg, the micro and macroclimate of the site have or are projected to change – then the replacement species should reflect the stated character and significance of the tree, as stated in Part 4 of the WHMP 2023. Guidance for this has been provided in the spreadsheet for individual trees and avenues

Contributory Significance

Trees given a ranking of Contributory significance contribute to the overall fabric of the landscape, without being significant as individual elements in their own right. General recommendations for all specimens of Contributory significance are as follows:

- Contributory trees should be retained were practical in a development, although removal may be permissible if the tree is in poor condition, or if it is required in order to manage the age and species distribution of the tree canopy as a whole.
- Like-for-like replacement is not required for Contributory trees. Specimen trees which are Contributory are not of individual importance; only their role in the wider fabric of the landscape and their contribution to the general canopy is of relevance.
- Replacement species should provide a contribution to the overall canopy which is equal to or greater than the individual it is replacing.
- Replacement stock should be propagated at least 2 years prior to replanting.

Figure 15: One of the many magnificent Ficus macrocarpa in *Carlton Gardens*

Not Significant

Trees assessed as "Not Significant" make no particular contribution to the heritage value of the Carlton Gardens and may be retained or removed as desired. However, the long-term retention of mature trees is

generally desirable, and consideration should be given to potential succession plantings, and the overall impact to the canopy. Trees currently assessed as "not significant" may become significant with time and sufficient growth.

A very small number of trees marked as "Not Significant" have a negative impact on the heritage values of the place, especially the aesthetic value. These trees are later additions and poorly placed or out of scale with the site. Given the limited opportunities for replanting specimen trees, the proactive removal of these specimens would be appropriate as it would create opportunities for planting new, more appropriate specimens. However, other factors beyond heritage may also need to be considered. These trees have been identified in the Appendix 2 spreadsheet.

3.4 Forward Planning

Discussion

Trees are currently assessed on an ad hoc basis with ULE's identified for a period of up to 10 years (ie all trees with a ULE above 10 are given the same rating). This information, while suitable for general landscape management, is insufficient for a garden with the heritage significance and management complexity of Carlton Gardens. To allow for sufficient forward planning all trees with an anticipated life expectancy of less than 20 years need to be identified. It is acknowledged that assessments over this time frame include an element of educated guesswork, but this period is necessary for forward planning for replacement, including planting of specimen trees and contract growing avenues. If trees exceed their anticipated life expectancy they may still be retained for a longer period of time. It is also important that assessments include a regular action list as pre-emptive arboriculture works will increase the life span and reduce the risk of trees on site.

Policy Recommendations

- The frequency and detail of tree assessments should be reviewed. Trees of Primary or Outstanding significance should, at a minimum, be assessed yearly with works scheduled and carried out within the recommended time frames
- All trees should be assessed for ULE / life expectancy with a timeframe of 20 years used. This level of detailed assessment should be repeated at least every 5 years to manage forward planning and propagation for tree replacement. ULE should be replaced by improved or more accurate methods for estimating tree vitality as they become available.
- Commence active replacement planning for all Primary and Outstanding trees with a life expectancy less than 20 years (see 3.5 and 3.6) and all other trees with a life expectancy less than 10 years (as already detailed in this document).

Actions

Action 1: Assess all trees of Primary and Outstanding significance within Carlton Gardens to identify all trees with a life expectancy of under 20 years and commence active replacement planning for these trees

3.5 Avenue Replacement

Discussion

Avenues and rows are particularly complex to manage in terms of succession planning. While made up of individual trees, Avenues biologically and aesthetically act as single entities – with the loss of one tree impacting on those around it. Over the last twenty years numerous options have been explored for managing the replacement of heritage avenues, with few being successful. The tight spacing of Australia's

heritage avenues make infill planting unviable – with young trees planted into gaps failing to perform due to the competition for light, water and nutrients from the surrounding mature specimens. Even if these trees do manage to survive they are usually stunted – and a piecemeal approach to planting will inevitably result in the loss of the most significant aesthetic characteristic an avenue poses – the uniform, soaring canopy of a double row of single age trees of the same species.

Arboriculturally, the best option for avenue replacement is forward planning for "block replacement" where trees are all removed at the same time in a logical segment, or their entire length, once a critical percentage reach end of life. Before this takes place a planned replacement taxa is selected and advanced stock grown off site. Replacement trees should be the same taxa when arboriculturally and climatically suitable, or one that meets the same heritage criteria when the original is no longer appropriate. New trees are then planted at the same spacing as the original avenue, but offset at least 2m to avoid areas of nitrogen drawdown around the original root mass.

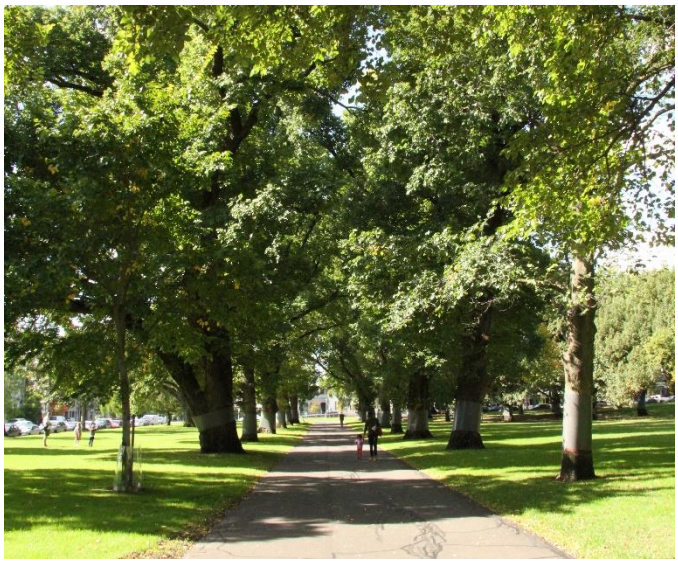

Figure 16: A young tree within Avenue 8. Such planting, while well intentioned, often fails to thrive in the competition of surrounding trees

The block replacement approach provides the best option for successful establishment of a new avenue, however it comes with two draw backs. Firstly, it may require that some remnants of the original avenue be removed while still in reasonably good condition. This is an acceptable practice for managing heritage landscapes, but can be an understandably difficult decision for managers to make. Secondly, it can require managing public expectations. The loss of any tree, no matter how old, or in how poor condition, can be upsetting to people and a proactive, data driven information campaign is required to manage public expectations. This may also include a discussion around the need to stagger planting, and the potential for even greater impact if replacement is delayed and multiple avenues require removal at the same time.

The good news however is that adjustment to tree loss within a landscape is relatively quick. Examples such as the replacement of the *Hesperocyparis macrocarpa* 'Aurea' row around the Alexander Parade boundary of Melbourne Cemetery, and *Grevillea robusta* avenue at the northern end of Fitzroy Gardens demonstrate successful examples of the replacement of heritage avenues and rows.

In Carlton Gardens only two avenues need replacement in the short term, the Poplars in North and South Gardens. Forward planning for other significant avenues should still take place, but the need for removal and replacement is not expected within the foreseeable future.

Policy Recommendations

- Avenue trees should have regular arboriculture inspections and any necessary structural or health works undertaken in order to extend the life expectancy of individual trees for as long as possible. Block replacement of avenue sections is recommended, but to maintain the character of the landscape, not all avenues should be replaced at once, regardless of their shared age. Regular

maintenance to extend the life of old trees will help reduce the impact of replacement work on the landscape whilst also maintaining the existing quality of those avenues in waiting.

- Infill planting any of the removed specimens is not recommended. It disrupts the uniformity of the avenue, and is typically unsuccessful as the competition from the surrounding trees inhibits the establishment of replacement trees.
- A small number of informal, widely spaced avenues in Carlton Gardens may be managed through infill planting (see recommendations for individual avenues).
- Avenues to be managed through block removal and replacement once a critical loss level is reached. A block would be an entire segment from one path intersection to another, but should consider the balance of the Avenue of a whole, and whether entire removal and replacement is warranted on aesthetic grounds. This means all the trees in the group are removed and replaced at the same time.
- The decision for block replacement should be triggered by either 40% of the original avenue trees having been removed (or requiring removal), or a 25% reduction in avenue canopy within 10 years. The City of Melbourne Urban Forest Team would then have 12 months to decide on whether to replace the avenue or persevere with retention.
- If the decision is made to retain the avenue, this should be reviewed after the loss of each additional tree or every 4 years thereafter, with the following being considered in decision making:
    - Avenues need to look like avenues; once loss detracts from this, the time for replacement has come (Exception for specified informal avenues and rows)
    - Maintaining the long-term canopy cover of the site requires that block replacements be staggered
- A public information campaign is to be developed prior to removal to educate the public about the need for replacement and how this is being managed
- Avenues are to be regularly assessed so that forward planning can commence early enough to allow advanced replacement stock to be procured. Nursery stock for Outstanding Avenues should ideally be 10-15 years old at the time of planting. Nursery stock for Primary Avenues should ideally be 5-8 years old. However, some species, especially evergreens, are not suitable for advanced container growth and in such cases younger trees should be used. The aim should be to establish trees with some immediate presence in the landscape while ensuring good health and vigour. (See also recommendations for individual avenues)

Actions

None specifically. Manage as per recommendations and the Implementation Plan in Section 5.1

3.6 Specimen Trees and Informal Groupings

Discussion

Succession planting for specimen trees poses a different, but equally challenging, problem to avenues. Specimen trees are often not important as individuals, but rather due to their contribution to the character of the landscape and how they frame views and lawn areas. While the colour, form and scale of a tree is important – what is more important is the balance and relationship between different trees and, most critically, where open areas are left unplanted.

There is usually some flexibility in species selection and individual tree locations for specimen tree plantings provided the overall canopy character and visual variety is maintained. Where care is required is in not clogging up open lawn areas and important vistas with inappropriate tree planting, as one of the easiest ways to damage a historic landscape is through planting trees in the wrong place. The catch from an

arboriculture viewpoint is that the areas most suitable for tree establishment (open lawn areas) are the very places where trees should not be planted.

This conundrum means that often some compromise is needed in the management of heritage landscapes, where a greater percentage of mature and over-mature trees is tolerated than urban forest best practice management would suggest. The historical importance of heritage landscapes means the greater level of maintenance and management intervention is warranted, and it is appropriate to actively manage trees to prolong their useful life.

Selecting suitable species for future planting is more straight forward. The majority of the historic species still present in Carlton Gardens are suitable from a climate and arboriculture perspective, partially because most inappropriate species failed years ago. The exception is poplars and *Quercus robur*, which have repeatedly failed to thrive on the site. Species which are susceptible to structural defects, pests and diseases should avoided, and in the interests of the long-term management of the site all trees should be appropriate for Melbourne's predicted future climate .

The overall canopy character of both Carlton Gardens North and South is similar. Structural tree planting comes from avenue plantings lining paths, with occasional specimen trees dotted in intervening lawn areas. Slightly more diversity can be found around the two lakes in Carlton Gardens South, and denser planting around the boundaries on all sides. Bosquets are limited to lawn areas LP6 and LP10 in Carlton Gardens South.

Policy Recommendations

- Undertake new specimen tree planting in line with drawings 9 and 10. Locations for specimen trees have some flexibility and should be determined on site by the City of Melbourne's Urban Forest team. The precise species for each location is to be determined by managers, with a list of suitable species being provided on page 39.
- Consideration should be given to the character and balance of the tree canopy as a whole. The canopy needs to maintain a mix of evergreen and deciduous species, conifers and broad leaf trees.
- Tree selections should be historically appropriate (ideally species that were in cultivation in Australia in the 1880s) and be climate and arboriculturally suitable. All trees listed on page 39 meet these criteria
- Locations need to have sufficient light and space to allow a good specimen tree to establish (not over crowded by existing trees)
- Locations need to support the existing landscape character. This means not crowding out open lawn areas or blocking critical views. Most specimen tree planting will be focused on garden edges, where screening from the surrounding streets is part of the historic character
- Trees need to be of an appropriate scale. The majority of the trees historically used in Carlton Gardens are large to very large specimens (heights over 20m and width of 15m). The exception is palms and Cordylines which provide important foliage contrast. Scale is of particular importance around the Royal Exhibition Building, where monumental species should continue to be used
- Eucalypts were an important part of early planting schemes. While restraint is required, the continued use of some Eucalypts in new plantings is important, and supports the desire of Traditional Owners to see more indigenous plants utilised, as noted in Part 2 of the WHMP 2023
- *Cordyline australis* and *Araucaria heterophylla* were also extensively used by Sangster and are now uncommon on site. Both species should be more widely used. The combination of *Ficus macrophylla* and *Schinus molle* as a planted couplet should also continue to be used

- Generally speaking the planting scheme at Carlton Gardens did not replicate species used in avenues within the specimen tree plantings. Avenues tended to focus on deciduous trees such as elms, planes, poplars and oaks while specimen trees focused more on large conifers and native species. For future planting, species used for avenues should be used with restraint within specimen tree plantings
- Lawn planting areas in Carlton Gardens North should remain free of specimen trees other than isolated single specimens. The exception is area LP15 around the playground (see 3.12.6) which has a history of change and may be more heavily planted
- Lawn planting areas in Carlton Gardens South should be loosely planted in line with Drawing 9
- Boundaries to all sides of Carlton Gardens should be more heavily planted with a mix of evergreen and deciduous screening trees. Trees should be mixed and not in rows or clumps of the same species
- Where possible, future replacement specimens for Outstanding trees should be propagated 10-15 years prior to the anticipated removal of the heritage tree and Primary Trees propagated 5-8 prior (see 3.3)

Actions

None specifically. Manage as per recommendations and the Implementation Plan in Section 5.1

3.7 Sourcing, Planting and Aftercare

Discussion

For trees to have the best chance at successful establishment they need to be of good quality stock, healthy, well structured and not soft or forced. Correct planting procedure and after planting care is critical to establishing healthy trees and minimising maintenance requirements into the future. Ideally, planning for tree replacement needs to commence at least two years before trees are propagated to allow good quality stock of the correct taxa to be sourced. It is always better to delay planting to get the right tree than to make inappropriate substitutes in the interests of getting anything in the ground.[19]

Policy Recommendations

Avenues (Sourcing)

- For avenues of Primary or Outstanding significance, sourcing of replacement stock for block avenues should commence 10-15 years before replanting is likely to take place, to allow sufficient time to procure and contract grow super advanced stock
- For avenues of Contributory significance, sourcing of replacement stock for block avenues should commence 5 years before replanting is likely to take place, to allow sufficient time to procure and contract grow super advanced stock
- Sourcing should commence immediately for avenues requiring replacement in the short term (Poplars in Avenue 9 and southern half of Avenue 6)
- Stock is to meet Australian Standard *AS2303 – Tree Stock for Landscape Use*
- Biennial inspections of contract grown material should be conducted by a qualified and experienced arborist to monitor stock condition and ensure correct form
- It is recommended that 20% more trees are purchased than what will be needed to allow for rejections of damaged, diseased or malformed trees
- An additional 10% of stock should be held in the nursery for 3 years following planting, to allow the replacement of damaged or failing trees and uphold the uniform look of the avenue

General and Specimen Trees (Sourcing)

- Sourcing should commence two years prior to planting to allow contract growing and speciality propagation where appropriate. Where the right tree can be sourced from within the nursery industry it may be, but choice must not be limited by what is commercially available
- Stock is to meet Australian Standard *AS2303 – Tree Stock for Landscape Use*
- General and specimen trees should be planted at 1.5 - 1.8m height, depending on the species. This strikes a good balance between providing landscape impact and ensuring good establishment

Possum Protection

- Possum predation can severely impact the growth and vigour of trees, and has the potential to result in tree mortality if left unchecked
- Possum guards need to be installed on all replacement trees, as well as neighbouring trees which may grant possums access via the canopy. Possum guards need to be at least 1500mm tall to prevent access. Freestanding guards on the outside of any stakes may be required around young trees in order to provide sufficient protection

Planting

- Trees are to be located in places suitable for the long-term establishment of a healthy tree. This means not under the canopy of existing specimens, nor directly on top of a recently removed tree
- Formative pruning to take place according to the Australian Standard to develop good structural integrity in all new trees
- Consideration may be given to over planting specimen trees to allow for strategic removals, but only if review and thinning can be scheduled into future maintenance works
- Trees to be planted in accordance with standard City of Melbourne tree planting details and in accordance with current best practice

Actions

None specifically. Manage as per recommendations and the Implementation Plan in Section 5.1

3.8 Species Selection

Discussion

Trees are living things, and will only grow successfully when carefully chosen, planted in the appropriate place and given appropriate care. This has dramatic implications for the management of heritage gardens. Plants that once thrived in a particular area may now struggle due to changes in the micro-climate (e.g. competition from surrounding trees, changed soil hydrology, increased exposure to northerly winds) or macro-climate (change in rain fall patterns, climate change led increases in temperature, extreme weather events). Furthermore, historical horticultural practices including extensive fertiliser and water applications are no-longer considered appropriate or environmentally sound.

With the climate of the world and Melbourne changing from what was considered 'the norm', and this change predicted to continue for the foreseeable future, considering a tree's suitability to that predicted future climate is important for the long-term success of the landscape. Trees are long lived and slow to establish, and therefore feel the effects of climate change more than shorter lived plants which can be easily replaced. Consider the trees already extant within Carlton Gardens; some of these are already around 140 years old. Even if global warming is put aside, these trees have already experienced significant climate change within their lives simply due to the increased urbanization of their surroundings.

Based on the above, current best practice is to select trees tolerant of projected future climate conditions. According to Part 4 of the WHMP 2023, 77% of survey participants agreed or strongly agreed that the management of Carlton Gardens needed to adapt to changing climate conditions.

While it is easy to access scientific estimates for future climatic conditions, until recently it was difficult to get any scientific data on what tree species are known to tolerate these conditions. The City of Melbourne sought to address this with the 2016 release of the City of Melbourne Future Urban Forest document, but this changed further in 2022 with the release of the publicly available CAT (Climate Assessment Tool) hosted on the Botanic Gardens Conservation International (BGCI) website. This provides an easily accessible search of multiple world-wide databases to determine the known climate suitability of thousands of species. The databases include natural occurrences, urban tree inventories, botanic garden living collection records and a model of a typical species to better assess poorly known species.

The CAT provides an assessment of a tree's known suitability for a given climate based on Mean Annual Temperature, also known as MAT. Mean Annual Temperature has been found to be a useful single variable for predicting the global cultivated distribution of a large number of species based on their natural range, and is thought to be a proxy for a range of processes related to climatic tolerances in specific climates (e.g. freezing temperatures, water dynamics) and is a climate variable that is not easily modified by management actions.[20]

The CAT shows which MATs different species are known to occur in for their natural range, in over 300 urban forests and in over 1000 botanic gardens. This gives a better representation of the true climatic suitability of a species than metrics based on natural distributions only, where processes such as competition and species interactions and geographic barriers limit distributions in ways not related to climate. The CAT is not intended to identify specific species that will be unsuited to future climates, but can be used to manage forest-level risks of climate change by drawing on large and diverse datasets.

Melbourne's historic MAT was 15°C, with future climate change predictions being for a MAT of 17°C under Emissions Limited / SSP2 by 2050 and MAT 19°C under a Business as Usual / SSp3 approach by 2090 (including some urban heat). This temperature increase is equivalent to shifting Melbourne more than 1000 km north, and has implications for tree selection. While, as discussed in Section 3.6, many of the taxa still present from the 1880s are well known in areas with Melbourne's potential future climates, but others are not known to occur in projected future climatic conditions and risks of climate unsuitability need to managed for long-lived species such as trees. The high heritage value of the place, and the role trees play in this, means it is important to select species that tolerate conditions now, and as much as we can know, into the future.

0	Not known and not likely
1	Not known but possible
2	Not known but likely
3	Near edge of BG range
4	Near edge of urban range
5	Near edge of natural range
6	Shoulder of BG range
7	Shoulder of urban range
8	Shoulder of natural range
9	Middle of BG range
10	Middle of urban range
11	Middle of natural range

Table 1: Interpreting CAT results

Mean Annual Precipitation, or MAP, is *not* included in the CAT's known climate suitability score as natural range precipitation is a less useful predictor of the global urban distribution of species, and local conditions are often modified through irrigation.[21] Yet in Melbourne, precipitation is another factor commonly considered when selecting species. As Melbourne's climate is predicted to become warmer and drier, preference should be given to those species with demonstrated drought tolerance, as advised in Part 3 of the WHMP 2023. Average MAP figures are available on the CAT, although these may not indicate the true tolerance threshold of a species. Many species in cultivation will establish and grow in climates drier than their

natural distribution would suggest is likely, for example, *Araucaria bidwillii* grows in Melbourne, where the current MAP is half of what it would receive in its natural distribution. Others may cope with a decrease in MAP but only if the relative humidity of the climate is high. It is important to be familiar not only with Melbourne's current and future predicted climates, but with the particulars of any species being considered for use in the landscape.

The two scenarios mentioned – SSP3 and SSP2 – are laid out by the UN's Intergovernmental Panel on Climate Change (IPCC). SSP2 assumes that some reduction to global emissions has been achieved, and based on this predicts the climate of 2050. SSP3 assumes that little has been done to reduce global emissions and based on this predicts the climate of 2090.

There are current arguments for and against the likelihood of each scenario, and at the time of writing, there is no firm recommendation as to which scenario to use for long-term planning.

Another consideration is that suitability to Melbourne's predicted *future* climate does not necessarily mean a species is suited to Melbourne's *current* climate. There are many tropical and subtropical species which could potentially perform wonderfully in Melbourne 70 years from now, but would not survive Melbourne's winters in the present. As the CAT also provides suitability scores for the current climate, an idea of current suitability can also be obtained (see Table 1). To do this, it is important to look at the CAT scores for the lower end of the temperature range under current conditions. Mean temperature of the coldest quarter and warmest month are also provided.

The known climate suitability scoring provided by the CAT is based on Mean Annual Temperature, and does not take into account the water requirements of a species, or the impact of weather extremes such as heat waves, frosts, water logging, compaction etc. It is a metric that can be applied to all 59,000 species of tree in any location in the world, but further research into the individual species being considered at a particular location should always be undertaken in order to include such factors in consideration (e.g. plant traits) and have the best information by which to make an informed decision.

The CAT can be used as a starting point for long-term planning informed by predictive modelling, but is not a full species selection strategy. Rather, it provides another factor to consider in the decision-making process. Informed professional knowledge of species performance, the idiosyncrasies of individual species to a specific site and set of conditions, arboricultural suitability and design requirements still need to be considered, and cannot be replaced by scientific data, as in many cases it simply doesn't exist. Horticulture and landscape management sits at the intersection of the sciences, humanities and trades. The scientific data on tree selection and climate suitability is rapidly expanding, and changing, but trees are complex organisms and there is still much to learn. These scientific tools are valuable additions to the suite of tools we have to manage places, but at this stage must be combined with professional knowledge and informed judgement calls. Additionally, a humanities-based approach of relying on professional opinion and experience is needed when determining design, amenity and heritage suitability.

Other factors that impact the longevity of a tree canopy is species and age distribution. As discussed in section 3.6, diverse age distribution isn't always possible or appropriate in heritage sites, but diverse distribution can be achieved. The diversity of species in Carlton Gardens is considered to add to the significance of the place, especially at a National Level (see 2.3.2). The more diverse the species selection within the gardens, the more resilient it will likely be against pest, disease and climate impacts, as even if one species or genus is affected, others remain.

