Hyde Park Tree Management Plan

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1 INTRODUCTION

Hyde Park has outstanding heritage significance. It was designed and developed in the late 19th and early 20th centuries and is one of Sydney's premier parks. The most visually dominating element in Hyde Park is its trees.

The Hyde Park Tree Management Plan was proposed by the Council of the City of Sydney in October 2004, following the failure and consequent removal of several large trees from Hyde Park North and Hyde Park South.

The Tree Management Plan informs the Hyde Park Plan of Management and Masterplan (henceforth known as PoM & Masterplan) of the strategies to be implemented to manage the tree resource of Hyde Park for future generations. It is an element of Volume 2 of the PoM & Masterplan and should be referred to for all tree related issues.

1.1 Purpose of the Hyde Park Tree Management Plan

The purpose of the Hyde Park Tree Management Plan is to develop proactive strategies for the effective management; maintenance and conservation of the tree population in Hyde Park and to give the community and Council's management staff a clear direction and vision for the future management of the Park's trees.

The aims are to:

- describe the special qualities of the Park's trees, their significance and the landscape character that they create;
- assess the health and condition of all existing trees;
- provide strategies for the long term removal and replacement of the Park's trees, setting priorities for Hyde Park North and Hyde Park South;
- to develop a consistent proactive management approach for the existing tree population;
- develop clear strategies and time frames for the removal and replacement of the trees in the central avenue; and
- develop community awareness and acceptance of tree management issues including tree removal, replacement strategies and disease management.

1.2 Scope of the Plan

The Hyde Park Tree Management Plan (TMP) focuses on the trees in Hyde Park North and Hyde Park South. It includes a survey of all of the existing trees in the Park and contains relevant heritage, environmental and arboricultural data relating to individual trees as well as distinct groups of trees such as avenue plantings.

1.3 Project Background

In recent years several large trees in Hyde Park have fallen over and other trees have lost large branches. In such a highly visited park this poses a high risk of injury to park users. This prompted the Council of the City of Sydney to assess the health and condition of the remaining tree population and to commission a number of reports from independent arborists.

These reports identified that the failure of the Hill's Figs in the central avenue was due to the effects of disease organisms, including *Phellinus* species, *Phytophthora cinnamomi* and *Armillaria luteobubalina* or a combination of these diseases. Following recommendations from the independent arborists' reports, over 40 trees have been removed from Hyde Park during the last two (2) years.

The City recognised the adverse risk management issues facing the Park's trees and determined that there was a need for a proactive long term approach to tree management within Hyde Park through the preparation of a Tree Management Plan.

A background of the tree diseases in Hyde Park is included in Appendix 1 and a Glossary of Terms used in this report is included in Appendix 5.

2 METHODOLOGY

2.1 Study Process

Preparation of the Hyde Park Tree Management Plan involved liaising with consultants and a Steering Committee and presenting findings to the community and stakeholders, detailing the aims and objectives of the TMP including species selection for new tree planting.

The preparation of the Hyde Park Tree Management Plan involved the mapping of the existing tree population located in Hyde Park North and Hyde Park South and comprehensive studies of the issues that affect these trees.

Detail plans of Hyde Park North and Hyde Park South were prepared by the City in April 2005 and August 2005 respectively.

Council's Tree Management Team then conducted visual assessments from the ground, of each and every tree. The age and condition of the trees were assessed. Field notes, observations and photographs were recorded during this assessment period and a Safe Useful Life Expectancy (SULE) analysis of the tree population was prepared.

Specialist soil scientists from Sydney Environmental and Soil Laboratory Pty Ltd were engaged to analyse soil samples from Hyde Park North and Hyde Park South to determine the present soil conditions as they relate to the growth and longevity of the existing trees and to provide recommendations and strategies to improve soil conditions for future planting.

A design analysis of Hyde Park identified significant vistas and planting patterns (refer to PoM & Masterplan).

An historical perspective on past plantings in relation to viewing corridors and vistas was considered, particularly in the context of Hyde Park being a late 19th/early 20th century period park. Significant trees were identified individually and in group plantings.

A heritage review was undertaken in 2006 by HBO + EMTB (PoM & Masterplan Vol.2 - 1.3).

The current arboriculture practices and tree management methods used by the City's Parks and Open Space Service Providers were assessed to identify any opportunities to improve the existing techniques.

Specific tree issues such as:

- inappropriate tree plantings
- over-mature trees
- hazardous trees
- disease and restrictive soil conditions and
- poorly performing trees

were also assessed.

3 THE PARK

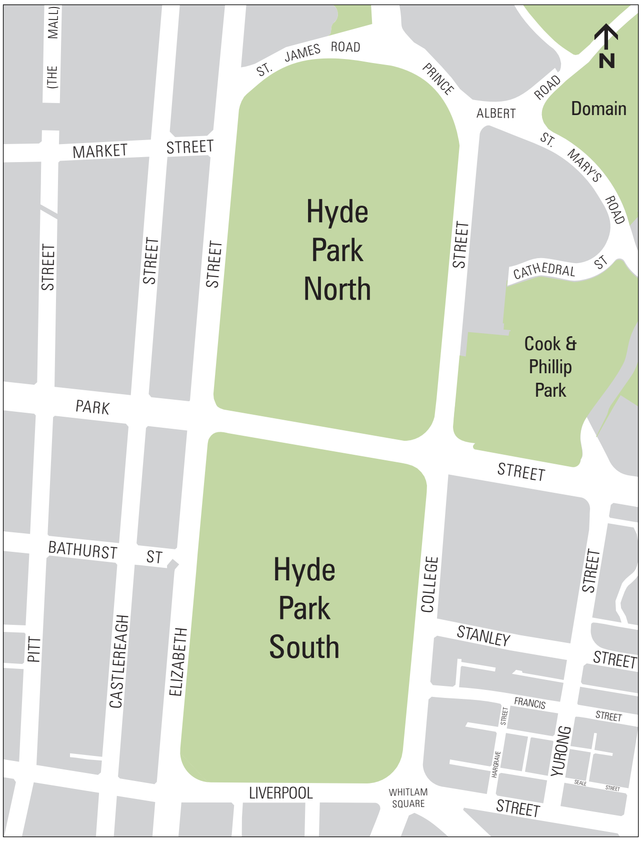
3.1 Site Description

Hyde Park occupies an area of 16.7 hectares of land in Sydney's CBD, extending from Queen Square to Liverpool Street, between Elizabeth and College Streets. Park Street runs through Hyde Park from East to West, dividing it into two sections; Hyde Park North is 8.3 hectares and Hyde Park South is 7.8 hectares.

Hyde Park is Crown Land that has been managed on behalf of the State, by the City of Sydney, since 1904. The Park is primarily used as a passive recreation space but is also used for community and cultural events.

Sydney's underground railway traverses the length of Hyde Park from North to South, with stations at St James in the NW corner of Hyde Park North and Museum in the SW corner of Hyde Park South.

The central avenue of *Ficus microcarpa* var. *hillii* (Hill's Fig), that links the Archibald Fountain in Hyde Park North with the Anzac Memorial in Hyde Park South, is the Park's most significant element.



Site plan

3.2 History

Hyde Park is Australia's oldest public park . In October, 1810 under a General Order of Governor Lachlan Macquarie, it was gazetted "that the portion of ground unoccupied in the town of Sydney known variously as the Common, the Exercising Ground or the Cricket Ground would in future be reserved exclusively for the recreation and amusement of the inhabitants and would be known as Hyde Park" (Sydney City Archives).

In addition to its early use as a racecourse and exercising ground for the troops, Hyde Park was used as a cricket ground from 1827 to 1856.

In the 1850s, after the closure of Macquarie Street and the removal of cricket to the Domain, Moreton Bay Fig trees were planted along the central avenue, stretching the entire length of the Park from Queens Square to Liverpool Street. The avenue was sometimes described as "Lover's Walk" (figure 1).

In 1871 these trees were described in the Sydney Morning Herald as:

"a magnificent avenue of noble trees, running north and south the entire length of the Park, forms the most delightful promenade in or out of the City. The trees have attained, since the time of their being planted, an immense size. They are chiefly Moreton Bay Figs, one of the handsomest evergreen trees in cultivation." (Sydney City Archives).

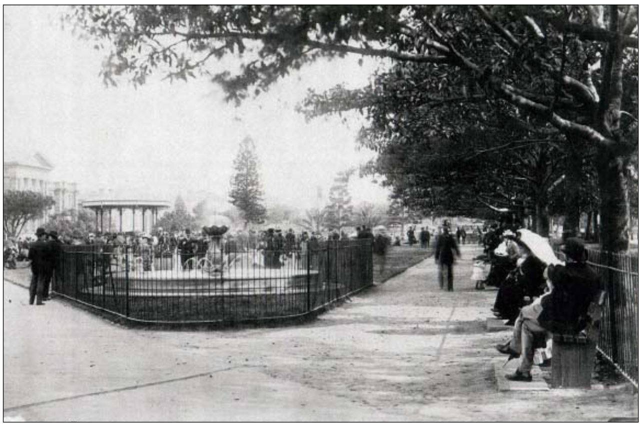


Figure 1: "Lover's Walk", Hyde Park. (*Mitchell Library*)

Responsibility for Hyde Park was transferred from the Colonial Secretary to the Municipal Council of Sydney in 1904.

In 1919, building began on the City's Underground Railway. In 1922 Council's Parks Committee gave the Railway Commissioners permission to continue the work by open cut trenching (see figure 2) instead of tunnel work.

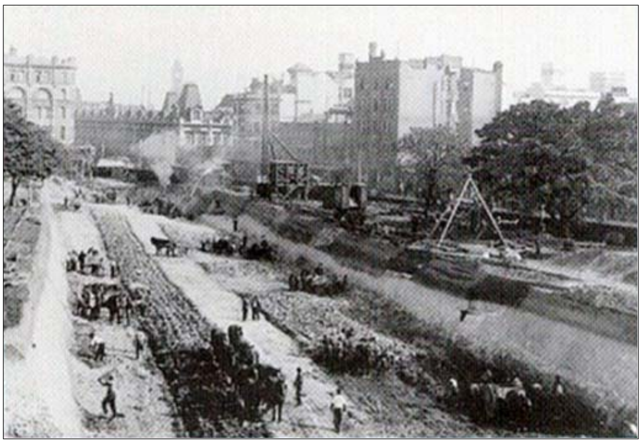


Figure 2: Open cut trenching for the underground railway. *(Mitchell Library)*

This was to enable the project to be completed more quickly and to provide work for many unskilled and unemployed men. The Committee argued that the Park could be made available for public use sooner and that the only permanent damage would be the removal of the avenue of Moreton Bay Fig trees (SMH May 28, 1922).

In 1926, following the decimation of the Park by the City Railways, the Municipal Council resolved to hold a competition for the design of a restored and re-furbished Hyde Park. The competition was won by Norman B. Weekes, who had previously worked for the Municipal Council of Sydney as an engineer.

A panel of Assessors was appointed to advise the Council in connection with the competition and the designs submitted for the remodelling of Hyde Park and in their report to Council, dated 16th August, 1927, they made the comment:-

"A most important factor in the success of the whole scheme is the choice of the trees for the avenues and other new planting. As mentioned in our previous report on the competition designs, we desire to emphasize the desirability of confirming the selection to a few varieties that will thrive in the rather poor soil of the Park, and especially the necessity of planting the avenues with one variety only to obtain uniformity to effect.

The only exception to this rule that might be considered is whether it might be advisable to plant two varieties in alternation, the one slow growing for the permanent avenue, and the other quick growing and short lived to obtain an immediate result, which would be cut out as soon as the permanent trees have made a sufficient growth" (Municipal Council Minutes 24th August 1927).

Norman B. Weekes' original design, which had been modified by the Assessors, was further modified to incorporate the War Memorial, designed by Bruce Dellitt. Though not in the original design, some of the Moreton Bay Figs near Elizabeth Street were removed in 1930, to make way for the Anzac Memorial.

Hyde Park, as we know it today, was constructed in general principle according to the amended plans between 1926 and 1934. It was one of the major urban projects of the depression years (Proudfoot, 1987[1]).

The central avenue of Hill's Fig was planted c.1930 following the construction of the City Underground Railway.

Despite the intentions of the 1927 Amended Assessors Report, in the years following the reconstruction phase, there was an uncommitted approach to the Park's management and maintenance.

Concern for the welfare of Hyde Park and its deteriorating condition prompted the Council of the City of Sydney to resolve, in 1984, to undertake the preparation of a Plan of Management to control the future development of Hyde Park. The commitment to this study, the first in the Park's history, recognised the significance of Hyde Park and the responsibility of Council, as Trustees of the Park, to manage this invaluable resource. (PoM 1989[2]) The study commenced in January 1987 and was completed as a draft, in January 1989.

The Works Committee considered the Draft Plan of Management as a guide for future development but it was not adopted by Council.

While the Draft Plan of Management has been recognised as a guide since its completion in 1989, tree management programs have been hindered by the absence of a clear tree management philosophy.

1 Proudfoot, H. (1987) - *Hyde Park Sydney, Statement of Significance and Historical Analysis*, December 1987
2 *Hyde Park Plan of Management and Masterplan*, Council of the City of Sydney, 1987-1989

3.3 Statement of Significance

A Statement of Significance and Historical Analysis for Hyde Park was prepared in December 1987 by Helen Proudfoot, an Urban History Consultant and Planner. Extracts from this report are included in the Draft PoM & Masterplan.

Significance of the Trees

The historical analysis included in Proudfoot's report makes reference to the trees creating a sense of place and dominating the planting and design. "Hyde Park is centred upon its great shaded promenade under the magnificent *Ficus microcarpa var. Hillii*", and "It is this formal quality which gives it (Hyde Park) its strength and memorability".

The tree plantings in Hyde Park have varying degrees of significance. "The main avenue planting of *Ficus microcarpa var. Hillii*, planted c.1930, is the main feature of the park and is its most significant element historically" (PoM, 1989). Many of the individual trees in Hyde Park North and Hyde Park South were planted prior to 1928 and some were planted c.1860, surviving the construction works associated with Sydney's underground railway. As remnants of the Victorian era of the park, these trees should be recognized for their historic significance (Significant Trees, Section 5.5).

3.4 Design Analysis

Hyde Park represents a rare historic example of a formal urban landscape design that has the potential to influence and delight millions of people. It is Sydney's premier park and was designed as the centrepiece of the CBD.

The original design principle was to create a formal landscape with emphasis on the central avenue and vista planting. The aim was to provide open spaces between the avenues, uncluttered by specimen trees or irrelevant contouring.

Hyde Park was developed as a retreat from the City, a quiet place where visitors of all ages could experience a diversity of activities in an uncluttered space dominated by tall trees. The original design was opposed to shrubberies and too many flower beds (City Archives). Boundary planting was intended to provide relief and contrast from the City's developing buildings.

The unique vista created by the central tree lined avenue is the most significant design element in Hyde Park and the aesthetic and amenity value provided by these trees complements this famous venue.

The formal quality of the design gives Hyde Park its strength and memorability and makes it Australia's foremost formal urban landscape. "The formal geometry and structure of Hyde Park must be reinforced in a consistent manner to unify its elements and functions". (PoM 1989 - Figure 4)

In the last several years, the formality of the original design has been compromised by the *ad hoc* planting of trees (Figure 5). This has occurred partly due to the absence of detailed planting plans. From the appearance of the Park today, it appears that the placement and species arrangement of trees has not been guided by any well conceived design concept. A wide variety of trees have been planted in an irregular fashion resulting in many areas of the Park having ambiguous landscape character.

The overall distribution of trees and density of canopy, together with overshadowing from the adjacent city buildings has restricted grass growth in several sections of the Park and has compromised the form of many trees. The end result has been a divergence from the original design intent, with no consistency to entrance planting and no park wide strategies for species selection for group plantings.

A major focus of the TMP for Hyde Park is to implement a program of tree removal and replacements that will reinforce the design strategies of the 2006 PoM & Masterplan (Figure 6).

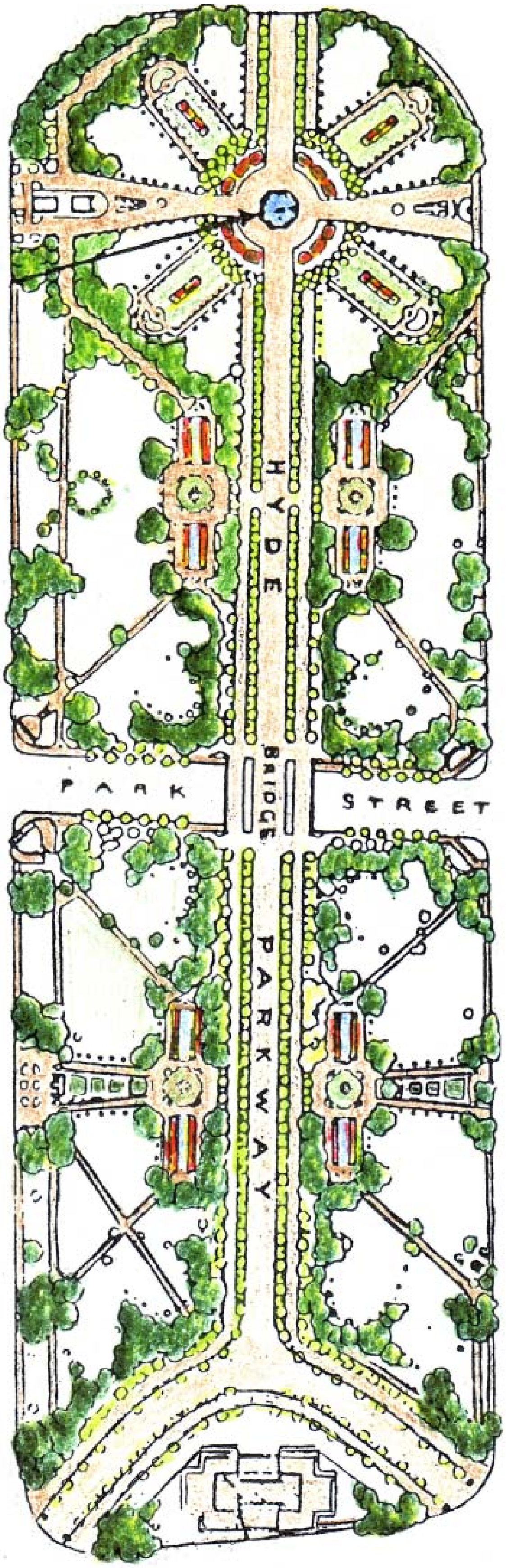


Figure 3: 1927 Norman Weekes modified design

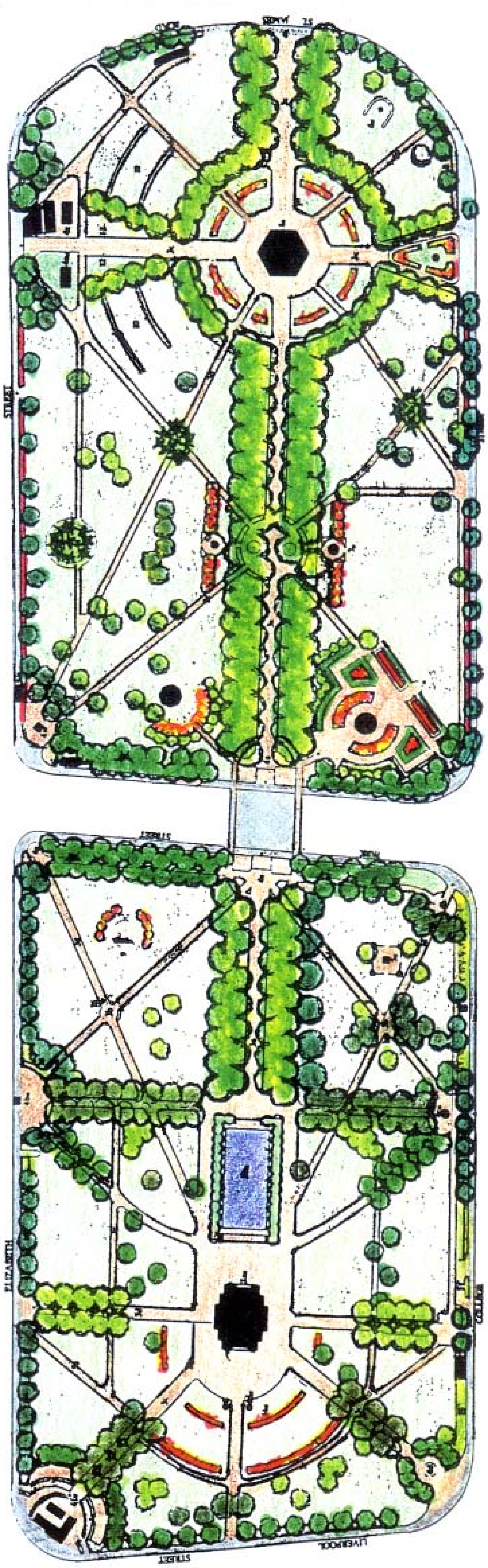


Figure 4: 1989 Plan of Management Masterplan

Aerial Photo of Current Ad Hoc Overplanting

Figure 5


Nagoya Gardens maintained as a formalised garden setting.
"Key hole" style tree planting frames and subtly focuses the main cross axis vista to Archibald Fountain from Market Street and St Marys Cathedral entrances while providing amenity shading to Nagoya Gardens and new terraced areas.
Low shrubs / hedge and groundcovers used to define outside edge of avenue.
Open grass areas maintained and enhanced through the removal of adhoc plantings while maintaining large parkland specimen trees to provide amenity shading.
Smaller specimen trees established to assist in defining the boundary to the main avenue, provide contrasting colour and texture and create / define smaller tranquil spaces while still maintaining clear sight lines throughout the park.
Ad hoc tree paltnings in open lawn areas selectively removed to open up grass areas.
Feature trees used to enhance and define main entrances to the park.
Pool of Reflection feature avenue trees retained.
Minor avenue trees retained to define cross axis path to the ANZAC Memorial and maintain amenity shading to existing paved seating areas.
Border trees re-established around the Archibald Fountain to define the edge of the space, reinstate the semi-enclosed character and define the landscape cartilage to the fountain.
Main avenue trees re-established in block replacement to maintain existing character and frame vistas from Macquarie Street and between the Archibald Fountain and the ANZAC Memorial.
Sandringham Gardens maintained as a formal parterre garden including the restoration of the existing pergola and re-establishing the climber. Views from central avenue to gardens to be opened up.
Boundary trees maintain and frame views to signicant buildings adjoining the park and external views into the park (e.g. St Marys Cathedral, Australian Museum, Sydney Grammer School, etc.).
Secondary avenue trees retained to define key pathway from main entrances and monuments to the ANZAC Memorial and Pool of Reflection and maintain amenity shading to existing paved seating areas.
Feature trees used to define boundary and create a landscape setting to the ANZAC Memorial.
Existing pine trees and shrubs relocated into new memorial setting to clear views to the ANZAC Memorial.
Avenue planting to new cascade water feature provides an opportunity to reinterpret the original Gallipoli Gardens planting scheme.
Main Avenue
Secondary Avenue
Minor Avenue
Boundary Planting
Entrance Feature
ANZAC Memorial Boundary Planting
Pool of Reection Avenue
Large Parkland Specimen
Main Avenue Border Planting
Palm Feature Planting
Sandringham Gardens Pergola

Figure 6

Park Entrances

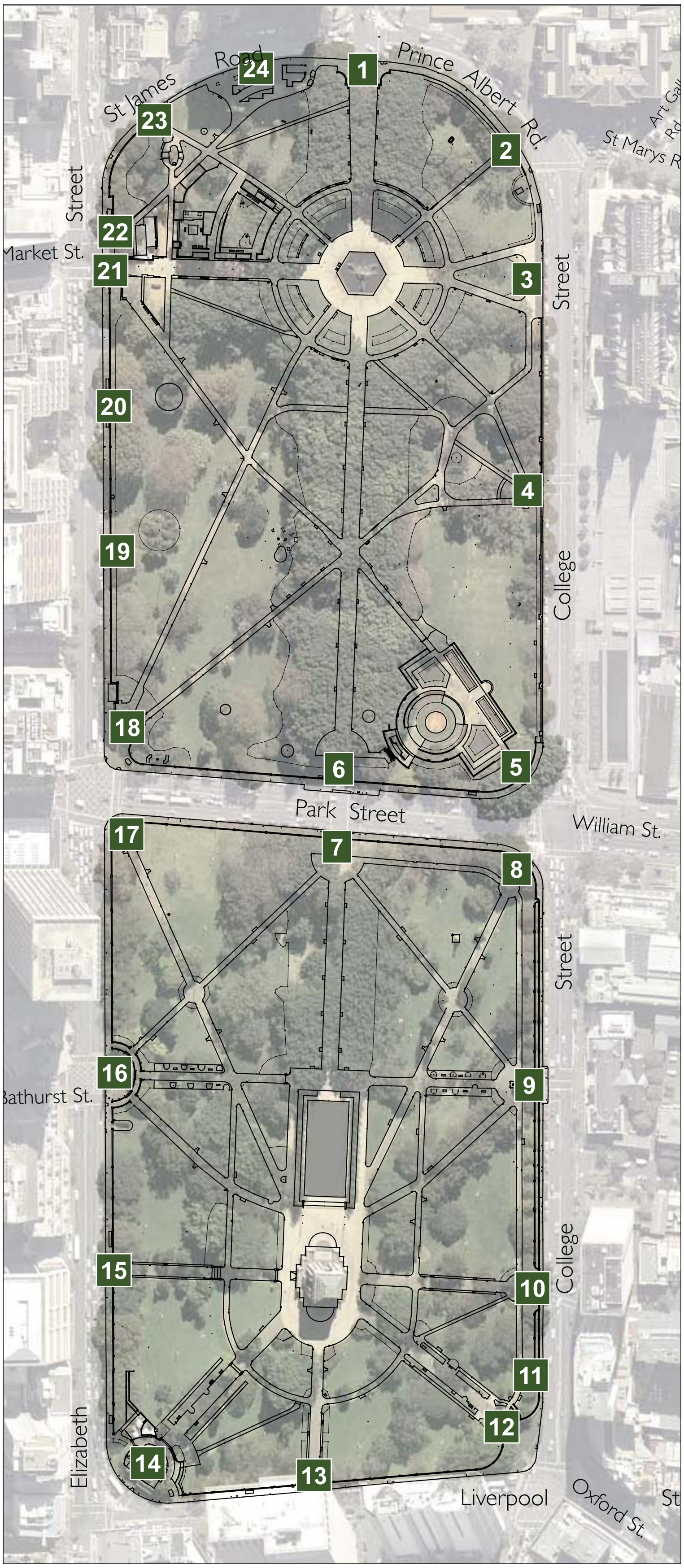
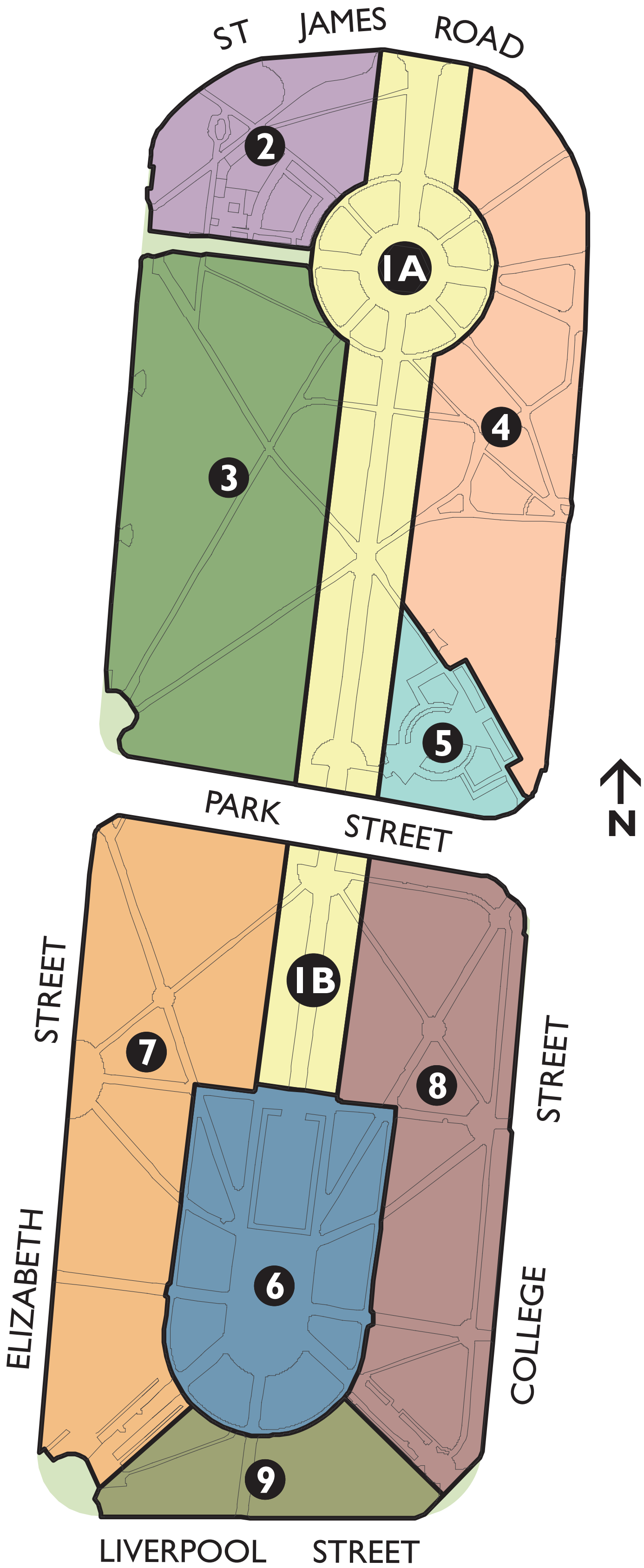


Figure 7

1	Queens Square or Macquarie Street
2	Prince Albert Road or Lands Dept.
3	St Marys Cathedral
4	Cook & Phillip Park
5	Sandringham Gardens
6	Park Street North
7	Park Street South
8	Australian Museum
9	Fraser Fountain or Sydney Boys Grammar School
10	Francis Street
11	College Street South
12	Whitlam Square or Oxford Street
13	Liverpool Street
14	Museum Station
15	Elizabeth Street South
16	Obelisk
17	Park Street West
18	Oddfellows Memorial
19	Tattersalls
20	Sheraton
21	Market Street
22	St James Station
23	The Law Courts or St James Road
24	St James Church

4 THE PRECINCTS

For the purpose of describing the tree management issues in Hyde Park, it has been divided into nine (9) precincts and 24 Park entrances (see Figure 7).



Legend

1 Precinct 1A & 1B
The Central Avenue

2 Precinct 2
Nagoya Garden, Hyde Park North

3 Precinct 3
Western Section, Hyde Park North

4 Precinct 4
Eastern Section, Hyde Park North

5 Precinct 5
Sandringham Garden, Hyde Park North

6 Precinct 6
Anzac Memorial, Hyde Park South

7 Precinct 7
Western Section, Hyde Park South

8 Precinct 8
Eastern Section, Hyde Park South

9 Precinct 9
Southern Section, Hyde Park South

4.1 PRECINCT 1 - The Central Avenue (includes Hyde Park North 1A & Hyde Park South 1B)

The central avenue planting of Hill's Figs, so characteristic of Hyde Park, is the most significant and fragile asset in the Park. The canopies of the trees that line the central avenue meet over the pathways to create an enclosure of space and generate patterns of light and shade that have a distinctive landscape character. The central avenue frames the vista between the Archibald Fountain in Hyde Park North and the Anzac Memorial in Hyde Park South.

Tree Management Issues

The most critical and pressing issue in relation to tree management in Hyde Park is the decline of the central avenue of Hill's Figs. A number of the Hill's Figs in the central avenue are suffering from the effects of disease organisms, including *Phellinus species*, *Phytophthora cinnamomi species* and *Armillaria luteobubalina* or a combination of these pathogens.

The trees have been planted into compacted impermeable subsoil leading to wet conditions under most of the trees. There is no sub surface drainage.

Tree removals have created gaps in the central avenue detracting from the visual impact of the vista.

A number of large *Eucalyptus sp.* and *Platanus sp.* have been planted along the edges of the central avenue impinging on the avenue planting. *Howea forsteriana* (Kentia Palms), *Strelitzia nicolai* (White Bird-of-Paradise) and *Monstera sp.* have been randomly planted as an understorey throughout the central avenue. Some of the Hill's Figs trees have been wounded by the practice of nailing fairy lights into their trunks.

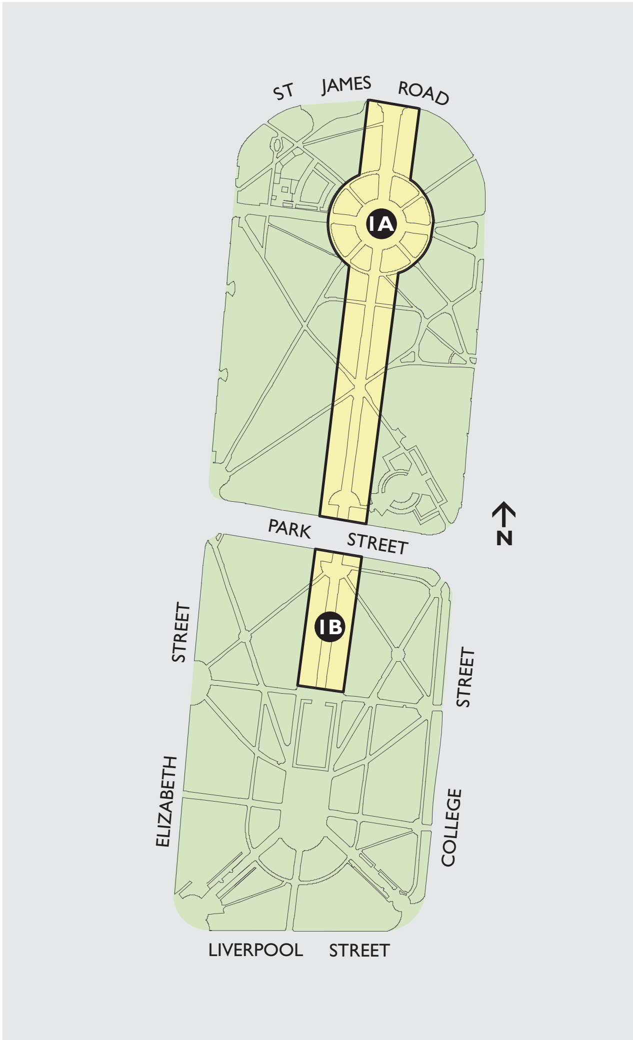


Figure 8: The central avenue of *Ficus microcarpa* var. *hillii* (Hill's Fig), Hyde Park North.

4.2 PRECINCT 2 - Nagoya Garden, Hyde Park North

The Nagoya Garden is a terraced ornamental garden located in the NW corner of Hyde Park North. It was completed in 1964 acknowledging Sydney's Sister City of Nagoya. This garden was upgraded in 1996 and includes extensive areas of paving and a series of retaining walls and raised garden beds planted with small trees and shrubs.