Policy Recommendations

Where like-for-like planting is not possible or appropriate it is important to select an alternative species that has the same characteristics as the identified heritage values of the tree that is being replaced.[22] Specific

recommendations on how to achieve this have been made for all trees in the accompanying spreadsheet, and have been developed in line with the following:

- **AHC Criterion (a):** '*Historic*' tree is of a taxa that was available at the time and/or reflects the design intent
- **AHC Criterion (b):** '*Botanic / Scientific*' tree is of similar rarity and botanical interest
- **AHC Criterion (d):** '*Principal characteristics*' tree reflects the design intent
- **AHC Criterion (e):** '*Aesthetic*' tree has similar aesthetic characteristics in terms of size, colour, form and seasonality with a focus on those that of the most importance in the context
- **AHC Criterion (f):** '*Creative or technical achievement*' tree reflects the design intent
- **AHC Criterion (g):** '*Social value*' tree has similar social appeal – may be linked to a breeder, group of people or matched to the design intent
- **AHC Criterion (i)** *'Indigenous tradition'* tree should be selected in consultation with, and to the approval of, relevant Traditional Owner groups

Trees should be selected based on the following:

- Select taxa for future plantings from the following lists. Trees have been selected as suitable for use as specimen plantings in Carlton Gardens. All taxa meet minimum criteria in regard to known climate suitability, heritage suitability and management requirements
- Any taxa which commonly exhibit structural defects, have pest or disease problems or have failed to thrive on site should not be used and have been excluded from the recommended lists
- Taxa marked with an * are suggested new species. These have been selected to increase the diversity of the canopy with selection based on their climate tolerance and heritage appropriateness
- Taxa marked with an # should be used in limited numbers. While it is important that any one taxon does not dominate the site, greater care is required with these trees which have a lower alignment with the heritage significance of the site
- For further detail, a full assessment of all taxa currently on site and proposed additions can be found on sheet 3 of the accompanying spreadsheet

List A: Specimen Trees for Carlton Gardens South and Carlton Gardens North

- *Agathis robusta*
- *Albizia julibrissin*
- *Angophora floribunda*
- *Araucaria bidwillii*
- *Araucaria cunninghamii*
- *Araucaria heterophylla*
- *Archontophoenix cunninghamiana*
- *Castanospermum australe#*
- *Corymbia calophylla*
- *Corymbia citriodora*
- *Corymbia maculata*
- *Erythrina crista-galli*
- *Ficus macrophylla*
- *Ficus platypoda*
- *Ficus rubiginosa*
- *Grevillea robusta*
- *Harpephyllum caffrum*
- *Liquidambar formosa*
- *Lophostemon confertus*
- *Magnolia grandiflora*
- *Melaleuca styphelioides*
- *Melia azedarach*
- *Phoenix canariensis*
- *Pinus canariensis*
- *Pinus patula#*
- *Pinus pinea*
- *Quercus canariensis*
- *Quercus canariensis x robur*
- *Quercus castaneifolia*
- *Schinus molle*
- *Stenocarpus sinuatus*
- *Syzygium floribundum*
- *Syzygium paniculatum*
- *Syzygium smithii*
- *Taxodium distichum*
- *Taxodium mucranatum#*
- *Washingtonia filifera*

List B: Specimen Trees for use around Playground in Carlton Gardens North

- *Acer palmatum*
- *Albizia julibrissin**
- *Ceiba insignis*
- *Ceratonia siliqua*
- *Corymbia calophylla*
- *Ficus platypoda*
- *Harpephyllum caffrum*
- *Jacaranda mimosifolia*
- *Lagerstroemia indica*
- *Liquidambar formosana*
- *Magnolia grandiflora*
- *Quercus acutissima*
- *Syzygium luehmannii*
- *Taxodium mucronatum*

List C: Elms suitable for use in Carlton Gardens avenues

- *Ulmus minor*[vii]
- *Ulmus procera*
- *Ulmus x hollandica*

Actions

None specifically. Manage as per recommendations and the Implementation Plan in Section 5.1

3.9 Propagation

In the past, best heritage practice was to propagate replacement trees from those already on site – occasionally by seed but more commonly by vegetative means such as cuttings. This meant that future trees

[vii] Note, Ulmus is in the process of taxonomic revision. For clarity, the names used in this report reflect those currently used in Victoria's nursery and landscape industry, rather than the current taxonomy which is not yet widely understood.

were descended from those already on site, the thinking being that this strengthened their heritage values. This is now known to be problematic.

For a number of years attempts to propagate heritage trees was known to frequently fail. Seeds would fail to germinate and cuttings would not strike. The reason for this is now better understood, and there is evidence suggesting that the age of the parent material is passed on to progeny propagated by cuttings, meaning that not only are cuttings less likely to strike successfully, but the progeny themselves are lacking in vigour and health.[23] As Carlton Gardens is known for its large and statuesque trees, replacement stock must not only be in good condition, but of good health.

It is thus recommended that replacement stock not be propagated from the trees currently existing in Carlton Gardens, but from high quality germplasm from the nursery industry.

The exception to this may be the *Ficus macrophylla* listed as having Aboriginal cultural significance. Consultation with the Traditional Custodians surrounding the management of these trees should occur. It should be noted that even if the desire to propagate from the original trees is there, it may not be possible. There are no other trees of social significance identified within Carlton Gardens where use of progeny would be desirable.

Policy Recommendations

- Do not propagate from trees on site unless good quality progeny can be assured. Consult with reputable nursery people as to the best approach
- Where desired, continue to work with Traditional Owner groups to propagate the heritage *Ficus macrophylla* . Be guided by the wishes of Traditional Custodian groups in the management of these trees

Actions

Action 2: Continue to work with Traditional Owner groups in the management of the two heritage *Ficus macrophylla*

3.10 Elms

Discussion

The spread of Dutch Elm Disease and the Elm Bark Beetle has devastated the elm populations of Europe and North America, with some reports estimating as much as 97% of the total elm population lost in affected areas.[24] As a result, the mature elms of Melbourne are now a rarity on a global scale.

Elms were suited to Melbourne's climate when they were planted in the late 1800s. Now, with a Mean Annual Temperature of 15° Celsius serving as an accepted measurement for climate suitability, Melbourne's climate is at the edge of the elms' known tolerance ranges, and it is predicted that this shift toward a warmer and drier climate will only continue.

Typically, it would not be recommended to continue planting taxa likely to struggle in the future climate if there are better suited taxa available, however, given Australia's status as an island currently free of Dutch Elm Disease, there are conservation values to be considered. Further more, the lack of specimens in the northern hemisphere means that predictions on the likely climate suitability of elms is hampered by lack of data, and based more strongly on anecdotal local evidence.

Policy Recommendations

It is, at this point, recommended to continue planting elms at Carlton Gardens, with the following considerations:

- Persevere with the elm avenues, however, do not reuse European elms for specimen plantings. Those isolated in an open lawn are more likely to struggle through the summer months, and the extra resources which elms require are best focused on the avenues
- Manage elms through additional summer irrigation, or soil water banking in winter, particularly while the trees are establishing
- Assess and reevaluate the condition of the elms with updated climate projections every 10 years
- Select specimens shown to have greater heat and drought tolerance where possible. For example, *Ulmus procera* and *Ulmus minor* are anecdotally more heat tolerant
- Develop a long term plan to manage the risk to the elm population in Melbourne and Carlton Gardens
- Reconsider the continued use of Elms if Dutch Elm Disease becomes established in Australia

Actions

None specifically. Manage as per recommendations and the Implementation Plan in Section 5.1

3.11 Ficus – Aboriginal Heritage

Two large Ficus macrophylla (1036852 and 1036933) are of particular significance within Carlton Gardens. These trees are of importance to Aboriginal people from across Victoria, with many public parks and reserves around Fitzroy and Carlton probably serving as meeting places, in particular the corner of Gertrude and Nicholson Streets under the shade of these trees.[25] As stated in Part 2 of the WHMP: Traditional Owner and First Peoples' Cultural Values Report, "*During the period that the Victorian Parliament sat at the Exhibition Building, from 1901 to 1927, State legislation was passed that directly affected Victorian Aboriginal people. One such decision was the closure of the Coranderrk Aboriginal Reserve (and some of the missions), which caused further displacement and unsettlement of people and ultimately brought many Aboriginal people to the Fitzroy area…. During the early twentieth century, Aboriginal people began returning to the Fitzroy area after the closure of Aboriginal missions and reserves, and with the onset of the Depression. Fitzroy became a hub for the Aboriginal community from the 1920s, with grassroots organisations appearing in the area in the 1950s.*"

The Carlton Gardens Master Plan states that "*The Moreton Bay Fig trees, which are of historic importance to the Aboriginal community, if lost, would be irreplaceable*."[26] Clearly this is problematic, as all trees have a finite life, but this makes clear that as much as possible needs to be done to protect these trees and plan for their future. The framework for this can be found in the Reconciliation Action Plan, and should be consulted as per Part 1 of the WHMP 2023.

Policy Recommendations

At the time of writing, plans are already in development for necessary works to be undertaken to improve the growing conditions and thus health of the *Ficus macrophylla* listed as being of Aboriginal cultural significance, particularly the northern most of the two. It is recommended that this work includes:

- Alleviating compaction around the root zones through appropriate relandscaping works. All works should be informed and directed by an arborist experienced in construction management and compaction reduction
- Reducing or excluding foot traffic to minimise future compaction. This does not need to exclude access, and could be in the form of a raised permeable surface such as a deck

- Removing or reducing the impermeable surface from around the trees
- Implementing a Fig Psyllid control program
- Installing irrigation

Actions

Action 3: Relandscape around the *Ficus macrophylla* of significance to the Traditional Owners to improve their health and growing conditions

Action 4: Regularly assess the trees and schedule and implement recommended maintenance works, including pre-emptive pest control and irrigation

3.12 Ten Year Tree Planting Priorities

The following outlines the 10 year planting priorities for Carlton Gardens. These have been identified through recommendations from the Master Plan, discussions with the City of Melbourne's Urban Forest and Open Space Planning Teams and assessment of trees on site.

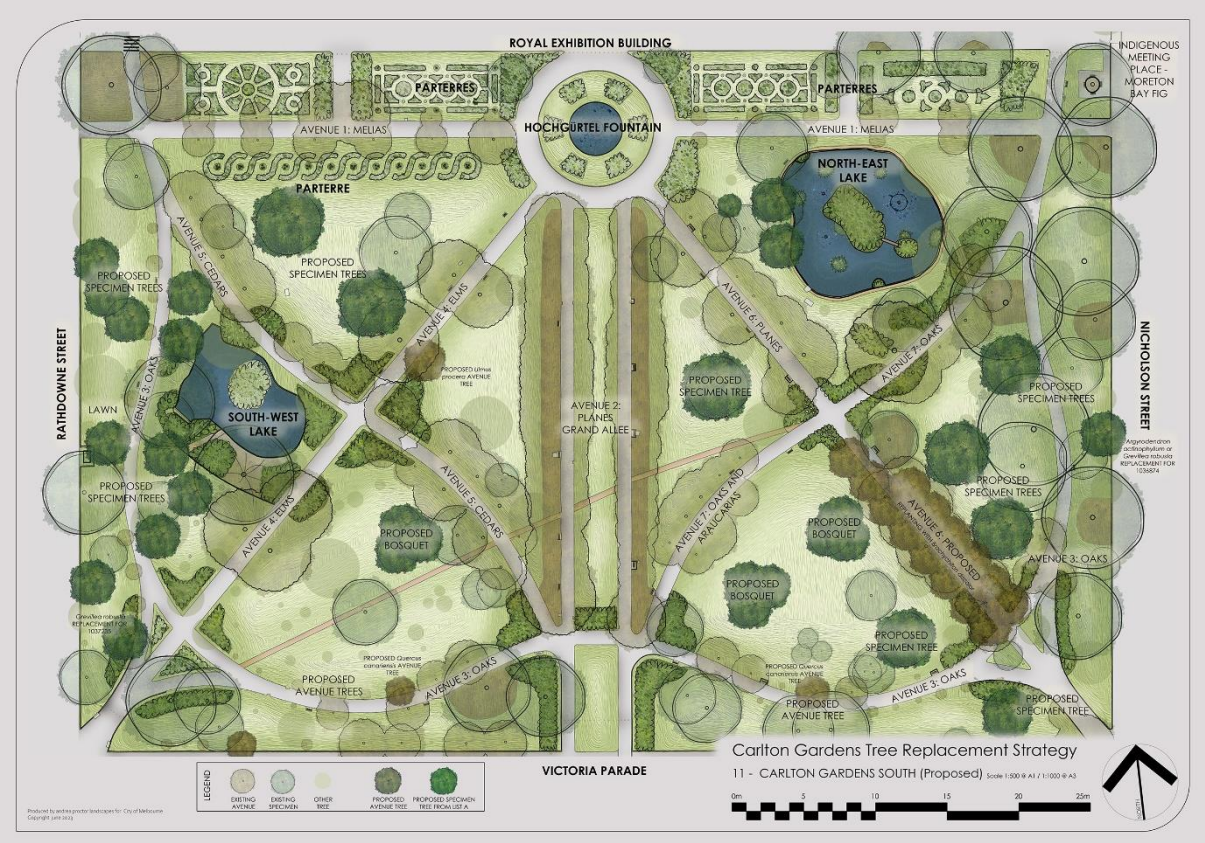

Figure 17: Tree Planting Plan, Carlton Gardens South

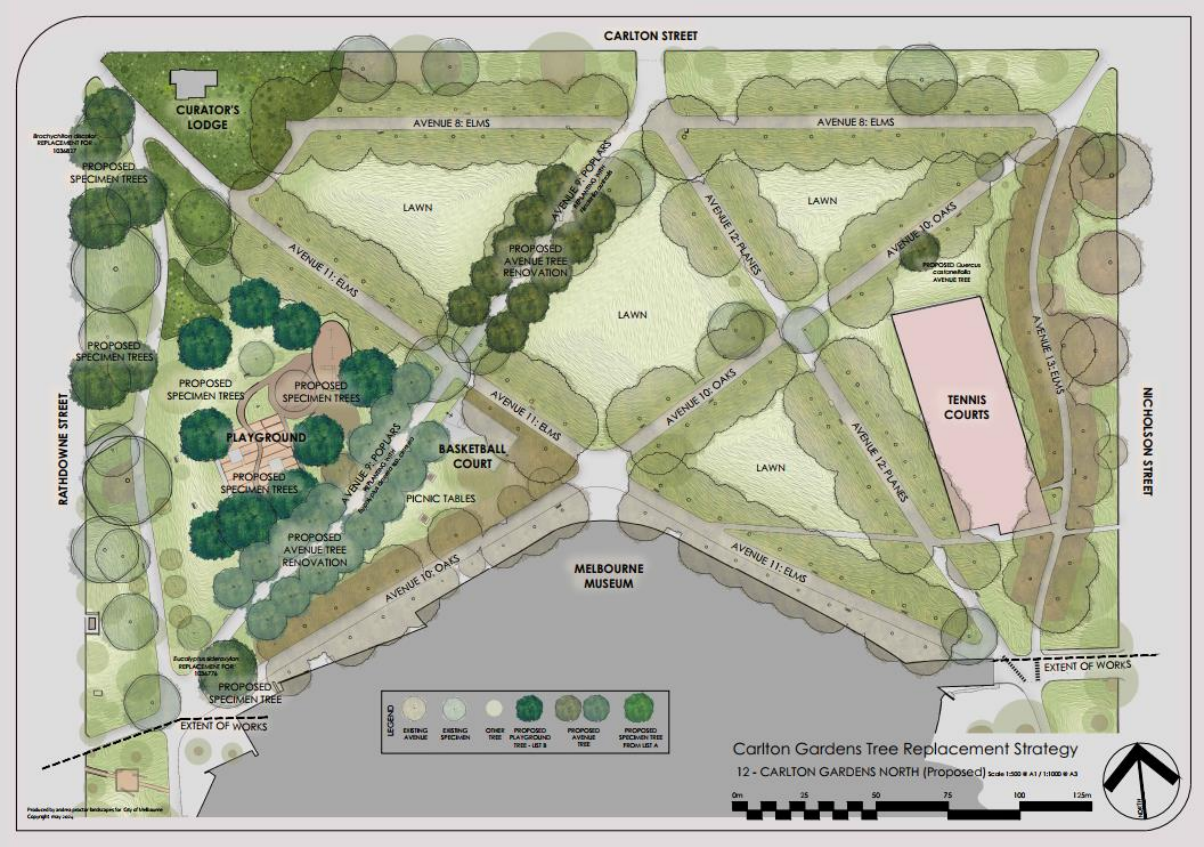

Figure 18: Tree Planting Plan, Carlton Gardens North

3.12.1 Poplar Avenue 6 Carlton Gardens South

Discussion

The southern section of Avenue 6 consists of an avenue *Populus alba.* They are thought to date from the late 19th or early twentieth century due to their size in an aerial photograph from the 1930s (Figure 61) which is the first clear photograph of the Avenue. There is no indication of the trees in images from 1879 (Figure 44) or 1888 (Figure 53 and Figure 52).

The Poplars have required considerable arboriculture management to mitigate the risk of failure and consequent risk to the public, with many having developed cavities and significant rot. It is not recommended that these trees be replaced 'like for like' due to the management issues with this species and the poor climate suitability of *Populus alba* to Melbourne's predicted future climate[27] The change away from *Populus alba* is also recommended in Part 4 of the WHMP 2023. Repeated attempts to replant the same species in Carlton Gardens North have failed. With these now being at the end of their lives it is time to consider alternative species. Although likely planted in the 1890s/1900s, no avenue is marked on any of the designs, nor specific species specified.

Figure 19: End of life Populus alba *in Avenue 6*

In considering options for alternative species, what is considered important is that the trees are markedly different and smaller than the Grand Alleé and that they contribute to the diversity of foliage and form in Carlton Gardens noted in Part 3, Appendix 1 of the WHMP 2023. The recommended replacement species chosen for the Avenue is *Brachychiton discolor* (Queensland Lace-bark Tree) for the following reasons:

- The species is known to be contemporary to the period of significance for Carlton Gardens. Flowers, leaves and pods were harvested in 1892 from a mature specimen of *Sterculia lurida* (synonym) at the Geelong Botanic Gardens by John Raddenberry (Curator 1872-1896) and sent to RBGV Melbourne for Baron von Mueller to identify. Mueller identified the species as *Brachychiton bidwillii*, which was later corrected by AW Jessep (RBGV Director 1941-1957) to *S. lurida*. Although the tree is recorded as planted in 1880, this is considered to be incorrect as correspondence to Raddenberry concerning the tree indicates that it had been planted earlier[28]
- The species performed well in the selection rubric.
- The Climate Assessment Tool (CAT) demonstrates that the species has good plasticity regarding climate suitability. It is known to grow in climates which are cooler than Melbourne's current Mean Annual Temperature, indicating the species will tolerate a Melbourne winter. Similarly, it's preferred climate – that of its natural habitat – is the equivalent of the Mean Annual Temperature predicted for Melbourne in 2090. This species is eminently suited to Melbourne's projected future climate
- This species has been selected for its aesthetic qualities. This species is statuesque in form and similar in habit to the current poplars, being appropriate for an avenue planting, but not of a size that will compete with or detract from the Grand Alleé. The silver underside of the leaves is likewise

reminiscent of the poplar, and this maintains a diversity of foliage, as well as trees, which adheres to the National heritage criteria[29]

Policy Recommendations

Remove and replace failing *Populus alba* trees in Avenue 6 with *Brachychiton discolor* in line with Drawing 9 in line with the following:

- Existing poplars are to be thoroughly removed, including stump grinding prior to any new planting. The use of translocation herbicide prior to removal is recommended to prevent sucker growth. All trees in the avenue are to be removed to allow successful establishment of the new avenue
- Avenue trees to be planted at the same time, and be of the same age, in order to maintain uniformity
- Replacement specimens to be contract grown according to Australian Standard AS2303 – *Tree Stock for Landscape Use,* starting as soon as practical so that the stock is as advanced as possible before going into the ground
- Trees should be planted in opposite pairs, spaced at 9.5m across the path and approximately 11m apart
- Trees are not to be planted in the same location as the existing poplars in order to avoid nitrogen drawdown; shift planting 2m to the south
- Avenue to be managed in accordance with general policy recommendations made in this document, including Section 3.5
- Poplars are at end of life and to be replaced within the next 24 to 36 months, allowing for sufficient time to source replacement trees

Actions

Action 5: Remove and replace failing *Populus alba* trees in Avenue 6 with *Brachychiton discolor*

Figure 20: Brachychiton discolor
Source: Left, Centennial Parklands, Robert Whyte via Save our Waterways

3.12.2 Oaks Avenue 3 in Carlton Garden South

Discussion

Avenue 3, which winds along the edge of Carlton Gardens South, has long been considered an avenue of oaks. Pictorial evidence is sparse for such a supposedly long-established avenue. The poplars of Avenue 6 and the planes of the Grand Alleé are readily identifiable in aerial photographs from 1949 (Figure 63) and 1962 (Figure 65 and Figure 67), due to their identical foliage and regular spacing. The same cannot be said for the oaks of Avenue 3. Some avenue and row trees can be distinguished in Figure 63 along the Victoria Parade frontage, but none to speak of along the eastern and western boundaries, especially in 1949. An avenue planting for the entirety of Avenue 3 is marked on 1879 plan for the 1888 exhibition by Reeds and Barnes, however, given other elements of this plan were not implemented, this cannot be assumed to have been actioned. Figure 45 from 1879 shows the clearest indication of an Avenue, with a very tight spacing of small trees of an indistinguishable species. The same trees are visible in Figure 47 and the Victoria Parade trees in Figure 46. The spacing of the trees along Rathdowne Street (western boundary) do not appear to be consistent with the avenue currently on site, being extremely close together. If they are the current Oaks then at some stage every second tree was removed. Further photos from the time of the exhibitions are inconclusive.

An argument can be made for a partial avenue planting of Avenue 3 at an early date given the presence of some 10 *Quercus robur* of a size indicative of being planted in the 1880-1890s. Three of these can be found at the intersection of Avenue 3 and Avenue 6, in the south-eastern corner the gardens. The remainder are scattered along the southern section of Avenue 3, running alongside Victoria Parade. There is no remnant of an oak avenue planting on the western section of Avenue 3, running along Rathdowne Street.

At best, the argument for this avenue historically being *Quercus robur* is nebulous. The avenue appears to have changed in form over time, and while *Quercus robur* is a reasonable conjecture as to species, no firm evidence exists for its past use. From a landscape character perspective, photographic evidence suggests that early avenue plantings were superseded in importance with the need to provide screening from Rathdowne and Nicholson Streets.

Figure 21: A mature Quercus robur *struggling in Carlton Gardens South. This photo was taken in April and the tree was already heavily defoliated*

Some large old *Q. robur* still exist along the eastern arm, and recent replanting of *Q. robur* has occurred along the southern and western sections of Avenue 3, with limited success. Both older and newer specimens of *Q. robur* are performing poorly, indicating that the species is simply not working at this site, and has not for some time. The elder trees are stressed with poor canopy cover, epicormic growth, and suffering from powdery mildew and possum predation. The younger trees are likewise suffering from possum damage and their growth appears to have tapered off after around 8-10 years.

Persisting with the use of *Quercus robur* in Carlton Gardens is not advised. There are a number of other oaks of similar form on site which are performing well and have better long-term climate suitability[viii] – including *Quercus cerris*, *Quercus castanifolia* and *Quercus canariensis* (Algerian Oak), a species that has a similar form and readily hybridises with *Q. robur*. These two species are so similar that it would even be feasible to mix the two in the avenue.

Policy Recommendations

Assess the existing *Quercus robur* in Avenue 3 and replace younger trees which are under-performing with *Quercus canariensis* in line with the following:

- Commission an arboriculture assessment with the aim of identifying underperforming trees less than 15 years old
- Thoroughly remove all underperforming oaks, including stump grinding prior to any new planting
- Replacement specimens to be contract grown according to Australian Standard AS2303 – *Tree Stock for Landscape Use,* starting as soon as practical so that the stock is as advanced as possible before going into the ground
- Trees to be planted in opposite pairs, spaced at 7m across the path and 12.3m apart. Trees vary between opposite and alternating depending on the curve of the path. New planting to match existing
- Replace the trees removed by the audit, and continue infilling along the eastern and southern sections. As this avenue always appears to have been less formal block replacement is not required, as long as replacement trees have sufficient space (away from competition) to establish successfully
- Trees are not to be planted in the same location as the existing oaks in order to avoid nitrogen drawdown; shift planting 2m to the south/east (parallel to the path)
- Avenue to be managed in accordance with general policy recommendations made in this document, including Section 3.5
- Oaks are struggling and should be replaced within the next 24 to 36 months, allowing for sufficient time to source replacement trees

Actions

Action 6: Assess the existing *Quercus robur* in Avenue 3 and replace younger trees which are under-performing with *Quercus canariensis*

3.12.3 Poplar Avenue 9 in Carlton Garden North

Discussion

Avenue 9 in Carlton Gardens North currently consists of a broken avenue of *Populus alba,* planted – or possibly replanted – as part of the reinstatement works undertaken by Bickford after the 1888 exhibition. The section south of the intersection with Avenue 11 is comprised only of recent replantings. Apart from the 5 older trees in the north, the integrity of the avenue is low due to repeated failures and resulting inconsistent spacing, and the lack of performance from recent replantings. The avenue is now so broken that it offers little in the way of an avenue, with the form, colour and texture of individual trees being more prominent than the closed canopy of an avenue.

As with Avenue 6 in the south, it is not recommended that these trees be replaced 'like for like' due to the climate suitability of *Populus alba* to Melbourne's predicted future climate[30] and lack of performance in

[viii] According to the Climate Assessment Tool.

recent past plantings. Although likely planted in 1880-1890s, no specific species is specified in any of the relevant plans.

Figure 22: Remnants of Avenue 9

In considering options for alternative species, Carlton Gardens North is considered to be of lower heritage significance than Carlton Gardens South – with the planting all post-dating the International Exhibitions and the form of the garden having changed over time. Maintaining diversity in the canopy in form, size and texture is important for the long-term character of the site – and having a successful tree that meets these criteria is of more importance than using a species typical of the era. There is capacity to maximise the diversity in the canopy by choosing two different species – one for the south side of the Avenue (nearest the playground) and a second for the northern side. This is considered appropriate given that Avenue 9 is only of contributory significance and there is precedent for changing avenue species at path intersections in Avenues 6 and 7 in Carlton Gardens South.

Figure 23: Flindersia australis *has been chosen as a replacement for the poplars due to its heritage and landscape suitability, similar form, and the diversity in foliage colour and texture it brings to Carlton Gardens north.*
Source left to right: Dayleys Fruit Tree Nursery, Ole Lantan's Seed Store Robert Whyte via Save our Waterways

The recommended replacement species chosen for the northern arm of the Avenue (between Avenues 1 and 8) is *Flindersia australis* (Australian Teak) for the following reasons:

- This species was available at the time of Carlton Gardens early establishment, being in nursery catalogues from 1865[31]
- The species performed well in the selection rubric. While *Brachychiton discolor* performed slightly better, this is being recommended for Carlton Gardens South, and from a landscape management and heritage perspective it is desirable to improve species diversity across the landscape

- The species has an appropriate rounded form and evergreen habitat which contrasts to the other Avenues in Carlton Gardens north. This diversity in foliage and tree species upholds the National heritage criteria[32], and is likewise noted in Part 3, Appendix 1 of WHMP 2023. Flindersia provides good contrast with the existing deciduous avenues.
- Flindersia has a similar rounded form and stature to *P. alba*, and gives thick canopy cover
- The Climate Assessment Tool demonstrates that the climate of this species in its natural distribution is comparable to Melbourne's current climate, which is likewise confirmed by its cultivation in horticulture. Records of the species being grown in cultivation indicate a plasticity of climate suitability which include Melbourne's current and future predicted climates

Figure 24: Eucalyptus cinerea *ssp.* cinerea *has been chosen as a replacement for the poplars due to its aesthetic and landscape suitability, similar form, and the diversity in foliage colour and texture it brings to Carlton Gardens north.*

The recommended replacement species chosen for the southern arm of the Avenue (between Avenues 1 and 10) is *Eucalyptus cinerea* ssp. *cinerea* (Australian Teak) for the following reasons:

- Diversity in foliage and tree species upholds the National heritage criteria[33], and is noted in Part 3, Appendix 1 of WHMP 2023. This taxa provides good contrast with the existing deciduous avenues.
- Eucalypts are part of the history of the site, and the north is home to several grand specimens, which will serve to tie in an avenue of *E. cinerea* to the rest of the site
- The taxa has been selected for its aesthetic qualities. In particular, this subspecies has spectacular juvenile foliage, with large silver leaves that will have a strong visual impact from a young age, especially contrasting against the dark trunk. This emulates the white underside of the *P. alba* leaves. With this silver foliage and rounded form, *E. cinerea* ssp. *cinerea* is of similar form and stature to *P. alba*
- The Climate Assessment Tool demonstrates that the climate of this species in its natural distribution is comparable to Melbourne's current climate, which is likewise confirmed by its cultivation in horticulture and use as a street tree. Records of the species being grown in cultivation indicate a plasticity of climate suitability which include Melbourne's current and future predicted climates

Policy Recommendations

Remove and replace failing *Populus alba* trees in Avenue 9 with *Flindersia australis* (Australian Teak) north of Avenue 11 and *Eucalptus cinerea* ssp. *cinerea* south of Avenue 11 in line with Drawing 10 in line with the following:

- Existing poplars are to be thoroughly removed, including stump grinding prior to any new planting. All trees in the avenue are to be removed to allow successful establishment of the new avenue

- Avenue trees to be planted at the same time, and be of the same age, in order to maintain uniformity. The southern avenue of trees may be planted at a different time to the northern avenue.
- Replacement specimens to be contract grown according to Australian Standard AS2303 – *Tree Stock for Landscape Use,* starting as soon as practical so that the stock is as advanced as possible before going into the ground
- Trees should be planted in opposite pairs, spaced at 8m across the path and approximately 13m apart, adjusting for the curve of the path
- Trees are not to be planted in the same location as the existing poplars in order to avoid nitrogen drawdown; shift planting 2m to the south
- Avenue to be managed in accordance with general policy recommendations made in this document, including Section 3.5
- Poplars are at end of life and to be replaced within the next 24 to 36 months, allowing for sufficient time to source replacement trees

Actions

Action 7: Remove and replace failing *Populus alba* trees in Avenue 9 with *Flindersia australis* to the north of Avenue 11 and *Eucalyptus cinerea* ssp. *cinerea* south of Avenue 11.

3.12.4 Specimen Trees Carlton Gardens South

Discussion

Barring a few select examples, the specimen trees of in Carlton Gardens South are important for their contribution to the character and fabric of the landscape, and not necessarily individually important in their own right. They provide anchors in the open spaces of the lawns, create ceilings and rooms, screen the Gardens from busy surrounding streets, and create focal points. Trees should be selected to provide contrast and juxtaposition of form, colour and texture, and consideration for the look and feel of the space should be given when selecting a taxon for planting.

Lawn areas are split into four character areas, discussed in greater detail in Section 3.1:

- LP 7 and LP8: High degree of botanical diversity and interest
- LP4, 5, 9 and 11: Open lawns with occasional, carefully selected specimen trees
- LP 1, LP2 and LP3: Dense, mixed species boundary planting
- LP 6 and LP10: Open lawns with "bosquets"

Policy Recommendations

Commence planting of the next generation of specimen trees in line with the following:

- Select taxa from
- List ***A*** on page 39
- Tree planting to be generally in line with Drawing 9, adjusted under arborist supervision for site conditions
- See also 3.6 for recommendations concerning specimen tree works
- Specific recommendations are made for replacement specimens for significant trees with a ULE under 10 years

Actions

Action 8: Plant replacement specimen trees in Carlton Gardens South. Planting to be staged based on removal time frames of surrounding trees

3.12.5 Specimen Trees Carlton Gardens North

Discussion

There are very few specimen trees in Carlton Gardens North, with lawn plantings primarily limited to boundary areas. Barring a few select examples, the specimen trees of in Carlton Gardens North are important for their contribution to the character and fabric of the landscape, and not necessarily individually important in their own right. They provide shade and anchors in the open spaces of the lawns and screen the Gardens from busy surrounding streets. Trees should be selected to provide contrast and juxtaposition of form, colour and texture, and consideration for the look and feel of the space should be given when selecting a taxon for planting.

Lawn areas are split into three character areas, discussed in greater detail in Section 3.1:

- LP16, 17, 18, 19, 20 and 21: Open with no to very few specimen trees
- LP12, 13 and 14: Dense, mixed species boundary planting
- LP 15: The playground area, with a mix of young trees of various success

Policy Recommendations

Commence planting of the next generation of specimen trees in line with the following:

- Select taxa from
- List ***A*** on page 39 for boundary plantings
- Do not plant more trees on lawn areas LP17-21
- Tree planting to be generally in line with Drawing 10, adjusted under arborist supervision for site conditions
- See 3.12.6 for specific recommendations regarding the Playground area
- See also 3.6 for recommendations concerning specimen tree works
- Specific recommendations are made for replacement specimens for significant trees with a life expectancy under 10 years

Actions

Action 9: Plant replacement specimen trees in Carlton Gardens North. Planting to be staged based on removal time frames of surrounding trees

3.12.6 Playground Carlton Gardens North

Discussion

As the installation of the playground is already a significant departure from the original character of the site, it is not unreasonable to make use of species which are likewise selected less for their heritage value, and more for their proven durability and suitability in a children-focused environment. Given the rigors of playground usage and the recommendations in Part 4 of the WHMP 2023, taxa should be selected to provide smaller trees with a mixed canopy, and allow for shade in summer and the sun in winter. A variety of colour, form and texture is important to tie in with the wider landscape, and not create an unconscious border around the playground.

Policy Recommendations
Commence planting of the next generation of specimen trees in line with the following:

- Select taxa from List B on page 39 for Playground plantings
- Tree planting to be generally in line with Drawing 10, adjusted under arborist supervision for site conditions
- See also 3.6 for recommendations concerning specimen tree works

Actions
Action 10: Plant new shade trees around the Playground in Carlton Gardens North. Planting can take place immediately

3.13 Remaining Avenues: Long Term Guidance

This section provides long term guidance for other avenues in Carlton Gardens. Replacement of these avenues is not anticipated within the life of this plan (2024-2034), but as discussed above, trees can be subject to sudden change. It is also feasible that some of these avenues may have a life expectancy that drops below 20 years within the time frames of this report, triggering the need to start the procurement process for replacement stock. The guidance provided here has been provided at the request of City of Melbourne to ensure a consistent approach to management of all Carlton Gardens' trees.

3.13.1 Avenue 1 Melias, *Melia azedarach*, Carlton Gardens South

Highest Significance Level: World
Significance: Primary

The Melia Avenue running along the southern side of the Royal Exhibition Building has been in place since the first redesign for the exhibitions. While a couple of the trees are thought to remain from the original planting (1037190, 1037193, 1440714), the majority are replacements. The species *Melia azedarach* is thought to have been selected in order to provide shade to the path, whilst remaining a shorter stature so as not to obscure views of the Royal Exhibition Building.

Recommendations:

- No replacement is recommended within the timeframe of this report
- Continue the practice of retaining all trees that do not pose an undue risk to the public
- If, due to unforeseen circumstances, replacement be required, like-for-like is appropriate in terms of species selection, given the design requirements and the future climate suitability of the *Melia azedarach*
- Infill replanting is permissible for this avenue
- Trees should be planted in opposite pairs, spaced at 8m across the path and approximately 21m apart
- See also 3.5 for recommendations concerning avenue works

Actions
None

3.13.2 Avenue 2 Grand Alleé, *Platanus x acerifolia*, Carlton Gardens South

Highest Significance Level: World
Significance: Outstanding

The Grand Alleé has been in place since the first redesign for the exhibitions and was intended to be an homage to the *Tapis Vert* (green carpet) at Versailles.[34] The double-line of trees with a wide sward running between them frames a critical view line from Victoria Parade to the Hochgürtel Fountain in the South Forecourt Terrace and beyond to the dome of the Royal Exhibition Building. All trees are original to that first planting, excepting one loss at the southern end none have been removed or replaced, and the overall quality of the avenue cannot be overstated. It is unique in Australia.

Recommendations:

- No replacement is recommended within the timeframe of this report
- Should individual trees fail or require removal, do not infill
- Continue the practice of retaining all trees that do not pose an undue risk to the public. Even if trees have significant crown loss (e.g. 1037017) the trunks help maintain the rhythm of the Alleé
- Should replacement be required, like-for-like is appropriate in terms of species selection, however consideration should also be given to using *Platanus orientalis* due to its visual similarity and better climate tolerance. The statuesque character of Planes and their wide canopy means they should be persevered for replacement planting schemes, as long as climate change does not start to significantly impact their performance in the landscape[ix]
- For this particular avenue, it is recommended that the contract growing of super advanced stock commence when the life expectancy of the avenue drops below 20 years. See 3.3 and 3.5 for further detail
- Trees should be planted in opposite pairs, spaced at 27.5m across the path and approximately 8m apart
- See also 3.5 for recommendations concerning avenue works

Actions
None

3.13.3 Avenue 4 Informal Elms, *Ulmus procera*, Carlton Gardens South

Highest Significance Level: National
Significance: Primary

This loose avenue is sparse with many gaps, however it is possible that it was never intended to be a complete avenue. The voids frame the space well, and the wide spacing means it does not compete with the Grand Alleé. At their current age and size, the elms have high aesthetic value.

Recommendations:

- The elms appear to have been planted in pairs, with some individuals now missing. Infill planting is appropriate in this instance due to the wide spacing and uneven character

[ix] Platanus x acerifolia has a ranking of 10 under current conditions (MAT 15) decreasing to 4 at MAT 19 – indicating it could be at the edge of its range under extreme climate change predictions. Oriental Plane (*Platanus orientalis*) has better long term climate appropriateness and could be a suitable replacement.

- Like-for-like replacement is appropriate in this instance, however if more climate-suitable strains of *Ulmus* sp. are available, it is recommended that they be selected and used in this instance. See section 3.10 for further information on the continued use of Elms
- Trees should be planted in opposite pairs, spaced at 11m across the path and at random intervals generally in line with current plantings
- See also 3.5 for recommendations concerning avenue works

Actions
Action 11: Infill plant gap in Avenue 4

3.13.4 Avenue 5, Conifers, Carlton Gardens South

Highest Significance Level: National
Significance: Primary

This is a mixed conifer avenue of *Araucaria cunninghammii* and *Cedrus deodara*. There are 2 semi-mature replacement cedars toward the southern end. The spacing of the avenue lacks consistency, with the northern section having a looser spacing than that in the southern section and the northern trees only existing as a row on the eastern side of the path. Also, unusually in Carlton Gardens, where the tree is an Avenue, it is alternately spaced at its southern end – possibly to accommodate the curved path.[x] This could all be deliberate, however, when combined with the infill planting the avenue lacks the formality and elegance of others on site.

Recommendations:
- No replacement is recommended within the timeframe of this report
- Start planning for block replacement when the life expectancy of the avenue drops below 15 years
- Should individual trees fail, do not infill
- Like-for-like is possible, however, if *Cedrus deodara* shows signs of declining due to the warming and drying climate, replace with *Araucaria cunninghamii*
- Trees should be planted in the same style as currently on site opposite pairs, this is generally around 13m apart, but dropping to 8m when working around pathway intersections. The northern side should be maintained as a row with the southern section an offset avenue. Trees should be 3m from the path edge
- See also 3.5 for recommendations concerning avenue works

Actions
None

3.13.5 Avenue 6 Informal Planes, *Platanus* x *acerifolia*, Carlton Gardens South

Highest Significance Level: National
Significance: Primary

[x] Part 3, Appendix 2 of the WHMP 2023 hypothesises that these trees may be the remnants of shrubbery plantings, but this does not seem likely based on a review of the historic photos and an understanding of historic planting practices

It appears Sangster planted a loose avenue of plane trees around 1883, although avenue planting is not noted on any plan until the 1920s (Figure 42 shows the avenue but appears to have considerable artistic license). These paired planes go right up to the Grand Alleé and confuse the definition of that more formal avenue. Contrasting specimens appear to have been interplanted planted within the avenue at the ends, which turns the loose spacing into a barrier to the lawn and reinforces the informal avenue effect.

Recommendations:

- No replacement is recommended within the timeframe of this report
- While outside the scope of the report, consider using an alternative species when replacement is required so as not to compete with the Grand Alleé. It will be important that this avenue is never larger than the Grand Alleé, and ideally should be replanted at an early date. Consideration may be given to mixed species planting as there is a historical precedent for this
- Should individual trees fail, do not infill
- Trees should be planted in opposite pairs, spaced at 9.5m across the path and approximately 13.5m apart
- See also 3.5 for recommendations concerning avenue works

Actions
None

3.13.6 Avenue 7 Oak and Bunya, Carlton Gardens South

Highest Significance Level: National
Significance: Primary

This is a short avenue of *Araucaria bidwillii, Quercus canariensis*, *Q. castanefolia* and *Q. acutissima* oaks, all of which are in good health and of appropriate size for their age. This mix of deciduous and evergreen is unique in Carlton Gardens.

Recommendations:

- No replacement is recommended within the timeframe of this report
- Like-for-like is appropriate with these species
- Should individual trees fail, do not infill
- Trees should be planted in opposite pairs, spaced at 9.5m across the path and approximately 8.5m apart on the wider side of the curve in the southern section, and 13m apart in the northern section. Keep the northern portion looser and more informal than the southern portion and maintain alternating Oaks and Bunya Pines in the southern section
- See also 3.5 for recommendations concerning avenue works

Actions
None

3.13.7 Avenue 8, Carlton Street Elms, *Umus procera*, Carlton Gardens North

Highest Significance Level: National
Significance: Primary

This avenue runs along the northern border of Carlton Gardens North. It is unique in the North as the only avenue planting which pre-dates the 1890 reconstruction after the Exhibitions and which was not disturbed by the temporary buildings. These trees are among the oldest in the gardens, and apart from a small section in the east which was replanted in the 1940/50s, the avenue is intact and a marvel to stroll along.

Recommendations:

- No replacement is recommended within the timeframe of this report
- Should individual trees fail, do not infill
- Like-for-like replacement is appropriate in this instance, however if more climate-suitable strains of *Ulmus* sp. are available, it is recommended that they be selected and used in this instance. See section 3.10 for further information regarding use of elms
- Trees should be planted in opposite pairs, spaced at 9.3m across the path and approximately 14.8m apart to the east of the Carlton Street entrance and 10.1m apart to the west of the entrance. Note that pairs are slightly offset with the southern tree consistently 1m (3') further west than the northern tree. This should continue with any future planting
- See also 3.5 for recommendations concerning avenue works

Actions
None

3.13.8 Avenue 10 Oaks, *Quercus castaneifolia*, Carlton Gardens North

Highest Significance Level: National
Significance: Primary

This oak avenue was part of the 1890 reconstruction of the north section of Carlton Gardens. The northern section is more intact than the southern section, which contains several replacement specimens which would have been impacted by the construction of Melbourne Museum in the 1990s. The predominant species is, unusually, *Quercus castaneifolia* and it is a very fine avenue of great beauty.

Recommendations:

- No replacement is recommended within the timeframe of this report
- Should individual trees fail, do not infill
- Remove recent infill plantings of *Quercus robur* as they are inconsistent and unsuitable for long term use on this site. Trees may be replaced with *Quercus castaneifolia* if desired
- *Quercus castaneifolia* is recommended as a suitable replacement due to climate tolerance and heritage suitability
- Trees should be planted in opposite pairs, spaced at 10.9m across the path and approximately 12.3m apart
- Consideration needs to be given to supplying sufficient soil volume for any replacement trees, given their proximity to the Museum wallSee also 3.5 for recommendations concerning avenue works.

Actions
Action 12: Remove young *Quercus robur* replacement plantings in Avenue 10 and replace with *Quercus castaneifolia*

3.13.9 Avenue 11 Elms, *Ulmus procera*, Carlton Gardens North

Highest Significance Level: National
Significance: Primary

This elm avenue was part of the 1890 reconstruction of the north section of Carlton Gardens. Apart from one replacement, it is entirely intact and very beautiful.

Recommendations:

- No replacement is recommended within the timeframe of this report
- Should individual trees fail, do not infill
- Like-for-like replacement is appropriate in this instance, however if more climate-suitable strains of *Ulmus* sp. are available, it is recommended that they be selected and used in this instance. See section 3.10 for further information regarding use of elms
- Trees should be planted in opposite pairs, spaced at 10.9m across the path and approximately 12.3m apart
- Consideration needs to be given to supplying sufficient soil volume for any replacement trees, given their proximity to the Museum wallSee also 3.5 for recommendations concerning avenue works.
- See also 3.5 for recommendations concerning avenue works

Actions
None

3.13.10 Avenue 12 Planes, *Platanus* x *acerifolia*, Carlton Gardens North

Highest Significance Level: National
Significance: Primary

This plane avenue was part of the 1890 reconstruction of the north section of Carlton Gardens. Apart from 2 replacements, it is intact and in fine condition. It is a smaller, more tightly spaced, version of the Grand Alleé, tucked away in the north and extremely beautiful.

Recommendations:

- No replacement is recommended within the timeframe of this report
- Should individual trees fail, do not infill
- Retain all trees that do not pose an undue risk to the public. Even if trees have significant crown loss the trunks help maintain the rhythm of this tightly spaced avenue
- Should replacement be required, like-for-like is appropriate in terms of species selection. The statuesque character of the planes and their wide canopy means they should be persevered with for replacement planting schemes, as long as climate change does not start to significantly impact their performance in the landscape[xi]
- For the southern portion of the row (south of the intersection with Avenue 10) trees should be planted in alternating pairs, spaced at 15.5m across the path and approximately 6m apart

[xi] See footnote ix, page 38

- For the northern portion of the row (north of the intersection with Avenue 10) trees should be planted in opposite pairs, spaced at 15.5m across the path and approximately 13m apart
- See also 3.5 for recommendations concerning avenue works

Actions
None

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[3] UNESCO, https://whc.unesco.org/en/list/1131/
[4] Parliament of Victoria, *The federal years 1901-1927* https://new.parliament.vic.gov.au
[5] Tree Logic (April 2021) *Arboricultural Assessment and Report Carlton Gardens Master Plan*
[6] Lovell Chen (2023) *Royal Exhibition Building & Carlton Gardens World Heritage Management Plan*
[7]Lovell Chen (2023) *Royal Exhibition Building & Carlton Gardens World Heritage Management Plan, Part 3 of 5: Appendix 1*, p10
[8] Lovell Chen (2023) *Royal Exhibition Building & Carlton Gardens World Heritage Management Plan, Part 3 of 5: Appendix 1*, p10
[9] City of Melbourne (2023) *Royal Exhibition Building & Carlton Gardens World Heritage Management Plan, Part 4 of 5: Carlton Gardens Master Plan*, p 8
[10] City of Melbourne (2023) *Royal Exhibition Building & Carlton Gardens World Heritage Management Plan, Part 4 of 5: Carlton Gardens Master Plan*, p 8
[11] Lovell Chen (2023) *Royal Exhibition Building & Carlton Gardens World Heritage Management Plan Part 3 of 5: Heritage Management Plan*, p 21
[12] City of Melbourne (2023) *Royal Exhibition Building & Carlton Gardens World Heritage Management Plan, Part 4 of 5: Carlton Gardens Master Plan*
[13] Lovell Chen (2023) *Royal Exhibition Building & Carlton Gardens World Heritage Management Plan Part 3 of 5: Heritage Management Plan*, Appendix 1
[14] Whitehead, G, (1997), *Civilising the city: A history of Melbourne's Public Gardens.* State Library of Victoria, Melbourne
[15] Meredith Gould Architects in association with Contour Design Aust (2006), *Carlton Gardens: Tree Conservation Strategy*, p 74
[16] Meredith Gould Architects in association with Contour Design Aust (2006), *Carlton Gardens: Tree Conservation Strategy*, p 71
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[20] Kendal, D, Dobbs, C, Gallagher, RV, Beaumont, LJ, Baumann, J, Williams, NSG, et al. (2018). *A global comparison of the climatic niches of urban and native tree populations.* Global Ecology and Biogeography 27, 629–637.
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[23] Schmidt, L, (1993), *Vegetative Propagation: Guidelines on grafting, air-layering and cuttings*, Los Banos: FAO
[24] Pinon, J, (2005) *Lutèce®, a resistant variety brings elms back to Paris,* All The News, Institut national de la recherche agronomique (INRA), Nantes, France
[25] GML Heritage (2023) *Royal Exhibition Building & Carlton Gardens World Heritage Management Plan, Part 2 of 5: Traditional Owners and First Peoples' Cultural Values for the Royal Exhibition Building and Carlton Gardens* p 60
[26] City of Melbourne (2023), *Royal Exhibition Building & Carlton Gardens World Heritage Management Plan Part 4 of 5: Carlton Gardens Master Plan*, p 34
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[31] Garden Plan Conservation Association of Australia (2009), *Plants Listed in Nursery Catalogues in Victoria 1855 to 1889* p 73

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[33] Minister for the Environment and Heritage (Federal), 'Inclusion of Places in the National Heritage List - Environmental Protection and Biodiversity Conservation *Act* 1999 (Commonwealth)', *Commonwealth of Australia Gazette*, No. P 7, 20 July 2004

[34] Lovell Chen (2023), *Royal Exhibition Building & Carlton Gardens World Heritage Management Plan, Part 3 of 5: Heritage Management Plan, Appendix A - Citations*, p B1.2

4 Garden Bed Replacement

4.1 History and Contemporary Layout

Over the course of Carlton Gardens' history, the garden beds in Carlton Gardens South have been fluid in form, function and presence, with the present extent of planting being a fraction of what was there in the Gardens' earliest days.