Tree Management Issues

Assymetrical treatment of the formal entry to the Park from Elizabeth Street.

Several trees located in this precinct are mature or over mature and several trees exhibit a serious decline in health.

Many trees have been suppressed by adjacent plantings.

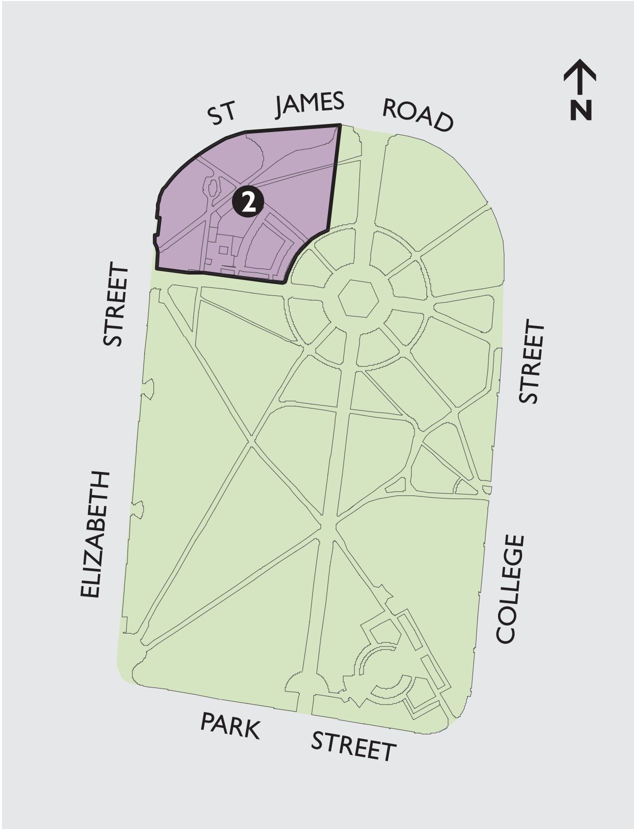


Figure 9: In ground chess area in Nagoya Garden.

Figure 10: A *Ficus macrophylla* (Moreton Bay Fig), tree No. 211(N) and a *Ficus rubiginosa* (Port Jackson Fig, tree No. 210(N), located on the northern side of the entrance to St. James Station were planted prior to 1928. Both have root zone restrictions from the adjoining retaining wall and pavement.

4.3 PRECINCT 3 - Western Section, Hyde Park North.

Extends from the Nagoya Garden in the north, to Park Street in the south. The open grassed area is dotted with specimen trees and palm grove plantings. The boundary planting along Elizabeth Street consists predominantly of *Platanus sp*. (Plane trees). The original design intent was for open grassed areas surrounded by trees.

Tree Management Issues

The informal garden area located at the western edge of the central avenue of Hill's Figs is spreading down the slope, encroaching into the open grassed area.

Many of the palms are over-mature and are in decline. (Figure 10)

Ad hoc planting of a number of specimen trees along the western side of this precinct has limited the open space areas.

A number of the mature trees in this precinct have had significant root damage during the construction of the pedestrian pathways that link Elizabeth Street to the central avenue. Several of the trees are in decline with pathways running through their root zones.

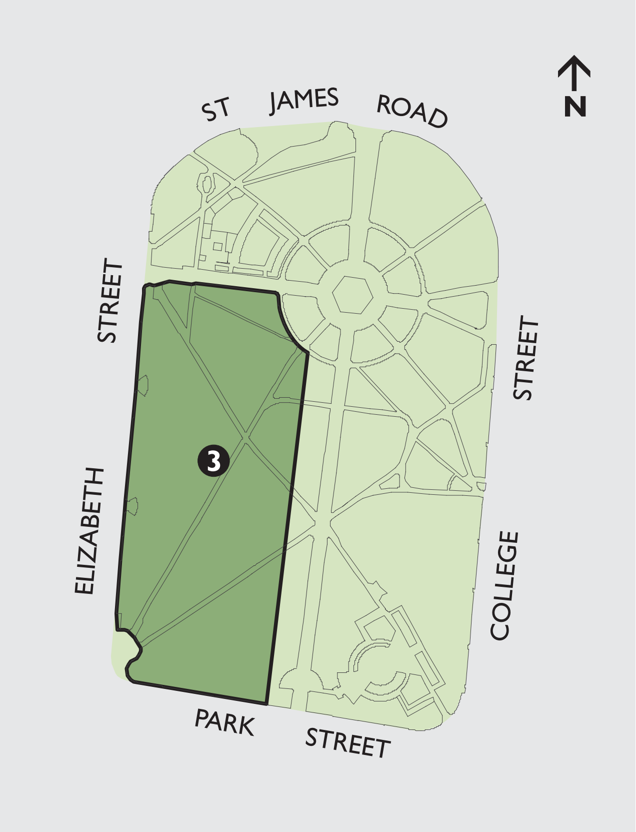


Figure 11: Palm grove planting at the intersection of the pathways.

4.4 PRECINCT 4 - Eastern Section, Hyde Park North

This precinct includes the vista that links the Archibald Fountain to St. Mary's Cathedral and extends from Prince Albert Road in the North down to the Sandringham Garden in the South. The PoM identifies the 'British Lawn' area as open grassland, allowing maximum flexibility to cater for varied uses.

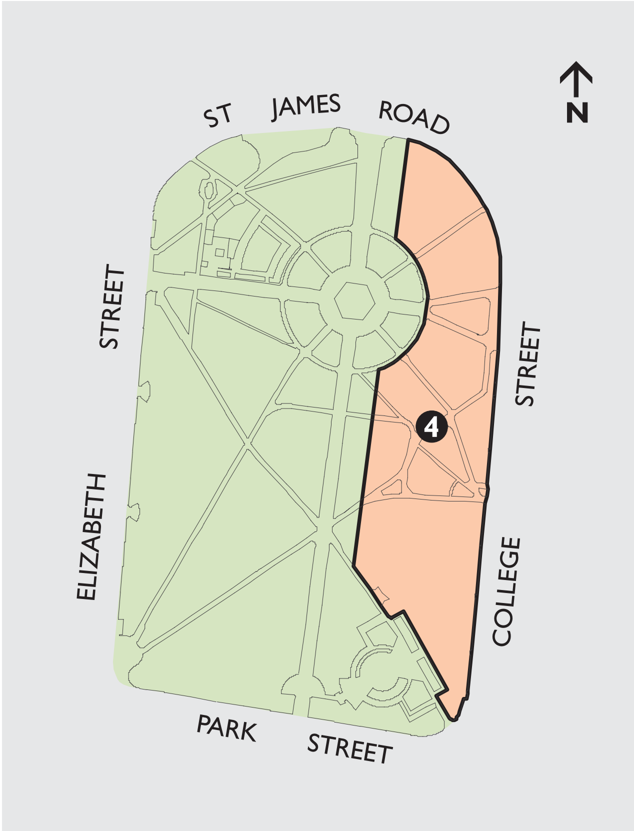
Tree Management Issues

The most northern section of this precinct has been over planted. The soil is compacted (Attachment 3) and a number of the trees are in poor condition.

The middle section of this eastern precinct has also been over planted in an *ad hoc* manner, with many of the existing trees suppressed by the canopies of adjacent trees and no grass understorey.

Figure 12: Suppressed canopy of *Harpephyllum caffrum* (Kaffir Plum).

The "British Lawn" area in the southern section of this precinct is used to accommodate a number of the larger events held in Hyde Park. Increasing visitation and changing patterns of use are issues that have impacted on tree management.



Direct mechanical damage to unprotected trees from pedestrians and vehicles is a problem and the extra traffic flow generated from these events has contributed to problems of soil compaction in the trees' root zones.

The issue of access is addressed in the Hyde Park PoM & Masterplan.

Figure 13: "British Lawn" area on the eastern side of Hyde Park North.

Figure 14: The trees on the College Street boundary have root restrictions from adjacent retaining wall.

4.5 PRECINCT 5 - Sandringham Garden, Hyde Park North

This is a sunken terraced garden in the south eastern corner of Hyde Park North, at the corner of College and Park Streets. The Garden was completed in 1953 and opened by Queen Elizabeth II during her visit to Australia in February 1954. This section of the park includes Wisteria covered pergolas and terraced gardens planted with annuals and perennial shrubs.

Tree Management Issues

The Park Street boundary is currently fragmented with poor specimens of mixed species including *Melaleuca quinquenervia*, *Acer negundo* and *Ficus microcarpa* var. *hillii*.

Smaller trees and shrubs are tending to isolate Sandringham Garden from the Central Avenue.

The issue of this 'ad hoc' planting is addressed in the 2006 PoM & Masterplan.

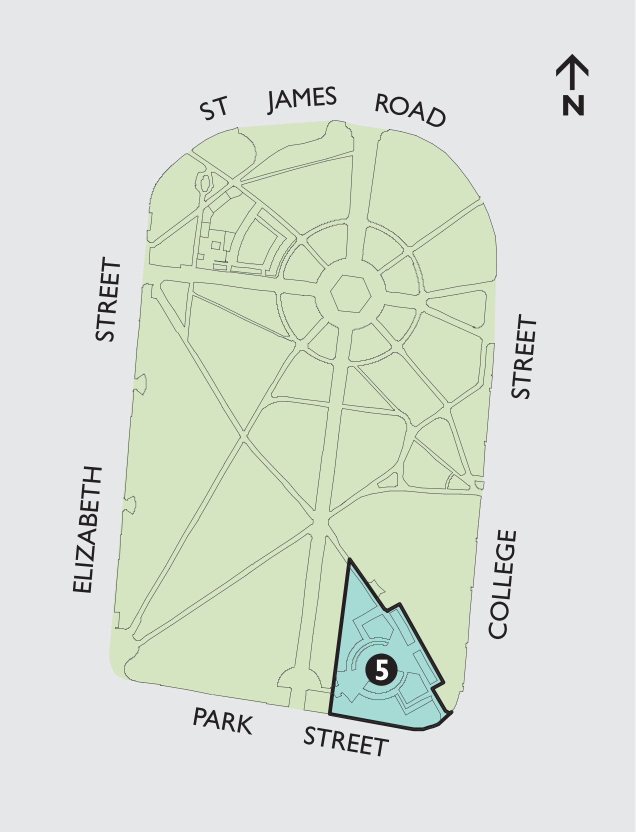


Figure 15: Sandringham Garden looking north to the "British Lawn" with St Mary's Cathedral in the background.

4.6 PRECINCT 6 - ANZAC Memorial, Hyde Park South

This precinct includes the area around the ANZAC Memorial building as well as the Pool of Reflection. There is an outer ring of *Ficus microcarpa* var. *hillii* (Hill's Figs) planted around the pedestrian pathway and an inner ring of *Pinus halepensis* (Lone Pines) surrounding the Memorial building.

Tree Management Issues

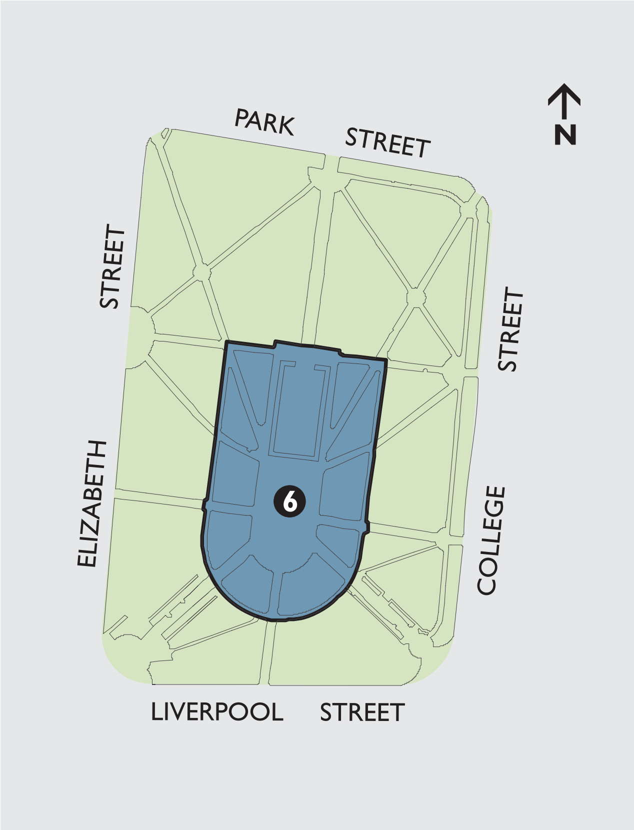
Many of the *Pinus halepensis* (Aleppo/Lone Pines) circling the ANZAC Memorial are in poor condition (Figure 16).

The Returned and Services League of Australia has advised that the Aleppo Pines on the eastern and southern side of the ANZAC Memorial building do not have irreplaceable heritage significance and has formally requested that the trees be removed for security reasons.

Figure 16: The *Pinus halepensis* (Aleppo Pines) circling the ANZAC Memorial are in poor condition.

The Aleppo Pines within the ANZAC Memorial's curtilage remain an important and significant element of reference and association and therefore the PoM & Masterplan will seek to suggest a more suitable planting location.

Figure 17: Pool of Reflection (looking south) flanked by *Populus alba.*



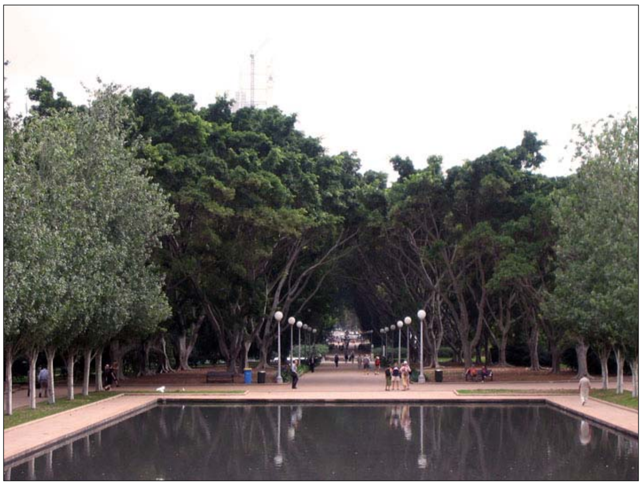


Figure 18: Pool of Reflection, Hyde Park South (looking north) flanked on both sides by avenues of *Populus alba.*

4.7 PRECINCT 7 - Western Section, Hyde Park South

This precinct extends from Park Street in the north to Liverpool Street in the south, between the central avenue on the east and Elizabeth Street on the west. The northern section has large turfed areas bounded by tree lined pedestrian pathways. The south western corner is affected by shadowing from the taller buildings along Elizabeth Street and the land slopes quite dramatically down towards the Museum Station entrance.

Tree Management Issues

Many of the trees in this section are in poor condition. They suffered major root damage when the pathways were upgraded during the 1990s.

There are a number of *Ficus macrophylla* (Moreton Bay Figs) that were planted prior to 1928, located along the Elizabeth Street boundary. The health of these trees is declining.

Figure 19: The northern section of the western side of Hyde Park South.

The PoM & Masterplan seeks to rationalise the design in this section of the Park and create greater areas of open space.

An avenue of Tallowwood (*Eucalyptus microcorys*) links the Obelisk on Elizabeth Street (entrance 16) with the ANZAC Memorial building.

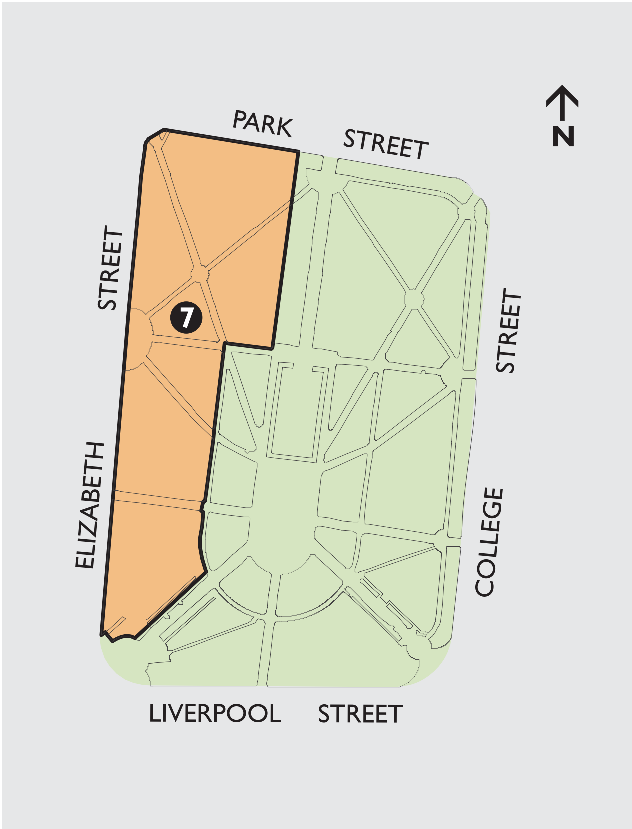
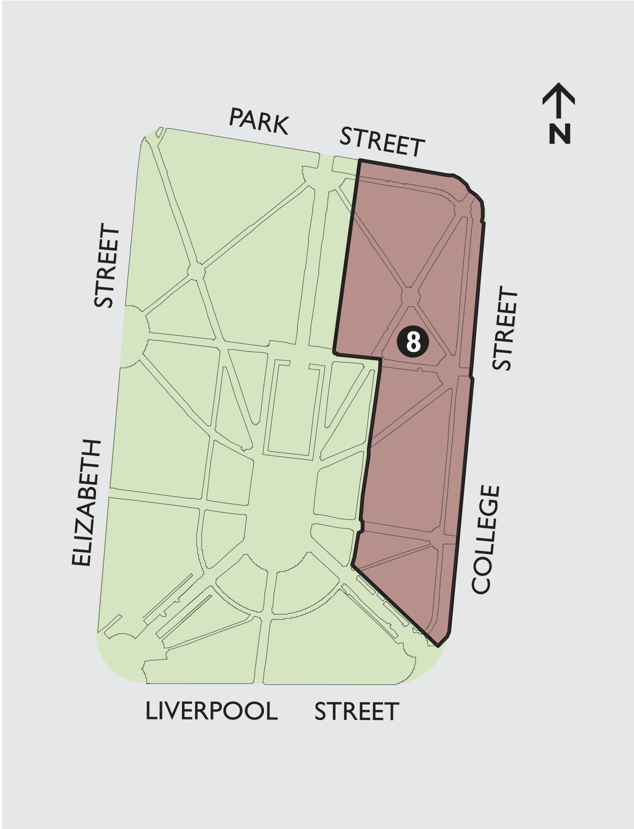


Figure 20: The EW pedestrian axis at the northern end of the Pool of Reflection is predominantly planted with Port Jackson Figs (*Ficus rubiginosa*) following the removal of most of the Oak trees that were previously planted in these locations.

4.8 PRECINCT 8 - Eastern Section, Hyde Park South

This precinct is bounded by Park Street in the north and includes the pedestrian link from Whitlam Square (entrance 12) to the ANZAC Memorial building. It includes the area between College Street on the east and the central avenue and the ANZAC Memorial precinct on the west.



Tree Management Issues

The southern section of this precinct has been over planted, cluttering the open space areas. A number of the smaller avenues have been planted with double rows of trees which have not performed well, due to suppression from the existing trees. The smaller trees tend to clutter the area rather than provide visual impact and amenity.

The *Sapium sebiferum* (Chinese Tallowwood) and *Stenocarpus sinuatus* (Queensland Firewheel Trees) that have been planted in this section of the Park, parallel to the existing Oak trees, have been suppressed and are in poor condition (Figure 21).

Figure 21: *Stenocarpus sinuatus* (Qld Firewheel, red arrow) and *Sapium sebiferum* (Chinese Tallowwood, blue arrow) have been suppressed and performed poorly.

An avenue of Tallowwood (*Eucalyptus microcorys*) links the Fraser Fountain on College Street (entrance 9) with the ANZAC Memorial building.

Figure 22: The northern section of this precinct includes large areas of uncluttered open space with some tree planting along the edges of the pedestrian pathways. The area includes seven (7) pedestrian pathways that criss-cross the area linking the Park's boundaries to the Central walkway and ANZAC Memorial.

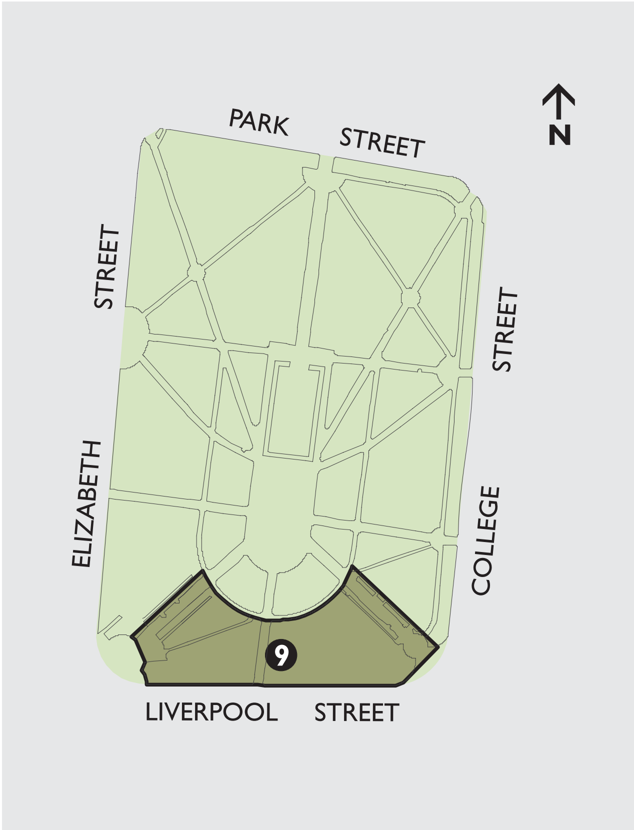
4.9 PRECINCT 9 - Southern Section, Hyde Park South

This precinct is bounded by Liverpool Street in the south and the diagonal pedestrian links from Museum Station in the west (entrance 14) and Whitlam Square or Oxford Street (entrance 12) in the east.

Tree Management Issues

There is *ad hoc* planting in this section of the Park with some consistency in the Plane tree planting along the Liverpool Street boundary.

The avenue planting of Crows Ash defining the pedestrian link from Museum Station to the Anzac Memorial is in extremely poor condition and the avenue of Figs defining the link to Whitlam Square are in various stages of decline.



5 THE TREES

5.1 Introduction

The most visually dominating elements in Hyde Park are the trees, with the figs in the central avenue, being of the greatest significance. The removal of a number of mature trees including several from the central avenue highlighted the need for this TMP.

5.1.1 Tree Survey

In order to gain a clear picture of the condition of the trees, an inventory was prepared. All of the trees were surveyed and their locations documented on survey plans (Attachment 2: Tree Location Plans).

The trees have been given the same numbers as those used in the 1988 Tree Survey, with 'N' or 'S' added to indicate whether located in Hyde Park North or Hyde Park South.

Graphic representations were prepared, indicating the total numbers of trees in the Park as well as their projected life expectancy (Sule Analysis, section 5.4).

5.1.2 Analysis of Results

The data collected for the Hyde Park Tree Management Plan provides a valuable tool to analyse the numbers, distribution and the overall health and condition of the current tree population in Hyde Park (Attachment 1: Tree Schedule).

The inventory indicates that there is currently a total of five hundred and eighty (580) trees, over three (3) metres tall, located in Hyde Park; 240 in Hyde Park North and 340 in Hyde Park South. The total includes 64 different species. (Appendix 3: Summary of Tree Population).

One of the findings is that *Ficus microcarpa* var *hillii* (Hill's Fig), is by far the dominant species in the Park, both visually and numerically, accounting for 16.9% of the total tree population.

The majority of the Hill's Figs are located in the central avenue and were planted circa 1930.

5.2 Health and Condition of the General Tree Population

Trees like all living organisms, grow, age and eventually die. The process of aging and death is called senescence and it is a natural part of a tree's life cycle (Harris, Clark & Matheny, 1999). As trees grow and develop over time, a number of changes occur in their biology. As they approach their maximum age they become more vulnerable to disease, wind and other causes of death.

Hyde Park has an ageing tree population that requires close assessment and constant monitoring to maintain an acceptable level of hazard or risk.

The trees in Hyde Park are living in a harsh environment. They have been exposed to increasing levels of pollution from automobile exhausts and compaction from increased levels of pedestrian and vehicular use of the Park.

Soil studies conducted in May 2005 (Attachment 3) revealed that sub soil conditions and lack of sub surface drainage in some sections of the Park have contributed to the early failure of a number of the trees.

Hazard assessments undertaken by independent arborists have identified that disease organisms including *Phellinus* species, *Phytophthora cinnamomi* and *Armillaria luteobubalina* or a combination of these diseases are affecting the health and condition of the Park's trees.

However, to date, the greatest threat to the general tree population in Hyde Park comes from the potential damage incurred by indiscriminate works within their Primary Root Zones (PRZ).

A major upgrade of the Pool of Reflection and the central avenue in Hyde Park South was completed in 1992. During these construction works a number of major tree roots were severed.

Figure 23: *Lophostemon confertus* (Brush Box) in Hyde Park South had roots severed during pathway upgrade.

A number of trees in Hyde Park North also had large woody roots severed during the 1996 upgrade.

It is difficult to predict the consequences of this damage, however it is highly likely that a number of these trees could fail during the next ten years. If major roots are severed a tree can immediately become liable to collapse (Lonsdale 1999).

The general debilitation of trees due to root severance can also make it easier for some decay fungi, such as *Armillaria sp.*, to invade and colonise the trees.

A number of the existing trees have basal injuries caused by heavy mowers and weed whippers (Figure 24). This type of damage, which is evident on the thick-barked buttresses of many mature specimens, can also allow the entry and development of decay fungi.

Figure 24: Mechanical damage to roots of *Ficus macrophylla* (Moreton Bay Fig) in Hyde Park.

A number of roads and pedestrian pathways cover a large proportion of the surface of Hyde Park. These impermeable surfaces have reduced the water and aeration available to the roots of the trees and this has caused a number of the trees to become stressed.

The few remaining *Quercus spp.* (Oak trees) located in Hyde Park South have reached maturity and are in decline. Most of the *Quercus robur* (English Oaks), in the avenue leading to the ANZAC Memorial in Hyde Park South, have been removed. *Quercus robur* do not grow well in Sydney and the remaining Oak trees located on the eastern side of the Park are severely stressed and are in decline.

A number of the *Ficus rubiginosa* (Port Jackson Fig), in Hyde Park South, are severely stressed from root damage and soil compaction and this has resulted in defoliation and mild sunburn (figure 25). In several situations the soil around the root plates of these trees is compacted.

Figure 25: Defoliation of severely stressed *Ficus rubiginosa* (Port Jackson Fig) in Hyde Park South

A great majority of the trees in Hyde Park will respond to remedial action that includes mulching, fertilizing and deep watering.

5.3 Health and Condition of the Central Avenue of Hill's Figs

The most critical tree management issue in Hyde Park today, is the decline of the central avenue of *Ficus microcarpa* var *hillii* (Hill's Fig). This has prompted the City to commission a number of reports from independent arborists to assess the health and condition of these trees.

The reports indicated that a number of the Hill's Figs growing in the central avenue are suffering from the effects of disease organisms, including *Phellinus species*, *Phytophthora species* and *Armillaria species* or a combination of these diseases (Appendix 1: Disease details and location map).

Several of the Hill's Figs located in the central avenue have fallen over or been removed to maintain public safety. This has left gaps in the avenue which has detracted from the visual impact provided by these trees.

The central avenue now consists of 102 trees extending from Queens Square in Hyde Park North to the Pool of Reflection in Hyde Park South. Thirty eight (38) of the original trees have failed or been removed in response to recommendations from hazard assessments undertaken by independent arborists.

The Hill's Figs in the central avenue were planted at 12 metre centres to achieve an increased rate of growth and more upright trunk formations with high branches. The vigour of the trees appears good, though the structure of the trees has been compromised by the severe pruning required to create the cathedral-type vista over the pedestrian walkway.

The trees were planted into compacted, impermeable subsoil (Attachment 3: Hyde Park Soil Investigations, 2005). This has led to wet conditions and a very poorly aerated soil profile under virtually the entire central avenue. The soil report states that "the subsoil has been contaminated (probably during trenching for the underground railway) and consists of tightly packed anthropogenic[3] mixed fill. This has caused "ponding" in the topsoil which has led to acute anoxic stress". The grade of the central avenue and the fact there is no subsurface drainage has no doubt contributed to the root rot problems that are now affecting the central avenue of Hill's Figs.

In March 1994, a number of large structural roots of the Hill's Figs in the central avenue of Hyde Park North were severed, close to the trunks of the trees, in order to install electrical cables.

In January 1996, Council commissioned a tree report from Arborcraft (consulting arborists), to assess the condition of the Hill's Figs in the central avenue. This report identified significant root damage to the figs from trenching works undertaken in March1994. The report suggested that "it would be highly likely that some of the *Ficus microcarpa* var. *hillii* (Hill's Figs) could blow over as a consequence of this damage to the roots". In conclusion the report stated "The trenching, the tendency for Hill's Figs to have included bark and the presence of root rot fungus are wild cards that will have an impact on Hyde Park North over the next 20 years. It is possible that the avenue effect will be lost in some areas".

As the 1996 report predicted, several of the Hill's Figs growing in the central avenue and around the Archibald Fountain have been removed.

Figure 26: The Hill's Figs growing on the eastern side of the Archibald Fountain in Hyde Park North have ceased to provide the amenity commensurate with the importance of Hyde Park. The trees have been infected with *Phytophthora sp.* and are declining at a rapid rate. (Figure 26 shows the thinning canopies of these trees)

In the sections of the avenue where trees have been removed, the trunks of the adjacent trees have been predisposed to sunburn from the sudden exposure to light radiation. This exposure has caused bark damage and the stimulation of weakly attached epicormic shoots. The removal of adjacent trees has also affected the dynamics of the remaining trees, with different exposure to strong winds and heavy rain.

Continuing root investigations of the Hill's Figs in the central avenue have been undertaken by independent arborists, to assess the hazard potential of these trees.

A report prepared by Tree Wise Men in September 2003 (Ref 1296) identified problems associated with the Hill's Figs. Section 4.2.4 of the report stated:

"Bark inclusions are predominantly confined to the Hill's Figs. Multiple trunk formation is typical of this species. More frequent monitoring is required."

And section 4.4.3 stated:

"The stock selected for any additional/replacement planting should be free of defects. Particular consideration should be given to avoiding trees that develop inclusions or co-dominant structures."

Tree root investigations of three (3) of the Hill's Figs in the central avenue were undertaken on 20 April and 3 May 2005 by independent arborists from Urban Tree Management Pty Ltd, to assess the evidence and/or extent of decay in the structural roots of the selected trees. The assessments included woody tissue testing, excavation and Resistograph® testing.

Twelve trees (12) were also tested with a Picus Sonic Tomograph® on the 22 and 23 April 2005 by independent arborists from Enspec Pty Ltd, to assess the percentage of solid wood in each of the trees' trunks.

Following the most recent failure (30 June 2005) of one of the Hill's Figs located in the central avenue, investigations identified a large cavity under the root crown where the buttress roots were attached to the tree's trunk. Evidence of soil borne fungi was detected.

A survey of each individual tree in the central avenue was completed in the first week of July 2005 by the City's Tree Management Team and a database has been established recording the presence of any fungal fruiting bodies. This database is to be updated annually to monitor the progress of any possible decay.

In August 2005 the investigation of the remaining trees in the central avenue was taken to a more detailed level and involved the removal of soil from specific locations at the base of the trees, using an Air Knife. Excavation by Air Knife is a non-destructive method of soil removal. This method has proven to be the most successful in gaining access below the root crowns to determine if the trees have decay or cavities.

The results of these detailed tree assessments identified that 34 trees required immediate removal to ensure public safety. The trees were removed on 19 September 2005.

The results of the arboricultural assessments together with the findings of the soil survey prepared by Sydney Environmental and Soil Laboratory P/L (Attachment 3) provide essential data that has been used to develop a comprehensive tree removal and replacement strategy for the trees in the central avenue (section 7.2 pp.33-34).

Figure 27: Decay within the trunk and buttress roots of a Hill's Fig that was removed on 19 September 2005.

Figure 28: Removal of Hill's Fig infected with *Phellinus sp*.

3 Anthropogenic mixed fill - sandy, stoney or claylike fill

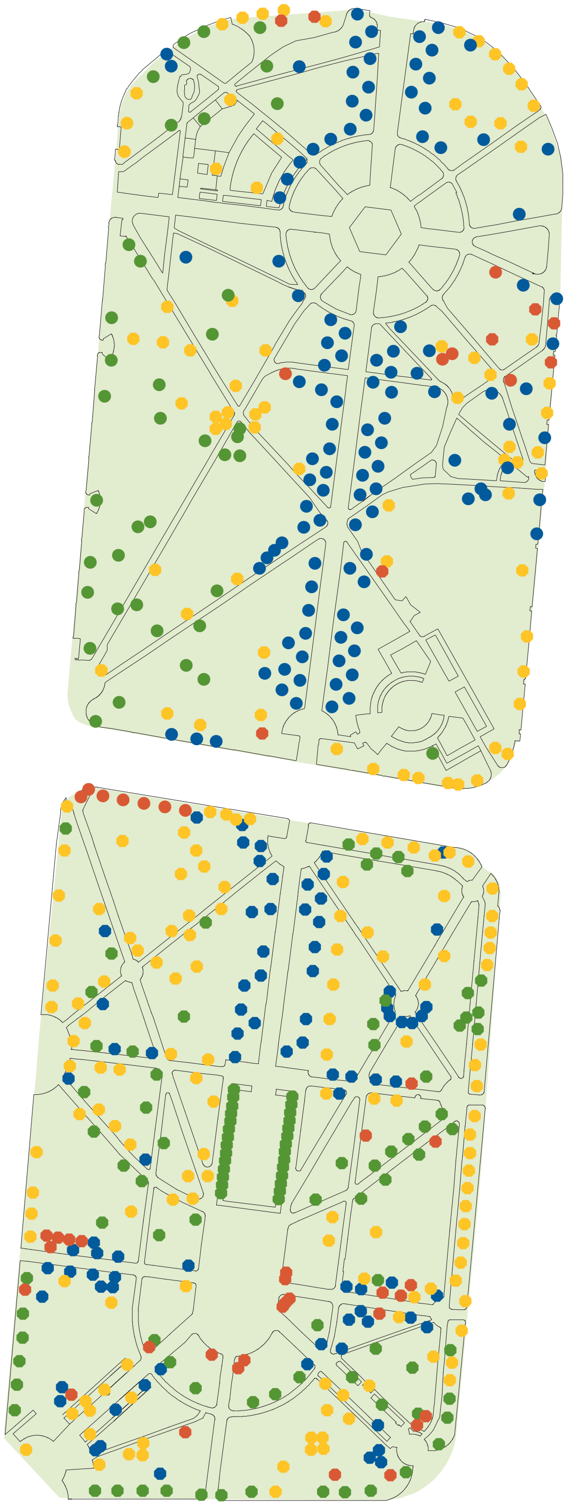
5.4 SULE Analysis

SULE is an acronym for Safe Useful Life Expectancy (Appendix 2: Sule categories). It is a system that was developed by Jeremy Barrell[4] in 1996, to assess tree life expectancy and how long trees can be expected to be retained safely and usefully near people.

In all situations safety has to be considered the absolute priority. Important secondary objectives are reasonable management costs and sustaining amenity. The priority when managing trees with a high hazard potential should be to reduce the risk to an acceptable level. This can be achieved by removing the tree, removing the targets or treating the tree (Barrell 1996).

A major role of trees in an urban environment is to provide visual amenity. Healthy trees have the potential to provide visual amenity in the future in a way that does not lead to injury/damage to people or property. Trees become less useful as maintenance costs become excessive and they begin to have a negative effect on amenity by interfering with better trees or inhibiting the establishment of new trees.

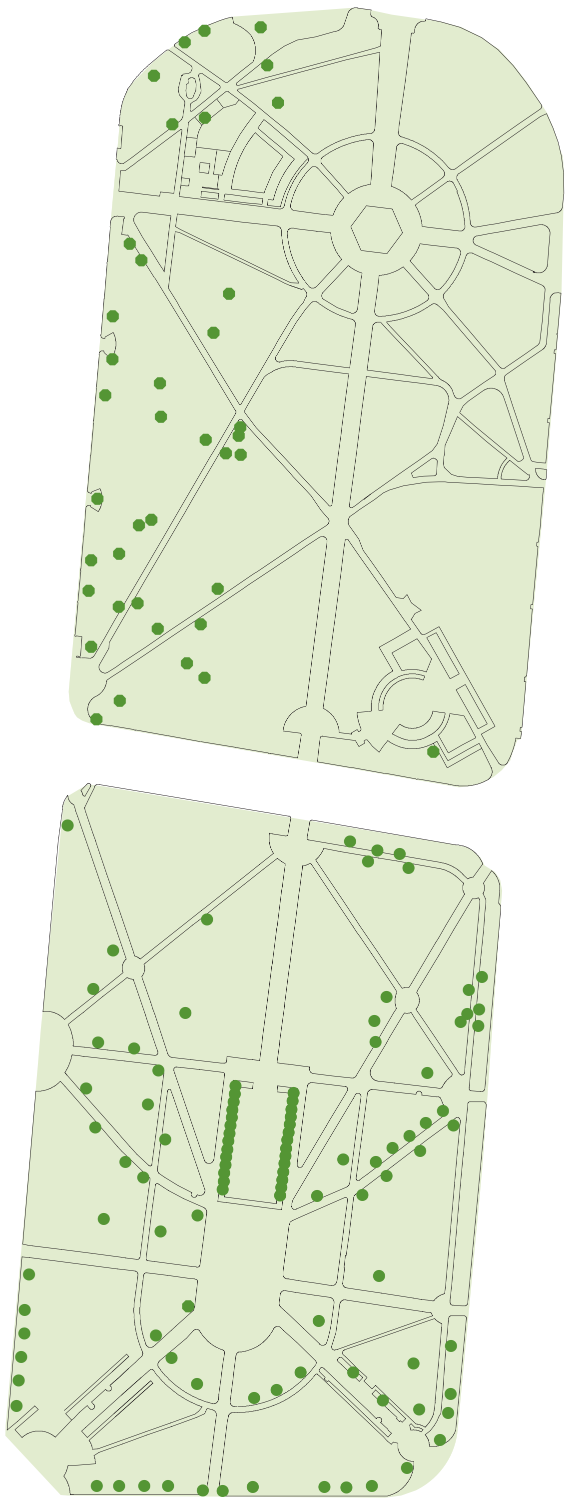
Mature and over-mature trees, particularly in stressful urban settings such as Hyde Park, have greatly reduced recuperative powers compared with younger trees. The additional stresses that have affected the trees in Hyde Park include soil compaction, poor drainage, drastic and repeated branch and root pruning and reduced solar access from surrounding development.



Safe Useful Life Expectancy (SULE) Analysis

- 43 trees to be removed within 5 years SULE (4)
- 187 trees appeared retainable for 5 - 15 years Short SULE (3)
- 204 trees appeared retainable for 15 - 40 years Medium SULE (2)
- 146 trees appeared retainable for more than 40 years Long SULE (1)

[4] Jeremy Barrell is a consulting arborist from Hampshire in the United Kingdom. He developed the concept of SULE as a method of systematically assessing trees on proposed development sites. In essence trees with the longest SULE would be the ones most worthy of retention.



Safe Useful Life Expectancy (SULE) Analysis

146 trees appeared retainable for more than 40 years

SULE categories were estimated for each and every tree in Hyde Park.

Trees assessed as having a Long SULE (ie. appeared retainable for more than 40 years) represented 27.2% of the total population.

Trees assessed as having a Medium SULE (ie. appeared retainable for up to 40 years) represented 31.6% of the total population.

Trees assessed as having a Short SULE (ie. appeared retainable for up to 15 years) represented 35.4% of the total population.

Trees assessed as due for removal within the next five (5) years represented 5.8%

The SULE results indicate that 72.8% of the total tree population in Hyde Park will require removal/ replacement within the next 40 years.

The various issues relating to extensive tree removals (eg. the public's sense of ownership of the Park) will become critical with each passing decade.

The SULE categories for each of the trees in Hyde Park are included in the Tree Schedule (Attachment 1).

5.5 Significant Trees

A number of the existing trees in Hyde Park were planted prior to 1928 and are nearing the end of their lives. These trees have considerable cultural and historical significance and where possible shall be preserved and protected.

As trees age they become more vulnerable to pest and disease and other environmental pressures such as drought, compaction and pollution; all of which cause the tree's decline and contribute to premature death.

The avenue of Hill's Figs, linking the Archibald Fountain in Hyde Park North and the ANZAC War Memorial in Hyde Park South, is the Park's most significant historical element. The avenue was planted in the early 1930s.

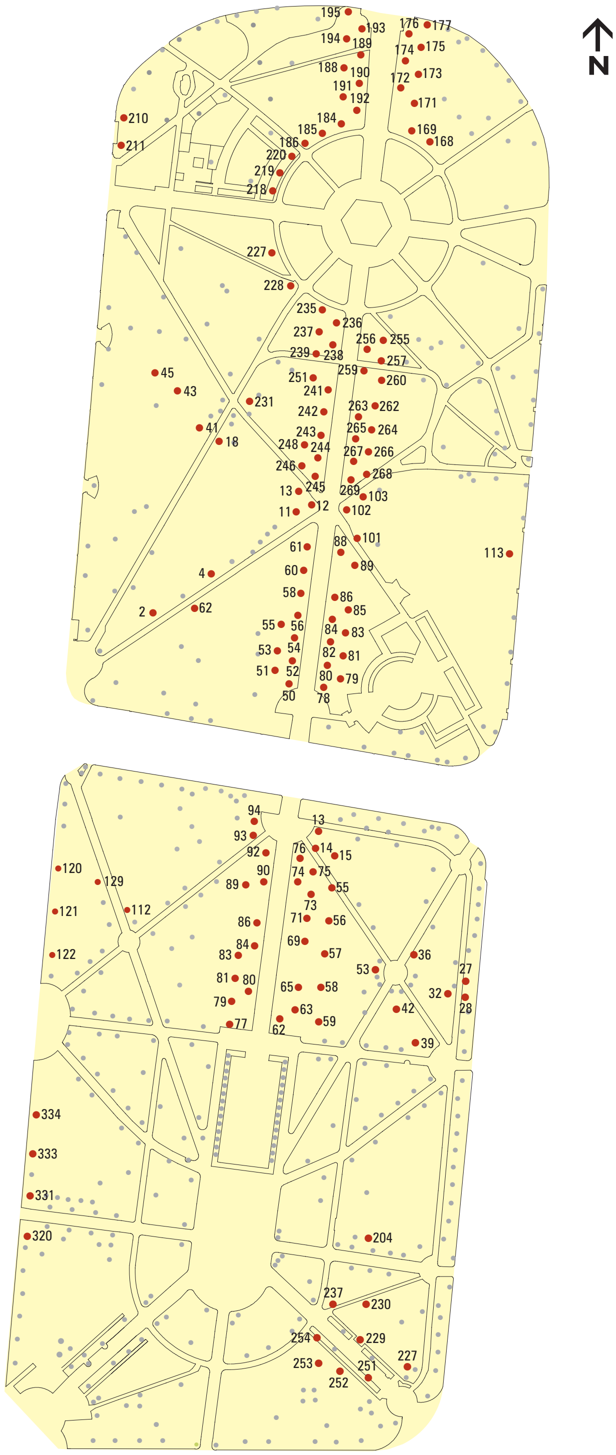
A number of individual trees located in Hyde Park are also significant. There are 11 Moreton Bay Fig trees that were planted prior to 1928, at which time most of the other original plantings were removed to allow for construction of the underground railway. One of these Figs is located in Hyde Park North, just north of the St James Railway Station entrance (see Figure 10 p12) and the other ten (10) trees are located in Hyde Park South.

The significant trees located in Hyde Park North and Hyde Park South, are listed in the City of Sydney's Significant Tree Register. Registering these specimens raises awareness of their historical value and improves the quality of their management and their prospect for a longer life.

Figure 29: *Ficus macrophylla* (Moreton Bay Fig) tree 120(S) located on the Elizabeth Street boundary of Hyde Park South (part of the original plantings, c.1860.

5.6 Significant Trees and their Locations

Botanical Name	Tree Number
Agathis robusta	39 (S)
Araucaria columnaris	28(S), 227(S), 53(S)
Araucaria cunninghamii	32(S), 204(S), 230(S)
Butia capitata	62(N), 231(N)
Ficus benjamina	43(N)
Ficus microcarpa var. hillii	central avenue
Ficus macrophylla	15(S), 55(S), 56(S), 57(S), 58(S), 59(S), 120(S), 121(S), 122(S), 211(N), 320(S), 331(S), 333(S), 334(S)
Ficus religiosa	129(S)
Ficus rubiginosa	210(N), 36(S), 42(S), 237(S), 251-254(S), 229(S)
Macadamia integrifolia	112(S)
Phoenix canariensis	2(N), 4(N), 45(N), 207(N)
Phoenix dactylifera	18(N), 41(N)
Pinus roxburghii	27(S)



Significant Tree Locations

6 SOIL ASSESSMENTS

In May 2005 the City of Sydney engaged the services of Sydney Environmental and Soil Laboratory Pty Ltd (SESL) to analyse the soil conditions in Hyde Park and report on the constraints and opportunities in relation to the growth and longevity of the tree population. Particular emphasis was placed on the possibilities for soil improvement and modification to prolong the Safe Useful Life Expectancy (SULE) of the present tree plantings, particularly the central avenue of Hill's Figs. The following documentation has been taken from that report. (Attachment 3 : Hyde Park, Sydney: Soil Conditions, June 2005)

6.1 Testing Methodology

Soil profiles to a depth of 600mm-800mm were taken from ten (10) locations in both Hyde Park North and Hyde Park South. (soil sampling locations: overleaf). A hand auger was used to minimise damage to the tree root systems. Care was taken to avoid any further spread of fungal diseases by washing tools in strong hypochlorite solutions between each location.

Physical and chemical analysis was performed on topsoil and subsoil samples from each location.

Samples were analysed using standard soil sample methodology covered by the ISO9002 certification and the experience and judgement of the qualified soil scientists employed by SESL.

6.2 Field Results

Topsoil

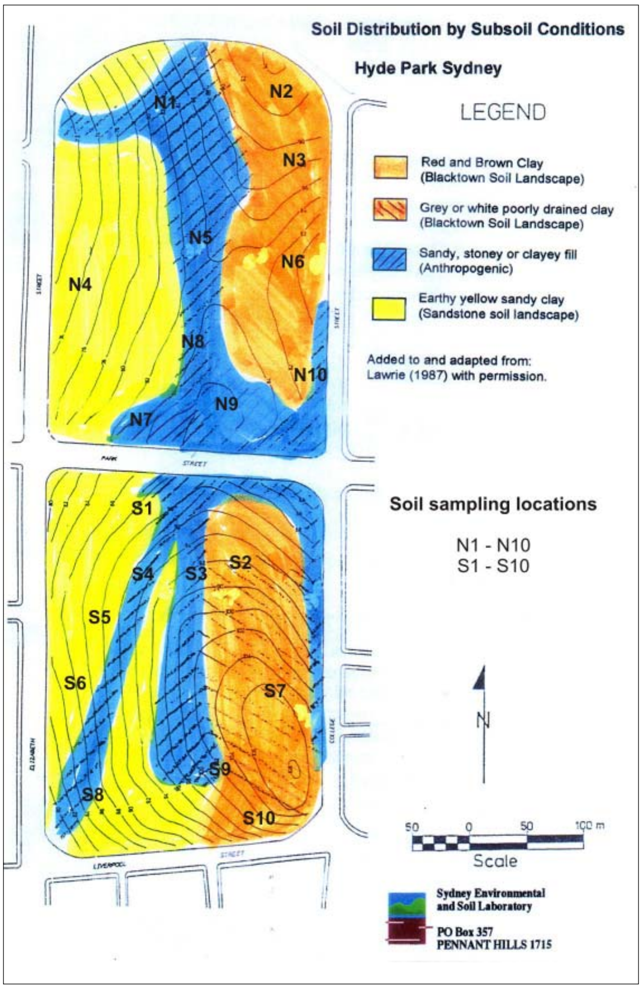
The topsoil for the Park as a whole, excluding the samples from the central avenue, show layers of a suitable depth, good physical structure, remarkably low density and acceptable permeability.

For the most part, the topsoil samples (in the areas tested) have a suitable texture and are not excessively compacted. The only exception is in Hyde Park South along Park Street, where more silty and heavy loam textures combined with high pedestrian traffic levels have combined to produce excessive densities and difficult conditions for root growth.

The samples taken from the central avenue were kept out of the statistical treatment since they show anomalous results and horizons that do not correspond to normal topsoil. The samples indicate a highly permeable, friable and organic topsoil overlying a dense impermeable subsoil.

Subsoil

The subsoil conditions over the Park, as a whole, are often not ideal and are likely to restrict rooting depths, particularly along the eastern side where heavy acidic clay underlies the area, there is little that can be done about this for existing plantings. For new plantings there are many practical interventions involving modification of the subsoil that will lead to a better developed root system. (Attachment 3: Soil Investigations)



Chemical Properties

In general the soils are reasonably well balanced chemically and show no salinity or gross abnormality that would be associated with acute stress or demise of trees.

An important conclusion is that all of the alkaline and calcic soils are located under the avenue of Hill's Figs. This effect may be the result of contamination of the soil from the massive disturbance following trenching for the railway tunnel.

6.3 Summary and Comment

The most important finding relevant to tree growth and longevity is the identification of compacted impermeable subsoil leading to wet conditions under most of the Hill's Figs in the central avenue.

6.4 Conclusions

Topsoil physical conditions are generally seen as favourable for an urban park of this type. The two exceptions are the very NE corner of Hyde Park North and northern section of Hyde Park South, facing Park Street, where loams rather than sandy loams show some compaction and wear.

The most difficult conditions for trees are caused by the "anthropic fill" and "grey clay" subsoil types. Both of these severely limit downward movement of water and lead to frequent ponding and wet conditions.

The soil profile under most of the avenue of Hill's Figs is poorly aerated. The subsoil is tightly packed anthropogenic mixed fill. Aeration is further limited by:-

- Excessive organic matter leading to a high oxygen demand
- Unsuitable topsoil
- Lack of any slope, lack of runoff
- Poor internal drainage in the soil profile.

The most important conclusion is that it is feasible to amend some of the existing man made constraints limiting tree establishment and growth. The results of the soil investigations indicate that there are a number of options available that should be adopted and maintained for future tree plantings.

6.5 Soil Recommendations

The recommendations note that the physical soil conditions under the avenue of Hill's Figs are the worst in the Park and suggest that complete removal and soil replacement is "the only perfectly satisfactory option".

Nutrient Levels

Corrections should be made to nutrient levels to eliminate any possibility of deficiencies causing additional stress on the trees. Ideally the efficacy of these additions should be checked, most usefully by foliage analysis before and after any additions are made. (Attachment 3: Soil Investigations, Volume 1, pp.29-30).

Physical Improvements

The major source of stress for the trees in Hyde Park is limiting soil oxygen levels brought about by an unsuitable soil profile having impermeable clay layers at remarkably shallow depth. (Hyde Park Soil Conditions, SESL 2005, Attachment 3: pp.30-33).

The present shallow depth to impermeable or otherwise unsuitable subsoil is seen as the major impediment to root system development in the Park. Improving these conditions for the Hill's Figs in the main avenue plantings is seen as the highest priority, but the suggested techniques could be applied to any individual tree.

When new tree plantings are contemplated the opportunity exists to modify subsoil conditions to improve the root structure and function of the new planting. This can be done with individual specimen planting or in a trench type planting.

A number of options have been included in SESL's Soil Report, detailing specific actions for soil improvement work around existing plantings.

7 TREE MANAGEMENT STRATEGIES

Hyde Park has an aging but culturally significant tree population. The issues relating to the management of this tree population are closely related to its location in the CBD and the pressures of increasing visitation and changing patterns of use.

Tree management includes more than just tree maintenance. In addition to the usual remediation operations such as mulching, fertilizing and the pruning of dead limbs, it also includes strategies for the removal/replacement of dead trees, species selection of new/replacement planting, regular inspection of trees for disease and/or damage and selective removal of trees planted at very close spacing.

It is essential that tree management is integrated into the overall landscape planning, design and management framework for Hyde Park and that the City of Sydney's various disciplines work together and coordinate their activities. In addition to landscape managers and aborists, it is imperative that landscape architects are involved in the process so that the aesthetic dimension of tree management is adequately presented and future planting designs are formulated to provide a coherent future landscape.

The 1989 Draft Plan of Management included a Masterplan (Figure 4) for Hyde Park, but to date there has never been a formal detailed planting plan adopted for the entire park. Unfortunately this has resulted in an *ad hoc* approach to tree selection and planting over many years, resulting in many areas of the Park losing their original landscape character.

It is essential for future planning purposes that detailed tree planting plans are prepared for Hyde Park North and Hyde Park South based on the design strategies proposed in the Hyde Park PoM & Masterplan. These plans shall indicate the locations of all existing trees as well as locations of any proposed planting and shall be used to program removal and replacement strategies for the Park's trees.

The Tree Management Plan (Attachment 1: Tree Assessment Schedule) shall inform the 2006 Plan of Management & Masterplan and will effectively guide the selection and placement of any future tree planting.

As the tree planting plans will have an enormous impact on the landscape for the next 100 years it is essential that the Hyde Park Tree Management Plan and the concept strategies included in the Hyde Park PoM and Masterplan are ratified by Council and become an integral part of Council's Tree Management Policy, rather than the views of the landscape management officers at the time.

The conservation of the trees in Hyde Park has to be balanced against the contemporary use of the Park. It is necessary for Council as the manager of Hyde Park, to resist the pressure of intrusions for specific recreational uses and entertainment that may compromise the tree population and alienate the majority of users in their pursuit of a place for non-organized passive recreation.

Future tree management strategies must include detailed guidelines and specifications for tree protection zones to be implemented during major events held in the Park.

A proactive maintenance program of annual root plate remediation that includes aeration and soil improvement along with detailed monitoring of all trees for evidence of disease and/or pathogens shall be included in the revised specifications.

The Tree Assessment Schedule (Attachment 1) and the Existing Tree Location Plans (Attachment 2) should be amended quarterly to reflect any tree removals or replacements.

In order to maintain a viable tree population in Hyde Park, it is vital to plant new trees and to replant declining trees in a planned and managed way with the support of the community.

7.1 Tree Removal/Replacement Strategies

Many of the trees in Hyde Park were planted c.1930 and therefore are similar in size and maturity. It follows that a number of these trees will become senescent and need to be replaced at around the same time. In some situations the trees have already ceased to contribute to the amenity of the Park and are compromising the amenity provided by trees of better health and condition. (Figure 30).

Where a wide variety of species have been planted in irregular fashion (such as in the eastern and western sections of Hyde Park), tree removal and replacement strategies can be effected with minimal visual loss, as only a small percentage of the total population of the existing trees need to be removed at any one time.

An approximate time frame has been proposed for the removal and replacement of all of the trees in Hyde Park North and Hyde Park South (refer to SULE analysis, p.24). This will ensure that the visual loss is managed and evenly distributed over time. A number of trees will not be replaced when they die because of the identified problem of *ad hoc* over crowding in the past.

Figure 30: The *Erythrina sykesii* (Coral Tree, red arrow) which has been planted under the canopy of the *Agathis robusta* (Kauri Pine, blue arrow) is crowding the natural form of the larger tree.

The development and implementation of tree removal and replacement strategies requires a consistent approach and commitment to planning. Long term planning is necessary when dealing with a landscape comprised of trees of a similar mature age, condition and heritage significance.

There are no pain-free approaches to tree removal and replacement. It is an emotive issue that can invoke considerable community opposition and misunderstanding. Most people respond strongly to the removal of trees that are not dead and some groups in the community vehemently oppose tree removal whatever the justification (Hitchmough, 1989). However many people will accept the need for tree replacement programs once they appreciate the issues involved.

The major factors that encourage the implementation of tree replacement programs in public open space include the concern for public safety and the maintenance of a high level of aesthetic return.

For the most part, tree removal in Hyde Park, will occur by natural attrition, except in situations where a tree or trees are posing a risk to public safety or compromise the amenity of other trees. However, it is inevitable that as the trees in Hyde Park become over-mature, they will need to be progressively removed and replaced. Sustained amenity can only be achieved by establishing a range of age classes (eg. young, semi-mature, mature and over-mature). This is a very important management tool that can be used effectively in Hyde Park if there is diligent record keeping relating to tree removals and replacements.

The City of Sydney has a duty, as the manager of Hyde Park, to ensure that the public is not exposed to unreasonable levels of risk from the mechanical failure of the trees in Hyde Park. At the same time, there is an expectation to maintain the amenity provided by the existing tree population.

To achieve this balance, Council has engaged the services of independent arborists to report on the health and mechanical integrity of the trees in Hyde Park.

A key priority of the Hyde Park PoM & Masterplan is the preparation of detailed planting plans for the Park.

7.1.1 Selection Criteria for Hyde Park's General Tree Population

Plant selection for public open space is a strategic process that addresses the long term. (Hitchmough,1989). Trees define spaces, regulate light, induce scale and are indicators of season changes.

Selecting the most appropriate species and variety of tree for a particular location and function profoundly influences the quality of a design. (Arnold, 1980)

The height and spread of the trees in Hyde Park are the most critical characteristics in relation to species selection. Large trees make an effective transition between human scale and the immensity of the surrounding city. Small trees cannot achieve this scale transition. Small trees can add texture and seasonal colour but have a limited place in urban design (Arnold,1980). They can impede circulation or block important vistas and because of their lower branching they often take up more space than large shade trees.

A diversity of species is important in reducing the impact of diseases on specific species in the Park.

The criteria for the selection of trees to be planted in Hyde Park includes:

Biological / Environmental Tolerances

- Climatic suitability
- Tolerance of low soil oxygen
- Tolerance of soil compaction
- Tolerance of atmospheric pollution
- Above average tolerance of root disturbance
- Low susceptibility to pests and disease
- Drought tolerance
- Shade tolerance

Aesthetic / Design Requirements

- Ultimate size of plant canopies
- Form and texture of plant canopies
- Predictable growth characteristics
- Deciduous versus evergreen
- Colour of plant foliage

Functional Requirements

- Tolerant of severe pruning
- Acceptable leaf/fruit fall
- Long lived
- Not prone to major limb shear
- Low capacity to lift paving

The overriding landscape character of Hyde Park is that of the late nineteenth and early twentieth centuries. It is therefore desirable that the size and form of the canopies of the trees selected for replacement planting reinforces the character of this period. The trees will be selected for their growth potential of 100 years or more and therefore sufficient space must be provided to permit the increase in size that will occur in the long term.

7.1.2 Species Selection for Hyde Park's General Tree Population

Based on the conceptual design proposed in the Hyde Park Plan of Management & Masterplan, detailed plans will be prepared identifying replacement tree locations and indicative species selection. The indicative planting pallettes shall be divided into specific precincts including:

- Central avenue
- Secondary avenues
- Major entrances
- Park boundaries
- Central avenue boundaries
- Anzac Memorial landscape setting
- Accent and planting
- Specimen planting

7.2 Central Avenue Removal / Replacement Strategy

The evenly aged and spaced plantings found in avenues present particular challenges when addressing methods of removal and replacement.

There are three techniques that may be used to replace trees planted in avenues:

- natural attrition - replace trees as they fail;
- selected removal - remove and replace every second or third tree or;
- block removal - remove blocks or sections of trees.

Natural Attrition

This option allows for the removal and replacement of individual trees gradually, as their condition becomes critical. However, the removal and replacement of individual trees within avenues must be carefully considered. When individual trees are removed the increased exposure of the remaining trees to sun and different wind loads usually leads to structural failure and decline. The intense competition for light, water and nutrients under the canopies of the existing mature trees, compromises the form of the young replacement trees, often resulting in irredeemably misshapen or stunted trees. Generally this option is not recommended due to the probability that the tree will perform poorly.

Selected Removal

Selected removal is generally not successful for the same reasons as natural attrition. Gradual removal will break up the character of the avenue and diminish the cathedral-type vista created by the existing trees. The gradual replacement of the central avenue with individual trees will also create problems of differential age and inconsistent canopy size.

Block Removal

The technically effective way to achieve satisfactory avenue replacement in the long term is to remove and replant entire sections or groups of trees. This is the only technique that can successfully achieve the uniform appearance typical of avenue planting. While dramatic, this is the only known and accepted approach to create growing conditions that allow for the uniform and consistent habit characteristic of avenues. (Tree Masterplan for Centennial Parklands, 2002).

Whilst block removal is likely to meet with public opposition and loss of amenity, in the short term, it is the only method available to overcome the difficulties of suppression and root competition associated with establishing young trees next to mature trees.

Block removal is also the only technique that will provide the opportunity to remove and replace the subsoil and to install the sub surface drainage that is required if the trees are to survive.

The central avenue is the most significant element in Hyde Park. The significance and value of the overall avenue as a collective unit is far greater than the value of any individual tree. The number of trees that have already been removed has impacted on the visual amenity of this unique vista.

It is imperative that planning for the removal and replacement process is started immediately so that the replacement trees will be ready to plant before the integrity of this crucial design element is lost.

Block removal is the preferred technique to replace the trees in the central avenue. The Hill's Figs will be removed in blocks of approximately thirty (30) trees at the one time, including both rows on each side of the pathway, simultaneously (Figure 31).

The removal of only one row of trees at a time, from either one or both sides of the pathway, will not be successful because the form of the replacement trees will be compromised by the close proximity of the remaining row of trees and the different dynamics of the site, including wind, water and sun, will impact on the remaining trees.

The replacement trees will be 'grown on' off site to a height of approximately 5-6 metres enabling the planting of advanced trees when the existing trees are removed. This will provide improved amenity and presentation at the time of replacement.

Figure 31: The Hill's Figs will be removed in blocks of approximately 30 trees at the one time. Both rows will be removed simultaneously, on each side of the central pathway.

The break up of the block removal into sub-units that are removed and replaced in stages over a five to ten (5-10) year period will help to reduce the visual impact.

Stage 1 the trees circling the Archibald Fountain in Hyde Park North (15 trees) and the central avenue of trees in Hyde Park South (23 trees).

Stage 2 the block of trees north of the Archibald Fountain to Queens Square, in Hyde Park North (14 trees).

Stage 3 half the block of trees between the Archibald Fountain and Park Street in Hyde Park North (25 trees).

Stage 4 half the block of trees between the Archibald Fountain and Park Street in Hyde Park North (28 trees).

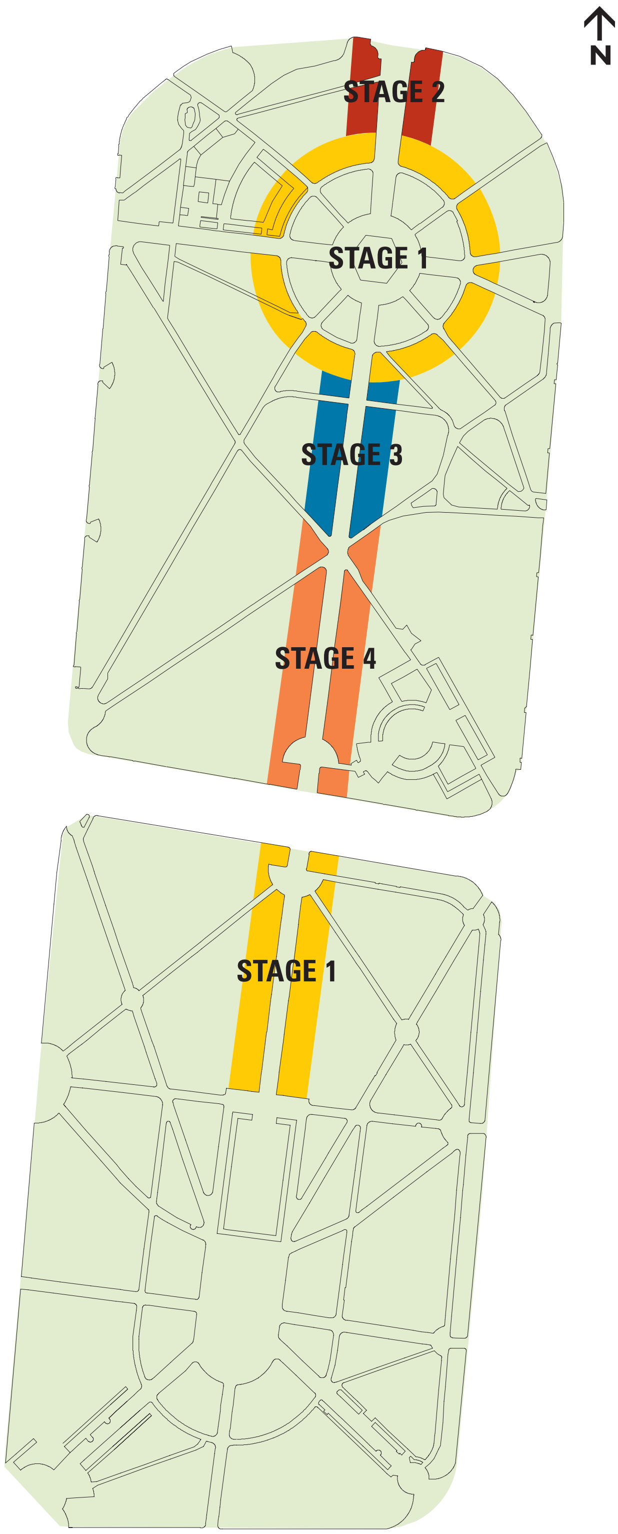
The most recent removal in September 2005 of twenty two (22) Hill's Figs from the central avenue has further reduced the visual impact of this vista to the point where the ring around the Archibald Fountain is no longer recognisable as part of the central avenue.

It is anticipated that replacement trees will take approximately five (5) years to be 'grown on' off site. Therefore it is envisaged that the first stage of the replacement planting can be started in the year 2011.

The health and vigour of the Hill's Figs in the central avenue will continue to be monitored and the extent of their decline will determine the program for replanting.

A major capital works project will be required when the trees are replaced, to remove and replace the subsoil and install sub surface drainage and services in the central avenue.

The proposed removal and replacement of the trees in the central avenue of Hyde Park can be flagged now, so that when the time comes, the removals have been largely understood and accepted.



Central Avenue Block Tree Removal Stages 1 - 4

7.2.1 Selection Criteria for the Central Avenue Tree Replacement

Plant selection must be based on a firm set of principles that includes the function and design intent as well as the most desirable and appropriate characteristics, no matter what their origin or type.

The clearly defined landscape character required for the central avenue in Hyde Park is governed by constraints that leave little room for arbitrary species selection. When trees are to be grown close enough together to form an avenue, the branch structure of the species is of critical aesthetic importance, not the open grown silhouette.

For aesthetic reasons, a large growing species is required to replace the central avenue, to allow the canopies of the trees to meet over the avenue, creating the dramatic cathedral-type framing of the vista between the Archibald Fountain in Hyde Park North and the ANZAC Memorial in Hyde Park South.

There are pronounced differences in the branch structure of the Hill's Figs growing in the central avenue in Hyde Park to specimens of the same species growing in other areas of open space. The avenue trees have been planted at 12 metre centres, forcing a more upright, thinner branch structure. Though the branches have grown upwards seeking the light required for photosynthesis, it has still been necessary to heavily prune the trees, to create the cathedral-type vista required. This practice has reduced the trees' ability to manufacture sugars for growth.

The improved technology associated with stock selection and improved growing techniques should ensure that the quality of the replacement trees will be vastly superior to the original plantings.

The replacement trees will be 'grown on' to establish a selection of advanced trees, approximately 5-8 metres tall. A "holding stock" of the selected tree will also be grown, at the same time, in the event of any unavoidable tree removals from the central avenue planting.

The criteria for the species selected to replace the central avenue included:

- **Suitability as avenue planting** (with cathedral style vista) – selected species should have the appropriate form and habit and be adaptable to pruning and shaping to achieve the required clearances;
- **Form and Scale** - must have appropriate growth habit and form, with an upright trunk (to minimize pruning requirements);
- **Height** – The ultimate dimension of the selected species needs to make a visual contribution to the vista created over the central avenue (20-25 metres).
- **Environmental tolerance** – including air pollution and avenue style planting;
- **Pest & Disease Resistance** – selected species should be resistant to disease and significant pest infestations.
- **Structure** – for safety reasons the selected species must have sound branching structure (to minimize hazards created by inherent defects);
- **Limited leaf /fruit fall** – the selected species must have an acceptable level of nuisance created by shedding of leaves or fruit. Those with large or heavy seed pods, excessive leaf drop, or fleshy fruit or flowers may lead to slip hazards.
- **Longevity** – The planting and establishment of the avenue planting represents a significant investment of time and resources by the City and an emotional drain on the Community, therefore the species selected should be long lived.

7.2.2 Species Selection Process

A range of potential tree species were considered for the replacement of the central avenue. The species investigated included:

- *Ficus microcarpa var hilli* (Hill's Fig)
- *Ficus macrophylla* (Moreton Bay Fig)
- *Ficus rubiginosa* (Port Jackson Fig)
- *Ficus superba var henneana* (Deciduous Fig)
- *Syzygium francisii* (Giant Water Gum)
- *Ficus obliqua* (Small Leafed Fig)
- *Argyrodendron actinophyllum* (Black Booyong)
- *Ficus virens* (White Fig)

7.2.3 Selected Species

The preferred option is to reinstate the central avenue with the existing tree species, the *Ficus microcarpa* var. *hillii* (Hill's Fig).