The initial Reed and Barnes design features many garden beds, lining both the paths and boundary fences, framing views and approaches, and as island beds in the lawns. An approximation of what was actually implemented has been drawn up based on research by Meredith Gould, and amended based on a review of photographic evidence completed for this report (Figure 25).

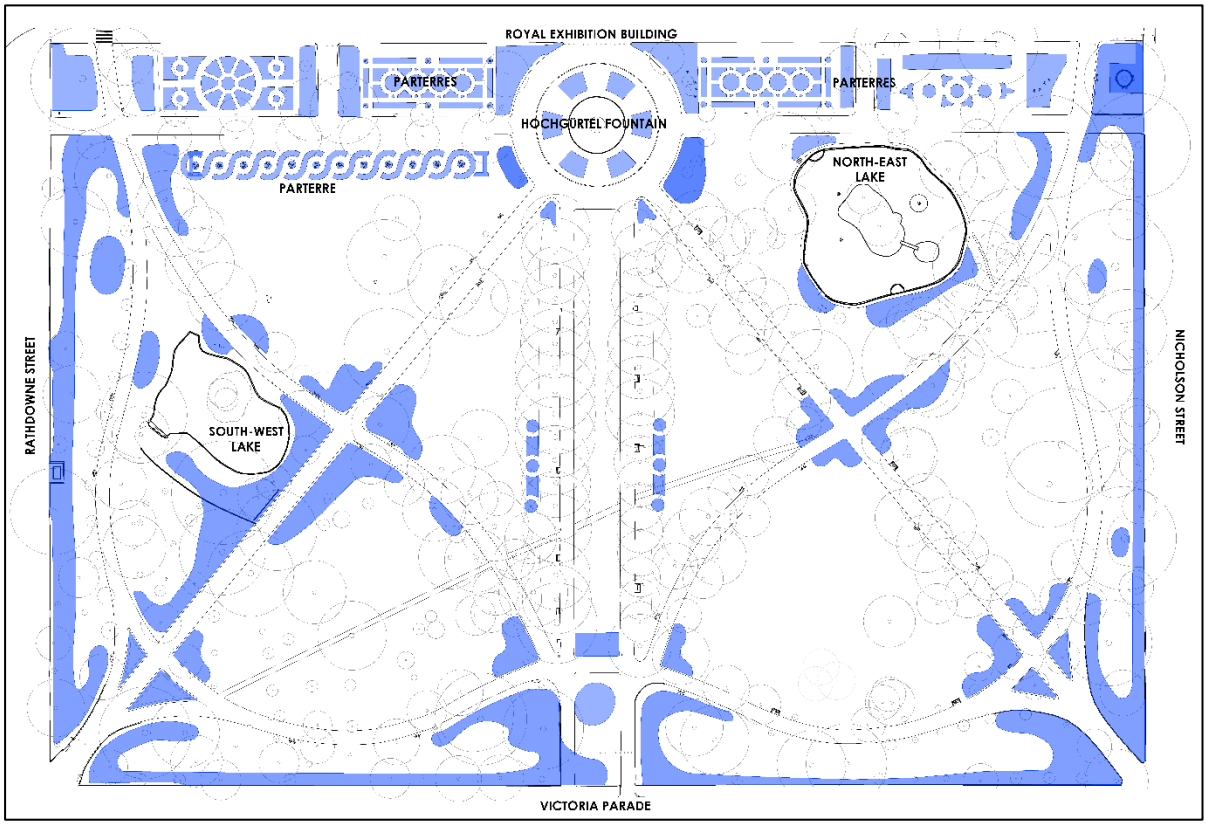

Figure 25: Postulated extent of garden bed and shrub plantings in 1880

In the design for the 1880 exhibition the southern section of Carlton Gardens was to be a pleasure garden featuring both formal and informal beds, shrubberies, and annual bedding displays. The beds were variously fenced and unfenced according to needs at the time, such as to delineate publicly accessible spaces from those only open to exhibition ticket holders.[35]

The beds along the boundary were placed to conceal the perimeter fence, which has since been removed, and thus the need for those beds no longer exists. There was no specific plant palette indicated, and plants identifiable in historic photographs are typical of those plants in cultivation and in fashion at the time – diverse in form and habit and including both natives and exotics. These beds were a mix of tree and shrub planting, a younger version of what surrounds the still fenced Royal Botanic Gardens Melbourne today.

It is widely believed that Sangster did not like the formality of the Reed and Barnes design, and while not deviating from it, usurped it in his own fashion with his plant selection and style[36]. Schooled in the predominant Picturesque / Gardenesque design style of the day, and one of the leading landscapers of the era[37], Sangster found the classical pomp of the Reed and Barnes design too formal[38]. The garden beds were populated in a 'Gardenesque' style, with individual specimens allowed to stand alone and somewhat apart from each other, rather than working together to form a united whole[39]. This was typical of the era and gave the beds an openness and something of a hodge-podge feel, a sort of genteel shabbiness.

Figure 26: Intersection of Avenues 6 and 7 showing tall, mixed and open plantings with picturesque style rockwork visible (1879). Source: State Library Victoria

As discussed by Foster, "*The carpet bedding and ribbon borders, the dazzling primary colours, the geometric forms of municipal gardening, all these were the antithesis of the picturesque. As if to neutralize this gaudy angularity, even in his municipal gardens Sangster fell back on a series of devices from the picturesque repertoire. On either side of the double avenue of planes in the Carlton Gardens, he punctured the formality by introducing irregular ponds, which he planted with yuccas, dragon-trees, palms, pampas grass and bamboos, and fringed in places with garden artichokes so that their leaves would be reflected in the water. But these were mere allusions to the grand tradition, mediated through the more recent passion for ferns or, in the case of the Carlton Gardens, a mid-Victorian addiction to exotic foliage plants to which the London Gardener' s Chronicle accorded the derisive name of phyllomania.*"[40]

In reviewing historic photographs and plans what becomes clear is that garden beds were a mix of ornamentation and practicality, were largely classical in distribution and layout, and Gardenesque in implementation. The strong, classical symmetry of the path system was mirrored in the garden beds layout (Figure 25), while being tweaked to the surrounding conditions in the individual shape of beds. Planted furcations at the southern corner entrances are a typical Gardenesque flourish, while clipped formal lawn edges are classical. Major intersections were generally planted, anchoring them in the landscape, and scattered garden beds, some possibly planted with annuals, were laid out near the south-west lake. Planting style was Gardenesque with overlays of the 19th century Australian taste for sub-tropical style foliage planting, with large leaved evergreens and strappy exotics providing visual interest amongst shrub beds.

Even Picturesque elements were included, with a "sublime" craggy, rockery in the garden beds at the junction of Avenues 6 and 7 (see Figure 27).

Figure 27: Intersection of Avenues 4 and 6 near the present day lake showing lawn edges, and foliage rich gardenesque style planting (1880). Source: Museums Victoria

This approach is typical of 19th century garden design in southern Australia, where British design trends from the Picturesque and Gardenesque traditions were cherry-picked, adapted and merged into a distinctive local style – similar examples of which can be seen at Williamstown Botanic Gardens, Fitzroy Gardens, Albury Botanic Gardens and the Melbourne's Domain Parklands[xii].

Under different management regimes and over time, the majority of the garden beds have been removed, or their layouts changed. Some, like those along the exterior fence, no longer served the space they resided within. Others, such as parterres along the Grand Alleé, were removed as the surrounding trees matured and canopy cover and water competition became too great for the lower-level plants.

From what was originally intended, very few garden beds remain. Recent work undertaken to revitalise the formal beds running along the southern face of the Royal Exhibition Building has been greatly successful, and the reinstated parterres are excellent. Garden beds have also been reinstated at the Rathdowne Victorian Street corner entrance in the Gardens' south-west, however there are no mirrored beds in the south-east corner due to the planting of Liquidambars in those spaces.

Some remnants of an informal garden bed can be found in the lawns around the north-eastern lake, however these are significantly degraded. That which runs alongside Avenue 7 is little more than unkempt

[xii] For a discussion on the melding of Picturesque and Gardenesque design principals in 19th century Melbourne gardens see the *Melbourne Gardens Maser Plan 2020 – 2040*, p 36 (Royal Botanic Gardens Victoria, available online)

Hedera helix, and serves as neither garden bed nor lawn. A similarly unkempt bed of strap leafed foliage plants lies between the *Ficus macrophylla* and *Taxodium distichum* along the south-western lake, which partially serves to mark the lake edge.

As a recommendation from the Carlton Gardens Master Plan, there is now the intention of reinstating garden beds within Carlton Gardens South. As for tree planting, the approach taken has been one of reconstruction. Designs of the new beds are based on our best understanding of the 1880s design, and modified to suit the contemporary design, use and tree canopy of the site.

4.2 Garden Bed Re-establishment Policies

Discussion

Garden beds within Carlton Gardens South have been lost over time, but considerable opportunity exists to re-establish beds, creating greater ground level definition and interest and improving the overall aesthetic value of the Gardens. Much of the 1880 design for the Gardens was elegant, practical and appropriate and can be interpreted well in a modern landscape. The main barrier to reinstatement is the changed site conditions and now mature tree canopy which needs to be accommodated in any design.

The overall approach has been to honour the design intent and style of the original garden bed plantings, while adapting it to the contemporary conditions. For example, it is important not to impact on the current social use of the site, including the use of the lake lawns for lounging, and maintaining open site lines into the Gardens, especially around street corners where road traffic safety becomes an issue.

In reviewing the historic photographs and plans the following garden bed features are considered to be important from a heritage perspective:

- Formal parterres at the forecourt and entrance to the Royal Exhibition Building (already implemented)
- Strongly ornamental and Gardenesque / sub-tropical style planting to anchor the parterres and Hochgürtel Fountain (already implemented)
- Maintenance of the strongly symmetrical design, with garden bed locations mirrored east/west along the Grand Alleé (with slight deviations around the lakes)
- Gardenesque and sub-tropical design features including loose, open planting punctuated with dramatic large-leaved foliage plants
- Picturesque rockwork in the bed at the junction of Avenues 6 and 7
- Lawn edges to garden beds
- The layering of history in the site and the need for one layer not to obscure another (for example garden beds should not interfere with the re-established parterre)
- Significant view lines need to be retained, including to the Hochgürtel Fountain, Royal Exhibition Building dome and down Spring Street

In addition to the above, the following practical requirements also need to be considered:

- Maintenance of open lawn areas allowing direct access to lake edges
- Management of slope and sediment issues around the south-west lake
- Lack of access to lake islands and the need for low maintenance planting
- Garden beds which hid the perimeter fence no longer have a fence to hide, and their reinstatement would obstruct casual pedestrian access to the Gardens, and block sight lines. This is particularly

true of the perimeter areas at the entrances, where line of sight is required for surrounding traffic. Public safety is a necessary consideration

- Maintenance practicalities and mechanisation in managing garden bed edges
- Tree growth has made some garden areas no-longer practical for planting (especially under Figs and Planes). Other beds need to be reshaped to incorporate established trees and prevent the creation of awkward maintenance areas
- Beds in the north-west corner of Carlton Gardens South would interfere with the now-established parterres as well as break the symmetry. Beds in the north-east and north-west of Carlton Gardens South are no long practical due to the size of the existing Ficus specimens, which overshadow the area
- Parterres which ran along the outside of the Grand Alleé may have provided interest while the trees were establishing, but are now overshadowed and out-competed by said trees. Reinstatement may be considered when the Alleé eventually requires replacement but is not practical at this time
- Some isolated island beds about the gardens could potentially be reinstated, however doing so may interfere with the symmetry of the gardens. The locations of these beds, while historic, lack design integrity

Policy Recommendations

A new Garden Bed plan has been developed based on the above considerations and discussions with the City of Melbourne and Heritage Victoria (Figure 28 and Drawing 15). This should be implemented gradually and guided by the Carlton Gardens Master Plan, in line with the following:

- Lawn edges should only be installed where indicated on the Garden Bed plan (Drawing 15). These have been added where historic evidence suggests they exist and it is currently practical to maintain them (e.g. not under large trees). Lawn edges to be 1200mm wide to allow mowing
- All garden beds to be edged with 5mm mild steel edging to maintain lines and assist with maintenance
- Include Picturesque style rockeries in the garden beds at the intersection of Avenues 6 and 7
- Planting design and layout is subject to detailed design and should adhere to the character descriptions provided in section 4.3
- New planting opportunities may become available through unanticipated loss of trees. Depending on the location, garden beds may be useful in adding interest, structure and form to a space when a mature tree is lost, and a young tree still establishing. The addition of any additional garden beds should reflect historical precedence and the practical and heritage requirements outlined in this report
- In regard to the above, the furcations at the corner of Nicholson Street and Victoria Parade should become garden bed planting if the Liquidambars are unexpectedly lost
- Take care working around the large trees, in particular *Ficus macrophylla*. Ground levels may need to be raised through the introduction of approved topsoil to create soil depth for planting. All soil preparation and planting works need to be developed in consultation with an arborist
- Consider including irrigation to the new garden beds as part of a future upgrade to the Carlton Gardens South irrigation. Excessive root competition from surrounding trees makes irrigation desirable to establish new plantings

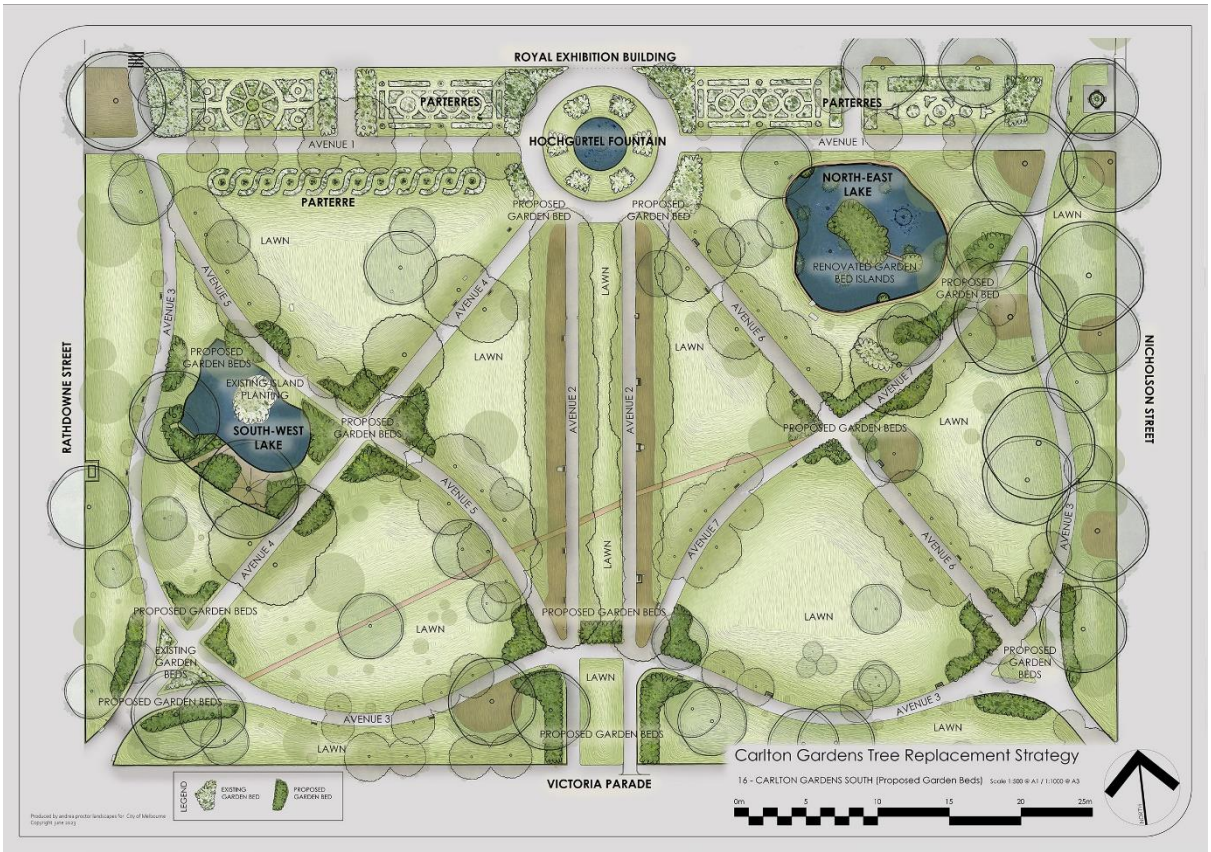

Figure 28: Proposed Garden Bed Planting in Carlton Gardens South

Actions

Action 13: Include irrigation to new garden beds as part of a future upgrade to the Carlton Gardens South irrigation.

4.3 Planting Design and Species Selection

Discussion

As for trees, garden plantings are living things and will only grow successfully when correctly chosen, planted in the appropriate place and given appropriate care. The growing conditions, particularly the site micro-climate, have changed dramatically from the 1880s when the site was predominantly full sun. Much of the site, particularly where garden beds sat at pathway edges, is now full-shade due to the mature tree canopy, and would also exhibit other growing limitations that come from advanced trees including dry, hydrophobic and nutrient poor soils. Interestingly, plantings from the 1880s were often drought tolerant, as irrigation was not practical at the time. It is the shade and the more extreme dry that comes from advanced trees that needs to be considered.

Another limitation is the intensely impractical nature of Gardenesque style plantings. The practice of treating each plant as an individual specimen, widely spaced from its neighbours, would have been extremely difficult to maintain, with weed growth and intense pruning intervention required. The fact that none of this planting style now exists across Victoria, or appears to have existed even 50 years after its heyday, is testament to the maintenance problems it incurred. Indeed, most historical photos which show Gardenesque style plantings were taken within the first 10 years of a gardens' establishment – including at Carlton Gardens.

Figure 29: Existing planting in Carlton Gardens. This planting is a good example of a reinterpreted gardenesque style scheme.

What can be maintained however is the look and feel of the Gardenesque. By interspersing shrubs and structural plants with groundcovers the open, loose and unstructured style can be maintained without the excessive pruning and open soil areas that were problematic.

Policy Recommendations

Select plants based on historical precedent, micro-climate suitability and to recreate the loose, structural planting design of the Sangster era. Planting design should be laid out in accordance with the sketches provided in Figure 31, 29 and 30, and the following principals:

- Plant selection to generally follow that provided in List D modified to availability and the design requirements of individual locations. These plants were all available in Melbourne nursery catalogues in the 1870s – 1890s[41], allowing for some interpretation of changing plant names and cultivar use. Plants labelled with an # were not in the catalogue list but have the correct aesthetic and were potentially available at the time
- Provide interest and drama through the inclusion of bold foliage plants such as Cordylines, Tree Ferns, Small Palms, New Zealand Flax, Pampas and Bamboo. Taxa marked with an * provide this textural contrast
- Maintain gaps between shrubs to create an open, Gardenesque like planting style and fill these with low groundcovers
- Ensure planting is loose and not too structured. It will be important to be less structured in the design and shy away from contemporary inclinations to create mass plantings. Species diversity will be important
- Use taller plants to frame views and create focal points
- Provide a balanced approach to symmetry across pathways – where planting is not a pure reflection, but is even in its mass and visual interest

List D: Garden Bed Plantings for Carlton Gardens South

- *Aechmea fasciata* #
- *Aeonium arborescens* 'Helichrysum'
- *Agave americana* 'Variegata' *
- *Agave parryi* *
- *Arthropodium cirratum*
- *Asplenium nidus* *
- *Aucuba japonica*
- *Billbergia nutans*
- *Cordyline australis* *
- *Correa pulchella*
- *Cortaderia* sp. *
- *Cotyledon orbiculata* (grey leaved form)
- *Doodia aspera*
- *Dracaena draco* *
- *Drepanostachyum falcatum*
- *Echeveria imbricata*
- *Fatsia japonica* *
- *Juniperus horizontalis*
- *Mahonia aquifolium*
- *Mahonia bealei*
- *Melianthus major*
- *Pachysandra terminalis*
- *Phoenix roebelenii* # *
- *Phormium cookianum* *
- *Phragmites australis* *
- *Pittosporum tobira*
- *Pteris umbrosa*
- *Plectranthus ecklonii*
- *Rhaphiolepis indica*
- *Ruscus hypoglossum* #
- *Tetrapanax papyrifera* *
- *Tradescantia andersoniana* group
- *Vinca minor*
- *Yucca gloriosa* *

Actions

None specifically. Manage as per recommendations and the Implementation Plan in Section 5.1

4.4 Garden Bed Priorities

The following outlines the 10 year garden bed planting priorities for Carlton Gardens. These have been identified through recommendations from the Master Plan, World Heritage Management Plan 2023, historical research, discussions with the City of Melbourne's Urban Forest and Open Space Planning Teams and Heritage Victoria, and an assessment of the site. It is desirable that any garden bed planting be co-timed to align with tree replacement works. In the event that individual trees or Avenues require replacement earlier or later than anticipated than this would impact the timing of garden bed installations.

4.4.1 South-Western Lake

Discussion

The garden beds around the lake are largely absent, with the space being lawn framed by established trees. The lawn, and the ground beneath the Ficus, are now used for sitting and picnicking by the water. There is ample opportunity to reinstate the pre-existing garden beds whilst retaining this social usage.

Figure 30: Western Lake. Planting on the Island is good, and provides a precedent for similar improved planting at the north-east lake

Policy Recommendations

- Reconstruction of the old beds around the lake as outlined in the Garden Bed Plan (Figure 28 and Drawing 15) is appropriate in this instance, bearing in mind the challenges of planting beneath a mature Ficus, and retaining some open space for social use
- Investigate suitable native plants for use, such as "water lilies, water reeds and sheoaks", as per the wishes of the Traditional Owners expressed in Part 2 of the WHMP 2023
- Incorporate reconstructed island/pocket beds and at the pathway intersections as part of other planting works
- Retain access to lake margins as per the drawings
- Remove the remaining camellias of the 1980s Peace Garden Ring for being both out of scale and at odds with the heritage of the space
- Erosion control of the banks requires addressing in detailed design for the space. The installation of new planting beds may provide the opportunity for the subtle, screened installation of any hardscaping required to manage erosion
- The island is in good condition and does not require any adjustments
- Layout and planting design in accordance with Section 4.2 and 4.3

Actions

Action 14: Create new garden beds on the southern bank of the south-west lake
Action 15: Create new garden beds near the south-west lake at the junction of Avenues 4 and 5
Action 16: Create a new garden beds framing the south-west lake along Avenues 3 and 5

4.4.2 North-Eastern Lake

Discussion

This lake has become popular with visitors and locals alike as a destination to sit on the grass, in the sun, and enjoy the sound of the fountains and view to the Royal Exhibition Building Dome. The area has changed significantly over time, and it is not possible to reconstruct earlier garden beds without destroying the current social usage of this space. However, there remain some opportunities beneath the trees and on the islands to improve planting detailing.