The Hill's Fig has its origin in the rainforests of coastal Queensland and commemorates Walter Hill who was a botanist and curator of the Brisbane Botanic Gardens from 1855 until 1881.

Form

This large evergreen tree can grow to a height of 20-25 metres. It has a smooth light grey trunk that generally branches into several large trunks, forming a broad open canopy 12-15 metres across, carrying a thick crown of glossy dark green leaves on slightly pendulous branchlets.

Leaves

The leaves are simple alternate narrow elliptical to ovate-oblong, 8-12cm long and 3-4cm wide; petiole 1.5-2.5cm long; apex blunt-acuminate; base cuneate; margin entire; venation reticulate, the midrib prominent beneath; glabrous; dark green and shiny above, paler beneath.

Fruit

Produces small figs about 7-10mm across, obovoid with a flattened apex and sessile base, green at first then salmon-pink with greenish-yellow warts on the surface, ripening in March-April.

Cultural Conditions

The Hill's Fig tolerates many urban conditions including pollution and root compaction. It grows easily in full sun or partial shade and thrives on well drained soils.

It appears that the Hill's Fig may have a propensity to be a host for the white rot fungus, *Phellinus species*. As there is limited documented information on this pathogen, the Council will continue to undertake further research and review, as necessary, to confirm the selection.

Council has the option to select an alternative tree species from the nominated selection criteria if the Hill's Fig is deemed unsuitable.

Figure 32: *Ficus microcarpa* var. *hillii* (Hill's Fig) canopy and form.

Figure 33: Hill's Fig leaf size and shape.

Figure 34: Hill's Fig - indicative size of replacement planting.

7.3 Management of the Existing Trees

The most critical management issue for the existing trees in Hyde Park is the lack of coordination between the different disciplines that carry out works or run events.

The health and physical structure of the trees have been seriously compromised by direct damage from construction works and activities associated with the major events conducted in the Park.

Mechanical Damage - Issues

Many trees have had major roots severed during construction works and service installations. Frequent and recurring injuries to trees have also been caused by basal abrasion from mowers and weed whippers. Contemporary use of the Park for festivals and events has contributed to direct mechanical damage of the trees (Figure 35).

Figure 35: Past practices to accommodate events have seriously compromised the health of the trees.

Mechanical Damage - Strategies

The Tree Management Team shall be notified of any proposed works within the critical root zones of all trees and shall scrutinise and assess the potential threat to existing trees and implement tree protection strategies in advance. Limit the opportunity for mechanical damage from mowers by placing a 50mm layer of organic mulch around the base of all trees. Mulch to a minimum of one (1) radial metre around the trunks of all mature trees (except the central avenue and where specific distances are noted for over-mature significant trees).

Service Installations - Issues

Excavation for services and other infrastructure has caused considerable damage to several mature trees. The existing services appear to have been installed in an uncontrolled manner. Such service installation poses a serious threat to existing trees.

Service Installations - Strategies

It is strongly recommended that all future service installation be vetted by the Tree Management Team to assess any potential threat to the existing tree population (severance of structural roots and/or restricted root zones). If any upgrade is required in the future, consideration should be given to relocating some services into common lines that may improve access for maintenance and reduce the damage to tree root plates. Hose cocks shall not be installed within the root zones of any new or existing trees. Hand excavation within the dripline of any trees.

Pests and Diseases - Issues

There have been no effective inspections of trees for disease and/or decay prior to the 2003 tree removals.

Figure 36: Fruiting body of Phellinus sp. detected by Council officers on 4 May 2005, on tree No.70(S), a Hill's Fig located in the central avenue of Hyde Park South.

Pests and Diseases - Strategies

The monitoring and control of pests and diseases shall be undertaken continuously (Figure 36) with inspections including the following actions:

- Identification
- Assessment of damage
- Immediate action undertaken (if required)
- Reporting details

All inspections shall be undertaken by a qualified arborist with minimum AQF level 5 qualification in Arboriculture or equivalent industry experience. Annual assessment for pests and disease by an independent arborist with minimum 5 years experience as approved by the City.

Tree Removal/Replacement - Issues

There has been reactive rather than proactive tree removal/replacement planting strategies and species selection. There has been no selective removal of trees that have been planted inappropriately.

Tree Removal/Replacement - Strategies

Remove trees with poorly developed crowns or suppressed form (Figure 37) that are growing under the canopies of adjacent trees. (Attachment 1 – Tree Schedule).

Figure 37: *Ulmus parvifola* (Chinese Elm) suppressed by adjacent Fig tree.

Tree Maintenance - Issues

Trees have had little maintenance other than pruning to remove deadwood. A number of trees have Mistletoe growing in them which has the potential to cause a decline in the health of the trees.

Tree Maintenance - Strategies

Trees shall be regularly maintained with records submitted detailing date of works completed, including mulching, fertilizing and pruning. Comprehensive details of maintenance requirements are included in the Service Providers Contract Specifications.

Pruning - Issues

The Hill's Fig trees growing in the central avenue of Hyde Park require constant pruning to maintain the design intent of the cathedral-type vista over the pedestrian walkway. Unfortunately this practice has had an adverse effect on the trees, reducing their ability to manufacture the sugars required for health and growth.

Figure 38: Removal of a large limb from a Hill's Fig located in the central avenue of Hyde Park North.

Removing even a single, large-diameter limb (Figure 38), can create a wound that the tree may not be able to close. The older and larger these trees become, the less energy they have to allocate to defence mechanisms for wound closure and decay or insect attack.

Pruning - Strategies

Select a suitable tree species for the central avenue to limit the pruning that is necessary to provide the 'cathedral' effect required. Pruning methods and techniques used shall be in accordance with the Australian Standard AS 4373-1996 *Prunity of Amenity Trees* and The Workcover Authority's *Code of Practice for the Amenity Tree Industry*, No. 34, May 1998. A copy of these documents must be available and held on site by the Contract Supervisor. All arborists shall have a minimum AQF Level 3 qualification in Arboriculture to carry out any pruning works within Hyde Park.

Soil Improvement - Issues
Many trees have compacted root environments and in the past have not had any root plate remediation.

Soil Improvement - Strategies
Ensure that Service Providers conduct an annual program of soil improvement for all tree root plates including the following:

- De-compaction and aeration
- Soil additives and soil replacement
- Testing of soil to determine pH
- NPK or complete fertiliser applications (as per recommendations in soil report)
- Mulching with aged woodchip to 50mm depth (AS 4454)

Reports to be submitted with details of any soil improvement or test results.

Comprehensive details of root plate remediation requirements shall be integrated into the Service Providers Contract Specifications.

Mulching - Issues
Lack of mulch around the base of trees has resulted in significant mechanical wounding to the trees' trunks and roots from mowers and trimmers.

Mulching - Strategies
Place a 50mm layer of organic mulch around the base of all trees (except avenue planting) in neat concentric circles to a distance of one (1) radial metre. The presence of mulch around the base of the trees aids in integrated pest management strategies (eg *Fig Psyllid*).

Irrigation - Issues
Previous to the mandatory water restrictions introduced by Sydney Water in July 2004, the central avenue of Hill's Figs were watered using an automatic irrigation system with an inflexible schedule. On several occasions this led to overwatering and exacerbated the problems associated with limited oxygen levels at shallow depth (Hyde Park Soil Investigations: Attachment 3). A number of significant mature trees are suffering from a lack of water.

Irrigation - Strategies
Prepare a water budget for all newly planted and mature trees to ensure they are not water stressed. Ensure that all tree irrigation systems are manually operated.

7.4 Management of Replacement Trees

Stock Selection and Size
Plant quality is most critical with long lived, large growing woody plants. Selection of quality stock is imperative to ensure the best chance of survival and to reduce the potential for growth defects. Select all stock using the Natspec Guidelines for Specifying Trees (Clark,2003) "Good trees in the landscape grow from good trees supplied by the grower".

Site Preparation and Planting
Planting of the nursery stock can be considered as the plant's final "potting on" (Clark, 1996). Attention to planting detail is essential to maximize the chances of successful establishment of the new plant. (refer to planting specification in Attachment 3).

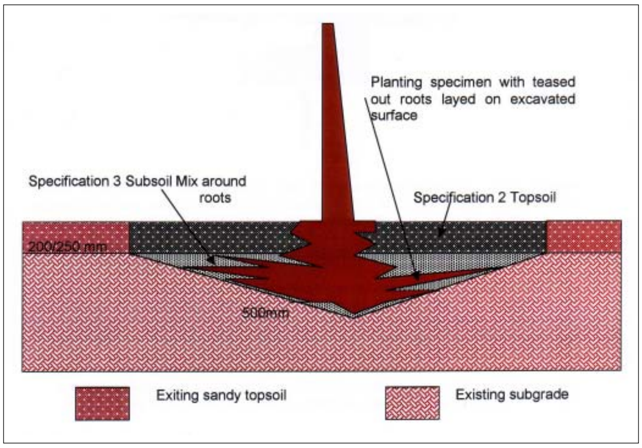


Figure 39: Planting detail for new specimens (Attachment 3: SESL Soil Investigations Vol.1 p.32).

It is imperative that the diameter of the planting hole for all new or replacement trees shall be a minimum of 2-3 times the diameter of the root ball and no deeper than the root crown.

Drainage
Install sub surface drainage in areas identified with drainage problems (Attachment 3: Soil investigations SESL 2005) before planting.

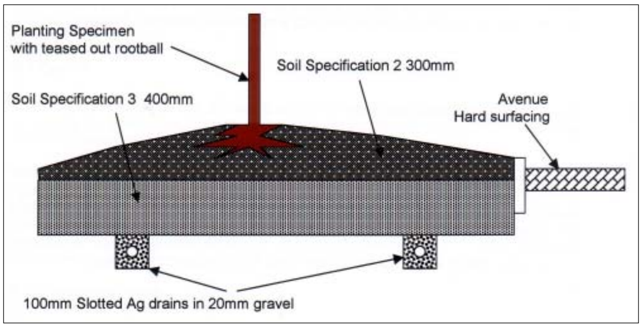


Figure 40: Soil specification for replanting in the central avenue (Attachment 3: SESL Soil Investigations Vol.1 p.35).

Regular Inspections

Newly planted trees require more intensive maintenance than trees that are well established. A qualified arborist (minimum AQF level 3 in Arboriculture) shall inspect young trees every twelve (12) months (minimum) to ensure that potential structural defects are detected early, in time for appropriate remedial treatment. Lift all tree canopies as required, to allow head clearance for pedestrians.

Watering

Water all trees as required to maintain healthy growth during the first two (2) years after planting. During dry summer conditions, new trees may need to be watered 2-3 times per week.

Provide temporary irrigation as required to maintain trees in peak condition at all times by having the capacity to apply a summer weekly target application of 25mm of water (approximately 12-13 litres of water per square metre).

Tree Protection

Install ornamental tree guards around all newly planted trees (except avenue planting) during the establishment phase (approx 2 years). Tree guards provide protection from casual acts of vandalism as well as accidental damage. Periodically inspect all trees fitted with tree guard for signs of chafing or constriction so that adjustments or removal of the guards can be carried out if necessary.

Fertilising

Where trees show evidence of nutrient deficiency, a soil analysis and report is to be prepared by a soil scientist to identify the deficiency and provide remedies.

Formative Pruning

Formative pruning is the selective pruning of a young tree to promote good form and branching structure. Formative pruning is most critical in the early stages of growth of a tree, in particular the first five to ten years. Limit pruning to the second or third year of growth, because newly planted trees need their leaves and shoot tips to provide food and substance to stimulate root production.

The goal in training young trees is to establish a strong trunk with sturdy well-spaced branches. Lateral branches contribute to the development of a sturdy well tapered trunk (ISA internet, 2005). These branches, known as temporary branches, help to protect the trunk from sun and mechanical injury while aiding with the tree's photosynthesis. Temporary branches should be kept short enough not to be an obstruction or compete with permanent branches.

Pruning shall be carried out in accordance with Australian Standard No 4373-1996 Pruning of Amenity Trees, by a skilled and experienced arborist, with a minimum AQF level 3 in Arboriculture.

Disease Management

Due to the presence of *Armillaria*, *Phytophthora* and *Phellinus* within various areas of Hyde Park North and Hyde Park South, the City requires strict hygiene practices to be implemented and undertaken at all times.

- Spades and other tools must always be washed free of soil before and between site works. In addition, tools should be regularly drenched in a solution of detergent or disinfectant.
- Prior to the commencement of works in another area of the Park or the City, all tools and vehicles must be washed free of soil and drenched. Cross contamination of soils must not occur.
- Boots and tyres are also an important means by which *Phytophthora* may be transported, as soil containing the fungus may cling to the boot or tyre. Wherever possible remove soil from boots and tyres and limit the movement of soil and fungus.
- Prior to the commencement of works, all staff and contractors must be advised of the diseases located within the soil and agree to undertake the hygiene practices required by the City.
- In areas where pathogens have been identified, the contractor must ensure that the strictest hygiene regimes are implemented, to limit the possibility of cross contamination on and off the site and contain the contaminated zones within the existing locations.
- All mechanical equipment is to be treated with the approved disinfectant prior to use on the site. All stockpiled site soil is to be stored in clearly marked locations within two (2) metres of the excavated area. Do not remove site soil unless otherwise authorised by the superintendent. Limit zone of excavation to a minimum.
- Only use disease free mulch.

Mulching

Mulch is an alternative to turf around trees and its use eliminates the potential for mechanical damage caused by mowers and Whipper Snippers®, that may lead to the development of decay and cracking (Lonsdale, 1999).

Place an 50mm layer of organic mulch around the base of all newly planted trees to a distance of one (1) radial metre from the trunk.

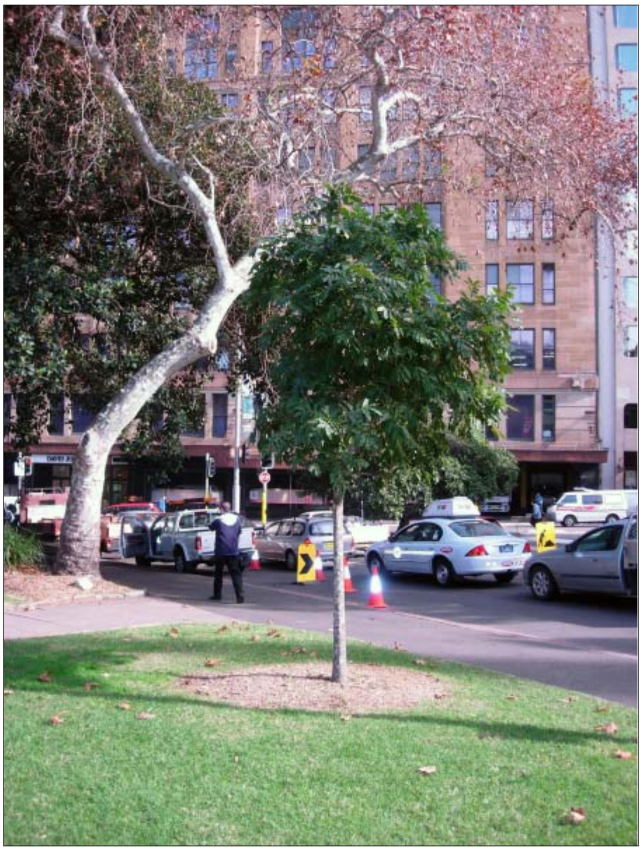


Figure 41: Mulch shall be installed at the base of all newly planted trees, to a radial distance of one (1) metre.

8 COMMUNITY CONSULTATION

The establishment of an effective and continuing relationship with the community in relation to tree management in Hyde Park is essential. It is crucial to the success of the management of the trees and this Tree Management Plan that the community is kept involved throughout the planning process - refer to the Hyde Park Plan of Management & Masterplan (Volume 2 - 1.4) Consultation and User Surveys.

Information panels have been exhibited in Hyde Park North and Hyde Park South since October 2004 informing the public of the City's tree management strategies and the proposed Hyde Park Tree Management Plan. The panels have displayed detailed information relating to the diseases that have affected the health and structure of the Hill's Figs in the central avenue and the history of the failures and removals.

In relation to tree management, community participation is ultimately not a consensus process; decisions must be made to achieve the best arboricultural outcome. The community may accept decisions they do not agree with if they understand the rationale behind them and have confidence in the integrity of those involved in making the difficult decisions. The critical factor in the success of any approach is the availability of confident and qualified arborists to provide guidance when required.

9 RECOMMENDATIONS

Tree Management

1) Implement the Tree Management Plan strategies to manage the longevity of the existing tree population and to provide strategies and principles for managing the removal, selection and placement of trees.

2) Strengthen role of Park Management and allocate adequate resources to manage and co-ordinate construction work, maintenance activities, event impacts and use of the Park to protect the Park's trees.

3) Improve communication and shared information systems among Park Management, Maintenance Service Providers and client users.

4) Hill's Figs in the central avenue to be inspected annually by an independent arborist to monitor the spread of previously identified pathogens.

5) Consulting arborists to have appropriate qualifications and experience (AQF5) in Arboriculture or demonstrated equivalent industry experience.

Tree Replacement

6) Implement the block removal and replacement strategies for the central avenue.

7) Replace and/or remediate the soil and install sub surface drainage in the central avenue at the same time as the trees are removed, as detailed in the Hyde Park Soil Investigations Report (June 2005).

8) Prepare a growing contract with a suitable supplier for 200 of the selected species. Source all trees from suppliers who have demonstrated quality standards and commitment to best practice in the propagation of plant material (NATSPEC Guide to Specifying Trees).

9) Prioritise the removal of trees with SULE categories of four (4) or five (5) over the next five years in accordance with the Tree Schedule. These are trees that are suppressed or have poor form.

10) New and replacement tree planting shall be carried out in accordance with the concept planting layout (refer to Hyde Park PoM & Masterplan).

Park Usage - Events

11) Develop tree protection zones for trees in activity areas during major events. Implement adequate protection measures for limited vehicles, structures or waste materials on the mulched area beneath the central avenue of Hill's Figs.

12) Ensure appropriate site management is implemented during major events so that trees are protected.

Tree Maintenance

13) Review and improve the Service Providers Specifications to address tree management issues specific to Hyde Park including event management, disease management and the care of the aging tree population.

14) Adopt a proactive monitoring and maintenance regime for all of the Park's trees including:

- detailed monitoring and data management including an annual reassessment of the SULE ratings.
- updating the Tree Assessment Schedule and Tree Location Plans (Attachments 1 and 2 respectively) to reflect any tree removals and/or amendments.
- an annual program of soil improvement (Attachment 3: Volume 1 of the Soil Report for recommended nutrient applications).
- monitoring and control of pests and diseases with annual inspections including the following actions:
  - > Identification
  - > Assessment of damage
  - > Immediate action undertaken (if required)
  - > Reporting details
- a 50mm layer of organic mulch placed in concentric circles around the base of all trees to one (1) radial metre from the trunks (except for the central avenue or where noted on plan).
- Prepare a water budget for all newly planted and significant trees. The trees shall be watered to provide adequate moisture for the tree's growth.

15) All arborists to have appropriate qualification and industry experience (AQF3) in Arboriculture to carry out any pruning works within Hyde Park.

16) Pruning methods and techniques used shall be in accordance with the Australian Standard AS 4373-1996 *Pruning of Amenity Trees*. A copy of this document must be available and held on site by the Contract Supervisor.

17) Direct consultation with the City's Tree Management Team prior to any excavation for hardworks or services.

10 IMPLEMENTATION, MONITORING AND REVIEW

10.1 Implementation

It is expected that the Hyde Park Tree Management Plan (TMP) will be implemented over several decades, as the longevity of the existing trees is unknown.

The TMP provides a framework by which tree removals and replacements may be guided and controlled. The TMP provides operational guidance and detailed ground maintenance specifications.

The Tree Management Plan is to be used as a dynamic and responsive document that continually changes when circumstances require it.

Any proposed changes to the Tree Management Plan should be assessed before they are implemented, to ensure that they are sympathetic with the overall objectives and do not have an adverse affect on the character of Hyde Park.

10.2 Monitoring and Review

The success of the Hyde Park Tree Management Plan will require effective communication. Different disciplines such as arboriculture, engineering, landscape design, planning and landscape management will need to coordinate their activities.

Regular inter-departmental reviews should be conducted between those officers responsible for the programming, coordination and implementation of any works in Hyde Park (PoM, 1989). This includes those parties responsible for security, lighting, building maintenance, service installations, landscape maintenance or improvements and any new project work. All proposed works shall be related to the Tree Management Plan.

The Tree Location Plans (Attachment 2) and the Tree Assessment Schedule (Attachment 1) shall be reviewed/ amended by the Service Provider on a bi-annual basis to ensure that any changes are documented and any history relating to tree failures is monitored and recorded.

The Tree Management Plan shall be reviewed for its effectiveness on a regular basis.

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Between June 2002 and June 2003, a number of the Hill's Figs in the central avenue of Hyde Park North and Hyde Park South fell over, prompting the Council of the City of Sydney to commission a number of reports from independent arborists.

On 18 July 2004, another Hill's Fig tree growing in the central avenue in Hyde Park South fell over. The City of Sydney immediately commissioned another arborist's report (Hill's Fig Failure, Tree Wise Men ref:1458) to provide recommendations for the future management of the remaining Hill's Fig trees.

Independent arborists from Tree Wise Men prepared a report in September 2004 (Ref: 1487) to provide an assessment of the hazard potential of twelve (12) Hill's Figs (trees earlier identified as having possible defects) located adjacent to the central avenue in both Hyde Park North and Hyde Park South.

This report identified that the trees were suffering from the effects of disease and/or fungi, including *Phellinus species*, *Phytophthora species* and *Armillaria species* or a combination of these diseases. The recommendation was for the immediate removal of six (6) figs because they were a danger to the public.

A review of the recommendations made by Tree Wise Men Australia P/L was undertaken by Sydney Arboricultural Services who noted that a seventh tree was also in a dangerous condition, being severely infected with the disease *Armillaria*. He recommended that the tree should be removed to reduce the possiblity of infection of the surrounding trees. The remaining five (5) trees were noted to have some decay in the main trunk; but could be retained in the short term with continual monitoring.

Disease Details

Phellinus sp. is a genus of white rot fungus. These fungi generally degrade the lignin (strengthening material) components of the wood more rapidly than the cellulose (sugars) and lead to reduced wood strength. The decayed areas within the tree may extend 2-3 metres above or below the fruiting bodies. It is thought to spread via spores off the fruiting body, found at the base of the tree trunk and through contact in the soil. The habit of the fungi and the methods of control are not known at this stage. The City has engaged the services of Dr Brett Summerell, a plant pathologist from the Royal Botanic Gardens, to research and provide recommendations on its treatment.

Figure 42: Fruiting body of *Phellinus sp.*

Armillaria luteobubalina is a soil borne fungus that causes root rot in a variety of native and exotic plants. The symptoms of the fungus include the death of branches, yellowing of foliage, poor vigour and the darkening and rotting of the larger roots. During May to June, small mushrooms under the trees canopy or on the trunk and white threads of fungi growth under bark on the trunk indicate that a tree is infected with the fungus. It spreads by means of root to root contact with infected trees, especially old decayed stumps and roots.

At present there is no simple method for controlling *Armillaria luteobubalina* so combinations of treatments are required. This includes the complete removal of the infected tree, including the tree stump and roots where possible, delaying the planting of new trees for as long as possible – up to two years. In some cases, a chemical treatment of the surrounding soil is also recommended, with a Phosacid ® Systemic Fungicide being applied on the soil of the surrounding trees.

Figure 43: White threads of fungi growth under the bark trunk indicate that the tree is infected with *Armillaria luteobubalina.*

Phytophthora cinnamomi is a microscopic soil borne disease that causes root rot in a wide variety of native and exotic plants. The pathogen is a virulent species and is of great concern, as there is no known long term control. Once trees become extensively decayed or infected by root rot fungus there is little that can be done to prevent death or failure.

Infection often results in the death of the plant, with early symptoms including wilting, yellowing and retention of dried foliage and darkening of younger feeder roots and occasionally the larger roots. The pathogen spreads through small swimming 'zoospores' which attach to and infect roots. The spores and structures of *Phytophthora* are microscopic and cannot be seen with the naked eye.

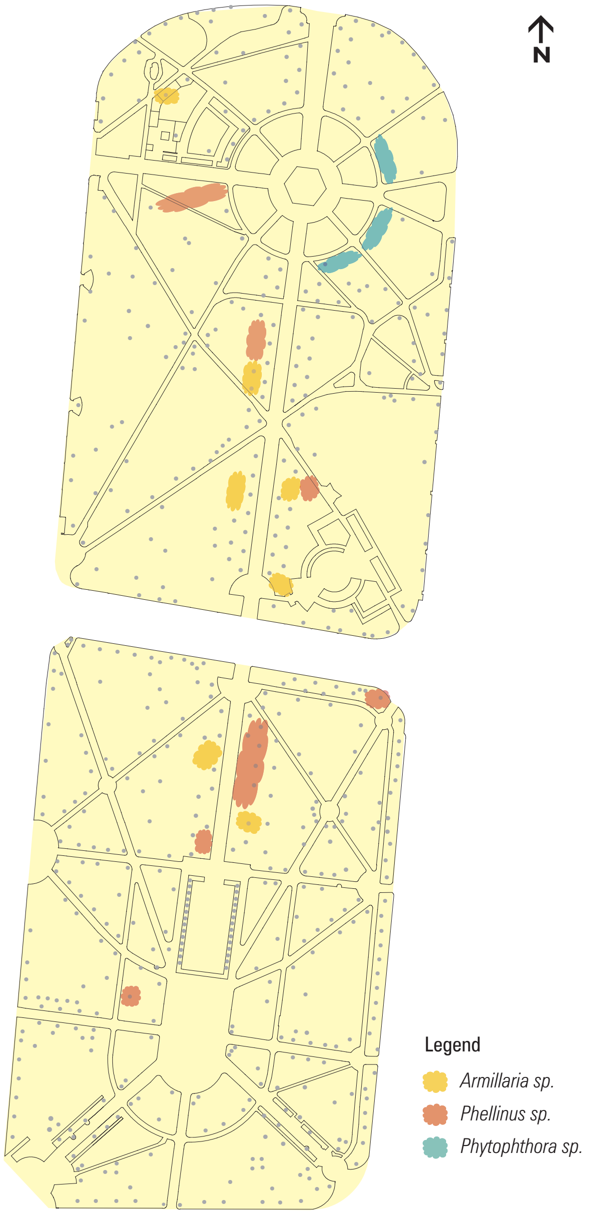
There is no way of visually telling if the pathogen is present in the soil. The spores are easily transported in storm water, drainage water and contaminated soil and on tools, footwear and vehicles.

The spores are also capable of surviving for extended periods of time and when conditions become favourable they germinate and renew the life cycle. This allows the *Phytophthora* to survive in dead plant tissue for a number of years.

At present there is no simple method for controlling *Phytophthora cinnamomi*. A combination of sanitation measures, good horticultural management, the selective use of some fungicides and the addition of organic matter to soils can be used to retard the activity of *Phytophthora*.

Newly planted trees are also susceptible to the affects of the diseases and fungi from the previous trees.

Treatment for *Armillaria* and *Phytophthora* is limited and as yet little information is known regarding the fungi *Phellinus*.

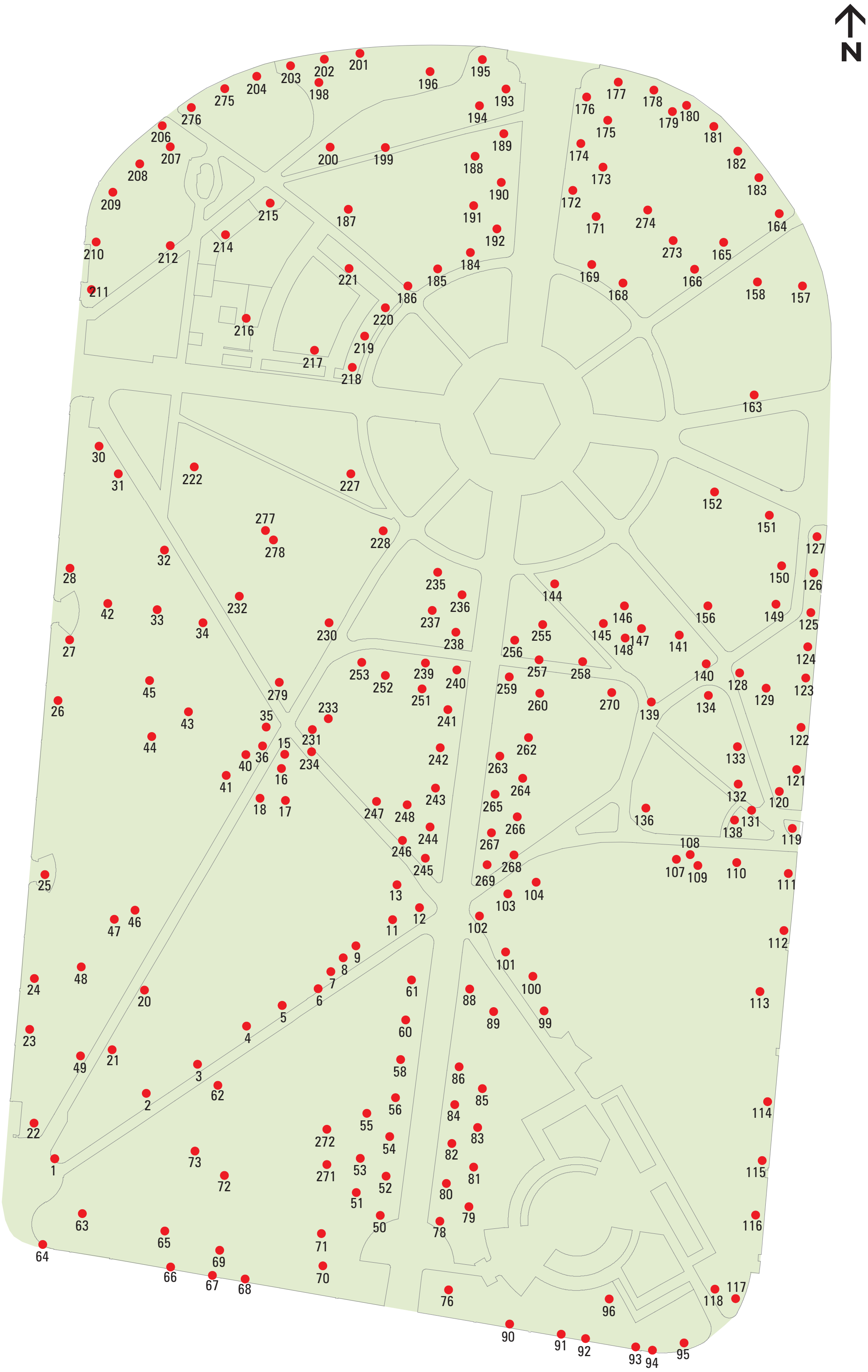


Location of Diseases - August 2005

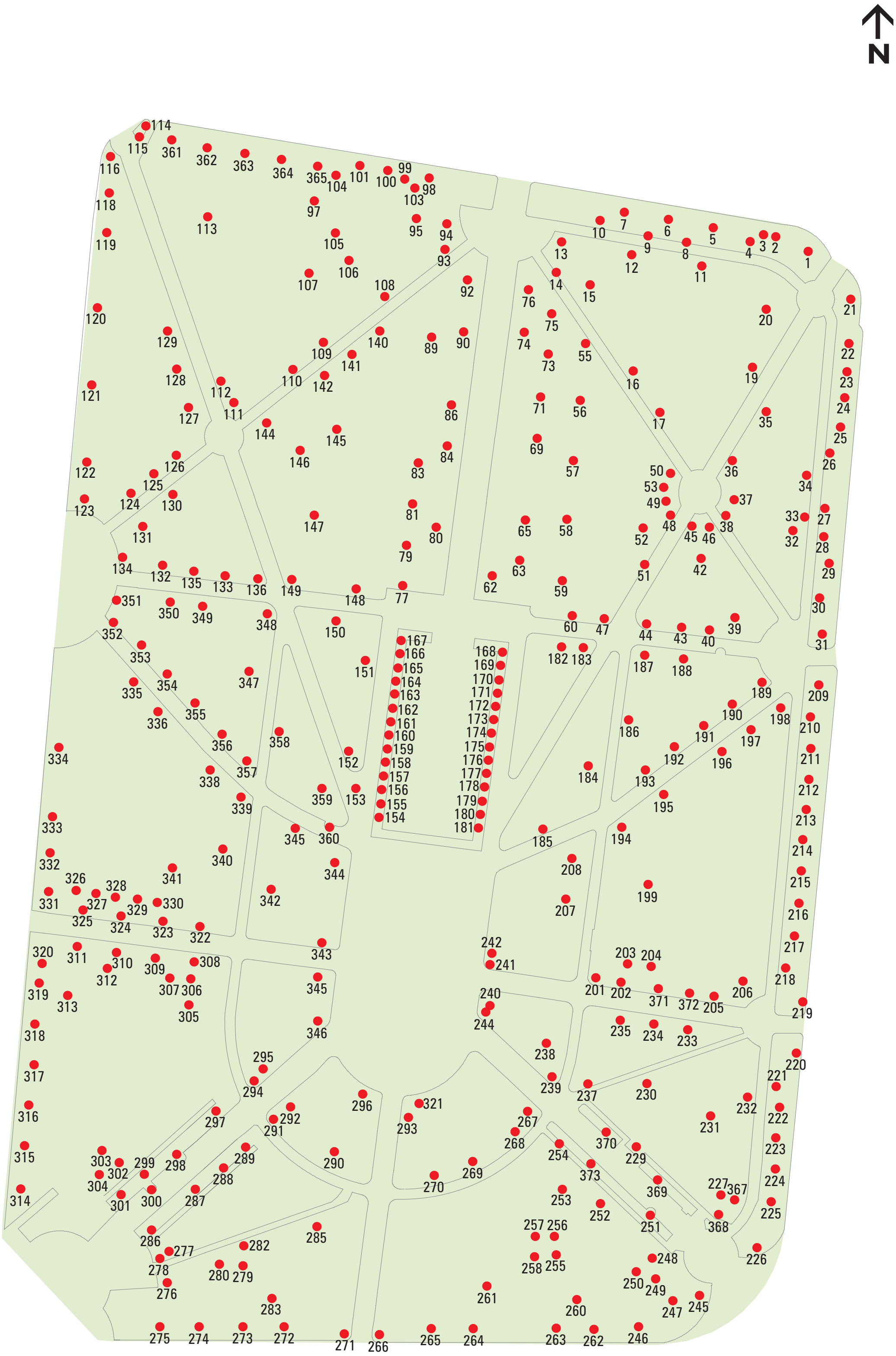
HYDE PARK NORTH EXISTING TREE LOCATIONS

APPENDIX 2

October 2005



HYDE PARK SOUTH EXISTING TREE LOCATIONS
October 2005



Botanical Name	Common Name	North	South
Acer negundo	Box Elder	1	0
Agathis robusta	Kauri Pine	0	1
Araucaria columnaris	Cook Pine	1	6
Araucaria cunninghamii	Hoop Pine	4	5
Brachychiton acerifolius	Illawarra Flame Tree	3	11
Brachychiton discolor	Qld Lacebark	4	1
Butia capitata	Jelly Wine Palm	2	0
Cedrus deodara	Deodara Pine	0	1
Celtis australis	Chinese Hackberry	0	7
Cinnamomum camphora	Camphor Laurel	1	0
Drypetes lasiogyna	Yellow Tulip	0	1
Erythrina sykesii	Coral Tree	0	1
Eucalyptus globulus/globulus	Tasmanian Blue Gum	1	0
Eucalyptus microcorys	Tallowwood	1	19
Eucalyptus paniculata x hybrida	Grey Ironbark	1	1
Eucalyptus sp.	Gum Tree	2	2
Ficus benjamina	Weeping Fig	2	0
Ficus macrophylla	Moreton Bay Fig	8	13
Ficus microcarpa var Hillii	Hill's Weeping Fig	93	44
Ficus religiosa	Bo Tree	0	1
Ficus rubiginosa	Port Jackson Fig	4	39
Ficus superba var Henneana	Deciduous Fig	1	0
Ficus virens	White Fig	1	0
Flindersia australis	Crow Ash	13	11
Flindersia benettiana	Bennett's Ash	2	2
Fraxinus oxycarpa	Red Ash	0	2
Ginko biloba 'Fastigiata'	Maidenhair Tree	0	2
Harpephyllum caffrum	Kaffir Plum	1	1
Howea forsteriana	Kentia Palm	1	0
Jacaranda mimosifolia	Jacaranda	3	0
Lagunaria patersonii	Norfolk Island Hibiscus	1	1
Lophostemon confertus	Brush Box	5	2
Liquidamber styraciflua 'Festeri'	Sugar Gum	1	1
Livistona australis	Cabbage Tree Palm	5	4
Macadamia integrifolia	Macadamia Tree	0	1
Magnolia sp.	Magnolia	0	1
Melaleuca quinquenervia	Broad-Leaf Paperbark	6	17
Metrosideros excelsa	NZ Christmas Bush	1	0
Pinus halepensis	Aleppo Pine	0	10
Pinus roxburghii	Chir Pine	0	2
Phoenix canariensis	Canary Island Date Palm	5	0

Botanical Name	Common Name	North	South
Phoenix dactylifera	Date Palm	2	1
Phoenix reclinata	African Wild Date	7	0
Phoenix sylvestris	Date Palm	1	0
Platanus x hybrida	London Plane Tree	20	35
Platanus orientalis	Oriental Plane Tree	3	2
Podocarpus elatus	Plum Pine	1	0
Podocarpus falcatus	Plum Fruited Yew	1	0
Populus alba	Silver Poplar	0	28
Populus deltoides	American Black Poplar	1	2
Populus nigra 'Italica'	Lombardy Poplar	1	0
Quercus x heterophylla	Hybrid Oak	0	1
Quercus ilex	Holm Oak	2	4
Quercus robur	English Oak	0	9
Robinia pseudoacacia 'Frisia'	Golden Robinia	0	2
Sapium sebiferum	Chinese Tallowwood	0	27
Stenocarpus sinuatus	Queensland Firewheel Tree	1	13
Syagrus romanzoffianum	Cocos Palm	13	0
Syzygium leuhmanii	Lilly Pilly	1	0
Tristaniopsis laurina	Water Gum	2	0
Ulmus glabra	Scotch Elm	1	0
Ulmus parvifolia	Chinese Elm	3	6
TOTAL 580		**240**	**340**

(After Barrell 1996, updated 01.04.2001)

The five categories and their sub-groups are as follows:

1. **Long SULE:** Trees that appeared to be retainable at the time of assessment for more than 40 years with an acceptable level of risk, assuming reasonable maintenance.

   (a) Structurally sound trees located in positions that can accommodate future growth.

   (b) Trees that could be made suitable for retention in the long term by remedial tree care.

   (c) Trees of special significance for historical, commemorative or rarity reasons that would warrant extraordinary efforts to secure their long term retention.

2. **Medium SULE:** Trees that appeared to be retainable at the time of assessment for 15–40 years with an acceptable level of risk.

   (a) Trees that may only live between 15 and 40 more years.

   (b) Trees that could live for more than 40 years but may be removed for safety or nuisance reasons.

   (c) Trees that could live for more than 40 years but may be removed to prevent interference with more suitable individuals or to provide space for new planting.

   (d) Trees that could be made suitable for retention in the medium term by remedial tree care.

3. **Short SULE:** Trees that appeared to be retainable at the time of assessment for 5–15 years with an acceptable level of risk.

   (a) Trees that may only live between 5 and 15 more years.

   (b) Trees that could live for more than 15 years but may be removed for safety or nuisance reasons.

   (c) Trees that could live for more than 15 years but may be removed to prevent interference with more suitable individuals or to provide space for new planting.

   (d) Trees that require substantial remedial tree care and are only suitable for retention in the short term.

4. **Remove:** Trees that should be removed within the next 5 years.

   (a) Dead, dying, suppressed or declining trees because of disease or inhospitable conditions.

   (b) Dangerous trees because of instability or recent loss of adjacent trees.

   (c) Dangerous trees because of structural defects including cavities, decay, included bark, wounds or poor form.

   (d) Damaged trees that are clearly not safe to retain.

   (e) Trees that could live for more than 5 years but may be removed to prevent interference with more suitable individuals or to provide space for new planting.

   (f) Trees that are damaging or may cause damage to existing structures within 5 years.

   (g) Trees that will become dangerous after removal of other trees for the reasons given in (a) to (f).

   (h) Trees in categories (a) to (g) that have a high wildlife habitat value that with appropriate treatment, could be retained subject to regular review.

5. **Small, young or regularly pruned:** Trees that can be reliably moved or replaced.

   (a) Small trees less than 5m in height.

   (b) Young trees less than 15 years old but over 5m in height. Formal hedges and trees

   (c) Intended for regular pruning to artificially control growth.

The following is a list of definitions relating to the terms and abbreviations that have been used in this report:

Age Classes

- (I) Immature refers to a well established but juvenile tree
- (S) Semi mature refers to a tree at growth stages between immaturity and full size.
- (M) Mature refers to a full sized tree. Trees can have a Mature Age Class for > 90% of their life span.
- (O) Over mature refers to a tree showing symptoms of irreversible decline.

Condition

Refers to the general form and structure of the scaffold (ie. trunk and major branches). It includes structural defects such as cavities, crooked trunks or weak trunk/ branch unions and canopy skewness. Generally described as Good (G), Fair (F) or Poor (P).

Critical Root Zone (CRZ)

Refers to a radial offset of five (5) times the trunk DBH measured from the centre of the trunk. Excavation within this area may seriously destabilize the tree. Fully elevated construction within this area is possible with specific root zone assessment.

Diameter at Breast Height (DBH)

Refers to the tree trunk diameter at breast height (1.4 metres above ground level).

Epicormic Shoots

Arise from adventitious or latent buds. These shoots often have a weak point of attachment. They are generally produced in response to stress in the tree.

Hazard

Refers to anything with the potential to cause harm/ damage to life or property.

Health

Refers to a tree's vigour as exhibited by the crown density, leaf colour, presence of epicormic shoots, ability to withstand disease and the extent of dieback.

Included/Inclusion-Stem/Bark

Refers to a genetic fault and potentially a weak point of attachment.

Primary Root Zone (PRZ)

Refers to a radial offset of ten (10) times the trunk DBH measured from the centre of the trunk. Excavation is possible within one offset only within this area and subject to specific rootzone assessment.

Scaffold Branch

Is a primary structural branch of the crown.

Senescence

Is the process of aging and death of trees.

Loam

A soil having a moderate amount of fine fractions fo sand and only a small amount of clay, over half of the particles being silt size.

Topsoil

The surface or top horizon of a soil profile usually exhibiting dark colour from high organic matter content, favourable structure and containing many organisms and roots. Defined as the A horizon in profile descriptions.

Subsoil

The second layer or set of horizons lying below the topsoil. May have bright colours, an accumulation of clay and other translocated materials, low organic matter content and few but large roots.

TREE ASSESSMENT SCHEDULE

HYDE PARK NORTH - May 2006

Tree No.	Tree Ref.	Botanical Name Common Name	Height (M)	Canopy Spread Rad (M)	DBH (mm)	CRZ Rad (M)	PRZ Rad (M)	Age	Vigour	Cond'n	SULE	Comments and Recommendations
1	1N	*Ficus microcarpa var Hillii* Hill's Fig	26	12	1300	6.5	13	M	Fair	Fair	2 Medium	Bark inclusion on south-east side Pavement works, limbs removed Monitor condition
2	2N	*Phoenix canariensis* Canary Island Date Palm	13	3	700	3.5	7	M	Good	Good	1C Long	Outer roots could be affected by pathway realignment Remove dead fronds
3	3N	*Stenocarpus sinuatus* Queensland Firewheel Tree	10	4	300	1.5	3	M	Fair	Fair	2C Medium	Mower damage tree possibly in decline minor deadwood branch stubs present
4	4N	*Phoenix canariensis* Canary Island Date Palm	10	3	700	3.5	7	M	Good	Good	1C Long	Remove dead fronds
5	5N	*Ulmus parvifolia* Chinese Elm	15	11	700	3.5	7.5	M	Good	Fair	2C Medium	Poor form, lopsided canopy damaged & misshapen branches Mulch to 2 metres around trunk
6	6N	*Viburnum odoratissimum* Sweet Viburnum	5	5				M	Good	Fair	3C Short	Poor specimen
7	7N	*Metrosideros excelsa* NZ Christmas Tree	4	5				M	Good	Fair	3C Short	Consider removal to allow for more suitable vista planting
8	8N	*Jacaranda mimosifolia* Jacaranda	10.5	3.5	500	3.5	7	M	Fair	Fair	3C Short	Poor condition, dead branches extensive epicormic growth Evidence of shedding branches
9	9N	*Syzygium luehmannii* Small Leafed Lilly Pilly	7	2.5	400	3	6	M	Poor	Poor	3C Short	Poor specimen, small tree Supressed by adjacent Hills Fig
10	10N	*Eucalyptus microcorys* Tallowwood	27	7	1000	5	10	M	Fair	Fair	**Removed 19.09.05**	Co-dominant structure, limbs removed,canopy suppressed by adjacent figs. Hollows and possum damage Armillaria detected 7.7.05
11	11N	*Ficus microcarpa var Hillii* Hills Weeping Fig	27	7	1100	5.5	11	M	Good	Good	3B Short	Part of significant avenue planting heavily pruned. Monitor for fruiting bodies
12	12N	*Ficus microcarpa var Hillii* Hills Weeping Fig	27	8	1100			M	Good	Good	3B Short	Part of significant avenue of Hills figs heavily pruned. Monitor for fruiting bodies

Tree No.	Tree Ref.	Botanical Name Common Name	Height (M)	Canopy Spread Rad (M)	DBH (mm)	CRZ Rad (M)	PRZ Rad (M)	Age	Vigour	Cond'n	SULE	Comments and Recommendations
13	13N	*Ficus microcarpa var Hillii* Hills Weeping Fig	27	10	1100			M	Good	Good	3B Short	Part of significant avenue of Hills figs heavily pruned. Monitor for fruiting bodies
14	14N	REMOVED									REMV'D	
15	15N	*Syagrus romanzoffiana* Cocos Palm	16	2.5	350	3	6	M	Fair	Fair	1C Long	Part of group planting of mixed palm species
16	16N	*Syagrus romanzoffiana* Cocos Palm	14	2.5	300	3	6	M	Fair	Fair	1C Long	Part of group planting of mixed palm species
17	17N	*Livistona australis* Cabbage Tree Palm	23	2	400	2	4	M	Good	Good	1C Long	Part of group planting of mixed palm species
18	18N	*Phoenix dactylifera* Date Palm	10	3	700	3.5	7	M	Good	Good	1C Long	Part of group planting of mixed palm species
19	19N	*Harpephyllym caffrum* Kaffir Plum **REMOVED March 2005**									REMV'D	Large branch failure Included bark, previous failures **REMOVED March 2005**
20	20N	*Cinnamomum camphora* Camphor laurel	20	10	900	4.5	9	M	Fair	Fair	2C Medium	Thin canopy, paved footway within critical root zone
21	21N	*Livistona australis* Cabbage Tree Palm	21	2	400	2	4	M	Fair	Fair	1C Long	Over mature Monitor
22	22N	*Ficus microcarpa var Hillii* Hills Weeping Fig	25	16	1100	5.5	11	M	Good	Fair	1C Long	Large significant tree framing SW entrance, heavily pruned. Raised garden bed, roots damaged Monitor for fruiting bodies
23	23N	*Platanus x hybrida* London Plane Tree	28	11	800	4	8	M	Good	Good	1 Long	No problems visible at the time of inspection
24	24N	*Platanus x hybrida* London Plane Tree	28	14	800	4	8	M	Good	Good	1 Long	Tap at the base of tree
25	25N	*Platanus x hybrida* London Plane Tree	28	13	900	4.5	9	M	Good	Good	1 Long	Large specimen located in concrete apron. Epicormics, branch stubs, limb removed. Retaining wall restriction, touching street light

Tree No.	Tree Ref.	Botanical Name Common Name	Height (M)	Canopy Spread Rad (M)	DBH (mm)	CRZ Rad (M)	PRZ Rad (M)	Age	Vigour	Cond'n	SULE	Comments and Recommendations
26	26N	*Platanus x hybrida* London Plane Tree	30	15	1100	5.5	11	M	Good	Good	1 Long	Roots have been damaged
27	27N	*Platanus x hybrida* London Plane Tree	30	13	800	4	8	M	Good	Good	1 Long	Limb removed Roots have been damaged
28	28N	*Platanus x hybrida* London Plane Tree	30	15	1000	5	10	M	Good	Good	1 Long	root damage
29	29N	*Ficus microcarpa var Hillii* Hills Weeping Fig	25	12	1100	5.5	11	M	Fair	Poor	**Removed 19.10.05**	Thin canopy, yellowed foliage Pavement within CRZ, root severed Hollows. T**est for Phytophthora**
30	30N	*Brachychiton acerifolius* Illawarra Flame Tree	5								1 Long	Small specimen crowded by adjacent Hills Fig.Minor dead branch tips Limited canopy development
31	31N	*Ficus benjamina* Weeping Fig	15	10	1000	5.5	11	M	Good	Fair	2B Medium	Inclusions, root severed pavement within CRZ Canopy crowded by adjacent Platanus
32	32N	*Ficus microcarpa var Hillii* Hills Weeping Fig	23	12	1100	5.5	11	M	Good	Good	2D Medium	limb removal pavement restriction and soil compaction
33	33N	*Quercus ilex* Holm Oak	13	9	900	4.5	9	M	Good	Fair	2D Medium	Area underneath canopy is completely paved, root compaction, epicormic growth sooty mould vehicles park under canopy. Manage rootzone
34	34N	*Flindersia australis* Australian Teak	12	5	500	2.5	5	M	Fair	Fair	2A Medium	Raised root plate Poor canopy development heavily pruned, sunscald
35	35N	*Syagrus romanzoffiana* Cocos Palm	16	3	350	2	4	M	Fair	Fair	2D Medium	Part of group planting of mixed palm species
36	36N	*Syagrus romanzoffiana* Cocos Palm	17	3	350	2	4	M	Fair	Fair	2D Medium	Part of group planting of mixed palm species
37	37N	*Livistona australis* Cabbage Tree Palm	22	2	400	2	4	M	Good	Good	**Removed 19.9.2005**	Part of group planting of mixed palm species Mower damage
38	38N	*Syagrus romanzoffiana* Cocos Palm	17	3	350	2	4	M	Fair	Fair	2D Medium	Part of group planting of mixed palm species mower damage

Tree No.	Tree Ref.	Botanical Name Common Name	Height (M)	Canopy Spread Rad (M)	DBH (mm)	CRZ Rad (M)	PRZ Rad (M)	Age	Vigour	Cond'n	SULE	Comments and Recommendations
39	39N	*Livistona australis* Cabbage Tree Palm	22	2	400	2	4	M	Poor	Poor	**Removed 19.9.2005**	**Tree is DEAD 8.8.05** **Removed September 2005**
40	40N	*Syagrus romanzoffiana* Cocos Palm	17	3	350	2	4	M	Fair	Fair	2C Medium	Part of group planting of mixed palm species
41	41N	*Phoenix dactylifera* Date Palm	16	3	700	3	6	M	Good	Good	1C Long	Mature specimen One of a pair framing the pathway
42	42N	*Populus deltoides* Cottonwood	17	10	900	5	10	O	Fair	Fair	2C Medium	Crowded by adjacent trees. Previously heavily pruned Some dead branches (large) Epicormic growth on trunk
43	43N	*Ficus benjamina* Weeping Fig	12	8	800	4	8	M	Fair	Fair	2C Medium	Tap at base, some dead branches canopy crowded by Platanus Monitor and relocate tap.
44	44N	*Platanus x hybrida* London Plane Tree	26	10	900	4.5	9	M	Good	Good	1 Long	Large specimen
45	45N	*Phoenix canariensis* Canary Island Date Palm	13	3	800	4	8	M	Good	Good	1C Long	Large specimen, crowded by adjacent Platanus and Ficus Consider transplanting
46	46N	*Brachychiton acerifolius* *Illawarra Flame Tree*	13	5	340	3	6	M	Good	Good	1 Long	Medium sized specimen surface roots present some mower damage
47	47N	*Livistona australis* *Cabbage Tree Palm*	23	2	400	2	4	M	Good	Good	1 Long	Large specimen tap at base
48	48N	*Livistona australis* Cabbage Tree Palm	22	2	400	2	4	M	Good	Good	1 Long	Large mature specimen
49	49N	*Lophostemon confertus* Brushbox	16	6	900	4.5	9	M	Good	Good	1 Long	Tap at base Mower damage, Root damage Pavement restrictions
50	50N	*Ficus microcarpa var Hillii* Hills Weeping Fig	26	10	800	4	8	M	Good	Good	3B Short	Part of significant avenue of Hills Figs heavily pruned. Monitor for fruiting bodies.
51	51N	*Ficus microcarpa var Hillii* Hills Weeping Fig	26	13	900	4.5	9	M	Fair	Fair	3B Short	Part of significant avenue of Hills figs heavily pruned

Tree No.	Tree Ref.	Botanical Name Common Name	Height (M)	Canopy Spread Rad (M)	DBH (mm)	CRZ Rad (M)	PRZ Rad (M)	Age	Vigour	Cond'n	SULE	Comments and Recommendations
52	52N	Ficus microcarpa var Hillii Hills Weeping Fig	26	10	800	4	8	M	Good	Fair	3B Short	Part of significant avenue of Hills Figs heavily pruned
53	53N	Ficus microcarpa var Hillii Hills Weeping Fig	26	13	900	4.5	9	M	Good	Good	3B Short	Part of significant avenue of Hills Figs heavily pruned Suppressed form
54	54N	Ficus microcarpa var Hillii Hills Weeping Fig	26	6	600	3	6	M	Fair	Fair	3B Short	Part of significant avenue of Hills Figs Suppressed form large limb removed
55	55N	Ficus microcarpa var Hillii Hills Weeping Fig	26	13	900	4.5	9	M	Fair	Fair	3B Short	Part of significant avenue of Hills Figs heavily pruned
56	56N	*Ficus microcarpa var Hillii* Hills Weeping Fig	26	6	900	4.5	9	M	Fair	Fair	3B Short	Part of significant avenue of Hills figs heavily pruned. Suppressed form. Monitor for fruiting bodies
57	57N	*Ficus microcarpa var Hillii* Hills Weeping Fig	26	13	900	4.5	9	M	Fair	Fair	**Removed 19.09.05**	Part of significant avenue of Hills figs heavily pruned, Inclusions **Inspected 7.7.05 recommended for immediate removal**
58	58N	*Ficus microcarpa var Hillii* Hills Weeping Fig	26	6	600	3	6	M	Fair	Fair	3B Short	Part of significant avenue of Hills figs heavily pruned.Suppressed form Monitor for fruiting bodies.
59	59N	*Ficus microcarpa var Hillii* Hills Weeping Fig	26	13	900	4.5	9	M	Fair	Fair	**REMV'D OCT 2004**	Part of significant avenue of Hills figs Armillaria detected Sept 2004 40% root crown ringbarked
60	60N	*Ficus microcarpa var Hillii* Hills Weeping Fig	26	7	700	3.5	7	M	Fair	Fair	3B Short	Part of significant avenue of Hills figs heavily pruned Suppressed form
61	61N	*Ficus microcarpa var Hillii* Hills Weeping Fig	26	8	1000	5	10	M	Good	Good	3B Short	Part of significant avenue of Hills figs heavily pruned
62	62N	*Butia capitata* Jelly Palm	9	2	500	3	6	M	Good	Good	1 Long	Tap located at base Remove dead fronds
63	63N	*Flindersia australis* Australian Teak	16	6	600	3	6	M	Fair	Fair	2C Medium	Root damage Limbs removed
64	64N	*Flindersia australis* Australian Teak	18	7	600	3	6	M	Fair	Fair	2C Medium	Limbs removed

Tree No.	Tree Ref.	Botanical Name Common Name	Height (M)	Canopy Spread Rad (M)	DBH (mm)	CRZ Rad (M)	PRZ Rad (M)	Age	Vigour	Cond'n	SULE	Comments and Recommendations
65	65N	*Lagunaria patersonia* Norfolk Island Hibiscus	17	4.5	500	3	6	M	Fair	Fair	2 Medium	Branch stubs from previous pruning. Minor deadwood
66	66N	*Melaleuca quinquenervia* *Broad leafed* Paperbark	17	6	600	3	6	M	Fair	Fair	2D Medium	Small specimen Pigeon damage at base, ringbarking
67	67N	Melaleuca quinquenervia Broad leafed Paperbark	10	4	500	3	6	M	Fair	Fair	2D Medium	Some deadwood/decay present pigeon damage at base, ringbarking
68	68N	Melaleuca quinquenervia Broad leafed Paperbark	13	5	600	3	6	M	Fair	Fair	2D Medium	Pigeon damage at base, ringbarking
69	69N	*Eucalyptus globulus/globulus* Tasmanian Blue Gum	18	8	700	3.5	7	M	Good	Fair	2D Medium	Evidence of previous termite infestation and branch shedding of large limbs, epicormic growth
70	70N	*Populus nigra 'Italica'* Lombardy Poplar	18	3	600	3	6	O	Poor	Poor	4D Remove	Very poor condition, extensive dieback deadwood and epicormic growth. REMOVE
71	71N	*Ficus virens* White Fig	28	10	800	4.5	9	M	Fair	Fair	3B Short	Located very close to Central Avenue Remove and replace at the same time as the Central Ave with the same species.
72	72N	*Platanus x hybrida* London Plane Tree	28	13	800	4	8	M	Good	Good	I Long	Root damage/ adjacent pond Large specimen, some deadwood & epicormic growth, some decay at stubs
73	73N	*Lophostemon confertus* Brushbox	18	6	600	3	6	M	Fair	Fair	1 Long	Large specimen Some deadwood, branch stubs included branch
74	74N	**REMOVED**									REMV'D	**REMOVED**
75	75N	**REMOVED**									REMV'D	**REMOVED**
76	76N	*Ficus macrophylla* Morton Bay Fig	26	9	700	3.5	7	M	Fair	Fair	2D Medium	Wounding from trunk injections and sunscald. Roots damaged by new pavement suppressed
77	77N	*Ficus microcarpa var Hillii* Hills Weeping Fig **FAILED 1.7.2005**	26	7	700	3	6	M	Fair	Fair	**Failed & Removed 1.7.2005**	Part of significant avenue of Hills figs heavily pruned.Suppressed form. **FAILED & REMOVED 1.7.2005**

Tree No.	Tree Ref.	Botanical Name Common Name	Height (M)	Canopy Spread Rad (M)	DBH (mm)	CRZ Rad (M)	PRZ Rad (M)	Age	Vigour	Cond'n	SULE	Comments and Recommendations
78	78N	*Ficus microcarpa var Hillii* Hills Weeping Fig	26	7	800	4	8	M	Fair	Fair	3B Short	Part of significant avenue of Hills figs heavily pruned Suppressed form
79	79N	*Ficus microcarpa var Hillii* Hills Weeping Fig	26	10	900	4.5	9	M	Fair	Fair	3B Short	Part of significant avenue of Hills figs heavily pruned Suppressed form, restriction from tunnel access
80	80N	*Ficus microcarpa var Hillii* Hills Weeping Fig	26	7	700	3.5	7	M	Fair	Fair	3B Short	Part of significant avenue of Hills Figs heavily pruned
81	81N	*Ficus microcarpa var Hillii* Hills weeping Fig	26	10	700	3.5	7	M	Fair	Fair	3B Short	Part of significant avenue of Hills figs heavily pruned, inclusions further investigation required
82	82N	*Ficus microcarpa var Hillii* Hills Weeping Fig	26	6	600	3	6	M	Fair	Fair	3B Short	Part of significant avenue of Hills figs heavily pruned
83	83N	*Ficus microcarpa var Hillii* Hills Weeping Fig	26	13	800	4	8	M	Fair	Fair	3B Short	Part of significant avenue of Hills figs heavily pruned
84	84N	*Ficus microcarpa var Hillii* Hills Weeping Fig	26	7	700	3.5	7	M	Fair	Fair	3B Short	Part of significant avenue of Hills figs heavily pruned
85	85N	*Ficus microcarpa var Hillii* Hills Weeping Fig	26	13	1000	5	10	M	Fair	Fair	3B Short	Part of significant avenue of Hills figs heavily pruned
86	86N	*Ficus microcarpa var Hillii* Hills weeping Fig	26	7	700	3.5	7	M	Fair	Fair	3B Short	Part of significant avenue of Hills figs heavily pruned
87	87N	*Ficus microcarpa var Hillii* Hills weeping Fig	26	13	1200	6	12	M	Fair	Fair	**Removed 19.09.05**	Part of significant avenue of Hills figs, 40% root crown ringbarked. Armillaria detected Sept 2004 **Inspected 7.7.2005. Monitor phellinus**
88	88N	Ficus microcarpa var Hillii Hills Weeping Fig	30	13	1200	6	12	M	Good	Fair	3B Short	Part of significant avenue of Hills figs heavily pruned
89	89N	Ficus microcarpa var Hillii Hills weeping Fig	26	13	1200	6	12	M	Good	Good	3B Short	Part of significant avenue of Hills figs heavily pruned
90	90N	*Acer negundo* Boxelder	13	6	730	3	6	M	Good	Good	2D Medium	Cavities, deadwood, branch stubs some decay present

Tree No.	Tree Ref.	Botanical Name Common Name	Height (M)	Canopy Spread Rad (M)	DBH (mm)	CRZ Rad (M)	PRZ Rad (M)	Age	Vigour	Cond'n	SULE	Comments and Recommendations
91	91N	*Melaleuca quinquenervia* Broad leafed Paperbark	14	4	550	4	8	M	Fair	Fair	2D Medium	Pigeon damage at base ringbarking. Branch stubs, some deadwood
92	92N	*Melaleuca quinquenervia* Broad leafed Paperbark	13	5	640	4	8	M	Fair	Fair	2D Medium	Pigeon damage at base ringbarking
93	93N	*Melaleuca quinquenervia* Broad leafed Paperbark	15	5	970	4	8	M	Fair	Fair	2D Medium	Pigeon damage at base ringbarking
94	94N	*Flindersia australis* Australian Teak	18	4	400	2	4	M	Fair	Good	2D Medium	Sunscald Some dead branches overhangs bus stop
95	95N	*Ficus microcarpa var Hillii* Hills Weeping Fig	22	13	1200	6	12	M	Good	Fair	2A Medium	Tap embedded at base Adjacent to power pole Further investigation required
96	96N	*Brachychiton discolor* Lacebark Kurrajong	20	6.5	400	4	8	M	Good	Good	1 Long	Minor deadwood
97	97N	*Quercus palustris* Pin Oak	18	8	800	4	8	M	Good	Good	**Failed. Removed 13.4.2006**	Large specimen
98	98N	Quercus sp. **REMOVED 2004**									**Removed 2004**	**REMOVED 2004**
99	99N	*Eucalyptus sp* . Eucalyptus	20	6	600	3	6	M	Fair	Poor	4A Remove	Large specimen in decline. Decay, dieback epicormic growth. Crowded by adjacent Fig and Plane tree. Removal recommended (1997)
100	100N	*Platanus x hybrida* London Plane Tree	24	13	1000	5	10	M	Good	Good	2A Medium	Large specimen Mistletoe infestation Decay present
101	101N	*Ficus microcarpa var Hillii* Hills Weeping Fig	26	13	1000	5	10	M	Good	GooFair	3B Short	Part of significant avenue of Hills figs Limb defects, cavity Pavement restriction
102	102N	*Ficus microcarpa var Hillii* Hills Weeping Fig	26	13	1000	5	10	M	Good	Fair	3B Short	Part of significant avenue of Hills figs Limb/trunk defects, defect at base Pavement restriction, mower damage
103	103N	*Ficus microcarpa var Hillii* Hills Weeping Fig	26	10	800	4	8	M	Good	Fair	3B Short	Part of significant avenue of Hills figs Inclusions, limb failure,suppressed Further investigation required

Tree No.	Tree Ref.	Botanical Name Common Name	Height (M)	Canopy Spread Rad (M)	DBH (mm)	CRZ Rad (M)	PRZ Rad (M)	Age	Vigour	Cond'n	SULE	Comments and Recommendations
104	104N	*Platanus x hybrida* London Plane Tree	26	13	1100	5.5	11	M	Good	Good	2C Medium	Very large specimen, paving impacts drainage system adjacent to tree
105	105N	REMOVED									REMV'D	REMOVED
106	106N	*Eucalyptus globulus* Tasmanian Blue Gum	21	7	1200	6	12	M	Fair	Fair	**Removed 19.09.05**	Large specimen, hollows, possibly hazardous. **Inspected 7.7.05** **Totally hollowed out by termites**
107	107N	*Syagrus romanzoffiana* Cocos Palm	11.5	4	240	2	4	O	Fair	Fair	3B Short	
108	108N	*Syagrus romanzoffiana* Cocos Palm	15	4	290	2	4	O	Fair	Fair	3B Short	
109	109N	*Syagrus romanzoffiana* Cocos Palm	16	3.5	310	2	4	O	Fair	Fair	3B Short	
110	110N	*Ficus macrophylla* Moreton Bay Fig	20	10	1299	6	12	M	Fair	Poor	2D Medium	Significant tree in decline sparse growth, paving restriction heavily pruned. Previously injected
111	111N	*Platanus x hybrida* London Plane Tree	14	6	600	3	6	M	Good	Good	2B Medium	Limb failure major root damage from construction of adjacent retaining wall
112	112N	*Platanus orientalis* Oriental Plane Tree	16	7	800	4	8	M	Good	Good	2B Medium	Retaining wall replaced major root damage Monitor condition
113	113N	*Ficus macrophylla* Morton Bay Fig	20	10	900	4.5	9	M	Fair	Fair	2D Medium	Large significant specimen Electricity box bolted to trunk - remove Stem injection wounding
114	114N	*Platanus x hybrida* London Plane Tree	18	8	700	3.5	7	S	Good	Good	2D Medium	Retaining wall within 1 metre of trunk structural root damage **Remove Mistletoe**
115	115N	*Platanus x hybrida* London Plane Tree	12	9	700	3.5	7	S	Good	Good	2D Medium	walls either side of tree
116	116N	*Platanus x hybrida* London Plane Tree	12	9	700	3.5	7	S	Good	Good	2D Medium	Wall failing

Tree No.	Tree Ref.	Botanical Name Common Name	Height (M)	Canopy Spread Rad (M)	DBH (mm)	CRZ Rad (M)	PRZ Rad (M)	Age	Vigour	Cond'n	SULE	Comments and Recommendations
117	117N	*Ficus microphylla var Hillii* Hills Weeping Fig	26	13	1200	6	12	M	Good	Good	2B Medium	Large significant specimen wall and path failing suppressed form
118	118N	*Eucalyptus sp.* Eucalyptus	20	8	600	3	6	M	Good	Fair	2A Medium	Termites Hollows not critical inspected 7.7.05 Monitor termites
119	119N	*Platanus x hybrida* London Plane Tree	15	7	600	3	6	M	Good	Fair	2A Medium	Retaining wall restriction major root damage
120	120N	*Ficus macrophylla* Moreton Bay Fig	16	5	900	4.5	9	O	Poor	Fair	2D Medium	Stem injection wounding, dieback evidence of limb failure. Soil compaction, mower damage Extensive deadwood
121	121N	*Lophostemon confertus* Brushbox	13	5	600	3	6	M	Fair	Fair	3C Short	wall restriction
122	122N	*Platanus x hybrida* London Plane Tree	20	12	800	4	8	M	Good	Good	2B Medium	adjacent to retaining wall excavation within 1 metre of trunk (1997) to access sewer, structural roots severed
123	123N	*Platanus x hybrida* London Plane Tree	24	6	600	3	6	M	Good	Fair	2B Medium	Limb failure major root damage from construction of adjacent retaining wall
124	124N	*Ficus rubiginosa* Port Jackson Fig	22	8	700	3.5	7	M	Poor	Poor	4A Remove	Severely stressed, extensive epicormic growth major root damage from wall construction, decayed stub
125	125N	*Platanus x hybrida* London Plane Tree	23	8	600	3	6	M	Fair	Fair	3C Short	major root damage from construction of adjacent retaining wall excavation within 1 metre of trunk
126	126N	*Quercus ilex* Holm Oak	12	4.5	350	3	6	O	Poor	Poor	4A Remove	Severely stressed, extensive epicormic growth sooty mould excavation within 1 metre of trunk
127	127N	*Platanus x hybrida* London Plane Tree	23	9	800	4	8	M	Fair	Fair	3C Short	major root damage, excavation within one (1) metre of trunk. Limb failure. Monitor
128	128N	*Syagrus romanzoffiana* Cocos Palm	20	1.5	300	2	4	O	Poor	Poor	4A Remove	Growing through canopy of Hills Fig in decline, totally suppressed no amenity value REMOVE
129	129N	*Ficus microcarpa var Hillii* Hills Weeping Fig	25	14	1300	6.5	13	M	Good	Fair	2B Medium	Inclusion, roots damaged Further investigation required Monitor condition