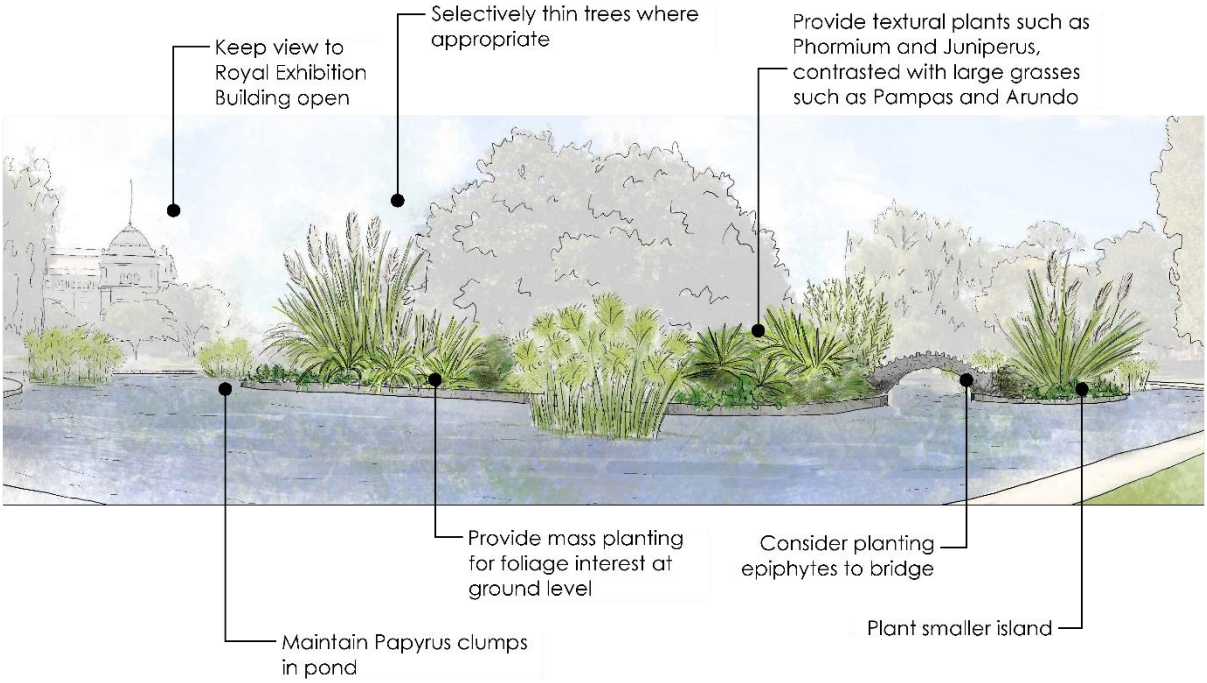

Figure 31: Sketch of proposed garden bed planting around the north-east lake

Policy Recommendations

- Investigate suitable native plants for use, such as "water lilies" and "water reeds" as per the wishes of the Traditional Owners expressed in Part 2 of the WHMP 2023
- Island beds and the bridge be replanted in a way which adds structure and foliage interest and requires minimal maintenance. Planting should be thinned to facilitate this while retaining existing historic and structural planting. See Figure 31
- A garden bed may be reinstated along Avenue 7, where *Hedera helix* is currently growing. This bed will need to be clearly delineated and subservient to current desire lines, whilst still allowing for social access and usage of the lawn. Being partially beneath canopy cover, care must be taken regarding species selection
- Garden beds at the intersection of Avenue 7 and Avenue 6 can be reinstated without interfering with current usage, and would serve to add interest and definition to the space. Incorporate picturesque rockwork into this space (see Figure 32)
- Layout and planting design in accordance with Section 4.2 and 4.3

Actions

Action 17: Create a new garden bed near the north-east lake and parallel to Avenue 7

Action 18: Rework planting on the islands of the north-east lake to add structure and foliage interest

Action 19: Create new garden beds at the junction of Avenues 6 and 7

Figure 32: Images of picturesque rockwork. Clockwise from top left, Royal Botanic Gardens Melbourne (source unknown, possibly State Botanical Collection or SLV), Carlton Gardens (SLV), contemporary reinterpretation RBG Melbourne (Laidlaw & Laidlaw Design), Royal Botanic Gardens Melbourne (SLV)

4.4.3 Entrance and framing beds

Discussion

One set of entrance beds has been reinstated at the intersection of Rathdowne Street and Victoria Parade and it is recommended that the opportunity be taken to expand this planting restore symmetry and balance by reconstructing beds at the intersection of Nicholson Street and Victoria Parade, and at the central termination of the Grand Alleé looking down Spring Street. This will not only restore what was originally there, but frame important views into the gardens, whilst obscuring the less aesthetically-pleasing views out of the gardens.

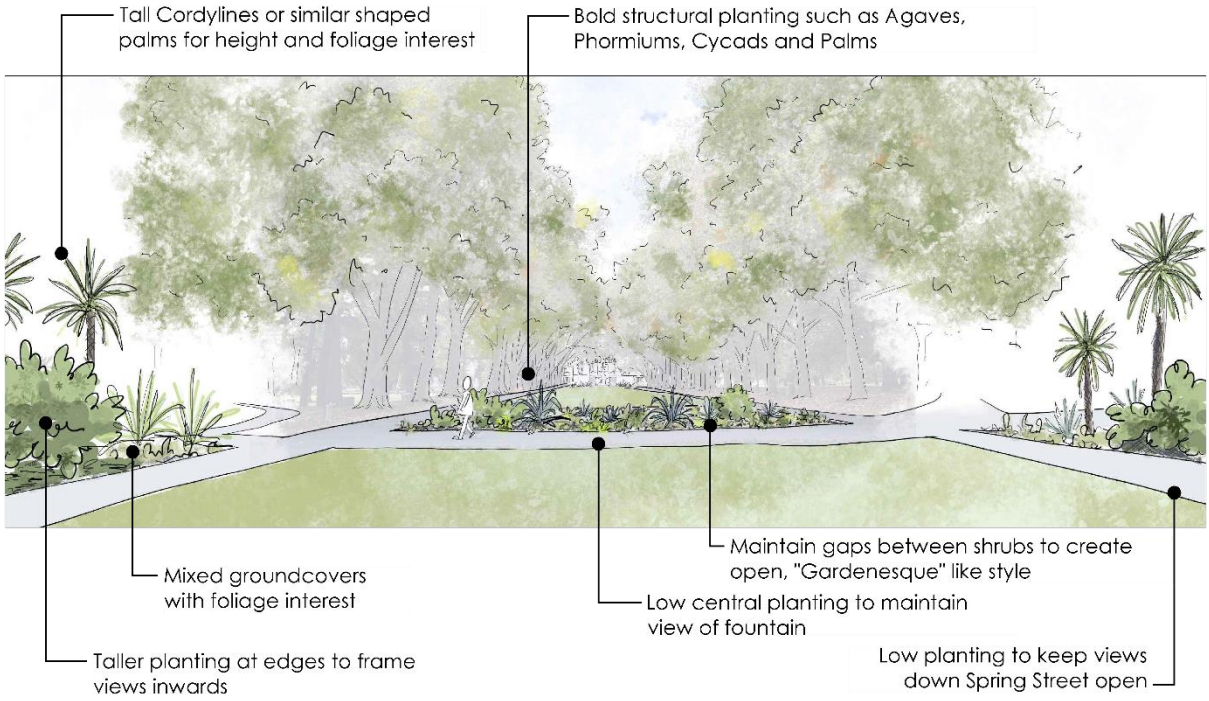

Figure 33: Sketch of proposed garden bed planting Victoria Parade entrance

Policy Recommendations

- The pre-existing triangle beds are to be retained, but planting design should be redesigned to imitate the Gardenesque form, wherein each plant is viewed as an individual, rather than part of a whole, resulting in aesthetically-pleasing messiness. Additional framing beds are to be added to reinstate the earlier design and reinforce the *patte d'oie* design
- Additional complementing beds on the inside corners of the intersection of Avenue 3 with Avenue 4 are recommended to reinstate historic planting and frame the view up Avenue 4, reinforcing the *patte d'oie* design
- The triangle beds in the south-east corner are home to mature Liquidambar trees. These may be planted if the trees are lost in future, but this is not anticipated within the life time of this report
- The garden bed at the termination of the Grand Alleé will lie at the end of the central sward. It should be in be Gardenesque in style as per Figure 33, with particular care taken regarding the height of the plants selected. Taller plants should be used at the edges to frame views and provide interest, with the centre planting consisting of plants of a much lower stature, so as to maintain the view to the Hochgürtel fountain

- Garden beds are to be reinstated to either side of the Grand Alleé to reinstate the earlier design and reinforce the *patte d'oie* design. Planting should be higher at the edges to frame the view, but kept low in the direction of Spring Street so the historic vista down is maintained
- All entrance garden beds, regardless of style, should remain practical in nature. The profile should remain low so as to maintain sight lines
- Consideration should be given to timing garden bed establishment so that it coincides with any changes to Avenue planting

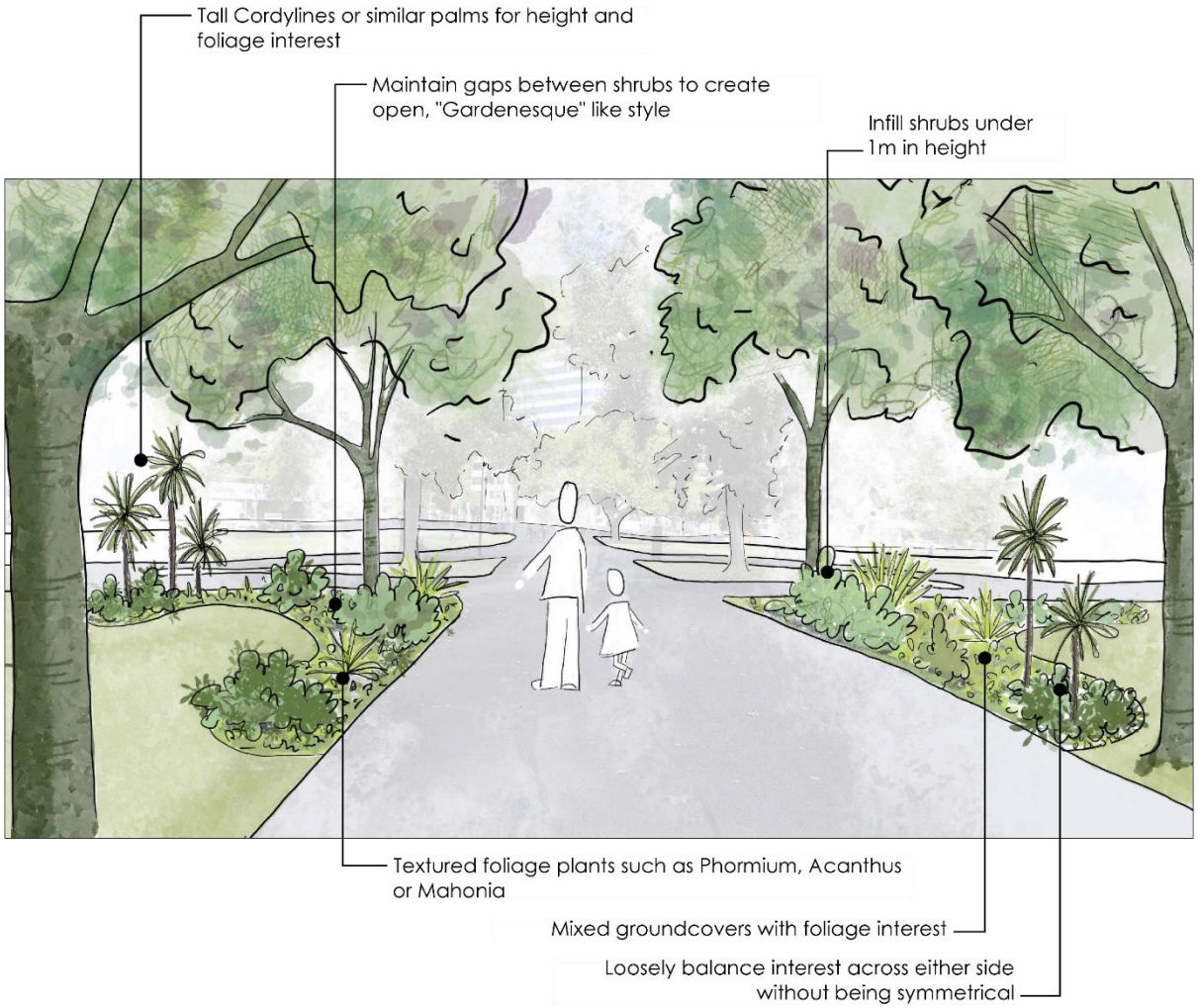

Figure 34: Sketch of proposed garden bed planting corner of Nicholson Street and Victoria Parade with new Brachychiton discolor *avenue trees*

Actions

Action 20: Create new garden beds framing the Grand Alleé at both the Victoria Parade and Hochgürtel Fountain ends

Action 21: Create new garden beds at the Nicholson Street and Victoria Parade entrance to frame Avenue 6. This should happen at the same time as the replacement of the Avenue 6 trees.

Action 22: Create new garden beds at the Rathdowne Street and Victoria Parade entrances to frame Avenue 4

Action 23: Rework existing planting at the Rathdowne Street and Victoria Parade entrance to match new gardenesque style planting elsewhere

[35] Lovell Chen (2023) *Royal Exhibition Building & Carlton Gardens World Heritage Management Plan*

[36] Lovell Chen, (2023), *Royal Exhibition Building & Carlton Gardens World Heritage Management Plan, Part 3 of 5 Heritage Management Plan, Appendix B,* p B1.27

[37] Aitken R, Looker M (ed) (2002), *The Oxford companion to Australian gardens*, the Australian Garden History Society, Oxford University Press, p 591

[38] Whitehead, G, (1997), *Civilising the city: A history of Melbourne's Public Gardens.* State Library of Victoria, Melbourne

[39] Aitken R, Looker M (ed) (2002), *The Oxford companion to Australian gardens*, the Australian Garden History Society, Oxford University Press, p 248

[40] Foster, JH (1989), *Victorian picturesque: the colonial gardens of William Sangster*, University of Melbourne, Parkville, Australia, p 13

[41] Garden Plan Conservation Association of Australia (2009), *Plants Listed in Nursery Catalogues in Victoria 1855 to 1889*

5 Review and Implementation

5.1 Implementation

Timing and Implementation

This report provides schematic design and high-level policy advice only. For all tree removals and plantings additional tree-specific guidance will be required. This includes ensuring timing of removals is guided by arboriculture professionals and the City of Melbourne Urban Forest Team, and that the make up and composition of the specimen planting in particular adheres to the recommendations made in this report. As planting will be done gradually all decisions will need to be made in the context of what works have previously taken place and considerable forward planning will be required. As living things, the condition of trees can be subject to sudden change, and planting may need to be brought forward or pushed back. While timing requires flexibility, it is hoped that this report provides sufficient guidance on species selection and replanting techniques to allow for any unforeseen future events.

In regard to garden bed layout, designs have been provided at a high level only and detailed layouts and planting design will be required. It is recommended that both horticultural and design expertise be sought in the development of detailed plans as the micro-climate of the site is complex.

Action 24: Continue to involve professional arborists, landscape architects and the Urban Forest Team in the implementation of this report

Heritage Approvals

Heritage Victoria is responsible for approving any works under the Heritage Act 2017, including tree removal and replanting works. Heritage Victoria have been consulted in the development of this plan and have recommended that the actions in this report be submitted for approval through the permit application process. This will both speed up and simplify future tree planting works for both Heritage Victoria and the City of Melbourne.

It is recommended that the permit application include the request that the finer detail of implementation be addressed by yearly reporting through conditions monitoring. Works should come under "conservation" and be exempt from permit fees.

Action 25: Apply to Heritage Victoria for a permit for tree removal and replanting works for the next 10 years

5.2 Review

This report covers works for the next 10 years, following which time it should be reviewed in full to allow for any changes in circumstances and to incorporate new developments which have occurred. It is anticipated that all of the works will have been completed by this time, but any that remain unfinished should, if appropriate, be rolled over into the new plan. Of utmost importance will be ensuring that the long-term direction of the tree planting strategy is respected, while allowing for changes in management practice, bio-security issues, climate knowledge and industry best practice. Tree planting is for the long term, and all decisions need to be mindful of the potential long term implications of decisions made now.

Action 26: Review the plan in 10 years time (2034)

6 Action Plan

The following is a prioritised list of works recommended in this document. The Plan expresses a long-term vision for the Gardens, and works will need to be staged. Works are generally prioritised based on the following considerations:

- Critical replacement priorities due to trees approaching end of life
- Planning works required to allow other projects to proceed (e.g. contract growing stock)
- Works which are relatively simple to implement from a cost or infrastructure perspective
- Projects that provide the greatest community benefit

This list of priorities will be subject to change, especially if unexpected opportunities arise, allowing the fast tracking of particular projects. Projects are listed in general order of priority.

Item	Planning Document	Short Term (2024-25)	Medium Term (2026-28)	Long Term (2029-34)
TREE REPLANTING				
Action 25: Apply to Heritage Victoria for a permit for tree removal and replanting works for the next 10 years	✓			
Action 2: Continue to work with Traditional Owner groups in the management of the two heritage *Ficus macrophylla*	✓			
Action 4: Regularly assess the trees and schedule and implement recommended maintenance works, including pre-emptive pest control and irrigation		ongoing		
Action 8: Plant replacement specimen trees in Carlton Gardens South. Planting to be staged based on removal time frames of surrounding trees		ongoing		
Action 9: Plant replacement specimen trees in Carlton Gardens North. Planting to be staged based on removal time frames of surrounding trees		ongoing		
Action 3: Relandscape around the *Ficus macrophylla* of significance to the Traditional Owners to improve their health and growing conditions		✓		
Action 6: Assess the existing *Quercus robur* in Avenue 3 and replace younger trees which are under-performing with *Quercus canariensis*		✓		
Action 10: Plant new shade trees around the Playground in Carlton Gardens North. Planting can take place immediately		✓		

Item	Planning Document	Short Term (2024-25)	Medium Term (2026-28)	Long Term (2029-34)
Action 11: Infill plant gap in Avenue 4		✓		
Action 12: Remove young *Quercus robur* replacement plantings in Avenue 10 and replace with *Quercus castaneifolia*		✓		
Action 1: Assess all trees of Primary and Outstanding significance within Carlton Gardens to identify all trees with a life expectancy of under 20 years and commence active replacement planning for these trees			✓	
Action 5: Remove and replace failing *Populus alba* trees in Avenue 6 with *Brachychiton discolor*			✓	
Action 7: Remove and replace failing *Populus alba* trees in Avenue 9 with *Flindersia australis* to the north of Avenue 11 and *Eucalyptus cinerea* ssp. *cinerea* south of Avenue 11.			✓	
CARLTON GARDENS SOUTH GARDEN BEDS				
Action 25: Apply to Heritage Victoria for a permit for tree removal and replanting works for the next 10 years	✓			
Action 13: Include irrigation to new garden beds as part of a future upgrade to the Carlton Gardens South irrigation.	✓			
Action 14: Create new garden beds on the southern bank of the south-west lake		✓		
Action 17: Create a new garden bed near the north-east lake and parallel to Avenue 7		✓		
Action 22: Create new garden beds at the Rathdowne Street and Victoria Parade entrances to frame Avenue 4		✓		
Action 21: Create new garden beds at the Nicholson Street and Victoria Parade entrance to frame Avenue 6. This should happen at the same time as the replacement of the Avenue 6 trees.			✓	
Action 16: Create a new garden beds framing the south-west lake along Avenues 3 and 5			✓	
Action 18: Rework planting on the islands of the north-east lake to add structure and foliage interest			✓	

Item	Planning Document	Short Term (2024-25)	Medium Term (2026-28)	Long Term (2029-34)
Action 20: Create new garden beds framing the Grand Alleé at both the Victoria Parade and Hochgürtel Fountain ends			✓	
Action 23: Rework existing planting at the Rathdowne Street and Victoria Parade entrance to match new gardenesque style planting elsewhere			✓	
Action 15: Create new garden beds near the south-west lake at the junction of Avenues 4 and 5				✓
Action 19: Create new garden beds at the junction of Avenues 6 and 7				✓
Action 26: Review the plan in 10 years time (2034)				✓

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Appendix 1: Detailed Tree Selection Criteria

The most complex tree management consideration at Carlton Gardens relates to the replacement of the heritage avenues. For the purposes of this report two in particular are under consideration as they are at end of life (section 3.12):

- Avenue 6, Poplars in Carlton Gardens South (*Populus alba*)
- Avenue 9, Poplars in Carlton Gardens North (*Populus alba*)

The problem with tree replacement for these Avenues is that there is no easy or obvious tree to select as a replacement for *Populus alba*. Poplars are visually distinctive, with clear white trunks, beautiful autumn foliage, distinctive grey leaves and of a size that is large enough to have presence in the landscape without being big enough to compete with the Exhibition Building and avenues of Planes and Elms. Few genera currently available for use in Melbourne have a similar aesthetic presence. Coupled with this is the problem that none of the Popular species that are readily available in Australia are known to be well suited to Melbourne's projected future climate (see Appendix 3). Further details on this are provided in section 3.8, including a detailed discussion on tree selection, especially in regard to climate and scientific data (Species Selection, page 35).

To address this problem and bring a level of objectivity to the selection process a selection rubric was developed. This rubric has been used for Avenue 6 and Avenue 9, but theoretically could be used for other Avenues across Carlton Gardens, or even adapted for similar sites elsewhere.

The scaffold of the rubric is based on similar work completed by the reports' authors for other projects, and found to be a successful means of comparing outcomes for decisions with complex selection criteria. It does this by listing all criteria and weighting them based on their importance. The final result is found by comparing the weighted score with the outcome of any disqualifying factors.

There are three points that need to be considered when using the rubric:

- That assessment needs to be undertaken by experienced professionals with knowledge of the subject (preferably as a collaborative process with required knowledge bases noted for each criteria)
- When making decisions, that the final weighted score needs to be considered side-by-side with any disqualifying factors
- The rubric, like the CAT, is just another decision-making tool. While it provides a level of objectivity, it should not replace professional knowledge, or be used to override a decision which experienced professionals consider to be poor

As for other places where this rubric has been used, the results should be considered by experienced professionals and decisions made accordingly. The place for professional knowledge is particularly important when two outcomes have very similar scores. There may also be factors, not considered as part of the rubric, which render a particular taxa unsuitable for use. This may particularly be the case if a taxa scores well on all criteria bar one, but is completely unacceptable on the grounds of that one criteria (e.g. biosecurity, high toxicity).

In the end tree selection for the Avenues is a design decision – albeit one that is made based on scientific and heritage principals. As with all design decisions there is not one "right" solution. There are many possible "right" solutions, all of which will provide good long-term outcomes for Carlton Gardens – but the rubric aims to provide an objective approach to selecting the best of these "right" solutions.

Use of the Rubric and Selection Criteria

The Rubric has been broken into two sections:

- Heritage: which assesses the potential taxa against the identified heritage values of the Avenues
- Performance: which assesses the potential taxa against a series of identified performance criteria

For each of these sections a series of criteria were developed, weighted and scored, leading to a final score for both heritage and performance. Each score is expressed as a number between zero and 100 with:

- zero indicating a taxa meets none of the criteria in any way
- 100 being a taxa which meets all of the criteria to the full extent possible

These scores were then equally weighted (50% heritage to 50% performance) to produce the final weighted score out of 100.