Tree No.	Tree Ref.	Botanical Name Common Name	Height (M)	Canopy Spread Rad (M)	DBH (mm)	CRZ Rad (M)	PRZ Rad (M)	Age	Vigour	Cond'n	SULE	Comments and Recommendations
130	130N	*Quercus palustris* Pin Oak **REMOVED**									REMV'D	REMOVED Dec 2004
131	131N	*Syagrus romanzoffiana* Cocos Palm	14	2	300	2	4	O	Good	Good	2A Medium	Close to junction of pathways.
132	132N	*Phoenix canariensis* Canary Island Date Palm	14	3	700	3.5	7	M	Good	Good	1 Long	Good specimen
133	133N	*Lophostemon confertus* Brushbox	14	6	400	4	8	M	Fair	Fair	3C Short	stressed and suppressed
134	134N	*Brachychiton discolor* Lacebark Kurrajong	15	5	700	3.5	7	M	Good	Good	2D Medium	Roots damaged, pavement restriction soil compaction
135	135N	Quercus mongolica Mongolian Oak	14	10	1200	6	12	M	Fair	Poor	**Removed 19.09.05**	Trunk defects, major cavities,termites and beehive in tree limb failures, pavement restrictions. **Inspected 7.7.05** **- immediate removal recommended**
136	136N	*Flindersia australis* Australian Teak	16	5.5	500	3	6	M	Good	Fair	3A Short	
137	137N	*Livistona australis* Cabbage Tree Palm	21	1.5	400	2	4	M	Good	Good	2C Medium	
138	138N	*Ficus rubiginosa* Port Jackson Fig	20	8	900	4.5	900	O	Fair	Fair	3D Short	suppressed form pavement restrictions, root damage Monitor
139	139N	*Araucaria cunninghamii* Hoop Pine	19	6	600	3	6	O	Fair	Fair	2D Medium	pavement restrictions, root damage lean to SE
140	140N	*Podocarpus elatus* Plum Pine	16	4	450	3	6	O	Fair	Fair	3 Short	suppressed form, sooty mould pavement restrictions
141	141N	*Ficus rubiginosa* Port Jackson Fig	22	14	1300	6.5	13	M	Good	Good	2A Medium	This tree has a history of limb failure (unexplained branch drop) Most recent failure recorded on 30.Jan 2006. Monitor closely and consider removal if failures continue
142	142N	*Ficus microcarpa var Hillii* Hills Weeping Fig **REMOVED 2004**									REMV'D	

Tree No.	Tree Ref.	Botanical Name Common Name	Height (M)	Canopy Spread Rad (M)	DBH (mm)	CRZ Rad (M)	PRZ Rad (M)	Age	Vigour	Cond'n	SULE	Comments and Recommendations
143	143N	*Ficus microcarpa var Hillii* Hills Weeping Fig	23	11	900	4.5	9	M	Fair	Fair	3B Short	Part of significant avenue of Hills figs inclusions, limb failure further investigation required
144	144N	*Ficus microcarpa var Hillii* Hills Weeping Fig	23	11	900	4.5	900	M	Fair	Fair	3B Short	Part of significant avenue of Hills figs further investigation required
145	145N	*Araucaria cunninghamii* Hoop Pine	26	4	600	3	6	O	Poor	Poor	3C Short	Suppressed form
146	146N	*Brachychiton acerifolius* Illawarra Flame Tree	16	5	700	4	8	M	Good	Good	2D Medium	crowded by adjacent trees.
147	147N	*Tristaniopsis laurina* Water Gum	12	4	250	2	4	M	Fair	Fair	4E Remove	crowded by adjacent trees
148	148N	*Tristaniopsis laurina* Water Gum	9	2.5	200	2	4	M	Fair	Fair	4E Remove	crowded by adjacent trees
149	149N	*Brachychiton discolor* Lacebark Kurrajong	16	5	700	3.5	7	M	Good	Good	2 Medium	
150	150N	*Lophostemon confertus* Brushbox	15	6	600	3	6	M	Poor	Poor	4A Remove	Very stressed specimen
151	151N	*Ficus microcarpa var Hillii* Hills Weeping Fig	19	9	900	4.5	9	M	Fair	Fair	3B Short	Raised root plate, surface roots constricted. Poor wound closure Pavement constriction
152	152N	*Ficus microcarpa var Hillii* Hills Weeping Fig	26	11	1100	5.5	11	M	Poor	Poor	3B Short	Possible hollows Mulch around base Picus Tomograph test @200 AGL (27.4.05) indicated solid wood
153	153N	*Ficus microcarpa var Hillii* Hills Weeping Fig	27	9	1100	5.5	11	M	Fair	Fair	**Removed 19.09.05**	Part of significant avenue of Hills figs inclusions, Armillaria detected **Inspected 7.7.2005**
154	154N	*Ficus microcarpa var Hillii* Hills Weeping Fig	28	9	1100	5.5	11	M	Fair	Fair	**Removed 19.09.05**	Part of significant avenue of Hills figs, inclusions. limb failure.Armillaria detected & *Phytophthora* **Inspected 7.7.05. No hollows. Monitor**
155	155N	*Ficus microcarpa var Hillii* Hills Weeping Fig	28	9	11	5.5	11	M	Fair	Fair	**Removed 19.09.05**	Part of significant avenue of Hills figs, inclusions limb failure. Armillaria detected. **inspected 7.7.05** Monitor for *Phytophthora*

Tree No.	Tree Ref.	Botanical Name Common Name	Height (M)	Canopy Spread Rad (M)	DBH (mm)	CRZ Rad (M)	PRZ Rad (M)	Age	Vigour	Cond'n	SULE	Comments and Recommendations
156	156N	*Harpephyllym caffrum* Kaffir Plum	16	5.5	500	4	8	M	Good	Fair	4E Remove	Poor canopy development due to proximity of adjacent Ficus rubiginosa. Evidence of minor root girdling
157	157N	*Flindersia australis* Australian Teak	16	6	450	4	8	M	Fair	Fair	3 Short	Poor condition
158	158N	*Ficus macrophylla* Moreton Bay Fig	23	6.5	1000	5	10	O	Poor	Poor	2A Medium	Large specimen in decline. Previously pruned. Poor regrowth, extensive defoliation. Monitor condition
159	159N	**REMOVED 2004**									**Removed 2004**	
160	160N	*Ficus microcarpa var Hillii* Hills Weeping Fig	23	9	900	4.5	9	M	Fair	Fair	**Removed 19.09.05**	Part of significant avenue of Hills figs Tested positive for Phytophthora **Inspected 7.7.05**
161	161N	*Ficus rubiginosa* Port Jackson Fig	22	6	800	4	8	M	Poor	Poor	**Removed 19.9.05**	Wrong species, part of Archibald planting monitor for fruiting bodies
162	162N	*Ficus microphylla var Hillii* Hills Weeping Fig	23	10	800	4	8	M	Fair	Fair	**Removed 19.09.05**	Part of significant avenue of Hills figs inclusions root damage, monitor for fruiting bodies Critical hollow
163	163N	*Ficus microphylla var Hillii* Hills Weeping Fig	22	9	800	4	8	M	Poor	Poor	3B Short	inclusions, root damage blaze on trunk monitor for fruiting bodies
164	164N	*Ficus microphylla var Hillii* Hills Weeping Fig	25	11	1200	6	12	M	Good	Good	2B Medium	Raised soil level at root crown soil compaction pavement restriction
165	165N	*Ulmus parvifolia* Chinese Elm	11	8	300	4	8	M	Good	Good	2 Medium	close to edge of pathway
166	166N	*Podocarpus elatus* Plum Pine	15	5.5	450	3	6	M	Fair	Fair	3C Short	Dual trunks, bark inclusion take the opportunity to remove and replace with an appropriate species
167	167N	*Ficus microcarpa var Hillii* Hills Weeping Fig	23	10	800	4	8	M	Fair	Fair	**Removed 19.09.05**	Part of significant avenue of Hills figs inclusions Critical hollow, root damage infected with Phytophthora sp.
168	168N	*Ficus microcarpa var Hillii* Hills Weeping Fig	23	12	900	4.5	9	M	Good	Good	3B Short	Part of significant avenue of Hills figs inclusions, root damage infected with Phytophthora sp.

Tree No.	Tree Ref.	Botanical Name Common Name	Height (M)	Canopy Spread Rad (M)	DBH (mm)	CRZ Rad (M)	PRZ Rad (M)	Age	Vigour	Cond'n	SULE	Comments and Recommendations
169	169N	*Ficus microcarpa var Hillii* Hills Weeping Fig	23	12	1000	5	10	M	Good	Good	3B Short	Part of significant avenue of Hills figs inclusions, root damage
170	170N	*Ficus microcarpa var Hillii* Hills Weeping Fig	23	11	1000	5	10	M	Good	Good	**Removed 19.09.05**	Part of significant avenue of Hills figs heavily pruned, pavement restrictions **Critical hollow removed 19.9.2005**
171	171N	*Ficus microcarpa var Hillii* Hills Weeping Fig	23	13	1000	5	10	M	Good	Good	3B Short	Part of significant avenue of Hills figs
172	172N	*Ficus microcarpa var Hillii* Hills Weeping Fig	23	8	800	4	8	M	Good	Good	3B Short	Part of significant avenue of Hills figs heavily pruned, pavement restrictions
173	173N	*Ficus microcarpa var Hillii* Hills Weeping Fig	23	11	1100	5.5	11	M	Good	Good	3B Short	Part of significant avenue of Hills figs
174	174N	*Ficus microcarpa var Hillii* Hills Weeping Fig	23	6	900	4.5	9	M	Good	Good	3B Short	Part of significant avenue of Hills figs heavily pruned, pavement restrictions
175	175N	*Ficus microcarpa var Hillii* Hills Weeping Fig	23	11	900	4.5	900	M	Good	Good	3B Short	Part of significant avenue of Hills figs
176	176N	*Ficus microcarpa var Hillii* Hills Weeping Fig	23	13	1100	5.5	11	M	Good	Good	3B Short	Part of significant avenue of Hills figs heavily pruned, pavement restrictions
177	177N	*Ficus microcarpa var Hillii* Hills Weeping Fig	23	13	1000	5	10	M	Good	Good	3B Short	Part of significant avenue of Hills figs heavily pruned, pavement restrictions
178	178N	*Flindersia australis* Australian Teak	22	5	500	2.5	5	M	Fair	Fair	2A Medium	Large limb removed suppressed form
179	179N	*Ulmus parvifolia* Chinese Elm	18	11.5	500	2.5	5	M	Good	Good	3C Short	Crowded by adjacent Flindersia lopsided canopy development stubs from previous lopping
180	180N	*Flindersia australis* Australian Teak	20	8	600	3	6	M	Good	Good	2A Medium	footpath restriction metal fence and star spikes in garden bed
181	181N	*Flindersia australis* Australian Teak	20	6	400	2	4	M	Good	Good	2A Medium	footpath restriction metal fence and star spikes in garden bed

Tree No.	Tree Ref.	Botanical Name Common Name	Height (M)	Canopy Spread Rad (M)	DBH (mm)	CRZ Rad (M)	PRZ Rad (M)	Age	Vigour	Cond'n	SULE	Comments and Recommendations
182	182N	*Flindersia australis* Australian Teak	20	6	400	2	4	M	good	Good	2A Medium	footpath restriction metal fence and star spikes in garden bed
183	183N	*Flindersia australis* Australian Teak	20	6	400	2	4	M	Good	Good	2A Medium	footpath restriction metal fence and star spikes in garden bed
184	184N	*Ficus microcarpa var Hillii* Hills Weeping Fig	30	13	1200	6	12	M	Good	Good	3B Short	Part of significant avenue of Hills figs heavily pruned, pavement restrictions
185	185N	*Ficus microcarpa var Hillii* Hills Weeping Fig	30	13	900	4.5	9	M	Good	Good	3B Short	Part of significant avenue of Hills figs heavily pruned, kerb restrictions
186	186N	*Ficus microcarpa var Hillii* Hills Weeping Fig	30	14	1100	5.5	11	M	Fair	Good	3B Short	Part of significant avenue of Hills figs heavily pruned, kerb restrictions
187	187N	*Brachychiton discolor* Lacebark Kurrajong	17	7	700	3.5	7	M	Fair	Fair	2D Medium	Large specimen Some root girdling Ground very compacted
188	188N	*Ficus microcarpa var Hillii* Hills Weeping Fig	30	13	1200	6	12	M	Good	Fair	3B Short	Part of significant avenue of Hills figs heavily pruned
189	189N	*Ficus microcarpa var Hillii* Hills Weeping Fig	30	8	800	4	8	M	Good	Fair	3B Short	Part of significant avenue of Hills figs heavily pruned, Inclusions Further investigations required
190	190N	*Ficus microcarpa var Hillii* Hills Weeping Fig	30	9	800	4	8	M	Good	Good	3B Short	Part of significant avenue of Hills figs heavily pruned, pavement restrictions
191	191N	*Ficus microcarpa var Hillii* Hills Weeping Fig	30	12	900	4.5	9	M	Good	Good	3B Short	heavily pruned, heavily pruned, Inclusions
192	192N	*Ficus microcarpa var Hillii* Hills Weeping Fig	30	10	900	4.5	9	M	Good	Good	3B Short	Part of significant avenue of Hills figs heavily pruned, pavement restrictions
193	193N	*Ficus microcarpa var Hillii* Hills Weeping Fig	30	11	900	4.5	9	M	Good	Good	3B Short	Part of significant avenue of Hills figs heavily pruned, pavement restrictions
194	194N	*Ficus microcarpa var Hillii* Hills Weeping Fig	30	12	900	4.5	9	M	Good	Good	3B Short	Part of significant avenue of Hills figs heavily pruned, Inclusions

Tree No.	Tree Ref.	Botanical Name Common Name	Height (M)	Canopy Spread Rad (M)	DBH (mm)	CRZ Rad (M)	PRZ Rad (M)	Age	Vigour	Cond'n	SULE	Comments and Recommendations
195	195N	*Ficus microcarpa var Hillii* Hills Weeping Fig	30	11	1600	8	16	M	Good	Good	3B Short	Part of significant avenue of Hills figs Heavily pruned Further investigations required
196	196N	*Eucalyptus saligna* Sydney Blue Gum	26	6	500	2.5	5	M	Fair	Good	2C Medium	Canopy crowded by adjacent Ficus Plant selection not suited to original design
197	197N	*Eucalyptus saligna* Sydney Blue Gum	4	1	150	0.75	1.5	M	Good	Good	4E Remove	Small tree located at entrance to Hyde Park North inappropriate selection **REMOVE 2006**
198	198N	*Ficus rubiginosa* Port Jackson Fig	13	9	800	4	8	M	Good	Fair	2D Medium	Large specimen located at railway entrance concrete right up to base,trunk wounds, split branch Previously heavily pruned. Decay present.
199	199N	*Araucaria cunninghamii* Hoop Pine	13	3	300	1.5	3	S	Fair	Fair	3C Short	Small specimen - severely stressed suckers at the base pavement restrictions consider removal
200	200N	*Araucaria cunninghamii* Hoop Pine	22	8	600	3	6	M	Good	Good	1B Long	Large specimen in good condition Ground very compacted some epicormic growth
201	201N	*Flindersia australis* Australian Teak	14	6	400	2	4	M	Fair	Fair	2B Medium	Located in planting hole in bitumen pathway. Stressed. In decline extensive root damage. Sunscald
202	202N	*Flindersia australis* Australian Teak	14	6	500	2.5	5	M	Fair	Good	2B Medium	Located in planting hole in bitumen pathway. Sparse canopy, stressed.Light pole in canopy. Extensive root damage.
203	203N	*Flindersia australis* Australian Teak	14	6	400	2	4	M	Fair	Good	2B Medium	Located in small planting hole in bitumen pathway. Stressed. Some uplifting of bitumen
204	204N	*Flindersia australis* Australian Teak	16	7	400	2	4	M	Fair	Good	2B Medium	Soil compaction root damage pavement restriction
205	205N	*Melaleuca armillaria* Bracelet Honey Myrtle	3	9	800	4	8	O	Poor	Poor	4A Remove	Large shrub type specimen. Branches growing through railway ramp handrail. **REMOVE 2006**
206	206N	*Platanus orientalis* Oriental Plane	18	8	600	3	6	M	Fair	Fair	3C Short	Uneven canopy development, crowded by adjacent fig Suppressed form, lean to north. Previous failures. Lopped
207	207N	*Phoenix canariensis* Canary Island Date Palm	18	4	700	3.5	7	M	Good	Fair	3C Short	Crowded by adjacent Ficus Growing at a lean to SE consider transplanting

Tree No.	Tree Ref.	Botanical Name Common Name	Height (M)	Canopy Spread Rad (M)	DBH (mm)	CRZ Rad (M)	PRZ Rad (M)	Age	Vigour	Cond'n	SULE	Comments and Recommendations
208	208N	*Ficus macrophylla* Moreton Bay Fig	30	14	1300	6.5	13	M	Good	Good	2D Medium	Large specimen. Habitat tree visually significant, some epicormic
209	209N	*Platanus orientalis* Oriental Plane	26	12	800	4	8	M	Good	Good	2B Medium	Large specimen in garden bed touching adjacent light pole. Co dominant structure, suppressed form
210	210N	*Ficus rubiginosa* Port Jackson Fig	22	9	800	4	8	M	Good	Good	2D Medium	Significant tree. Limb removed Pavement/wall restriction
211	211N	*Ficus macrophylla* Moreton Bay Fig	26	16	2000	10	20	O	Good	Fair	2D Medium	Significant tree planted prior to 1928. Epicormic growth Extensive root flare, located adjacent to steps and retaining wall, previous branch shedding.
212	212N	*Ficus superba v. henneana* Deciduous Fig	15	11	600	3	6	M	Good	Good	2D Medium	Good condition, adjacent to pathway Minor trunk damage Crowded by adjacent *Quercus sp* . canopy
213	213N	*Quercus sp* Oak	20	9	700	3.5	7	M	Fair	Poor	**Removed Sept 05**	Extensive epicormic growth along trunk and major branches. Large amount canopy rem'd. **inspected 7.7.05 Armillaria symptoms**
214	214N	*Araucaria columnaris* Cooks Pine	30	3	800	4	8	M	Good	Good	1C Long	Large, significant specimen Located in raised planting area.
215	215N	*Ficus macrophylla* Moreton Bay Fig	19	10	900	4.5	9	M	Fair	Fair	2B Medium	Large specimen in paved area Root flare, compaction. Epicormics previous pruning. Minor trunk damage
216	216N	*Ficus microcarpa var Hillii* Hills Weeping Fig	26	12	1200	6	12	M	Fair	Fair	2A Medium	Inclusions, limb removal New pavement works Wall restrictions
217	217N	*Ficus microcarpa var Hillii* Hills Weeping Fig	26	10	1200	6	12	M	Fair	Fair	2A Medium	pavement restrictions
218	218N	*Ficus microcarpa var Hillii* Hills Weeping Fig	26	9	1200	6	12	M	Fair	Good	3B Short	Part of significant avenue of Hills figs pavement restrictions, dieback
219	219N	*Ficus microcarpa var Hillii* Hills Weeping Fig	26	11	1200	6	12	M	Good	Good	3B Short	Part of significant avenue of Hills figs
220	220N	*Ficus microcarpa var Hillii* Hills Weeping Fig	26	10	1200	6	12	M	Fair	Fair	3B Short	Part of significant avenue of Hills figs pavement restrictions, dieback Bark inclusion on NW side

Tree No.	Tree Ref.	Botanical Name Common Name	Height (M)	Canopy Spread Rad (M)	DBH (mm)	CRZ Rad (M)	PRZ Rad (M)	Age	Vigour	Cond'n	SULE	Comments and Recommendations
221	221N	*Afrocarpus falcatus* Yellowwood	12	8	800	4	8	M	Fair	Fair	2C Medium	Suppressed by adjacent Ficus
222	222N	*Ficus microcarpa var Hillii* Hills Weeping Fig	28	11	1100	5.5	11	M	Fair	Fair	3B Short	Part of significant avenue of Hills figs Previously pruned, stubs and epicormic growth
223	223N	*Ficus microcarpa var Hillii* Hills Weeping Fig	28	11	1100	5.5	11	M	Fair	Fair	**Removed 19.09.05**	Part of significant avenue of Hills figs Critical hollow
224	224N	*Ficus microcarpa var Hillii* Hills Weeping Fig	28	11	1100	5.5	11	M	Fair	Fair	**Removed 19.09.05**	Part of vista planting between Archibald and Elizabeth Street. Inspected 7.7.05 *Phellinus* detected. Monitor
225	225N	*Ficus microcarpa var Hillii* Hills Weeping Fig	28	11	1100	5.5	11	M	Fair	Poor	**Removed 19.09.05**	Part of vista planting between Archibald and Elizabeth Street. Inspected 7.7.05.*Phellinus* detected. Recommended for immediate **REMOVAL**
226	226N	*Ficus microcarpa var Hillii* Hills Weeping Fig	28	10	1100	5.5	11	M	Fair	Fair	**Removed 19.09.05**	Part of significant avenue of Hills figs
227	227N	*Ficus microcarpa var Hillii* Hills Weeping Fig	28	10	1100	5.5	11	M	Fair	Fair	3B Short	Part of significant avenue of Hills figs
228	228N	*Ficus microcarpa var Hillii* Hills Weeping Fig	28	10	1300	6.5	13	M	Fair	Fair	3B Short	Part of significant avenue of Hills figs
229	229N	*Ficus microcarpa var Hillii* Hills Weeping Fig	28	9	1400	7	14	M	Fair	Fair	**Removed 19.09.05**	Part of significant avenue of Hills figs
230	230N	*Jacaranda mimosifolia* Jacaranda	17	9	700	3.5	7	M	Good	Good	2A Medium	Suppressed by adjacent Ficus Pavement restriction
231	231N	*Butia capitata* Jelly Palm	9	2	55	3	6	M	Good	Good	2A Medium	Mature specimen Part of palm clump planting at pathway intersection
232	232N	*Platanus x hybrida* London Plane Tree	28	12	800	4	8	M	Good	Good	1 Long	
233	233N	*Syagrus romanzoffiana* Cocos Palm	15	3.5	300	3	6	M	Fair	Fair	2A Medium	Part of palm clump planting at intersection of pathways

Tree No.	Tree Ref.	Botanical Name Common Name	Height (M)	Canopy Spread Rad (M)	DBH (mm)	CRZ Rad (M)	PRZ Rad (M)	Age	Vigour	Cond'n	SULE	Comments and Recommendations
234	234N	*Syagrus romanzoffiana* Cocos Palm	15	3.5	300	3	6	M	Fair	Fair	2A Medium	Part of palm clump planting at intersection of pathways
235	235N	*Ficus microcarpa var Hillii* Hills Weeping Fig	26	11	1100	5.5	11	M	Fair	Fair	3B Short	Part of significant avenue of Hills figs Pavement restriction
236	236N	*Ficus microcarpa var Hillii* Hills Weeping Fig	26	11	1000	5	10	M	Fair	Fair	3B Short	Part of significant avenue of Hills figs inclusions, limb removal
237	237N	*Ficus microcarpa var Hillii* Hills Weeping Fig	26	8	1000	5	10	M	Fair	Fair	3B Short	Part of significant avenue of Hills figs Limb removal. Decay and cavity
238	238N	*Ficus microcarpa var Hillii* Hills Weeping Fig	26	5	700	3.5	7	M	Fair	Fair	3B Short	Part of significant avenue of Hills figs limb removal
239	239N	*Ficus microcarpa var Hillii* Hills Weeping Fig	26	9	1000	5	10	M	Good	Good	3B Short	Part of significant avenue of Hills figs
240	240N	*Ficus microcarpa var Hillii* Hills weeping Fig **REMOVED 2004**									REMV'D	**REMOVED OCTOBER 2004**
241	241N	*Ficus microcarpa var Hillii* Hills Weeping Fig	26	7	1000	5	10	M	Good	Fair	3B Short	Part of significant avenue of Hills figs
242	242N	*Ficus microcarpa var Hillii* Hills Weeping Fig	26	7	800	4	8	M	Good	Good	3B Short	Part of significant avenue of Hills figs New pavement, root damage
243	243N	*Ficus microcarpa var Hillii* Hills Weeping Fig	26	7	900	4.5	9	M	Good	Good	3B Short	Part of significant avenue of Hills figs
244	244N	*Ficus microcarpa var Hillii* Hills Weeping Fig	26	6	900	4.5	900	M	Good	Good	3B Short	Part of significant avenue of Hills figs
245	245N	*Ficus microcarpa var Hillii* Hills Weeping Fig	26	6	800	4	8	M	Fair	Fair	3B Short	Part of significant avenue of Hills figs
246	246N	*Ficus microcarpa var Hillii* Hills Weeping Fig	26	13	900	4.5	9	M	Good	Good	3B Short	Part of significant avenue of Hills figs

Tree No.	Tree Ref.	Botanical Name Common Name	Height (M)	Canopy Spread Rad (M)	DBH (mm)	CRZ Rad (M)	PRZ Rad (M)	Age	Vigour	Cond'n	SULE	Comments and Recommendations
247	247N	*Eucalyptus microcorys* Tallowwood	26	7	800	4	8	M	Good	Poor	2B Medium	Large specimen. Lopsided canopy development due to competition from adj. Fig. Leans to west Inspected 7.7.05 no fungus detected
248	248N	*Ficus microcarpa var Hillii* Hills Weeping Fig	26	8	900	4.5	9	M	Good	Good	3B Short	Part of significant avenue of Hills figs
249	249N	*Ficus microcarpa var Hillii* Hills Weeping Fig	26	11	800	4	8	M	Good	Good	**Removed 19.09.05**	Part of significant avenue of Hills figs **Critical hollow extends into buttresses**
250	250N	*Ficus microcarpa var Hillii* Hills Weeping Fig	26	11	1000	5	10	M	Good	Good	**Removed 19.09.05**	Part of significant avenue of Hills figs **Critical hollow extends into buttresses**
251	251N	*Ficus microcarpa var Hillii* Hills Weeping Fig	26	13	1000	5	10	M	Good	Good	3B Short	Part of significant avenue of Hills figs
252	252N	*Jacaranda mimosifolia* Jacaranda	8	5	520	2.5	5	M	Fair	Poor	3B Short	Suppressed from adjacent Ficus lopsided canopy. Dead branches and branch stubs
253	253N	*Liquidambar styraciflua* Sweet Gum	6		570	2.5	5.7	M	Poor	Poor	4A Remove	Poor specimen, limb failure Suppressed by adjacent Jacaranda & Ficus **REMOVE 2006**
254	254N	*Ficus microcarpa var Hillii* Hills Weeping Fig	26	11	1000	5	10	M	Good	Good	**Removed 19.9.2005**	Part of significant avenue of Hills figs
255	255N	*Ficus microcarpa var Hillii* Hills Weeping Fig	26	12	1100	5.5	11	M	Good	Good	3B Short	Part of significant avenue of Hills figs
256	256N	*Ficus microcarpa var Hillii* Hills Weeping Fig	26	7	800	4	8	M	Good	Good	3B Short	Part of significant avenue of Hills figs
257	257N	*Ficus microcarpa var Hillii* Hills Weeping Fig	26	11	900	4.5	9	M	Good	Good	3B Short	Part of significant avenue of Hills figs
258	258N	*Quercis ilex* Holm Oak	25	6	500	2.5	5	M	Poor	Fair	3B Short	Suppressed form Previously pruned Extensive epicormic growth along major branches
259	259N	*Ficus microcarpa var Hillii* Hills Weeping Fig	26	8	800	4	8	M	Good	Good	3B Short	Part of significant avenue of Hills figs

Tree No.	Tree Ref.	Botanical Name Common Name	Height (M)	Canopy Spread Rad (M)	DBH (mm)	CRZ Rad (M)	PRZ Rad (M)	Age	Vigour	Cond'n	SULE	Comments and Recommendations
260	260N	*Ficus microcarpa var Hillii* Hills Weeping Fig	26	11	1100	5.5	11	M	Good	Good	3B Short	Part of significant avenue of Hills figs
261	261N	*Ficus microcarpa var Hillii* Hills Weeping Fig	26	8	900	4.5	9	M	Good	Good	**Removed 19.9.2005**	Part of significant avenue of Hills figs Defective branch to be removed **Critical Hollow - removed**
262	262N	*Ficus microcarpa var Hillii* Hills Weeping Fig	26	13	1000	5	10	M	Good	Good	3B Short	Part of significant avenue of Hills figs
263	263N	*Ficus microcarpa var Hillii* Hills Weeping Fig	26	13	800	4	8	M	Good	Good	3B Short	Part of significant avenue of Hills figs
264	264N	*Ficus microcarpa var Hillii* Hills Weeping Fig	26	11	900	4.5	900	M	Good	Good	3B Short	Part of significant avenue of Hills figs
265	265N	*Ficus microcarpa var Hillii* Hills Weeping Fig	26	7	800	4	8	M	Good	Good	3B Short	Part of significant avenue of Hills figs
266	266N	*Ficus microcarpa var Hillii* Hills Weeping Fig	31	8	900	4.5	900	M	Good	Good	3B Short	Part of significant avenue of Hills figs
267	267N	*Ficus microcarpa var Hillii* Hills Weeping Fig	32	8	900	4.5	900	M	Good	Good	3B Short	Part of significant avenue of Hills figs
268	268N	*Ficus microcarpa var Hillii* Hills Weeping Fig	30	14	900	4.5	9	M	Good	Good	3B Short	Part of significant avenue of Hills figs
269	269N	*Ficus microcarpa var Hillii* Hills Weeping Fig	30	7	700	3.5	7	M	Good	Good	3B Short	Part of significant avenue of Hills figs
270	270N	*Lophostemon confertus* Brushbox						M	Fair	Fair	3B Short	Previously heavily pruned. Low hazard
271	271N	*Eucalyptus sp.* Eucalyptus	23					M	Poor	Poor	3C Short	Poor canopy development due to proximity of adjacent Ficus and Platanus
272	272N	*Platanus x hybrida* London Plane Tree	26	13	900	4.5	9	M	Good	Good	3C Short	Large specimen Some dead/decayed branches, hanger

Tree No.	Tree Ref.	Botanical Name Common Name	Height (M)	Canopy Spread Rad (M)	DBH (mm)	CRZ Rad (M)	PRZ Rad (M)	Age	Vigour	Cond'n	SULE	Comments and Recommendations
273	273N	*Ulmus glabra* Scotch Elm	15	8	500	3	6	M	Good	Fair	2C Medium	Dual trunks- bark inclusion noted. Minor decay at old pruning wounds Prune to lift canopy remove dual trunk
274	274N	*Flindersia australis* Australian Teak	16	7	400	2	4	M	Good	Fair	2C Medium	Large specimen. Exposed roots some root rot. Evidence of previous pruning
275	275N	*Filndersia benettiana* Bennett's Ash	3					Y	Good	Good	1 Long	Young specimen - planted 2003? Mulched to 1 radial metre
276	276N	*Flindersia benettiana* Bennett's Ash	3					Y	Good	Good	1 Long	Young specimen Planted 2003? Has been mulched to 1 radial metre
277	277N	*Howea forsteriana* Kentia Palm	17	3	350	2	4	M	Good	Fair	1C Long	Isolated specimen
278	278N	*Syagarus romanzoffiana* Cocos Palm	11	3	350	2	4	M	Good	Good	2A Medium	Isolated specimen
279	279N	*Phoenix hybrid (canariensis x reclinata) called P.sylvestris* Date Palm	8	2	500	3	6				2B Medium	Part of palm clump at pathway intersection. Mature specimen, tap at base

TREE ASSESSMENT SCHEDULE

HYDE PARK SOUTH - May 2006

Tree No.	Tree Ref.	Botanical Name Common Name	Height (M)	Canopy Spread Rad(M)	DBH (mm)	CRZ Rad (M)	PRZ Rad (M)	Age	Vigour	Condtn	SULE	Comments
1	1S	*Ficus microcarpa var. Hillii* Hills weeping Fig	19	9	1700	8.5	17	M	Good	Fair	2B Medium	Defective limb over Park street. Twig dieback Fruiting body of Phellinus Inspected 7.7.05. Monitor *Phellinus* .
2	2S	*Flindersia australis* Australian Teak	19	5	500	2.5	5	M	Good	Fair	2B Medium	Heavily suppressed. Deadwood to 100mm
3	3S	*Melaleuca quinquenervia* Broad leaved paperbark	10	4	600	3	6	M	Average	Poor	3C Short	Trees ringbarked by pigeons
4	4S	*Melaleuca quinquenervia* Broad leaved paperbark	10	4	600	3	6	m	Fair	Good	2D Medium	Twig dieback
5	5S	*Melaleuca quinquenervia* Broad leaved paperbark	10	4	600	3	6	M	Fair	Good	2D Medium	Trees ringbarked by pigeons
6	6S	*Melaleuca quinquenervia* Broad leaved paperbark	12	4	600	3	6	M	Fair	Good	2D Medium	Trees ringbarked by pigeons
7	7S	*Melaleuca quinquenervia* *Broad leaved paperbark*	10	3	600	3	6	M	Fair	Good	2D Medium	Trees ringbarked by pigeons
8	8S	*Araucaria cunninghamii* Hoop Pine	19	3	600	3	6	M	Fair	Fair	1 Long	New pavement works. Pavement wall restriction
9	9S	*Araucaria cunninghamii* Hoop Pine	16	3	900	4.5	9	M	Fair	Fair	1 Long	New pavement works. Pavement wall restriction
10	10S	*Platanus x hybrida* London Plane Tree	14	5	500	2.5	5	M	Good	Good	1 Long	Mistletoe
11	11S	*Platanus x hybrida* London Plane Tree	10	4	200	1	2	S	Good	Good	1A Long	
12	12S	*Platanus x hybrida* London Plane Tree	12	4	220	1.1	2	S	Good	Good	1A Long	

Tree No.	Tree Ref.	Botanical Name Common Name	Height (M)	Canopy Spread Rad(M)	DBH (mm)	CRZ Rad (M)	PRZ Rad (M)	Age	Vigour	Condtn	SULE	Comments
13	13S	*Ficus microcarpa var. Hillii* Hills Weeping Fig	18	9	700	3.5	7	M	Fair	Good	3B Short	Pavement wall restriction Roots damaged/cut Soil compaction. Suppressed form
14	14S	*Ficus microcarpa var. Hillii* Hills weeping Fig	16	6	600	3	6	M	Fair	Fair	3B Short	New pavement works (1997). Pavement wall restriction Roots damaged/cut Trunk hard against path.
15	15S	*Ficus macrophylla* Moreton Bay Fig	16	6	900	4.5	900	O	Fair	Poor	2D Medium	
16	16S	*Celtis australis* Hackberry	12	5	500	2.5	5	M	Good	Good	2 Medium	
17	17S	*Brachychiton discolor* Lacebark Kurrajong	14	3.5	430	2.1	4.3	M	Average	Average	2A Medium	
18	18S	**REMOVED**									REMV'D	
19	19S	*Brachychiton acerifolius* Illawarra Flame Tree	11	2	330	1.65	3.3	O	Poor	Poor	3C Short	Previous failure/s. Lopped
20	20S	*Celtis australis* Hackberry	12	5	900	4.5	9	M	Good	Good	2C Medium	Roots damaged/cut. Soil compaction. Suppressed form
21	21S	*Ficus microcarpa var Hillii* Hills Weeping Fig	10	3	250	1.25	2.5	S	Average	Average	2A Medium	
22	22S	*Platanus x hybrida* London Plane Tree	10	4	280	1.4	2.8	S	Good	Good	2C Medium	
23	23S	*Platanus x hybrida* London Plane Tree	6	2	150	0.75	1.5	S	Average	Average	2C Medium	
24	24S	*Platanus x hybrida* London Plane Tree	8	3	300	1.5	3	S	Good	Fair	2C Medium	Limb/trunk defects. Canker on trunk. Reduced vigour compared to the other four trees of same age. Monitor **inspected 7.7.05**
25	25S	*Platanus x hybrida* London Plane Tree	7	3	180	0.9	1.8	S	Good	Good	2C Medium	