Weighting and Scoring

Each criteria is weighted based on its individual importance to the success of the project. For performance criteria this weighting is consistent for all avenues, however for heritage criteria the weighting alters to reflect the specific heritage values of the individual avenue. Methodology for determining the weighting of each criteria is listed Table 4 and Table 5 (below). Weighting methodology is based on similar work undertaken for other projects and found to be successful and is as follows:

Table 2: Rubric Weighting

WEIGHTING	
1.0	Essential to success
0.8	Very desirable
0.5	Beneficial
0.2	Possibly of benefit
0.0	No benefit

To use the rubric each possible new taxa is scored against the weighted criteria. Criteria given a weighting of 0.0 ("No Benefit") do not need to be scored as doing so will make no difference to the final recommendations. Methodology scoring is listed Table 4 and Table 5 (below). Scoring methodology is based on similar work undertaken for other projects and found to be successful and is as follows:

Table 3: Rubric Scoring

SCORING	
5	Meets the criteria to an outstanding degree
4	Meets the criteria in full
3	Meets the criteria with some complexities to be resolved
2	Meets the criteria in a limited degree and/or has significant complexities
1	At risk of not meeting the criteria
0	Does not meet the criteria, or has a negative effect

While scores are given numerically, all scores are qualitative in nature as they are based on objective professional opinion and not firm scientific data. Data such as climate assessments or City of Melbourne tree

records may be used to guide the scoring process, but the limitations of current climate and tree selection data makes a qualitative professional assessment the best option. Objectivity is provided through the rubric itself and by the scoring being undertaken by people with the appropriate listed professional experience.

Heritage Criteria

Heritage criteria have been developed based on the significance levels outlined in the World Heritage Management Plan 2023 and the tree assessment undertaken for this report. As the aim at Carlton Gardens is for reconstruction, this means matching the values of the current species as closely as possible. The one exception to this is Traditional Owner values which have their own set of identified criteria.

The criteria are weighted based in accordance with Table 2 and based on their relative importance. For heritage criteria, the weighting for each criteria will be individual for each Avenue, and dependent on the heritage values of *that particular avenue*. As the most complex item to assess, aesthetic significance has been further broken down into a number of individually weighted criteria, with these combined back into a *single* score for aesthetic significance as a whole.[13]

Table 4: Heritage Criteria Weighting and Scoring

Criteria	Description and considerations for scoring	Considerations for weighting	Justification and Referencing
Historic significance *Experience requirements for scoring: heritage*	How well does the proposed new taxa meet the historic values of the current taxa as defined in the individual avenue assessment? Highest scores will be given for like for like, then to trees that were known to be growing in Carlton Gardens or which were available at the time of planting (as in listed in historic nursery catalogues or from examples from the era which are growing, or were grown, in other Victorian gardens) Lowest scores should be given for taxa identified as not suitable by the WHMP.	Consideration needs to be given to whether the planting was part of the original layout or a later date. For Carlton Gardens South historic significance is of greater importance than in Carlton Gardens North due to the complete replanting after the 1888 exhibition[xlii]. In the absence of other factors, historic should be weighted as 1.0 for original plantings in CGS, 0.8 for later plantings in CGS and original plantings in CGN, and 0.5 for later plantings in CGN. Avenues with no historic significance would be weighted as 0.0	Lovell Chen, (2023) *Royal Exhibition Building & Carlton Gardens World Heritage Management Plan Part 3 of 5: Heritage Management Plan*, Section 3.7 Carlton Gardens soft landscape elements; the individual Avenue assessments found in sections 3.12 and 3.13; Brookes, M (1992), *Plants listed in nursery catalogues in Victoria 1855-1889*

[13] Although it may look like aesthetic significance has three times the weighting of other criteria due to the added number of criteria considered, this is not the case. The calculations in the rubric combine these three criteria to create a single score for aesthetic significance that can be equally weighted against the other criteria.

Criteria	Description and considerations for scoring	Considerations for weighting	Justification and Referencing
Botanic significance *Experience requirements for scoring: heritage and horticulture*	How well does the proposed new taxa meet the botanic values of the current taxa as defined in the individual avenue assessment? Highest scores will be given for like for like, then to trees that are of similar botanic interest as defined by the individual heritage assessment of the avenue. Lowest scores should be given for taxa identified as not suitable by the WHMP.	Botanic significance is relatively low at Carlton Gardens and does not appear to be a priority for the original designers. Avenues of identified botanic significance should be weighted between 0.5 and 0.8 (depending on the identified values of the Avenue). Avenues with no botanic significance would be weighted as 0.0	GML Heritage, Lovell Chen, (2023) *Royal Exhibition Building & Carlton Gardens World Heritage Management Plan Part 1 of 5: Overview Site Management Plan*, and *Part 3 of 5: Heritage Management Plan*, Section 3.7; the individual Avenue assessments found in sections 3.12 and 3.13
Social significance *Experience requirements for scoring: heritage and horticulture*	How well does the proposed new taxa meet the social values of the current taxa as defined in the individual avenue assessment? Highest scores will be given for like for like, then to trees that are of similar social interest as defined by the individual heritage assessment of the avenue. Lowest scores should be given for taxa identified as not suitable by the WHMP.	Social significance is relatively low for Carlton Gardens' Avenues. Avenues of identified social significance should be weighted between 0.5 and 0.8 (depending on the identified values of the Avenue). Avenues with no social significance would be weighted as 0.0	Lovell Chen, (2023) *Royal Exhibition Building & Carlton Gardens World Heritage Management Plan Part 3 of 5: Heritage Management Plan*, Section 3.4; the individual Avenue assessments found in sections 3.12 and 3.13
Traditional Owner values *Experience requirements for scoring: heritage and horticulture*	How well does the proposed new taxa contribute to Traditional Owner values and desires for the place. Highest scores will be given for indigenous species followed by Victorian native species and then Australian natives. Exotic species score low against this criteria. Lowest scores should be given for taxa identified as not suitable by the WHMP.	Traditional Owner desires for more native plants were identified as part of the latest World Heritage Management Plan, but it is noted that this includes planting across the site and not just trees. As such this criteria would generally be weighted as 0.5 (beneficial)	GML Heritage, (2023) *Royal Exhibition Building & Carlton Gardens World Heritage Management Plan Part 2 of 5: Traditional Owner and First Peoples' Cultural Values for the Royal Exhibition Building and Carlton Gardens Section* 4.5.3, page 76, Revegetation with indigenous plants; the individual Avenue assessments found in sections 3.12 and 3.13

Criteria	Description and considerations for scoring	Considerations for weighting	Justification and Referencing
Aesthetic significance *Experience requirements for scoring: heritage and design*	How well does the proposed new taxa contribute to the aesthetic values of the place as defined in the individual avenue assessment? Highest scores will be given for like for like, then to trees that look similar to the existing taxa as per the following criteria. Lowest scores should be given for taxa identified as not suitable by the WHMP.	Aesthetic values are highly important for Avenues in Carlton Gardens. In particular, the National Heritage List (cited in the WHMP 2023) identifies the formality, diversity and *"contrasting colours and forms"*[xliii] and the importance of the classical design intent. This classical intent also contributes to the World Heritage significance as a setting for the Exhibition Building. As such aesthetic value should have an overall rating of 1.0	Lovell Chen, (2023) *Royal Exhibition Building & Carlton Gardens World Heritage Management Plan Part 3 of 5: Heritage Management Plan*, Section 3.7, page 50, Carlton Gardens soft landscape elements; the individual Avenue assessments found in sections 3.12 and 3.13
Due to the number of variables in measuring aesthetic significance, the following sub-criteria have been developed			
Seasonality *Experience requirements for scoring: Heritage, design and horticulture*	How well does the new taxa match the current taxa in terms of seasonality? Does it match its evergreen / deciduous nature and time of year? Is any seasonal colouration (e.g. flowers, leaves) similar?	Seasonality contributes to the *"contrasting colours and forms"*[xliv] but not the classical design intent as most avenues were seasonally similar. Traditionally there has been a diverse mix of seasonality across the site, giving more flexibility in regard to new planting as the value is less reliant on any one avenue. As such it should be weighted as 0.5 (beneficial)	GML Heritage, (2023) *Royal Exhibition Building & Carlton Gardens World Heritage Management Plan Part 1: Overview Site Management Plan,* Section 4.6, page 49, Statement of Significance; Spencer, Roger (1995-2005), *Horticultural Flora of South-Eastern Australia,* https://hortflora.rbg.vic.gov.au/ ; the individual Avenue assessments found in sections 3.12 and 3.13

Criteria	Description and considerations for scoring	Considerations for weighting	Justification and Referencing
Form, shape and colour *Experience requirements for scoring: Heritage, design and horticulture*	How well does the new taxa match the form, shape and colour of the existing taxa? Highest scores go to taxa with the similar form, shape and colour Moderate scores go to taxa that have the right form and shape but wrong colour and vice versa Taxa which either complete with higher significance avenues or are too small to provide presence in the landscape should score lowly	Form, shape and colour contribute to the *"contrasting colours and forms"* as well as the classical design intent. As such it should be weighted as 1.0 (essential to success)	GML Heritage, (2023) *Royal Exhibition Building & Carlton Gardens World Heritage Management Plan Part 1 of 5: Overview Site Management Plan,* Section 4.6, page 49, Statement of Significance; Spencer, Roger (1995-2005), *Horticultural Flora of South-Eastern Australia,* https://hortflora.rbg.vic.gov.au/ ; the individual Avenue assessments found in sections 3.12 and 3.13
Visual Diversity of canopy *Experience requirements for scoring: Heritage, design and horticulture*	What contribution does the new taxa make to visual diversity in the tree canopy? Compared to the rest of the site, does the taxa provide variation in terms of form, colour and seasonality? Taxa that are already used in a nearby avenue should score very lowly.	Visual Diversity contributes to the *"contrasting colours and forms"* and helps to emphasise the classical design intent by distinguishing the different avenues. As such it should be weighted as 1.0 (essential to success)	GML Heritage, Lovell Chen, (2023) *Royal Exhibition Building & Carlton Gardens World Heritage Management Plan Part 1 of 5: Overview Site Management Plan,* Section 4.6, page 49, Statement of Significance; and *Part 3 of 5: Heritage Management Plan,* Section 3.7, page 50, Carlton Gardens soft landscape elements; Spencer, Roger (1995-2005), *Horticultural Flora of South-Eastern Australia,* https://hortflora.rbg.vic.gov.au/ ; the individual Avenue assessments found in sections 3.12 and 3.13

Performance Criteria

Performance criteria have been developed based on best practice arboricultural, design, environmental, management and climate criteria. These criteria review the trees for arboricultural and landscape suitability for use in Carlton Gardens in order to provide the best chance of future success. Unlike heritage criteria, performance criteria are evenly weighted for all avenue in accordance with Table 2. This is because performance factors do not differ in requirements across the site.

Table 5: Performance Criteria Weighting and Scoring

Criteria	Description and considerations for scoring	Determination of Weighting	Justification and Referencing
Climate	How well is this taxon known to be suited to Melbourne's current and projected future climate? Consider the ranking given by the CAT for MAT15 (current) MAT17 (SS2) and MAT19 (SS3). Review MAP and identify any concerns, noting that MAP is a less reliable indicator of performance than MAT. Highest scores should be given for taxa with a CAT score of 9 or higher (middle of known climate range) for all three climate scenarios. Reduce score for any MAP concerns. Moderate scores should be given for taxa with a CAT score of 9 or higher for current climate and 6 or higher (shoulder of known range) for SS2 or SS3 scenarios. Reduce score for any MAP concerns. Lowest scores should be given for taxa with CAT scores of 5 or under (near edge of known range) for any climate scenario or for trees that are known to perform poorly in Melbourne at the present time	Climate suitability is essential for the success of Avenues and work for this report indicated a plentiful number of species known to be climate suitable available for use. Therefore, climate is weighted as 1.0 (essential to success)	See section 3.7 for full discussion on methodology and use of MAT and MAP in tree selection; Climate Assessment Tool, http://cat.bgci.org ; the individual Avenue assessments found in sections 3.12 and 3.13
Experience requirements for scoring: Arboriculture / Urban Forestry			

Criteria	Description and considerations for scoring	Determination of Weighting	Justification and Referencing
Arboricultural management: Structure *Experience requirements for scoring: Arboriculture / Urban Forestry*	Does the taxa have any known propensities for structural defects such as limb shed, bifurcation or root plate failure. Consider standard arboricultural concerns in relation to structure. City of Melbourne tree data may be used to inform assessments, but arboricultural advice from those working in the field should also be considered. Highest scores should be given for taxa which do not have a history of being high maintenance or having structural defects Moderate scores should be given for taxa with moderate, manageable defects such as a tendency to bifurcation. Lowest scores should be given for taxa with a propensity for high risk defects such as limb shed and root plate failure.	Structural integrity impacts a trees' maintenance requirements and can impact on a trees usefulness in the landscape. This is particularly relevant to avenue trees which are always high traffic areas. However, with the right level of maintenance can largely be managed, especially in a site such as Carlton Gardens. Therefore structure is weighted as 0.5	Mattheck C, Bethge K, Weber K, (2015), *The Body Language of Trees: Encyclopedia of Visual Tree Assessment ;* the individual Avenue assessments found in sections 3.12 and 3.13

Criteria	Description and considerations for scoring	Determination of Weighting	Justification and Referencing
Arboricultural management: Health *Experience requirements for scoring: Arboriculture / Urban Forestry*	Does the taxa have any known pest, disease or localised environmental problems (e.g. susceptible to waterlogging or compaction). Consider any biotic or abiotic factors (except macro-climate) which are known to limit the growth or performance of the taxa. Consider standard arboricultural concerns in relation to health. City of Melbourne tree data may be used to inform assessments, but arboricultural advice from those working in the field should also be considered. Highest scores should be given for taxa which do not have known health risks and which are performing well elsewhere in Melbourne and surrounding suburbs. Moderate scores should be given for taxa with moderate, manageable health risks, especially those that may be an aesthetic concern but rarely impact the Vigor of the tree. Lowest scores should be given for taxa with a propensity for poor vigour and performance.	Health impacts a trees' aesthetic value and usefulness in the landscape. At a species level City of Melbourne have found it to be the most reliable train for determining long term success in the landscape. Therefore it has been weighted as 1.0	Mattheck C, Bethge K, Weber K, (2015), *The Body Language of Trees: Encyclopedia of Visual Tree Assessment ;* the individual Avenue assessments found in sections 3.12 and 3.13

Criteria	Description and considerations for scoring	Determination of Weighting	Justification and Referencing
Weediness *Experience requirements for scoring: Arboriculture / Urban Forestry, environmental management*	Does the taxa have a known propensity to weediness? Consider if it is known to self-seed or reproduce vegetatively. Consider the species form of any cultivars. Consider climate change and if a taxa has a weed history in warmer and dryer climates. While weed lists can be helpful with assessment, these tend to only identify the worst offenders and localised environmental knowledge of a trees' propensity to spread should also be considered. Highest scores should be given to trees with no known weed history in southern Australia. Moderate scores should be given to taxa with some potential for self-sowing and spreading, especially if this is not known to occur in Melbourne (e.g. may be a weed in unmanaged regional areas). Lowest scores should be given for taxa with a propensity for self-sowing and spreading within Victoria and/or NSW.	Weediness impacts a trees' long term management and potential feasibility in the landscape. However in inner Melbourne this risk is more manageable. Therefore weediness is weighted as 0.2	Cook M, *Weeds of Melbourne*, https://weedsofmelbourne.org/ ; Centre for Invasive Species Solutions, *Weeds Australia, https://weeds.org.au/ ;* the individual Avenue assessments found in sections 3.12 and 3.13

Criteria	Description and considerations for scoring	Determination of Weighting	Justification and Referencing
Public Amenity and Design *Experience requirements for scoring: Landscape Architecture / Planning*	Does the taxon meet the public amenity and design requirements of the site? Does it provide the correct amount of solar access? Is it suitable for its current position in regard to size, landscape management and the expectations of park users? Will it look appropriate from a design perspective (as opposed to heritage aesthetics)? How much will the taxa impact the use of lawn areas? Highest scores should be given to trees that are the best option based on their function and landscape merits. Moderate scores should be given to taxa with some landscape suitability and with low level amenity and design problems, especially those which are able to be managed. Lowest scores should be given for taxa which will limit park use and enjoyment or cause management issues.	Public amenity and design impacts on the publics' use and enjoyment of the place. CGN has a much stronger neighbourhood focus, with use potentially impacted by tree selection. Therefore amenity and design would be weighted as 1.0 (essential to success) CGS has a more passive function, with lawns being the principal focus. The weighting for CGS would be 0.8, as avenues have less impact on amenity.	Lovell Chen, (2023) *Royal Exhibition Building & Carlton Gardens World Heritage Management Plan Part 3 of 5: Heritage Management Plan*, Section 3.7, page 50, Carlton Gardens soft landscape elements; Spencer, Roger (1995-2005), *Horticultural Flora of South-Eastern Australia*, https://hortflora.rbg.vic.gov.au/ ; Thompson Berrill Landscape Design, (2021) *City of Melbourne Open Space Strategy*, page 13 with reference to Carlton Gardens North ; the individual Avenue assessments found in sections 3.12 and 3.13 and WHMP reference on page 27

Selecting taxa for assessment

Taxa were selected for assessment based on traditional tree selection methodologies, in particular individual knowledge, discussion with colleagues and consideration of existing taxa used in and around Melbourne and in heritage landscapes. In addition to this the existing "like for like" taxa were also placed through the matrix to provide a base line for assessment.

The list reviewed attempted to cast the net wide, considering more predictable replacements (e.g. taxa already on site) and more unusual choices. To this end a small number of "calibration species" were also chosen. These were trees that were expected to score lowly, and which would be considered inappropriate based on traditional selection methods, but were put through the rubric for the sake of testing its' reliability and pre-emptively answering selection questions.

[xlii] Lovell Chen, (2023) *Royal Exhibition Building & Carlton Gardens World Heritage Management Plan Part 3 of 5: Heritage Management Plan,* Section 3.4.2, page 34

[xliii] Lovell Chen (2023) *Royal Exhibition Building & Carlton Gardens World Heritage Management Plan, Part 3 of 5: Appendix 1*, p10

[xliv] Lovell Chen (2023) *Royal Exhibition Building & Carlton Gardens World Heritage Management Plan, Part 3 of 5: Appendix 1*, p10

Appendix 2: Spreadsheet Data

Detailed data with full heritage assessment, replacement notes, descriptors and assessment of potential new taxa can be found as a separate file. This document should be referred to for further detail during any individual tree planting and replacement decisions.

Appendix 3: Climate assessment of Poplars

As discussed in Appendix 1, most Poplars are not well suited to Melbourne's climate and their unique look makes them difficult replace from an aesthetic perspective. For the sake of completeness, a list of all known Populus species was extracted from World Flora online and run through the BGCI climate assessment tool for Carlton Gardens. The results are as follows. Please note that climate is not the only assessment criteria to be considered and this list is provided for the sake of thoroughness.

Key

0	Not known and not likely
1	Not known but possible
2	Not known but likely
3	Near edge of BG range
4	Near edge of urban range
5	Near edge of natural range
6	Shoulder of BG range
7	Shoulder of urban range
8	Shoulder of natural range
9	Middle of BG range
10	Middle of urban range
11	Middle of natural range

Poplars with Some Future Climate Suitability

(shoulder of range or above for all three climate scenarios. Order alphabetical)

Taxon	MAT 15 (CURRENT)	MAT 17 (SSP2)	MAT 19 (SSP3)
*Populus brandegeei**	5	8	8
Populus deltoides	11	8	8
Populus euphratica[+]	11	11	11
Populus fremontii	11	11	8
*Populus guzmanantlensis**	5	5	11
Populus simaroa[+]	8	11	11

** may be limited due to lack of cold tolerance*

[+] *not commonly grown in Australia (if available at all) and considered too experimental for consideration*

Poplars with Poor Climate Suitability

(edge of range or below for any taxa. Order alphabetical)

Taxon	MAT 15 (CURRENT)	MAT 17 (SSP2)	MAT 19 (SSP3)
Populus ×acuminata	0	0	0
Populus ×berolinensis	0	0	0
Populus ×berolinensis	0	0	0
Populus ×candicans	0	0	0
Populus ×canescens	0	0	0

Taxon	MAT 15 (CURRENT)	MAT 17 (SSP2)	MAT 19 (SSP3)
Populus ×jackii	0	0	0
Populus ×xiaohei	0	0	0
Populus adenopoda	11	11	5
Populus afghanica	3	2	2
Populus alba	8	6	3
Populus amurensis	2	2	2
Populus angustifolia	5	5	2
Populus balsamifera	3	2	2
Populus cathayana	5	2	2
Populus charbinensis	6	3	2
Populus ciliata	6	6	2
Populus girinensis	0	0	0
Populus glauca	3	3	3
Populus grandidentata	3	2	2
Populus haoana	8	5	2
Populus heterophylla	11	8	5
Populus hsinganica	2	2	2
Populus ilicifolia	2	2	2
Populus iliensis	2	2	2
Populus intramongolica	2	2	2
Populus kangdingensis	2	2	2
Populus lancifolia	9	2	2
Populus lasiocarpa	11	8	2
Populus laurifolia	2	2	2
Populus mainlingensis	2	2	2
Populus mexicana	2	2	5
Populus mexicana	2	2	5
Populus nigra	6	6	3
Populus pilosa	2	2	2
Populus pruinosa	5	5	2
Populus pseudoglauca	9	2	2
Populus pseudomaximowiczii	2	2	2
Populus pseudosimonii	6	2	2
Populus qamdoensis	5	2	2
Populus schneideri	2	2	2
Populus simonii	6	5	2
Populus suaveolens	2	2	2

Taxon	MAT 15 (CURRENT)	MAT 17 (SSP2)	MAT 19 (SSP3)
Populus tomentosa	11	8	2
Populus tomentosa	11	8	2
Populus tremula	3	2	2
Populus tremuloides	3	3	2
Populus trichocarpa	6	3	2
Populus trinervis	11	2	2
Populus violascens	3	0	0
Populus wuana	2	2	2
Populus xiangchengensis	2	2	2
Populus yatungensis	2	2	2
Populus yuana	2	2	2
Populus yunnanensis	8	3	3

In addition to the above, no climate records were found for the following taxa

- *Populus ×brayshawii*
- *Populus ×gansuensis*
- *Populus ×hastata*
- *Populus ×heimburgeri*
- *Populus ×hinckleyana*
- *Populus ×hopeiensis*
- *Populus ×hybrida*
- *Populus ×inopina*
- *Populus ×jrtyschensis*
- *Populus ×parryi*
- *Populus ×pseudotomentosa*
- *Populus ×rollandii*
- *Populus ×smithii*
- *Populus ×xiaozhuanica*
- *Populus alaschanica*
- *Populus berkarensis*
- *Populus keerqinensis*
- *Populus manshurica*
- *Populus minhoensis*
- *Populus nakaii*
- *Populus ningshanica*
- *Populus platyphylla*
- *Populus qiongdaoensis*
- *Populus shanxiensis*
- *Populus wenxianica*

Appendix 4: Historic Plans

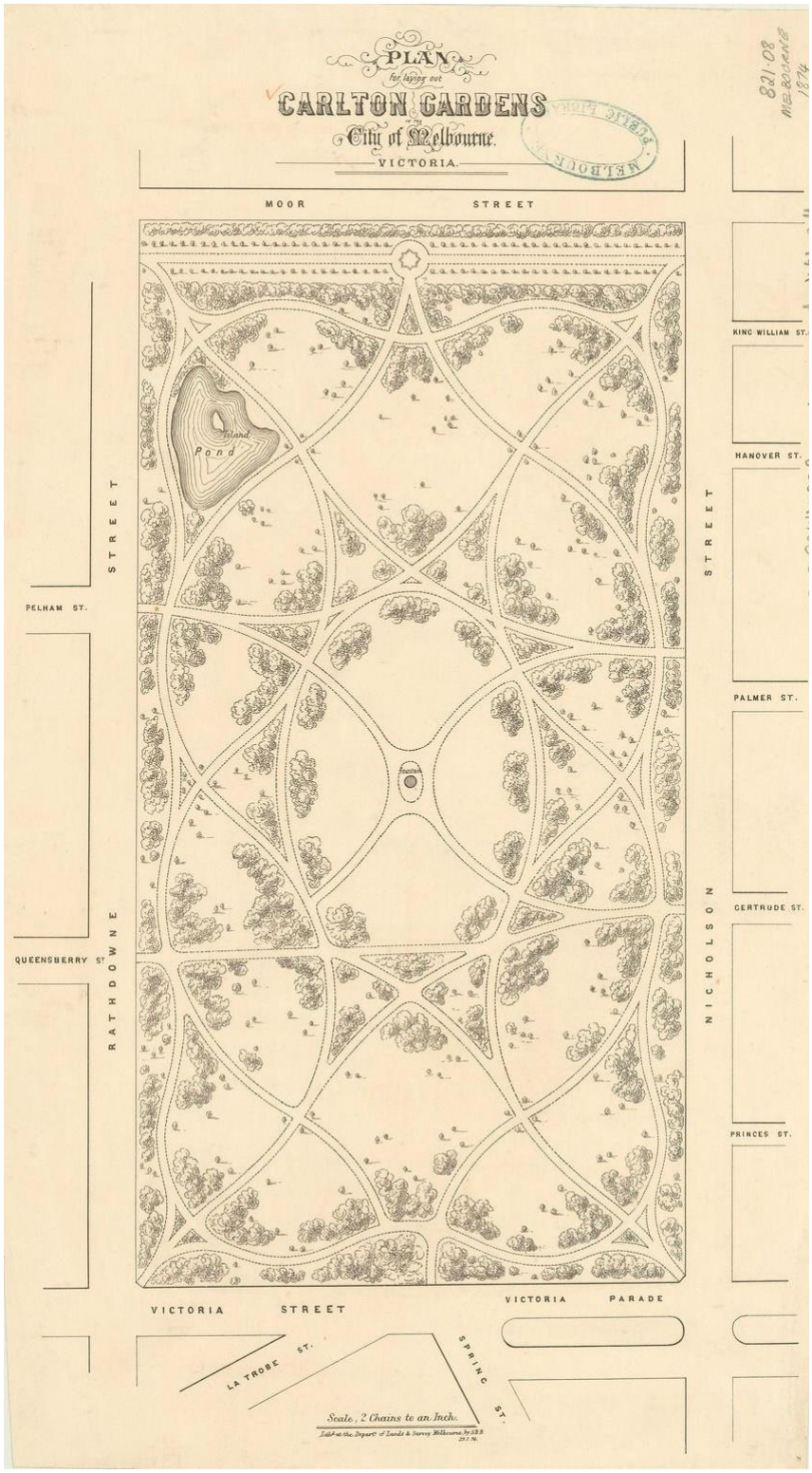

Figure 35: Bonney, S.B. (Samuel B.). (1874) Plan for laying out Carlton Gardens [cartographic material]: in the city of Melbourne, Victoria / lithd. at the Department of Lands & Survey, Melbourne by S.B.B., 29.1.74. MAPS 821.08 MELBOURNE 1874. State Library Victoria. Melbourne, Victoria.