Tree No.	Tree Ref.	Botanical Name Common Name	Height (M)	Canopy Spread Rad(M)	DBH (mm)	CRZ Rad (M)	PRZ Rad (M)	Age	Vigour	Condtn	SULE	Comments
26	26S	*Araucaria columnaris* Cooks Pine	21	1	700	3.5	7	M	Good	Good	1C Long	New pavement works. Some dieback
27	27S	*Pinus roxburghii* Chir Pine	18	8	900	4.5	9	M	Good	Good	1C Long	New pavement works.
28	28S	*Araucaria columnaris* Cooks Pine	18	1	500	2.5	5	M	Good	Good	1C Long	New pavement works. Twig dieback
29	29S	*Platanus x hybrida* London Plane Tree	6	3.5	280	1.4	2.8	S	Good	Good	2C Medium	
30	30S	*Ficus rubiginosa* Port Jackson Fig	6	3	260	1.3	2.6	S	Average	Average	2C Medium	
31	31S	*Ficus rubiginosa* Port Jackson Fig	5	3	260	1.3	2.6	S	Average	Average	2C Medium	
32	32S	*Araucaria cunninghamii* Hoop Pine	23	5	800	4	8	M	Good	Good	1C Long	New pavement works
33	33S	*Livistona australis* Cabbage Tree Palm	12	1	220	1.1	2.2	S	Good	Good	1A Long	
34	34S	*Livistona australis* Cabbage Tree Palm	12	1	220	1.1	2.2	S	Good	Good	1A Long	
35	35S	*Brachychiton acerifolius* Illawarra Flame Tree	8	2	220	1.1	2.2	M	Good	Good	2C Medium	
36	36S	*Ficus rubiginosa* Port Jackson Fig	15	5	800	4	8	M	Fair	Fair	2A Medium	Limb removal/failure. New pavement works Pavement/wall restriction. Branch torn out
37	37S	*Sapium sebiferum* Chinese Tallow Tree	9	2	180	0.9	1.8	S	Average	Average	3C Short	
38	38S	*Sapium sebiferum* Chinese Tallow Tree	9	2	180	0.9	1.8	S	Average	Average	3C Short	

Tree No.	Tree Ref.	Botanical Name Common Name	Height (M)	Canopy Spread Rad(M)	DBH (mm)	CRZ Rad (M)	PRZ Rad (M)	Age	Vigour	Condtn	SULE	Comments
39	39S	*Agathis robusta* Kauri Pine	25	8	800	4	8	M	Good	Good	1C Long	New pavement works. Soil compaction Significant tree
40	40S	*Erythrina sykesii* Coral Tree	10	3.5	350	1.75	3.5	M	Average	Average	4E Remove	Cavity. Previous failures. Decay Crowding the adjacent Kauri Pine
41	41S	*Ficus rubiginosa* Port Jackson Fig	2.5	2	140	0.7	1.4	S	Average	Average	2A Medium	
42	42S	*Ficus rubiginosa* Port Jackson Fig	12	4	800	4	8	O	Poor	Fair	2A Medium	Roots damaged/cut.
43	43S	*Fraxinus oxycarpa* Desert Ash	9	3	180	0.6	1.8	M	Average	Average	3B Short	
44	44S	*Quercus robur* English Oak	14	5	600	3	6	O	Poor	Fair	3B Short	New pavement works. Pavement/wall restriction
45	45S	*Sapium sebiferum* Chinese Tallow Tree	8	2.5	150	0.75	1.5	S	Average	Average	3C Short	
46	46S	*Sapium sebiferum* Chinese Tallow Tree	8	2.5	150	0.8	1.5	S	Average	Average	3C Short	
47	47S	*Fraxinus oxycarpa* Desert Ash	10	2.5	260	1.3	2.6	M	Fair	Fair	3A Short	
48	48S	*Sapium sebiferum* Chinese Tallow Tree	8	2.5	150	0.8	1.5	S	Poor	Poor	3A Short	
49	49S	*Sapium sebiferum* Chinese Tallow Tree	8	2	180	0.6	1.8	S	Average	Average	3C Short	
50	50S	*Sapium sebiferum* Chinese Tallow Tree	8	2	150	0.8	1.5	S	Average	Average	3C Short	
51	51S	*Araucaria columnaris* Cooks Pine	20	1.5	500	2.5	5	M	Good	Good	1C Long	New pavement works. Twig dieback **inspected 7.7.05** no hollows detected

Tree No.	Tree Ref.	Botanical Name Common Name	Height (M)	Canopy Spread Rad(M)	DBH (mm)	CRZ Rad (M)	PRZ Rad (M)	Age	Vigour	Condtn	SULE	Comments
52	52S	*Araucaria columnaris* Cooks Pine	22	1.5	700	3.5	7	M	Good	Good	1C Long	Twig dieback
53	53S	*Araucaria columnaris* Cooks Pine	20	1.5	700	3.5	7	M	Good	Good	1C Long	Limb/trunk defects. Twig dieback
54	54S	*Celtis australis* Nettle Tree	10	4	300	1.5	3	M	Good	Good	1A Long	Soil compaction
55	55S	Ficus rubiginosa Port Jackson Fig	18	7	900	4.5	9	M	Fair	Fair	2D Medium	New pavement works. Pavement wall restriction Roots damaged/cut. Soil compaction.
56	56S	Ficus macrophylla Moreton Bay Fig	16	6	900	4.5	9	M	Fair	Fair	2D Medium	
57	57S	Ficus rubiginosa Port Jackson Fig	14	5	700	3.5	7	M	Fair	Fair	2D Medium	Roots damaged/cut
58	58S	Ficus macrophylla Moreton Bay Fig	17	7	1000	5	10	O	Poor	Fair	2D Medium	Significant tree planted pre 1928 Limb/trunk defects. Mower damage. **Inspected 7.7.05.** poor canopy density
59	59S	Ficus macrophylla Moreton Bay Fig	15	5	800	4	8	O	Poor	Poor	2D Medium	Limb removal/failure.
60	60S	Quercus robur English Oak	15	5	400	2	4	M	Fair	Fair	3C Short	
61	61S	Ficus microcarpa var Hillii Hills Weeping Fig	14	7	600	3	6	M	Good	Good	**Removed 19.9.2005**	Critical hollow removed
62	62S	*Ficus microcarpa var. Hillii* Hills Weeping Fig	14	7	500	2.5	5	M	Good	Good	3B Short	Limb removal/failure
63	63S	*Ficus microcarpa var. Hillii* Hills Weeping Fig	14	7	500	2.5	5	M	Good	Good	3B Short	
64	64S	*Ficus microcarpa var Hillii* Hills Weeping Fig **REMOVED 2004**	14	7	500	2.5	5	M	Good	Fair	REMV'D	REMOVED 2004

Tree No.	Tree Ref.	Botanical Name Common Name	Height (M)	Canopy Spread Rad(M)	DBH (mm)	CRZ Rad (M)	PRZ Rad (M)	Age	Vigour	Condtn	SULE	Comments
65	65S	*Ficus microcarpa var Hillii* Hills Weeping Fig	14	7	500	2.5	5	M	Good	Good	3B Short	
66	66S	*Ficus microcarpa var Hillii* Hills Weeping Fig **REMOVED 2004**	14	7	500	2.5	5	M	Good	Fair	**Removed Oct 2004**	Fruiting bodies. Further investigations required Fungus at base **REMOVED OCT 2004**
67	67S	*Ficus microcarpa var Hillii* Hills Weeping Fig **REMOVED 2004**	14	7	500	2.5	5	M	Good	Fair	**Removed Oct 2004**	Fruiting bodies. Further investigations required Fungus at base **REMOVED OCT 2004**
68	68S	*Ficus microcarpa var Hillii* Hills Weeping Fig	14	7	600	3	6	M	Good	Good	**Removed 19.9.2005**	
69	69S	*Ficus microcarpa var. Hillii* Hills Weeping Fig	14	7	600	3	6	M	Good	Good	3B Short	
70	70S	*Ficus microcarpa var. Hillii* Hills Weeping Fig	14	7	700	3.5	7	M	Good	Good	**Removed 19.9.2005**	Critical hollow
71	71S	*Ficus microcarpa var. Hillii* Hills Weeping Fig	14	7	500	2.5	5	M	Good	Good	3B Short	
72	72S	*Ficus microcarpa var. Hillii* Hills Weeping Fig	16	7	600	3	6	M	Good	Good	**Removed 19.9.2005**	Critical hollow extends into buttresses
73	73S	*Ficus microcarpa var. Hillii* Hills Weeping Fig	16	7	500	2.5	5	M	Good	Good	3B Short	
74	74S	*Ficus microcarpa var. Hillii* Hills Weeping Fig	16	7	800	4	8	M	Good	Good	3B Short	
75	75S	*Ficus microcarpa var. Hillii* Hills Weeping Fig	16	7	600	3	6	M	Good	Good	3B Short	
76	76S	*Ficus microcarpa var. Hillii* Hills Weeping Fig	16	7	1000	5	10	M	Good	Good	3B Short	
77	77S	*Ficus microcarpa var. Hillii* Hills Weeping Fig	17	10	900	4.5	9	M	Good	Good	3B Short	New pavement works

Tree No.	Tree Ref.	Botanical Name Common Name	Height (M)	Canopy Spread Rad(M)	DBH (mm)	CRZ Rad (M)	PRZ Rad (M)	Age	Vigour	Condtn	SULE	Comments
78	78S	*Ficus microcarpa var. Hillii* Hills Weeping Fig	17	7	700	3.5	7	M	Good	Good	**Removed 19.9.2005**	
79	79S	*Ficus microcarpa var. Hillii* Hills Weeping Fig	17	10	800	4	8	M	Good	Good	3B Short	
80	80S	*Ficus microcarpa var. Hillii* Hills Weeping Fig	17	7	700	3.5	7	M	Good	Good	3B Short	
81	81S	*Ficus microcarpa var. Hillii* Hills Weeping Fig	17	10	1000	5	10	M	Good	Good	3B Short	
82	82S	*Ficus microcarpa var. Hillii* Hills Weeping Fig **REMOVED 2004**	17	7	700	3.5	7	M	Good	Fair	REMV'D	Fruiting bodies. Further investigations required Fungus at base **REMOVED OCT 2004**
83	83S	*Ficus microcarpa var. Hillii* Hills Weeping Fig	17	10	1200	6		M	Good	Fair	3B Short	**inspected 7.7.05** Major hole at base with decay within NW No fruiting body detected.
84	84S	*Ficus microcarpa var. Hillii* Hills Weeping Fig	17	7	700	3.5	7	M	Good	Good	3B Short	
85	85S	*Ficus microcarpa var. Hillii* Hills Weeping Fig **REMOVED 2004**	17	7	850						REMV'D	
86	86S	Ficus microcarpa var Hillii Hills Weeping Fig	12	4	350	1.8	3.5	S	Good	Good	3B Short	
87	87S	Ficus microcarpa var Hillii Hills Weeping Fig **REMOVED 2004**									REMV'D	
88	88S	Ficus microcarpa var Hillii Hills Weeping Fig **REMOVED 2004**									REMV'D	
89	89S	Ficus microcarpa var Hillii Hills Weeping Fig	14	4	300	1.5	3	M	Good	Good	3B Short	Inclusion
90	90S	Ficus microcarpa var Hillii Hills weeping Fig	14	4	280	1.4	2.8	M	Good	Good	3B Short	

Tree No.	Tree Ref.	Botanical Name Common Name	Height (M)	Canopy Spread Rad(M)	DBH (mm)	CRZ Rad (M)	PRZ Rad (M)	Age	Vigour	Condtn	SULE	Comments
91	91S	*Ficus microcarpa var. Hillii* Hills Weeping Fig **REMOVED 2004**									REMV'D	
92	92S	Ficus microcarpa var Hillii Hills Weeping Fig	18	10	1000	5	10	M	Good	Good	3B Short	Cavity & decay
93	93S	*Ficus microcarpa var Hillii* Hills Weeping Fig	20	10	900	4.5	9	M	Good	Good	3B Short	New pavement works. Pavement/wall restriction Soil compaction
94	94S	*Ficus microcarpa var Hillii* Hills Weeping Fig	20	10	800	4	8	M	Good	Good	3B Short	New pavement works. Pavement/wall restriction Soil compaction
95	95S	*Platanus orientalis* London Plane Tree	18	5	600	3	6	M	Good	Good	1 Long	soil compaction. Suppressed form
96	96S	*Platanus orientalis* London Plane Tree **REMOVED**									REMV'D	
97	97S	*Platanus orientalis* London Plane Tree	18	5	700	3.5	7	M	Good	Fair	2B Medium	Co-dominant structure. Further investigation required. Epicormic growth. Canker
98	98S	*Melaleuca quinquenervia* Broad Leafed Paperbark	15	3	500	2.5	5	M	Fair	Good	2D Medium	
99	99S	*Melaleuca quinquenervia* Broad leaved paperbark	15	3	400	2	4	M	Fair	Good	2D Medium	
100	100S	*Melaleuca quinquenervia* Broad leaved paperbark	15	3	800	4	8	M	Fair	Good	2D Medium	Pigeon. Further investigation required. Pigeon damage at base
101	101S	*Melaleuca quinquenervia* Broad leaved paperbark	15	3	700	3.5	7	M	Fair	Good	2D Medium	Roots damaged/cut.
102	102S	**REMOVED**									REMV'D	REMOVED
103	103S	*Robinia p. 'Frisia'* Golden Robinia									REMV'D	REMOVED

Tree No.	Tree Ref.	Botanical Name Common Name	Height (M)	Canopy Spread Rad(M)	DBH (mm)	CRZ Rad (M)	PRZ Rad (M)	Age	Vigour	Condtn	SULE	Comments
104	104S	*Phoenix dactiphyla* Jelly Palm	12	2	250	1.25	2.5	M	Fair	Fair	3A Short	
105	105S	*Quercus robur* English Oak	18	5	400	2	4	M	Good	Fair	2C Medium	Soil compaction
106	106S	*Quercus robur* English Oak	18	5	500	2.5	5	M	Good	Fair	2C Medium	Soil compaction
107	107S	*Quercus robur* English Oak	18	5	700	3.5	7	M	Good	Fair	2C Medium	Limb removal failure. Soil compaction
108	108S	*Quercis ilex* Holm Oak	18	7	600	3	6	M	Good	Good	2C Medium	New pavement works. Pavement/wall restriction. Soil compaction
109	109S	*Quercis ilex* Holm Oak	18	8	900	4.5	9	M	Good	Good	2C Medium	New pavement works. Pavement/wall restriction. Soil compaction
110	110S	*Brachychiton acerifolius* Illawarra Flame Tree	16	4	320	1.6	3.2	M	Fair	Fair	2A Medium	
111	111S	*Livistona australis* Cabbage Tree Palm	23	1	480	2.4	4.8	M	Fair	Fair	2A Medium	
112	112S	*Macadamia integrifolia* Macadamia	14	8	850	4.25	8.5	M	Good	Good	2D Medium	
113	113S	*Platanus x hybrida* London Plane Tree	12	3	280	1.4	2.8	M	Good	Good	2D Medium	
114	114S	*Robinia pseudoacacia 'Frisia'* Golden Robinia	10	3	170	0.8	1.7	M	Fair	Fair	4A **REMOVE**	Roots have been severely damaged by construction works at entrance to Park. Will lead to problems with suckering REMOVE June 2006
115	115S	Robinia p. 'Frisia' Golden Robinia	12	3	200	1	2	M	Fair	Fair	4A **REMOVE**	Roots severely damaged Problems with suckering REMOVE
116	116S	*Ulmus parvifolia* Chinese elm	7	9	400	2	4	M	Fair	Fair	2C Medium	New pavement works. Pavement/wall restriction. Soil compaction

Tree No.	Tree Ref.	Botanical Name Common Name	Height (M)	Canopy Spread Rad(M)	DBH (mm)	CRZ Rad (M)	PRZ Rad (M)	Age	Vigour	Condtn	SULE	Comments
117	117S	*Populus italica "Nigra"* Lombardy Poplar	18	2	600	3	6	O	Good	Fair	**Removed 20.9.2005**	Hollows. Soil compaction. **Inspected on 7.7.05** and recommended for **Remove and grind immediately**
118	118S	*Platanus x hybrida* London Plane Tree	18	9	800	4	8	M	Good	Good	1 Long	Roots damaged/cut. Soil compaction
119	119S	*Platanus x hybrida* London Plane Tree	15	6	240	1.2	2.4	M	Fair	Fair	2A Medium	
120	120S	*Ficus macrophylla* *Moreton Bay Fig*	20	12	1400	7	14	M	Good	Good	1C Long	Roots damaged
121	121S	Ficus macrophylla Moreton Bay Fig	18	10	900	4.5	9	M	Fair	Fair	1C Long	Limb removal/failure. Roots damaged/cut
122	122S	Ficus macrophylla Moreton Bay Fig	18	10	1400	7	14	M	Fair	Fair	1C Long	Limb removal/failure. Roots damaged/cut
123	123S	Celtis australis Nettle Tree	16	7	500	2.5	5	M	Good	Fair	2C Medium	Suppressed form
124	124S	Brachychiton acerifolius Illawarra Flame Tree	10	2	250	1.25	2.5	M	Fair	Fair	2B Medium	Previous failure/s
125	125S	Quercis ilex Holm Oak	18	8	600	3	6	M	Good	Good	1 Long	New pavement works. Soil compaction
126	126S	Brachychiton acerifolius Illawarra Flame Tree	15	2.5	300	1.5	3	M	Fair	Fair	2B Medium	
127	127S	Drypetes sp.	18	7	600	3	6	M	Good	Good	1 Long	Soil compaction
128	128S	*Brachychiton acerifolius* Illawarra Flame Tree	14	4	470	2.4	4.7	O	Poor	Poor	3A Short	Previous failure
129	129S	*Ficus religiosa* Bo Tree	19	8	1000	5	10	O	Fair	Fair	2 Medium	Limb/trunk defects

Tree No.	Tree Ref.	Botanical Name Common Name	Height (M)	Canopy Spread Rad(M)	DBH (mm)	CRZ Rad (M)	PRZ Rad (M)	Age	Vigour	Condtn	SULE	Comments
130	130S	Brachychiton acerifolius Illawarra Flame Tree	12	4	400	2	4	M	Good	Good	3A Short	
131	131S	*Ginko biloba* Maidenhair Tree	14	5	600	3	6	M	Good	Fair	2C Medium	Suppressed form/Inclusion
132	132S	Ficus rubiginosa Port Jackson Fig	14	5	500	2.5	5	M	Good	Fair	1 Long	New pavement works. Pavement/wall restrictions Suppressed form
133	133S	Ficus rubiginosa Port Jackson Fig	16	6	700	3.5	7	M	Good	Good	1 Long	New pavement works. Pavement/wall restrictions Deadwood
134	134S	Celtis australis Nettle Tree	16	6	600	3	6	O	Good	Good	2C Medium	Limb removal/failure
135	135S	Ficus rubiginosa Port Jackson Fig	3	2	100	0.5	1	Y	Good	Good	3C Short	
136	136S	Ficus rubiginosa Port Jackson Fig	3	1	80	0.4	0.8	Y	Good	Good	3C Short	
137	137S	*Magnolia sp.* *(Less than 3 metres)*										
138	138S	*Magnolia sp.*										
139	139S	*Magnolia sp.*										
140	140S	*Brachychiton acerifolius* Illawarra Flame Tree	12	2	320	1.6	3.2	M	Good	Good	2A Medium	
141	141S	*Quercus ilex* Holm Oak	16	5	500	2.5	5	M	Good	Good	1 Long	Hollows. Soil compaction. New pavement works. Further investigation required.
142	142S	*Brachychiton acerifolius* Illawarra Flame Tree	14	4.5	320	1.6	3	M	Fair	Fair	2A Medium	

Tree No.	Tree Ref.	Botanical Name Common Name	Height (M)	Canopy Spread Rad(M)	DBH (mm)	CRZ Rad (M)	PRZ Rad (M)	Age	Vigour	Condtn	SULE	Comments
143	143S	Quercis ilex Holm Oak **REMOVED**									REMV'D	
144	144S	*Brachychiton acerifolius* Illawarra Flame Tree	12	2.5	240	1.2	2.4	M	Fair	Fair	2A Medium	
145	145S	*Populus deltoides* Cottonwood	21	10	800	4	8	O	Good	Fair	2 Medium	Limb removal/failure. Requires regular monitoring. Limb Shed. Reduction pruning required.
146	146S	*Populus deltoides* Cottonwood	21	10	800	4	8	O	Good	Fair	2 Medium	Limb removal/failure. Requires regular monitoring. Limb Shed. Reduction pruning required.
147	147S	*Eucalyptus microcorys* Tallowwood	23	9	800	4	8	M	Good	Good	1 Long	Possum damage. Soil compaction. Twig dieback
148	148S	*Ficus rubiginosa* Port Jackson Fig	14	8	700	3.5	7	M	Fair	Good	2B Medium	Pavement/wall restriction. Soil compaction.Thin canopy
149	149S	*Ficus rubiginosa* Port Jackson Fig	16	10	800	4	8	M	Poor	Fair	2 Medium	
150	150S	Ficus rubiginosa Port Jackson Fig	16	8	0.8	4	8	M	Fair	Fair	2B Medium	Roots damaged/cut by pathway
151	151S	Pinus roxburghii Chir Pine	16	4	600	3	6	M	Good	Good	2 Medium	Soil compaction
152	152S	Ficus rubiginosa Port Jackson Fig	16	9	900	4	9	M	Fair	Fair	2A Medium	Limb removal/failure. New pavement works Pavement/wall restriction.
153	153S	Ficus rubiginosa Port Jackson Fig	16	8	800	4	8	M	Fair	Fair	2A Medium	Limb removal/failure. New pavement works Pavement/wall restriction.
154	154S	Populus alba Silver Poplar	13m	1	280	1.4	2.8	S	Good	Good	1 Long	Pavement/wall restriction.
155	155S	*Populus alba* Silver Poplar	13	1	280	1.4	2.8	S	Good	Good	1 Long	Pavement/wall restriction.

Tree No.	Tree Ref.	Botanical Name Common Name	Height (M)	Canopy Spread Rad(M)	DBH (mm)	CRZ Rad (M)	PRZ Rad (M)	Age	Vigour	Condtn	SULE	Comments
156	156S	*Populus alba* Silver Poplar	13	1	280	1.4	2.8	S	Good	Good	1 Long	Pavement/wall restriction.
157	157S	*Populus alba* Silver Poplar	13	1	280	1.4	2.8	S	Good	Good	1 Long	Pavement/wall restriction. Decay. Borer
158	158S	*Populus alba* Silver Poplar	13	1	280	1.4	2.8	S	Good	Good	1 Long	Pavement/wall restriction.
159	159S	*Populus alba* Silver Poplar	13	1	280	1.4	2.8	S	Good	Good	1 Long	Pavement/wall restriction. Decay. Borer
160	160S	*Populus alba* Silver Poplar	13	1	280	1.4	2.8	S	Good	Good	1 Long	Pavement/wall restriction.
161	161S	*Populus alba* Silver Poplar	13	1	280	1.4	2.8	S	Good	Good	1 Long	Pavement/wall restriction.
162	162S	*Populus alba* Silver Poplar	13	1	280	1.4	2.8	S	Good	Good	1 Long	Pavement/wall restriction. Cavity. Decay
163	163S	*Populus alba* Silver Poplar	13	1	280	1.4	2.8	S	Good	Good	1 Long	Pavement/wall restriction. Cavity.decay
164	164S	*Populus alba* Silver Poplar	13	1	280	1.4	2.8	S	Good	Good	1 Long	Pavement/wall restriction.
165	165S	*Populus alba* Silver Poplar	13	1	280	1.4	2.8	S	Good	Good	1 Long	Pavement/wall restriction.
166	166S	*Populus alba* Silver Poplar	13	1	280	1.4	2.8	S	Good	Good	1 Long	Pavement/wall restriction.
167	167S	*Populus alba* Silver Poplar	13	1	280	1.4	2.8	S	Good	Good	1 Long	Pavement/wall restriction.
168	168S	*Populus alba* Silver Poplar	13	1	280	1.4	2.8	S	Good	Good	1 Long	Pavement/wall restriction.

Tree No.	Tree Ref.	Botanical Name Common Name	Height (M)	Canopy Spread Rad(M)	DBH (mm)	CRZ Rad (M)	PRZ Rad (M)	Age	Vigour	Condtn	SULE	Comments
169	169S	*Populus alba* Silver Poplar	13	1	280	1.4	2.8	S	Good	Good	1 Long	Pavement/wall restriction. Cavity
170	170S	*Populus alba* Silver Poplar	13	1	280	1.4	2.8	S	Good	Good	1 Long	Pavement/wall restriction. Cavity. Decay
171	171S	*Populus alba* Silver Poplar	13	1	280	1.4	2.8	S	Good	Good	1 Long	Pavement/wall restriction. Cavity. Decay. Borer
172	172S	*Populus alba* Silver Poplar	13	1	280	1.4	2.8	S	Good	Good	1 Long	Pavement/wall restriction. Cavity. Decay. Borer
173	173S	*Populus alba* Silver Poplar	13	1	280	1.4	2.8	S	Good	Good	1 Long	Pavement/wall restriction.
174	174S	*Populus alba* Silver Poplar	13	1	280	1.4	2.8	S	Good	Good	1 Long	Pavement/wall restriction. Cavity
175	175S	*Populus alba* Silver Poplar	13	1	280	1.4	2.8	S	Good	Good	1 Long	Pavement/wall restriction. Cavity
176	176S	*Populus alba* Silver Poplar	13	1	280	1.4	2.8	S	Good	Good	1 Long	Pavement/wall restriction. Cavity. Decay
177	177S	*Populus alba* Silver Poplar	13	1	280	1.4	2.8	S	Good	Good	1 Long	Pavement/wall restriction.
178	178S	*Populus alba* Silver Poplar	13	1	280	1.4	2.8	S	Good	Good	1 Long	Pavement/wall restriction.
179	179S	*Populus alba* Silver Poplar	13	1	280	1.4	2.8	S	Good	Good	1 Long	Pavement/wall restriction.
180	180S	*Populus alba* Silver Poplar	13	1	280	1.4	2.8	S	Good	Good	1 Long	Pavement/wall restriction.
181	181S	*Populus alba* Silver Poplar	13	1	280	1.4	2.8	S	Good	Good	1 Long	Pavement/wall restriction. Cavity. Decay

Tree No.	Tree Ref.	Botanical Name Common Name	Height (M)	Canopy Spread Rad(M)	DBH (mm)	CRZ Rad (M)	PRZ Rad (M)	Age	Vigour	Condtn	SULE	Comments
182	182S	*Ficus rubiginosa* Port Jackson Fig	4	2	180	0.6	1.8	S	Good	Good	2A Medium	
183	183S	*Quercus robur* English Oak	12	8	500	2.5	5	M	Fair	Fair	3B Short	Co dominant structure. Pavement/wall restriction soil compaction
184	184S	Flindersia australis Australian Teak	15	5	600	3	6	M	Good	Good	1 Long	
185	185S	Ficus rubiginosa Port Jackson Fig	17	9	800	4	8	M	Fair	Good	1 Long	Soil compaction
186	186S	Celtis australis Nettle Tree	10	3	550	2.5	5.5	O	Poor	Fair	3A Short	Soil compaction. Damaged/wounded roots
187	187S	Ficus rubiginosa Port Jackson Fig	3	2	170	0.8	1.7	Y	Good	Good	2A Medium	
188	188S	Ficus rubiginosa Port Jackson Fig	2	1	80	0.4	0.8	Y	Good	Fair	2B Medium	damaged/wounded roots. Borer damage
189	189S	Eucalyptus microcorys Tallowwood	18	8	600	3	6	M	Good	Good	1 Long	Co dominant structure. Pavement/wall restriction possum damage
190	190S	Eucalyptus microcorys Tallowwood	16	6	500	2.5	5	M	Good	Good	1 Long	Possum damage. Soil compaction.
191	191S	Eucalyptus microcorys Tallowwood	18	7	600	3	6	M	Good	Good	1 Long	Co-dominant structure. Possum damage. Soil compaction
192	192S	Eucalyptus microcorys Tallowwood	18	7	600	3	6	M	Good	Good	1 Long	Possum damage. Soil Compaction
193	193S	Eucalyptus microcorys Tallowwood	18	7	600	3	6	M	Good	Good	1 Long	Possum damage. Roots damaged/cut. Soil compaction
194	194S	Eucalyptus microcorys Tallowwood	16	7	500	2.5	5	M	Good	Fair	1 Long	Soil compaction. Twig dieback and epicormic growth

Tree No.	Tree Ref.	Botanical Name Common Name	Height (M)	Canopy Spread Rad(M)	DBH (mm)	CRZ Rad (M)	PRZ Rad (M)	Age	Vigour	Condtn	SULE	Comments
195	195S	Eucalyptus microcorys Tallowwood	18	7	600	3	6	M	Good	Good	1 Long	Roots damaged/cut. Soil compaction Roots damaged south side
196	196S	Eucalyptus microcorys Tallowwood	18	6	600	3	6	M	Good	Good	1 Long	Soil compaction
197	197S	*Eucalyptus sp.*	12	2	200	1	2	M	Fair	Fair	4E Remove	Cavity & decay. Wrong species for avenue
198	198S	*Eucalyptus microcorys* Tallowwood	18	7	600	3	6	M	Good	Good	1 Long	Soil compaction
199	199S	*Ficus rubiginosa* Port Jackson Fig	12	11	900	4.5	9	M	Fair	Good	2B Medium	Limb removal/failure
200	200S	Ficus rubiginosa Port Jackson Fig	13	2.5	800	4	8	O	Poor	Poor	REMV'D	Previous failure. Decay REMOVED
201	201S	Sapium sebiferum Chinese Tallow Tree	6	1.5	150	0.7	1.5	S	Poor	Poor	3A Short	
202	202S	*Lagunaria patersonia* Norfolk Island Hibiscus	12	2	300	1.5	3	M	Fair	Fair	3B Short	Cavity
203	203S	*Livistona australis* Cabbage Tree Palm	8	1	170	0.8	1.7	M	Good	Good	2A Medium	
204	204S	*Araucaria cunninghamii* Hoop Pine	18	8	600	3	6	M	Good	Good	1 Long	
205	205S	*Quercus robur* English Oak	15	8	600	3	6	M	Good	Good	2C Medium	New pavement works. Soil compaction
206	206S	*Flindersia australis* Australian Teak	12	3	430	2	4	M	Poor	Poor	3A Short	
207	207S	*Ficus microcarpa var Hillii* Hills Weeping Fig	22	8	750	3	7.5	M	Fair	Fair	2B Medium	Decay

Tree No.	Tree Ref.	Botanical Name Common Name	Height (M)	Canopy Spread Rad(M)	DBH (mm)	CRZ Rad (M)	PRZ Rad (M)	Age	Vigour	Condtn	SULE	Comments
208	208S	*Ficus microcarpa var Hillii* Hills Weeping Fig	22	7	550	5	5.5	M	Poor	Poor	2B Medium	Cavity, decay
209	209S	*Ficus rubiginosa* *Port Jackson Fig*	6	3	220	1	2	Y	Good	Good	2C Medium	
210	210S	*Ficus rubiginosa* Port Jackson Fig	4	2	150	0.7	1.5	Y	Fair	Fair	2C Medium	
211	211S	*Platanus x hybrida* London Plane Tree	10	2	180	0.6	1.8	S	Fair	Fair	2C Medium	
212	212S	*Platanus x hybrida* London Plane Tree	10	2	180	0.6	1.8	S	Fair	Fair	2C Medium	
213	213S	*Platanus x hybrida* London Plane Tree	10	2	200	1	2	S	Fair	Fair	2C Medium	
214	214S	*Platanus x hybrida* London Plane Tree	10	2	180	0.9	1.8	S	Fair	Fair	2C Medium	
215	215S	*Platanus x hybrida* London Plane Tree	10	2	150	0.7	1.5	S	Fair	Fair	2C Medium	
216	216S	*Ficus rubiginosa* *Port Jackson Fig*	18	6	900	4.5	9	M	Fair	Fair	2C Medium	New pavement works. Roots damaged/cut Wall repaired
217	217S	Platanus x hybrida London Plane Tree	10	2	160	0.8	1.6	S	Fair	Fair	2C Medium	
218	218S	*Ficus rubiginosa* *Port Jackson Fig*	6	2	200	1	2	Y	Poor	Poor	2C Medium	
219	219S	*Ficus rubiginosa* Port Jackson Fig	16	8	1000	5	10	M	Fair	Fair	2B Medium	Pavement/wall restriction. Wall 1 metre from trunk
220	220S	*Ficus macrophylla* Port Jackson Fig	14	7	1100	5.5	11	M	Fair	Fair	2B Medium	Limb removal/failre. Pavement/wall restriction Soil compaction

Tree No.	Tree Ref.	Botanical Name Common Name	Height (M)	Canopy Spread Rad(M)	DBH (mm)	CRZ Rad (M)	PRZ Rad (M)	Age	Vigour	Condtn	SULE	Comments
221	221S	Ficus rubiginosa Port Jackson Fig	6	3	200	1	2	Y	Good	Good	1A Long	
222	222S	Platanus x hybrida London Plane Tree	10	2	160	0.8	1.6	S	Good	Good	2C Medium	
223	223S	*Platanus x hybrida* London Plane Tree	10	2	200	1	2	S	Good	Good	2C Medium	
224	224S	*Ficus microcarpa var Hillii* Hills Weeping Fig	10	3	300	1.5	3	S	Good	Good	1A Long	
225	225S	*Ficus microcarpa var Hillii* Hills Weeping Fig	7	2	220	1.1	2.2	S	Good	Good	1A Long	
226	226S	*Ficus microcarpa var Hillii* Hills Weeping Fig	10	3	300	1.5	3	S	Good	Good	1A Long	
227	227S	*Araucaria columnaris* Cooks Pine	23	1	400	2	4	M	Fair	Good	1 Long	Soil compaction
228	228S	Ficus rubiginosa Port Jackson Fig **REMOVED**									REMV'D	REMOVED
229	229S	Ficus rubiginosa Port Jackson Fig	13	6	700	3.5	7	M	Fair	Fair	2B Medium	Limb removal/failure. New pavement works Pavment/wall restrictions
230	230S	*Araucaria cunninghamii* Hoop Pine	20	5	600	3	6	M	Good	Good	1 Long	
231	231S	*Ficus macrophylla* Moreton Bay Fig	16	6	1000	5	10	M	Good	Good	1 Long	
232	232S	*Ficus rubiginosa* Port Jackson Fig	18	8	1000	5	10	M	Fair	Good	2B Medium	New pavement works. Roots damaged/cut Soil compaction
233	233S	*Sapium sebiferum* Chinese Tallow Tree (REPLACED Quercus)									3C Short	