Edward La Trobe Bateman's original 1856 design as updated in 1874 by Clement Hodgkinson.

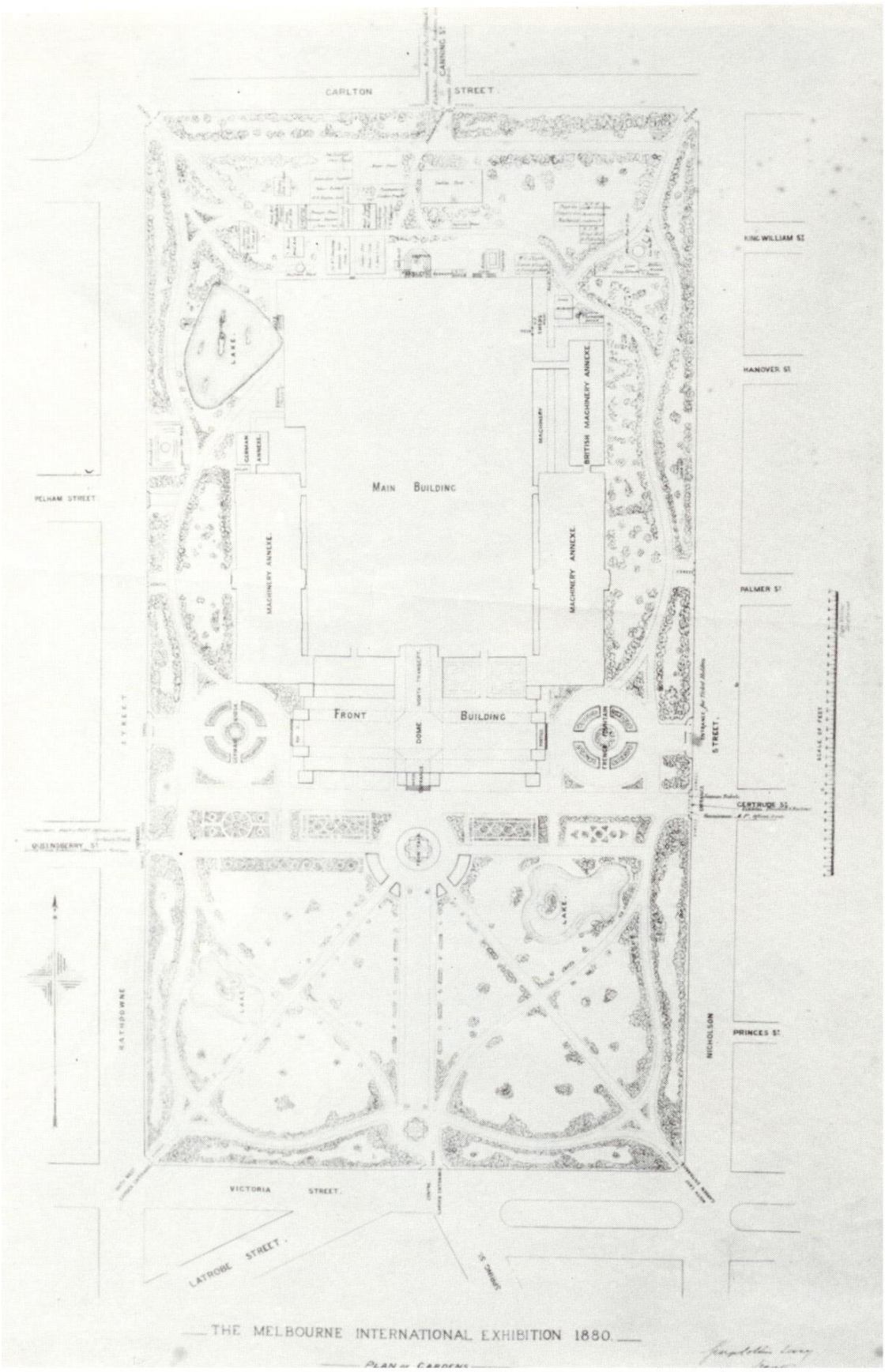

Figure 36: 1879 Reed and Barnes design for the Royal Exhibition Building and amended Carlton Gardens, reproduced from Melbourne International Exhibition 1880–81 Official Record.

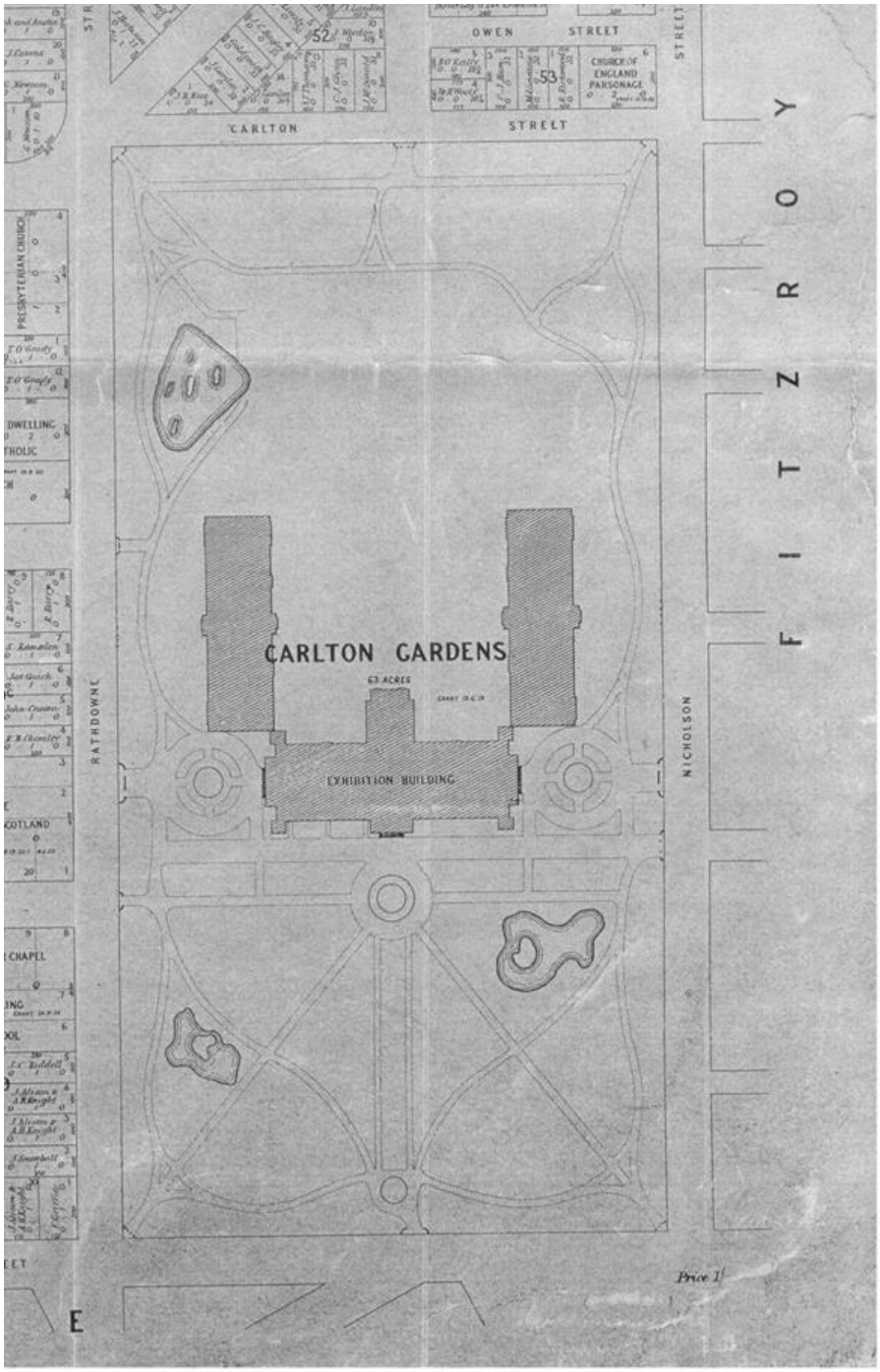

Figure 37: No date, Department of Lands and Survey showing hard landscape elements and water bodies after the temporary exhibition buildings were removed but before Hodgkinson's reconstruction of Carlton Gardens North.

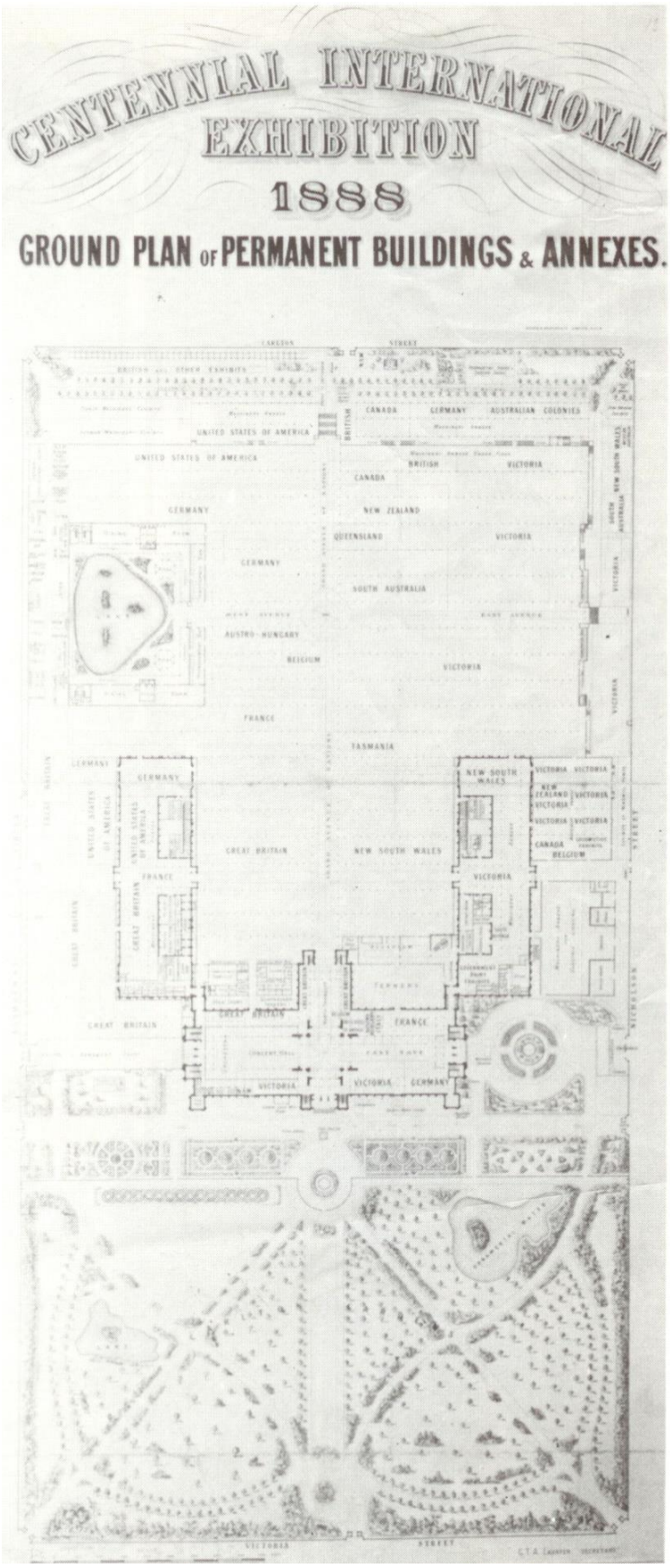

Figure 38: The Reed and Barnes 1879 design as altered for the 1888 International Exhibition, from the Official record of the Centennial International Exhibition, Melbourne, 1888–1889

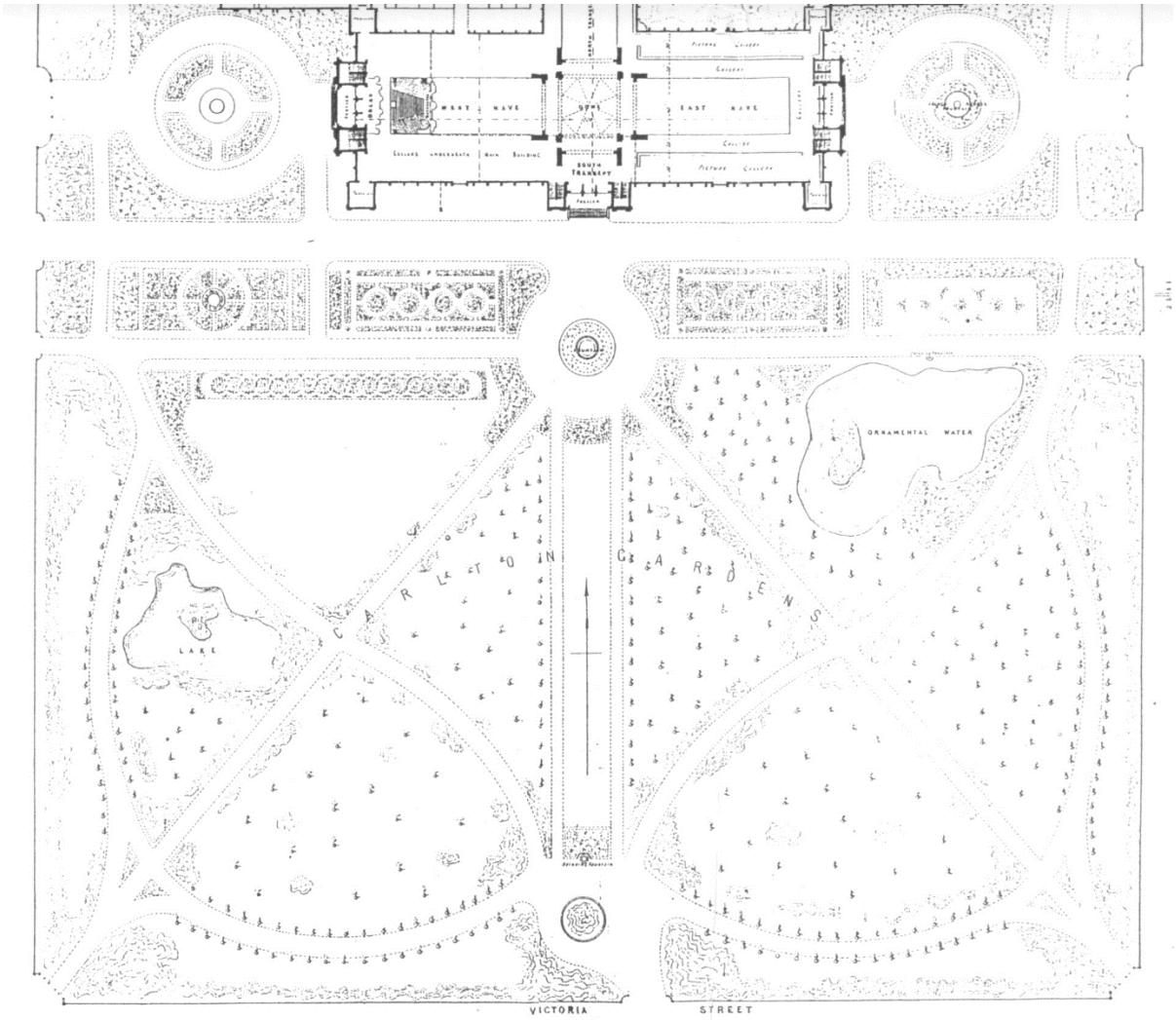

Figure 39: A close up of the Reed and Barnes 1879 design as altered for the 1888 International Exhibition, specifically Carlton Gardens South.

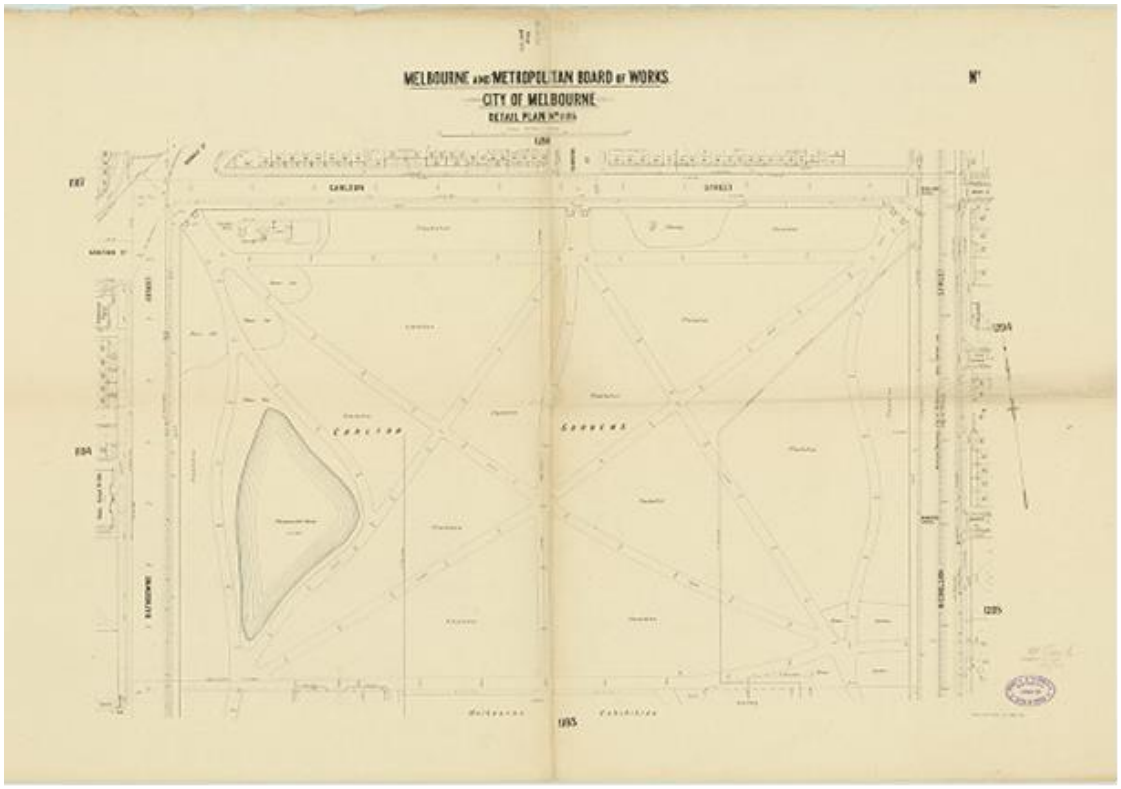

Figure 40: 1899 Melbourne and Metropolitan Board of Works detail plan of Carlton Gardens North, showing the 1890 Bickford reconstruction after the 1888 International Exhibition.

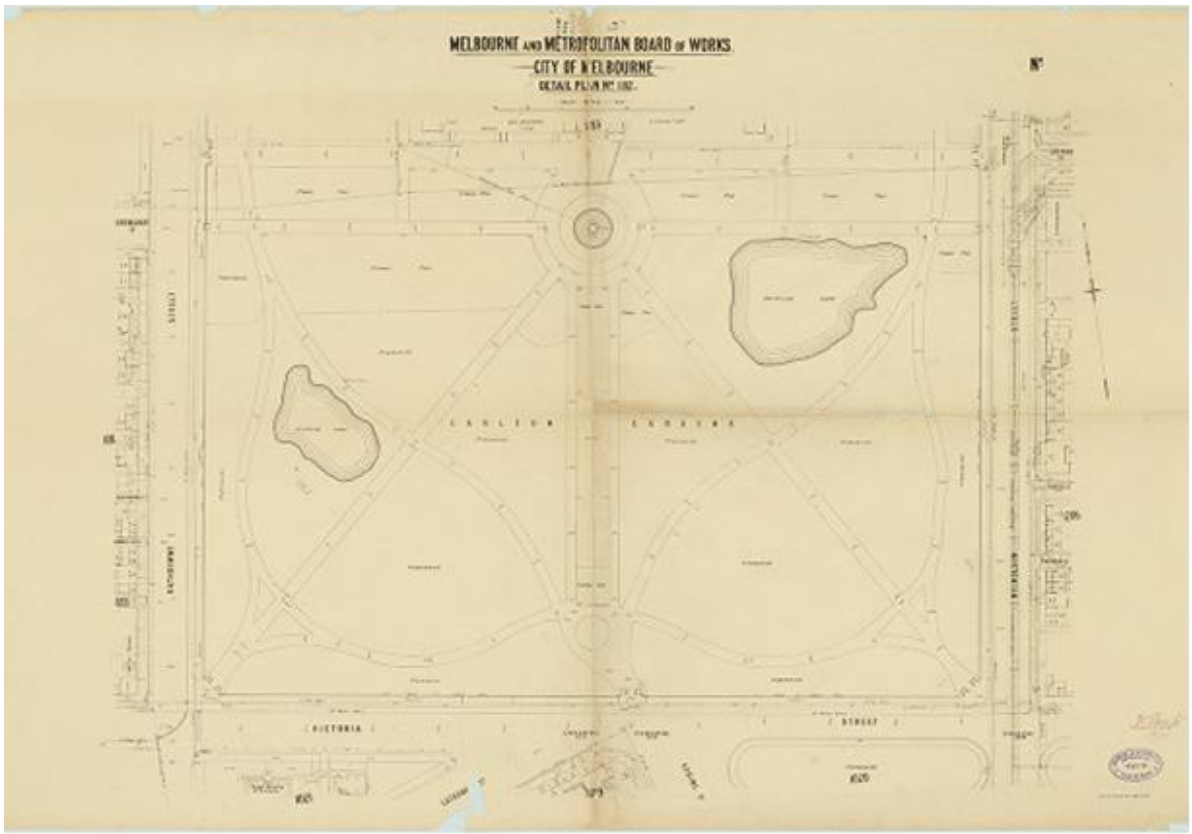

Figure 41: 1899 Melbourne and Metropolitan Board of Works detail plan of Carlton Gardens South.

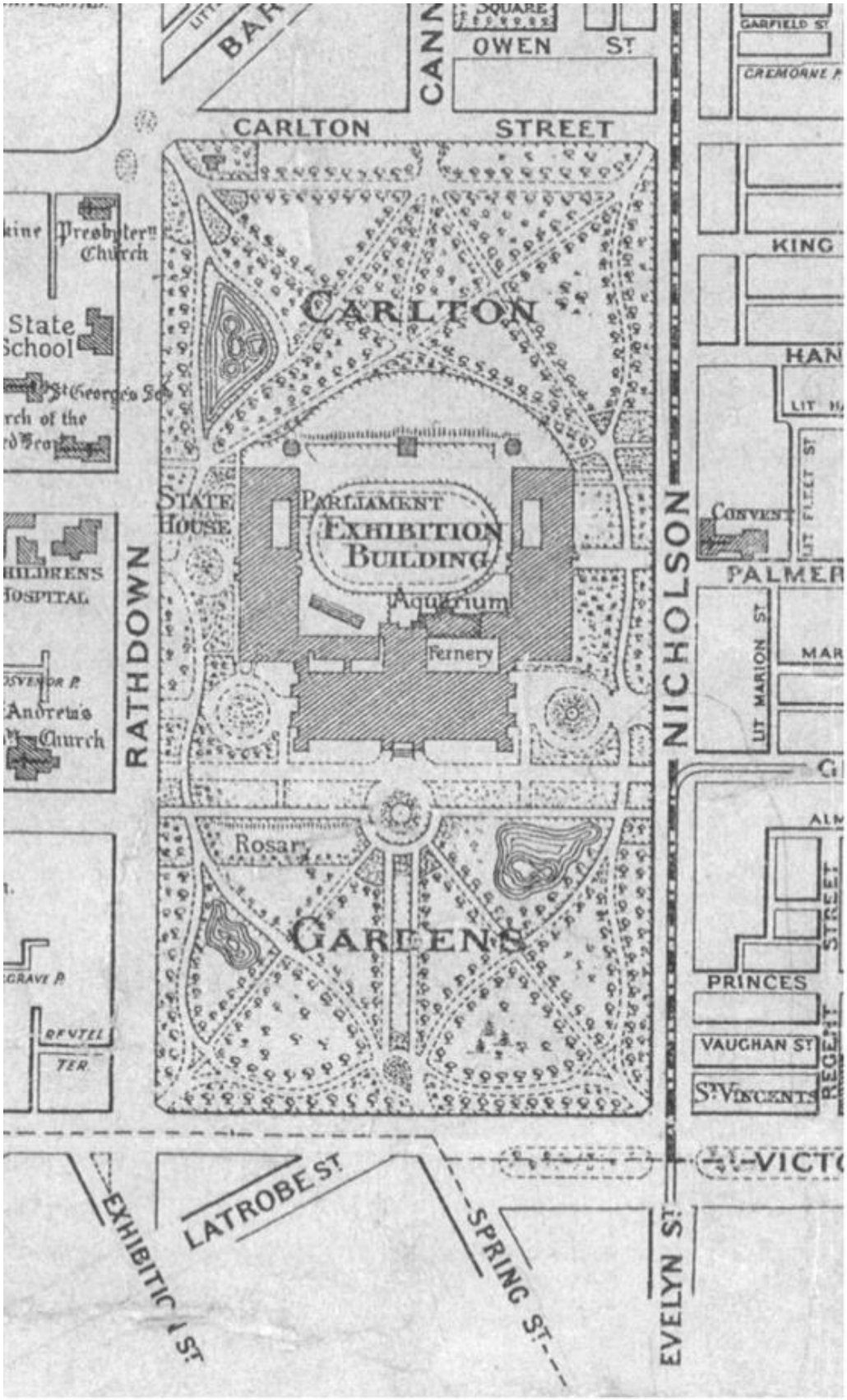

Figure 42: 1920s, Melbourne City Council Historical Plan, Land Survey Group.

Note: This plan appears to have considerable artistic license as it is not consistent with historic photographs.

Appendix 5: Illustrated Time Line

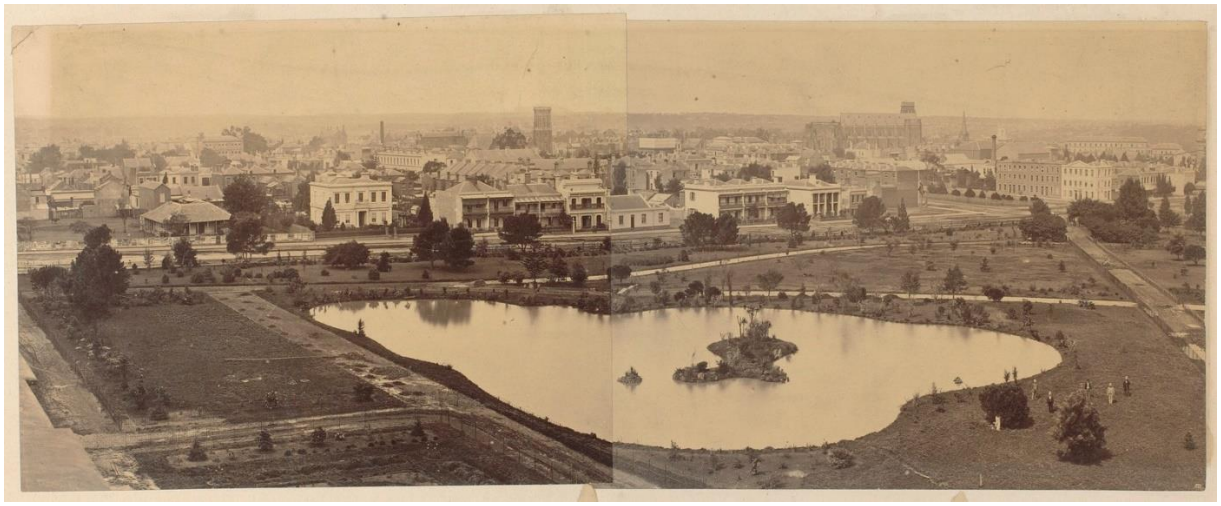

Figure 43: Nettleton, Charles. (1879) [View from Exhibition Buildings towards St. Patrick's Cathedral, Melbourne] [picture]. H14127. State Library Victoria. Melbourne, Australia.

Taken from the roof of the Royal Exhibition Building looking south-east toward the eastern lake and Nicholson Street.

Figure 44: Unattributed. (1879) [Melbourne from the Carlton Gardens looking south] [picture]. H4543. State Library Victoria. Melbourne, Australia.

Taken from the roof of the Royal Exhibition Building looking south down one side of the Grand Alleé toward Victoria Parade.

Figure 45: Supplied by City of Melbourne. Photograph C: 1879, view of the Royal Exhibition Building under construction, from Rathdowne Street looking north-east. MV 3243

Figure 46: Unattributed. (1879) [Melbourne from the Carlton Gardens] [picture]. H4512. State Library Victoria. Melbourne, Australia.

Taken from the roof of the Royal Exhibition Building looking down Avenue 6 toward Victoria Parade and Nicholson Street corner.

Figure 47: Nettleton, Charles (?). (1880) [View from the roof of the Exhibition Building, Carlton Gardens] [picture]. H141261. State Library Victoria. Melbourne, Australia.

Taken from the roof of the Royal Exhibition Building looking toward Rathdowne Street and the termination of Avenue 1 and Avenue 3

Figure 48: Hart, Ludovico. (1880) Photograph - Main Exhibition Building from Corner of Spring and Victoria Parade, Carlton, 1880-1881. MM 107801. Museums Victoria Collections. Melbourne, Australia.

Taken looking up Avenue 4 toward the Hochgürtel Fountain and Royal Exhibition Building.

Figure 49: Unattributed. (1880-1881) Photograph - Main Exhibition Building from South-West, Rathdowne Street, Carlton, 1880-1881. MM 107900. Museums Victoria Collections. Melbourne, Australia.

Taken from Rathdowne Street looking north-east toward the Royal Exhibition Building.

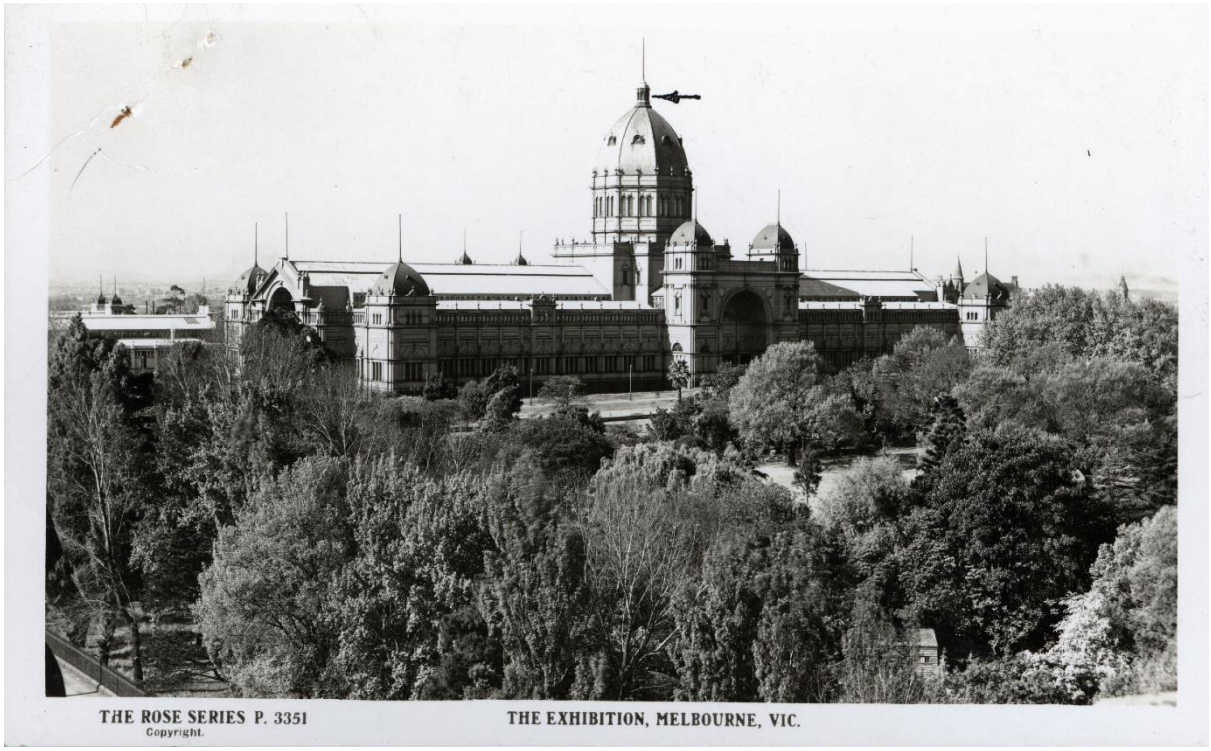

Figure 50: Rose Stereograph Company, (1880-1881) Postcard - South West Facade, Exhibition Building, Rose Series, Melbourne, circa 1930. SH 960622. Museums Victoria Collections. Melbourne, Australia.

Taken from Rathdowne Street looking north-east to the Royal Exhibition Building.

Figure 51: Nettleton, Charles. (1883) View of Melbourne (West) from the terrace of the Exhibition Building, Carlton Gardens. H848. State Library Victoria. Melbourne Australia.

Taken from the roof of the Royal Exhibition Building looking down Avenue 4 toward the intersection of Victoria Parade x Rathdowne Street.

Figure 52: Nettleton, Charles. (1883) View of Melbourne (South West) from the terrace of the Exhibition Building, Carlton Gardens [picture] H845. State Library Victoria. Melbourne, Australia.

Taken from the roof of the Royal Exhibition Building looking south down the Grand Alleé toward Victoria Parade.

Figure 53: Unattributed. (1888) Photograph - Main Exhibition Building from Corner of Nicholson Street and Victoria Parade, Carlton, 1880-1881. MM 130653. Museums Victoria Collections. Melbourne, Australia.

Taken looking across Nicholson Street and up Avenue 6 to the Hochgürtel Fountain.

Figure 54: Lindt, J.W. (1888). International Exhibition. H2013.372/5. State Library Victoria. Melbourne, Australia.

Taken from across Nicholson Street toward the eastern entrance of Avenue 1.

Figure 55: Nettleton and Arnest. (1890) Photograph - Carlton Gardens & Queen's Coffee Palace, Melbourne, circa 1890. MM 109787. Museums Victoria Collection, Melbourne Victoria.

Taken from the roof of the Royal Exhibition Building looking south-east down Avenue 4 toward the entrance at Victoria Parade x Rathdowne Street.

Figure 56: Lindt, J.W. (1878-1894) Exhibition Gardens, Melbourne, [Vic.] [picture] / Lindt. H2008.59/23 State Library Victoria, Melbourne Australia.

Taken from across the western lake looking north-east toward the Royal Exhibition Building.

Figure 57: Charles Henry Hunt (c. 1895). Antique Print & Map Room

Figure 58: Hill, T.M. (1900-1910?) Exhibition Building, Melbourne. H2004.84/14. State Library Victoria, Melbourne Australia. Taken looking north-west across the eastern lake toward the Royal Exhibition Building and Avenue 1.

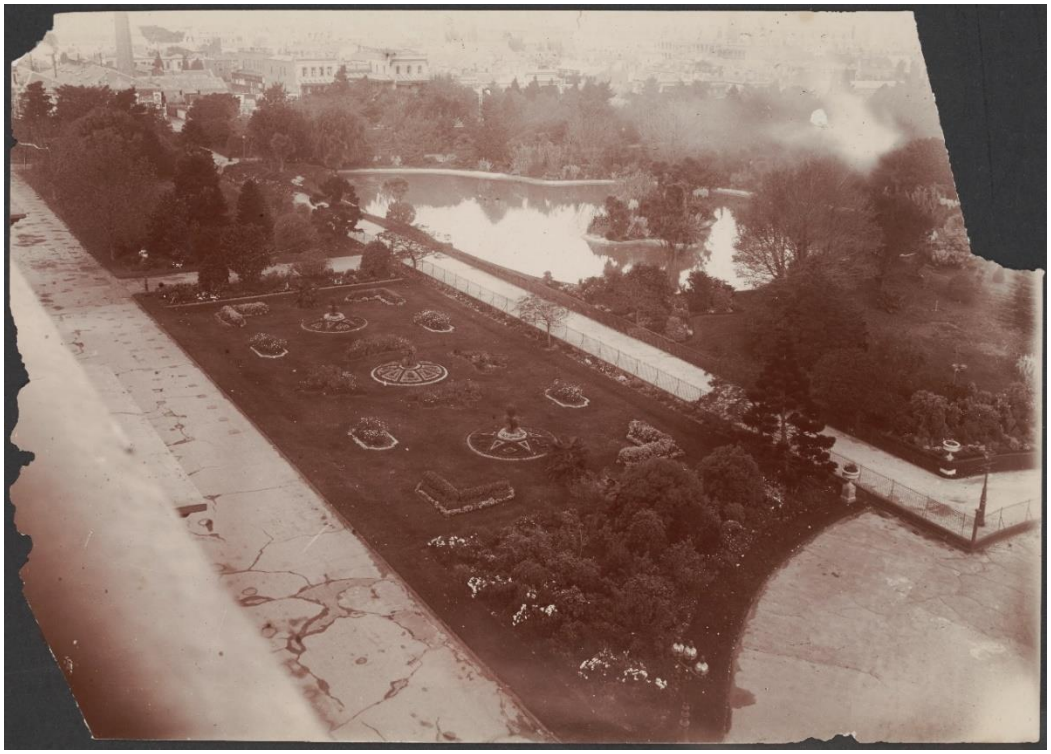

Figure 59: Hill, T.M. (1900-1910?) View from roof of the Royal Exhibition Building, Melbourne. H2004.84/12. State Library Victoria, Melbourne, Australia.

Taken from the roof of the Royal Exhibition Building looking south-east toward the eastern lake and garden beds.

Figure 60: Lindt, J.W. (1905) Postcard - South East Facade, Exhibition Building, JW Lindt, Melbourne, circa 1905. SH 960662. Museums Victoria Collections, Melbourne, Australia.

Taken looking across Nicholson Street north-west toward the eastern lake and Royal Exhibition Building.

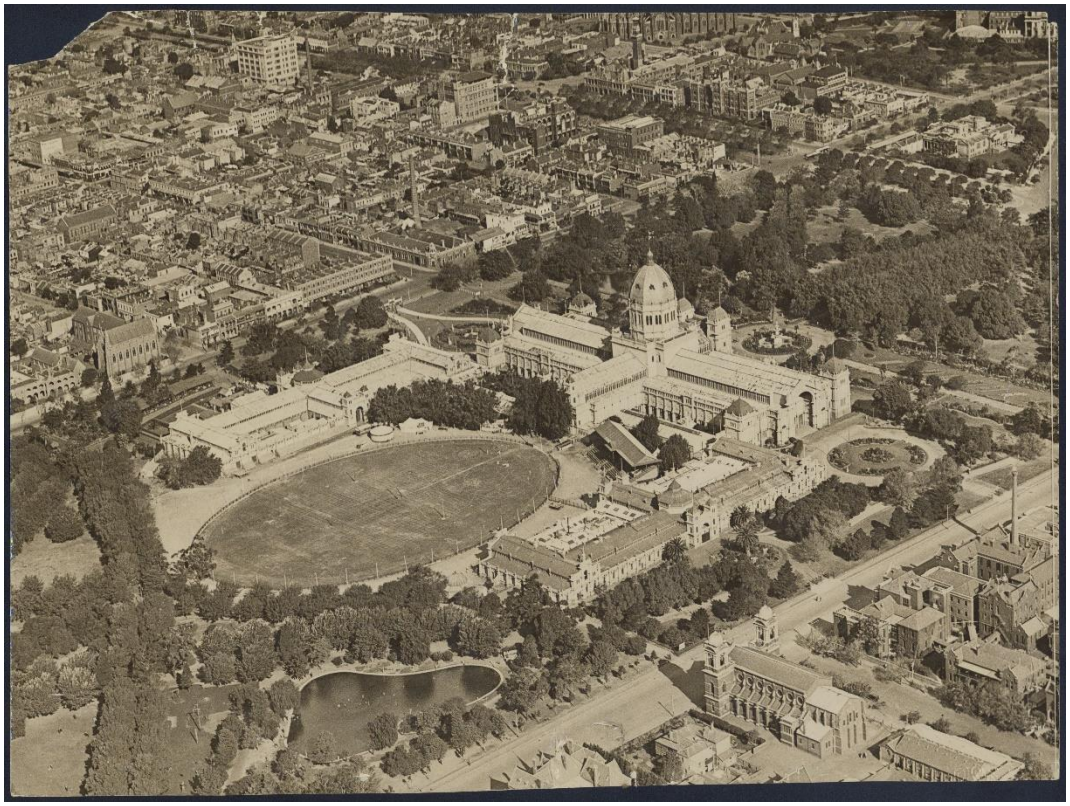

Figure 61: Airspy, photographer (1931?) Aerial view of the Exhibition Buildings, Carlton, Victoria. 2958427. State Library Victoria, Melbourne, Australia

Figure 62: Pratt, C.D. (1930-1948) [Exhibition Buildings in Carlton Gardens, Vic.] [picture]. H91.160/514. State Library Victoria, Melbourne, Australia.

Figure 63: Unattributed. (1949) Aerial Photograph of Carlton Gardens South, City of Melbourne

Figure 64: Unattributed. (1949) Aerial Photograph of Carlton Gardens North, City of Melbourne

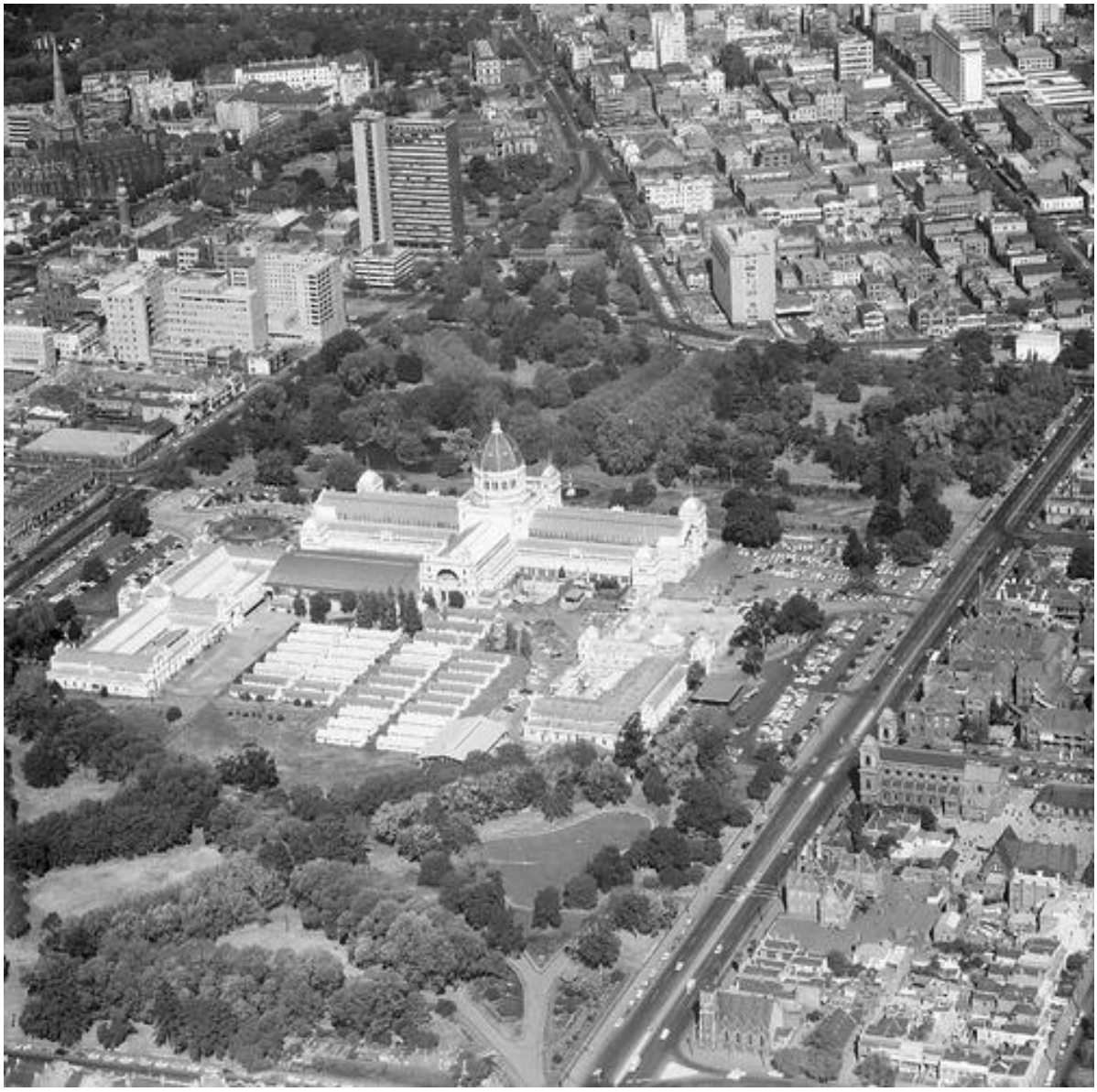

Figure 65: Payens, J. (1962) Negative - Aerial View of the Royal Exhibition Building, Carlton, Victoria, Apr 1962. MM 134764. Museums Victoria Collections, Melbourne, Australia.

Figure 66: Payens, Jim. (1962) Negative - Aerial View of the Royal Exhibition Building, Carlton, Victoria, Apr 1962. MM 134753. Museums Victoria Collections. Melbourne, Australia.

Figure 67: Payens, Jim. (1962) Photograph - Aerial View of the Royal Exhibition Building, Carlton, Victoria, Apr 1962. MM 134769. Museums Victoria Collection. Melbourne, Australia.

Appendix 6: World Heritage Management Plan Statement of Significance

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