Tree No.	Tree Ref.	Botanical Name Common Name	Height (M)	Canopy Spread Rad(M)	DBH (mm)	CRZ Rad (M)	PRZ Rad (M)	Age	Vigour	Condtn	SULE	Comments
234	234S	*Quercus robur* English Oak	14	6	400	2	4	M	Good	Good	2B Medium	Soil compaction
235	235S	*Quercus robur* English Oak	10	2	200	1	2	O	Poor	Poor	4A Remove	
236	236S	*Quercus robur* English Oak	10	2	300	1.5	3	O	Poor	Poor	**Removed 19.9.2005**	Limb/trunk defects. New pavement works Pavement/wall restriction. Wounding. Further investigation required. Inspected 7/7/05, recommended for immediate removal
237	237S	*Ficus rubiginosa* Port Jackson Fig	9	4	500	2.5	5	M	Fair	Good	3D Short	Pavement restriction Sunburned, defoliated. Stressed
238	238S	*Ficus microcarpa var Hillii* Hills Weeping Fig	23	11	1000	5	10	M	Fair	Good	1 Long	Roots damaged/cut. Soil compaction
239	239S	*Stenocarpus sinuatus* *Qld Firewheel tree*	9	2	200	1	2	O	Poor	Poor	3C Short	Branch failure. Decay
240	240S	*Pinus halepensis* Aleppo Pine	10	4	300 + 200	2	4	O	Fair	Fair	4A Remove	Co-dominant structure
241	241S	*Pinus halepensis* Aleppo Pine	10	2	200	1	2	O	Poor	Poor	4A Remove	
242	242S	*Pinus halepensis* Allepo Pine	9	3	270	1.3	2.7	O	Poor	Poor	4A Remove	Decay. Cavity
243	243S	*Pinus halepensis* Allepo Pine	8	3	200	1	2	O	Poor	Poor	4A Remove	Decay
244	244S	Pinus *halepensis* Allepo Pine	4	2	200	1	2	O	Poor	Poor	4A Remove	Decay and failures
245	245S	*Ficus microcarpa var Hillii* Hills Weeping Fig	16	10	1000	5	10	M	Good	Good	1 Long	New pavement works. Pavement/wall restriction Roots damaged/cut. Soil compaction
246	246S	*Ficus microcarpa var Hillii* Hills Weeping Fig	16	10	900	4.5	9	M	Good	Good	1 Long	Roots damaged/cut. Soil compaction

Tree No.	Tree Ref.	Botanical Name Common Name	Height (M)	Canopy Spread Rad(M)	DBH (mm)	CRZ Rad (M)	PRZ Rad (M)	Age	Vigour	Condtn	SULE	Comments
247	247S	*Ulmus parvifolia* *Chinese elm*	15	4	240	1.2	2.4	M	Fair	Fair	4A Remove	Totally suppressed by adjacent Ficus Hillii
248	248S	*Sapium sebiferum* Chinese Tallow Tree	6	1.5	220	1.1	2.2	S	Fair	Fair	3C Short	Previous failure. Decay
249	249S	*Sapium sebiferum* Chinese Tallow Tree	5	1	130	0.6	1.3	S	Poor	Poor	3C Short	Decay
250	250S	*Sapium sebiferum* Chinese Tallow Tree	5	1.5	140	0.7	1.4	S	Poor	Poor	3C Short	Decay
251	251S	*Ficus rubiginosa* Port Jackson Fig	13	5	600	3	6	O	Poor	Fair	3 Short	New pavement works. Pavement/wall restriction Further investigation required
252	252S	*Ficus rubiginosa* Port Jackson Fig	15	8	600	3	6	M	Fair	Good	2B Medium	New pavement works. Roots damaged/cut Soil compaction. Pysllid present.
253	253S	*Ficus rubiginosa* Port Jackson Fig	17	9	900	4.5	9	M	Fair	Good	2B Medium	Roots damaged/cut. Soil compaction
254	254S	*Ficus rubiginosa* Port Jackson Fig	13	4	400	2	4	M	Fair	Fair	2 Medium	New pavement works. Pavement/wall restriction Wounding
255	255S	*Melaleuca quinquenervia* Broad leaved paperbark	16	5	600	3	6	M	Fair	Fair	2D Medium	Soil compaction. Pigeon damage at base.
256	256S	*Melaleuca quinquenervia* Broad leaved paperbark	10	4	600	3	6	M	Fair	Poor	2D Medium	Inclusion/s. Soil compaction. Pigeon damage at base
257	257S	*Melaleuca quinquenervia* Broad leaved paperbark	16	3	400 x 2	3	6	M	Fair	Fair	2D Medium	Co-dominant structure. Soil compaction. Pigeon damage at base.
258	258S	*Melaleuca quinquenervia* Broad leaved paperbark	16	3	500	2.5	5	M	Fair	Fair	2D Medium	Co-dominant structure. Soil compaction. Pigeon damage at base
259	259S	*Platanus x hybrida* London Plane Tree						Y			REMV'D	Young tree REMOVED MAY 2005 (dead)

Tree No.	Tree Ref.	Botanical Name Common Name	Height (M)	Canopy Spread Rad(M)	DBH (mm)	CRZ Rad (M)	PRZ Rad (M)	Age	Vigour	Condtn	SULE	Comments
260	260S	*Platanus x hybrida* London Plane Tree	6	1	100	0.5	1	S	Fair	Poor	4 Remove	Young tree, mechanical damage Inappropriate location, do not replace when removed
261	261S	Flindersia australis Australian Teak	14	5	600	3	6	M	Fair	Fair	2B Medium	Roots damaged/cut
262	262S	Platanus x hybrida London Plane Tree	8	1.5	120	0.6	1.2	S	Fair	Fair	1A Long	
263	263S	*Platanus x hybrida* *London Plane Tree*	12	4	330	1.6	3.3	M	Fair	Fair	1A Long	
264	264S	Platanus x hybrida London Plane Tree	12	3	400	2	4	M	Fair	Fair	2A Medium	Previous failures. Decay
265	265S	Platanus x hybrida London Plane Tree	19	9	700	3.5	7	M	Good	Good	1 Long	Soil compaction. Wounding
266	266S	Ficus microcarpa var Hillii Hills Weeping Fig	11	6	mulit	2	4	SM	Good	Good	1 Long	Soil compaction. Surface roots caused by intermittent waterlogging
267	267S	Sapium sebiferum Chinese Tallow Tree	12	4	250	1.2	2.5	M	Fair	Fair	3A Short	Decay
268	268S	Ficus rubiginosa Port Jackson Fig	14	6	900	4.5	9	M	Good	Good	1 Long	New pavement works. Pavement/wall restriction Roots damaged/cut. Soil compaction
269	269S	Ficus microcarpa var Hillii Hills Weeping Fig	9	1.5	230	1.15	2.3	Y	Good	Good	1A Long	
270	270S	Ficus microcarpa var Hillii Hills Weeping Fig	9	2	220		2.2	Y	Good	Good	1B Long	Decay, cavity and inclusions
271	271S	*Ficus microcarpa var Hillii* Hills Weeping Fig	14	6	multi	2	4	S	Good	Good	1A Long	Soil compaction
272	272S	*Platanus x hybrida* *London Plane Tree*	17	8	900	4.5	9	M	Fair	Fair	1A Long	Soil compaction

Tree No.	Tree Ref.	Botanical Name Common Name	Height (M)	Canopy Spread Rad(M)	DBH (mm)	CRZ Rad (M)	PRZ Rad (M)	Age	Vigour	Condtn	SULE	Comments
273	273S	Platanus x hybrida London Plane Tree	17	6	500	2.5	5	M	Fair	Fair	1A Long	Soil compaction. Wounding
274	274S	*Platanus x hybrida* London Plane Tree	16	6	300 + 200	2	4	M	Fair	Fair	1A Long	Mower damage. Epicomic growth
275	275S	*Platanus x hybrida* London Plane Tree	16	5	400	2	4	M	Fair	Fair	1A Long	Epicormic growth
276	276S	*Harpephyllum caffrum* Kaffir Plum	8	2.5	360	1.8	3.6	M	Fair	Fair	2A Medium	
277	277S	*Sapium sebiferum* Chinese Tallow Tree	8	2	180	900	1.8	S	Fair	Fair	3 Short	Decay
278	278S	*Sapium sebiferum* Chinese Tallow Tree	6	1.5	180	900	1.8	S	Poor	Poor	3 Short	Decay
279	279S	*Melaleuca quinquenervia* Broad leaved paperbark	10	4	500	2.5	5	M	Fair	Fair	2 Medium	Soil compaction. Pigeon damage at base.
280	280S	*Melaleuca quinquenervia* Broad leaved paperbark	10	3	400	2	4	M	Fair	Fair	2 Medium	Soil compaction. Pigeon damage at base.
281	281S	Melaleuca quinquenervia Broad leaved paperbark									REMV'D	**REMOVED MAY 2005**
282	282S	*Melaleuca quinquenervia* Broad leaved paperbark	10	3	400	2	4	M	Fair	Fair	2 Medium	Soil compaction. Pigeon damage at base.
283	283S	*Liquidambar styraciflua* Liquidambar	16	9	400 x 2	3	6	M	Fair	Fair	3B Short	Co-dominant structure. Roots damaged/cut Soil compaction
284	284S	*Eucalyptus globulus* Tasmanian Blue Gum	22	10	900	4.5	9	O	Good	Poor	**Removed 19.9.2006**	Hollows @ 4 and 5 metres above GL Further investigation required. Inspected 7/7/05 Recommended for immediate removal
285	285S	*Stenocarpus sinuatus* Qld Firewheel tree	12	2.5	380	1.9	3.8	O	Fair	Fair	4C Remove	Cavity, splits and cracks Remove 2006

Tree No.	Tree Ref.	Botanical Name Common Name	Height (M)	Canopy Spread Rad(M)	DBH (mm)	CRZ Rad (M)	PRZ Rad (M)	Age	Vigour	Condtn	SULE	Comments
286	286S	*Flindersia australis* Australian Teak	13	4	400	2	4	M	Fair	Good	2B Medium	New pavement works. Pavement/wall restriction.
287	287S	*Eucalyptus sp.* Gum Tree	9	1	130	0.5	1	Y	Good	Good	3B Short	Touching Park light
288	288S	*Flindersia australis* Australian Teak	5	1	90	0.5	1	Y	Good	Good	2 Medium	Street light
289	289S	*Flindersia australis* Australian Teak	21	5	500	2.5	5	O	Fair	Fair	3A Short	New pavement works. Pavement/wall restriction
290	290S	*Ficus microcarpa var Hillii* Hills Weeping Fig	17	12	1100	5.5	11	M	Good	Good	1 Long	Roots damaged/cut. Soil compaction
291	291S	*Stenocarpus sinuatus* *Qld Firewheel tree*	16	3	300	1.5	3	M	Fair	Fair	3A Short	
292	292S	*Ficus microcarpa var Hillii* Hills Weeping Fig	15	5	380	1.9	3.8	S	Good	Good	1B Long	Inclusion.
293	293S	*Pinus halepensis* Aleppo Pine	8	2.5	450	2.25	4.5	O	Poor	Poor	4A Remove	
294	294S	*Stenocarpus sinuatus* Qld Firewheel tree	9	2	200	1	2	O	Poor	Poor	4E Remove	Planted too close to Hills Weeping Fig
295	295S	*Ficus microcarpa var Hillii* Hills Weeping Fig	11	4	240	1.2	2.4	S	Good	Good	1B Long	Inclusion
296	296S	*Pinus halepensis* Aleppo Pine	12	4	390	1.8	3.9	O	Poor	Poor	4 Remove	Previous failures. Decay
297	297S	Flindersia australis Australian Teak	16	5	500	2.5	5	M	Fair	Good	2C Medium	New pavement works. Pavement/wall restrictions
298	298S	Flindersia australis Australian Teak	16	5	700	3.5	7	M	Fair	Good	2C Medium	New pavement works. Pavement/wall restrictions

Tree No.	Tree Ref.	Botanical Name Common Name	Height (M)	Canopy Spread Rad(M)	DBH (mm)	CRZ Rad (M)	PRZ Rad (M)	Age	Vigour	Condtn	SULE	Comments
299	299S	Flindersia australis Australian Teak	18	3	400	2	4	M	Fair	Fair	2C Medium	New pavement works. Pavement/wall restrictions Suppressed form
300	300S	Stenocarpus sinuatus Qld Firewheel tree	18	2	500	2.5	5	M	Good	Good	2C Medium	New pavement works. Pavement/wall restrictions Suppressed form. Wounding
301	301S	Flindersia australis Australian Teak	18	4	600	3	6	M	Good	Good	2C Medium	New pavement works. Pavement/wall restrictions
302	302S	Sapium sebiferum Chinese Tallow Tree	6	2	140	0.7	1.4	S	Fair	Fair	4C Remove	Inclusion. Decay
303	303S	Sapium sebiferum Chinese Tallow Tree	6	2	260	1.3	2.6	S	Fair	Fair	3B Short	Decay
304	304S	*Sapium sebiferum* Chinese Tallow Tree	5	1	110	500	1	S	Fair	Fair	3B Short	Decay. Cavity
305	305S	*Cedrus deodara* Deodara Pine	10	2.5	280	1.4	2.8	M	Fair	Fair	2A Medium	
306	306S	*Stenocarpus sinuatus* Qld Firewheel tree	5	1	100	0.5	1	Y	Good	Good	3C Short	Inclusions. Decay
307	307S	*Stenocarpus sinuatus* Qld Firewheel tree	14	3	400	2	4	M	Good	Good	3C Short	Soil Compaction
308	308S	*Sapium sebiferum* Chinese tallow Tree	9	2.5	250	1	2.5	M	Poor	Poor	3A Short	Decay
309	309S	*Sapium sebiferum* Chinese Tallow Tree	9	2.5	250	1	2.5	M	Poor	Poor	3A Short	Decay. Cavity. Inlusion
310	310S	*Sapium sebiferum* Chinese Tallow tree	9	2.5	250	1	2.5	M	Poor	Poor	3A Short	
311	311S	*Sapium sebiferum* Chinese Tallow tree	9	3	240	1	2.4	M	Poor	Poor	3A Short	

Tree No.	Tree Ref.	Botanical Name Common Name	Height (M)	Canopy Spread Rad(M)	DBH (mm)	CRZ Rad (M)	PRZ Rad (M)	Age	Vigour	Condtn	SULE	Comments
312	312S	Stenocarpus sinuatus Qld Firewheel tree	6	1	110	0.5	1	S	Fair	Fair	2A Medium	Splits/Cracks. Decay
313	313S	Ginko biloba Maidenhair Tree	16	2	260	1.3	2.6	M	Fair	Fair	3B Short	Inclusion. Decay. Cavity
314	314S	Platanus x hybrida London Plane Tree	16	3	400	2	4	M	Fair	Fair	1 Long	Soil compaction. Services adjacent
315	315S	Platanus x hybrida London Plane Tree	21	9	900	4.5	9	M	Good	Good	1 Long	Soil compaction.
316	316S	Platanus x hybrida London Plane Tree	21	8	800	4	8	M	Good	Good	1 Long	Roots damaged/cut. Soil compaction
317	317S	Platanus x hybrida London Plane Tree	21	9	800	4	8	M	Good	Good	1 Long	Soil compaction
318	318S	Platanus x hybrida London Plane Tree	21	11	800	4	8	M	Good	Good	1 Long	Roots damaged/cut. Soil compaction
319	319S	Platanus x hybrida London Plane Tree	22	5.5				M	Good	Good	4C Remove	Decay. Cavity
320	320S	Ficus macrophylla Moreton Bay Fig	21	8	1300	6.5	13	M	Good	Good	1 Long	Limb removal/failure. Soil compaction. Poor pruning technique.
321	321S	*Pinus halepensis* Allepo Pine	8	2.5	300	1.5	3	O	Poor	Poor	4A Remove	
322	322S	Sapium sebiferum Chinese tallow Tree	6	2	200	1	2	M	Poor	Poor	3C Short	
323	323S	Sapium sebiferum Chinese Tallow tree	9	3	270	1.3	2.7	M	Poor	Poor	3C Short	Decay. Borer
324	324S	Sapium sebiferum Chinese Tallow Tree	7	2.5	200	1	2	M	Poor	Poor	3A Short	

Tree No.	Tree Ref.	Botanical Name Common Name	Height (M)	Canopy Spread Rad(M)	DBH (mm)	CRZ Rad (M)	PRZ Rad (M)	Age	Vigour	Condtn	SULE	Comments
325	325S	Sapium sebiferum Chinese Tallow Tree	8	2	150	0.7	1.5	M	Poor	Poor	4A Remove	
326	326S	Stenocarpus sinuatus Qld Firewheel tree	14	2	310	1.5	3	O	Fair	Fair	4C Remove	Splits/Cracks. Decay
327	327S	Stenocarpus sinuatus Qld Firewheel tree	10	2	190	1	2	M	Fair	Fair	4E Remove	Decay
328	328S	Stenocarpus sinuatus Qld Firewheel tree	7	2	240	1.2	2.4	M	Fair	Fair	4E Remove	Splits/Cracks. Decay
329	329S	Stenocarpus sinuatus Qld Firewheel tree	13	1.5	260	1.3	2.6	M	Fair	Fair	4C Remove	Splits/Cracks. Decay
330	330S	Stenocarpus sinuatus Qld Firewheel tree	12	2.5	340	1.7	3.4	M	Fair	Fair	3B Short	
331	331S	Ficus macrophylla Moreton Bay Fig	21	10	1200	6	12	M	Good	Good	1 Long	Limb removal/failure. Soil compaction.
332	332S	Platanus x hybrida London Plane Tree	23	6	800	4	8	M	Good	Fair	1 Long	Soil compaction. Lean to north.
333	333S	*Ficus macrophylla* *Moreton Bay Fig*	21	10	900	4.5	9	O	Fair	Fair	2 Medium	Limb removal/failure. Soil compaction
334	334S	Ficus macrophylla Moreton Bay Fig	21	12	1300	6.5	13	M	Good	Good	1 Long	Roots damaged/cut. Soil compaction Poor pruning technique
335	335S	Eucalyptus microcorys Tallowwood	22	7	600	3	6	M	Good	Fair	2 Medium	Soil compaction. Lean to east.
336	336S	Eucalyptus microcorys Tallowwood	24	8	800	4	8	M	Good	Good	1 Long	Soil compaction.
337	337S	Eucalyptus microcorys Tallowwood	10	2	290	1.5	2.9	O	Poor	Poor	**Removed**	Previous failures. Decay **REMOVED**

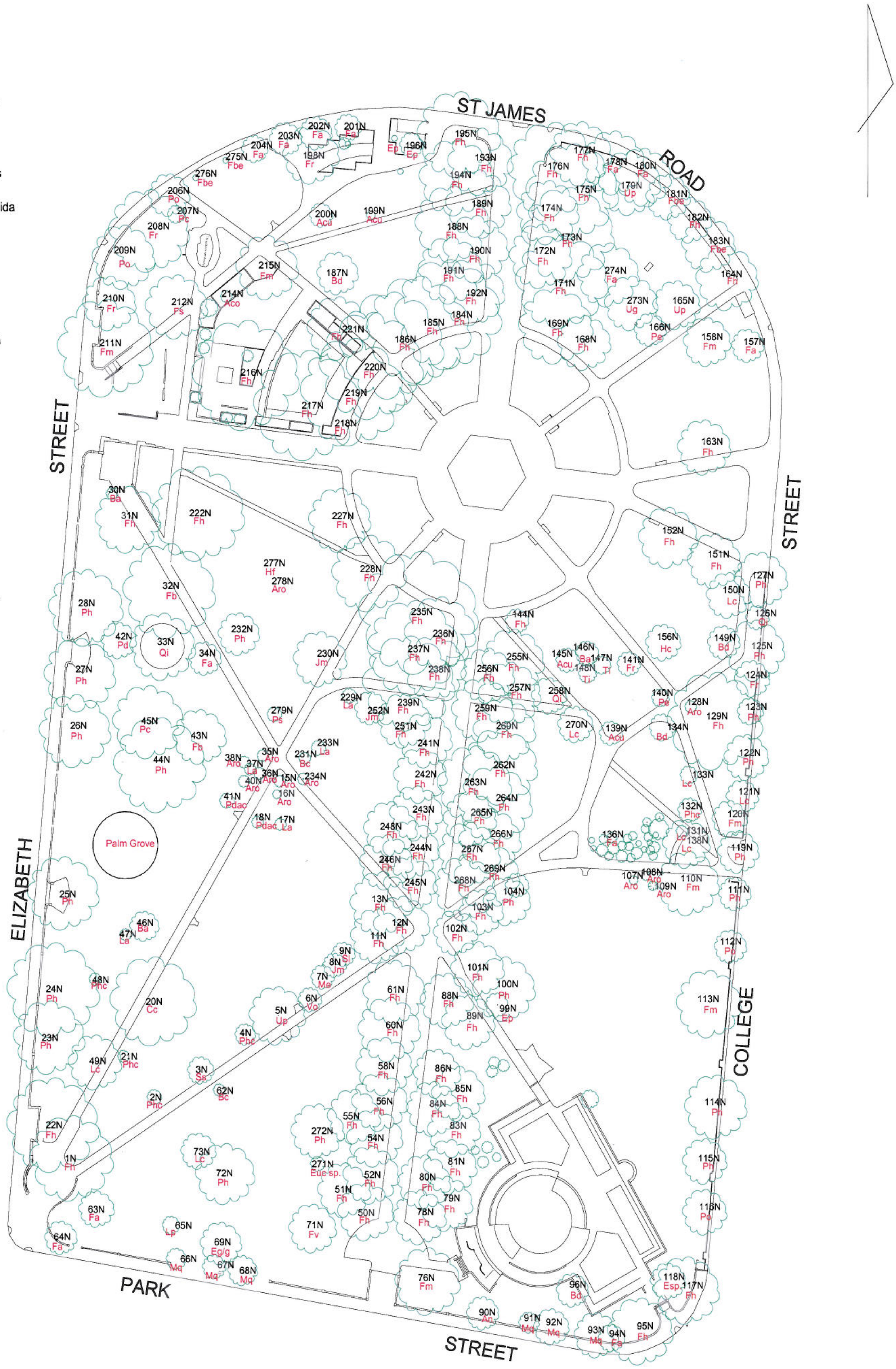
Tree No.	Tree Ref.	Botanical Name Common Name	Height (M)	Canopy Spread Rad(M)	DBH (mm)	CRZ Rad (M)	PRZ Rad (M)	Age	Vigour	Condtn	SULE	Comments
338	338S	Eucalyptus microcorys Tallowwood	24	8	700	3.5	7	M	Good	Good	1 Long	Soil compaction
339	339S	Eucalyptus microcorys Tallowwood	26	12	800	4	8	M	Good	Good	1 Long	Pavement/wall restriction. Soil compaction.
340	340S	Ficus microcarpa var Hillii Hills Weeping Fig	27	11	1000	5	10	M	Good	Fair	2B Medium	Inclusion/s. Remove branches suppressing Magnolia
341	341S	*Magnolia sp.* *Magnolia*	6	2	100	0.5	1	S	Good	Good	1A Long	
342	342S	*Ficus microcarpa var Hillii* Hills Weeping Fig	28	11	1000	5	10	M	Good	Fair	1 Long	Inclusion/s. Roots damaged/cut. Soil compaction
343	343S	*Pinus halepensis* *Aleppo Pine*	4	3	450	2.25	4.5	O	Poor	Poor	3B Short	Decay
344	344S	*Pinus halepensis* Aleppo Pine	3	1.5	110	0.5	1	S	Good	Good	1A Long	
345	345S	Ficus rubiginosa Port Jackson Fig	10	3	500	2.5	5	O	Fair	Fair	2A Medium	Lopped. Decay
346	346S	Pinus halepensis Allepo Pine/Lone Pine	2.5	1	80	0.4	0.8	S	Poor	Poor	2C Medium	
347	347S	*Ficus microcarpa var Hillii* Hills Weeping Fig	28	9	900	4.5	9	M	Good	Good	1 Long	Soil compaction
348	348S	*Quercus x heterophylla* Hybrid Oak	25	7	700	3.5	7	M	Good	Good	1 Long	New pavement works. Pavement/wall restrictions
349	349S	*Ficus rubiginosa* Port Jackson fig	14	6	600	3	6	M	Fair	Fair	2B Medium	New pavement works. Pavement/wall restrictions
350	350S	*Ficus rubiginosa* Port Jackson Fig	6	2	150	0.7	1.5	O	Good	Good	2B Medium	Inclusion

Tree No.	Tree Ref.	Botanical Name Common Name	Height (M)	Canopy Spread Rad(M)	DBH (mm)	CRZ Rad (M)	PRZ Rad (M)	Age	Vigour	Condtn	SULE	Comments
351	351S	*Celtis occidentalis* Hackberry	18	7	400	3	6	M	Good	Good	2C Medium	
352	352S	*Ficus macrophylla* Moreton Bay Fig	13	3	370	1.6	3.7	O	Poor	Poor	3C Short	Poor specimen planted too close to path
353	353S	Eucalyptus microcorys Tallowwood	26	7	600	3	6	M	Good	Good	1 Long	Soil compaction. Twig dieback
354	354S	Eucalyptus microcorys Tallowwood	22	8	500	2.5	5	M	Good	Fair	2B Medium	Soil compaction. Suppressed form
355	355S	Eucalyptus microcorys Tallowwood	24	7	800	4	8	M	Good	Fair	2B Medium	Lean to north-east.
356	356S	*Eucalyptus microcorys* Tallowwood	24	6	600	3	6	M	Good	Fair	2B Medium	Soil compaction. Suppressed form
357	357S	*Eucalyptus microcorys* Tallowwood	20	6	270	1.4	2.7	M	Fair	Fair	3B Short	Previous failures
358	358S	*Ficus microcarpa var Hillii* Hills Weeping Fig	26	11	900	4.5	9	M	Good	Good	1 Long	Roots damaged. Soil compaction
359	359S	*Lophostemon confertus* Brushbox	12	3.5	320	1.5	3.2	O	Fair	Fair	2A Medium	Previous failures
360	360S	*Lophostemon confertus* Brushbox	12	3.5	380	1.6	3.8	O	Poor	Poor	2A Medium	Previous failures
361	361S	*Ulmus parvifolia* *Chinese Elm*	4					Y	Good	Good	4E Remove	Part of row of 5 trees planted approx 2003 left over street tree planting
362	362S	*Ulmus parvifolia* Chinese Elm	4					Y	Good	Good	4E Remove	Part of row of 5 trees planted approx 2003 left over street tree planting
363	363S	*Ulmus parvifolia* Chinese Elm	4					Y	Good	Good	4E Remove	Part of row of 5 trees planted approx 2003 left over street tree planting

Tree No.	Tree Ref.	Botanical Name Common Name	Height (M)	Canopy Spread Rad(M)	DBH (mm)	CRZ Rad (M)	PRZ Rad (M)	Age	Vigour	Condtn	SULE	Comments
364	364S	*Ulmus parvifolia* Chinese Elm	4					Y	Good	Good	4E Remove	Part of row of 5 trees planted approx 2003 left over street tree planting
365	365S	*Ulmus parvifolia* Chinese Elm	4					Y	Good	Good	4E Remove	Part of row of 5 trees planted approx 2003 left over street tree planting
366	366S	No tree										NO TREE
367	367S	*Sapium sebiferum* Chinese Tallow tree									4E Remove	Very poor form
368	368S	*Sapium sebiferum* Chinese Tallow Tree									4E Remove	Tree has poor form and broken branches
369	369S	*Flindersia benettiana* Bennett's Ash						Y	Good	Good	1 Long	
370	370S	*Flindersia benettiana* Bennett's Ash						Y	Good	Good	1 Long	

LEGEND

Acu	Araucaria cunninghamii
Aco	Araucaria columnaris
An	Acer negundo
Aro	Arecastrum romanzoffianum
Ba	Brachychiton acerifolius
Bd	Brachychiton discolor
Bc	Butia capitata
Cc	Cinnamomum camphora
Eg/g	Eucalyptus globulus/globulus
Em	Eucalyptus microcorys
Eh	Eucalyptus paniculata x hybrida
Ep	Eucalyptus pilularis
Esp.	Eucalyptus species
Fa	Flindersia australis
Fb	Ficus benjamina
Fbe	Flindersia benettiana
Fm	Ficus macrophylla
Fh	Ficus microcarpa var hillii
Fr	Ficus rubiginosa
Fs/h	Ficus superba var henneana
Fv	Ficus virens
Hc	Harpephyllum caffrum
Hf	Howea forsteriana
Jm	Jacaranda mimosifolia
Lp	Lagunaria patersonia
La	Livistona australis
Lc	Lophostemon confertus
Mq	Melaleuca quinquenervia
Pc	Phoenix canariensis
Pdac	Phoenix dactylifera
Prec	Phoenix reclinata
Ps	Phoenix sylvestris
Ph	Platanus x hybrida
Po	Platanus orientalis
Pe	Podocarpus elatus
Pd	Populus deltoides
Pni	Populus nigra 'Italica'
Qp	Quercus ilex
Qp	Quercus palustris
Ss	Stenocarpus sinuatus
Sl	Syzygium leuhmanii
Tl	Tristaniopsis laurina
Ug	Ulmus glabra
Up	Ulmus parvifolia



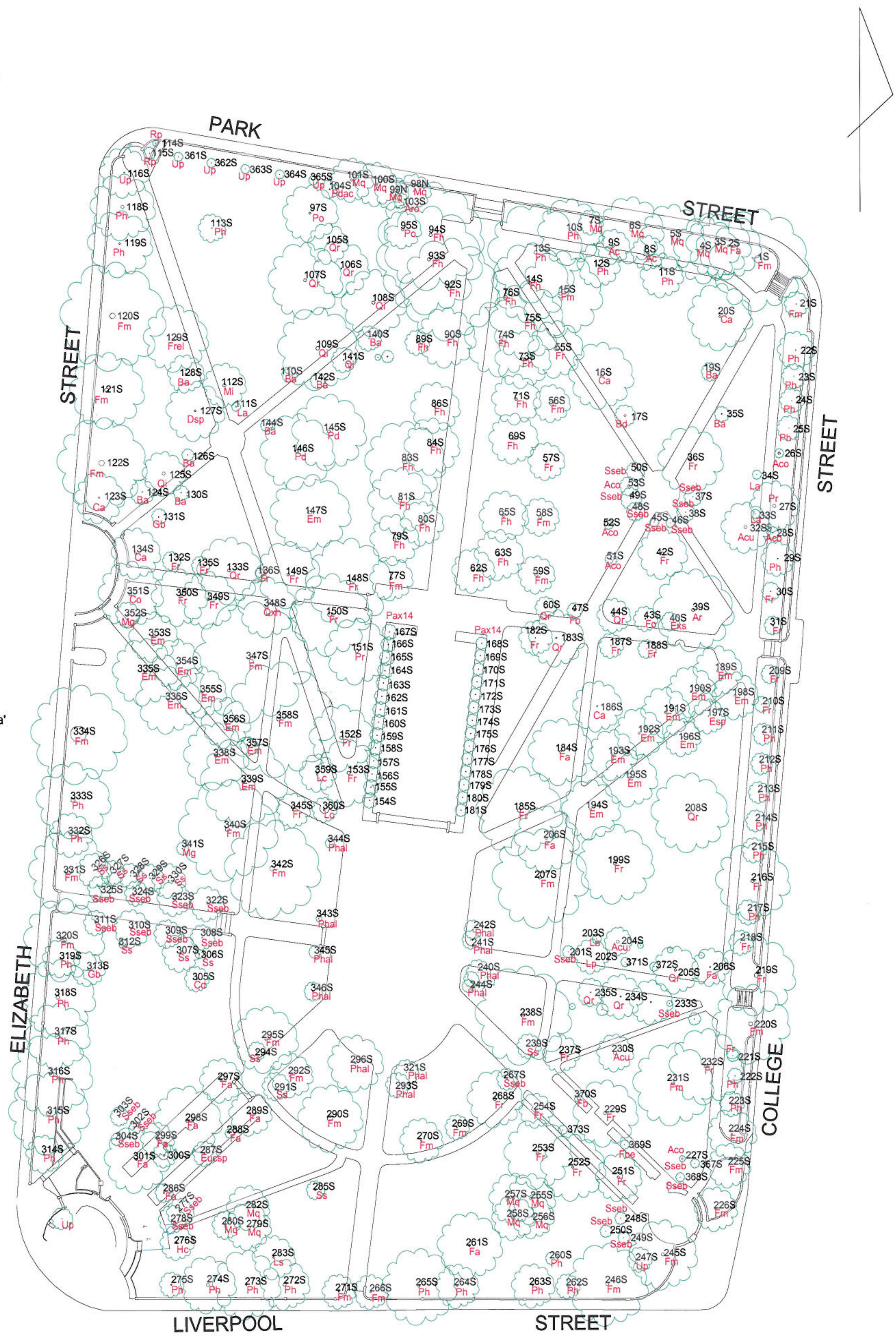
HYDE PARK NORTH TREE LOCATION PLAN

Date: OCTOBER 2005

Scale: 1:1000 @ A2 sheet size

LEGEND

- Ar — Agathis robusta
- Aco — Araucaria columnaris
- Acu — Araucaria cunninghamii
- Aro — Arecastrum romanzoffianum
- Ba — Brachychiton acerifolius
- Bd — Brachychiton discolor
- Cd — Cedrus deodara
- Ca — Celtis australis
- Co — Celtis occidentalis
- Dsp — Drypetes species
- Exs — Erythrina x sykesii
- Em — Eucalyptus microcorys
- Esp. — Eucalyptus species
- Fa — Flindersia australis
- Fbe — Flindersia benettiana
- Fo — Fraxinus oxycarpa
- Fm — Ficus macrophylla
- Fh — Ficus microcarpa var hillii
- Fr — Ficus rubiginosa
- Fre — Ficus religiosa
- Fv — Ficus virens
- Gb/f — Ginkgo biloba 'Fastigiata'
- Hc — Harpephyllum caffrum
- Lc — Lophostemon confertus
- Lp — Lagunaria patersonia
- La — Livistona australis
- Lp — Lagunaria patersonia
- Ls — Liquidambar styraciflua
- Lc — Lophostemon confertus
- La — Livistona australis
- Mi — Macadamia integrifolia
- Mg — Magnolia grandiflora
- Mq — Melaleuca quinquenervia
- Pdac — Phoenix dactylifera
- Phal — Pinus halepensis
- Pr — Pinus roxburghii
- Ph — Platanus x hybrida
- Po — Platanus orientalis
- Pa — Populus alba 'Fastigiata'
- Pd — Populus deltoides
- Qi — Quercus ilex
- Qr — Quercus robur
- Qxh — Quercis x hybrida
- Qh — Quercus x heterophylla
- Rp — Robinia pseudoacacia 'Frisia'
- Sseb — Sapium sebiferum
- Ss — Stenocarpus sinuatus
- Up — Ulmus parvifolia



HYDE PARK SOUTH TREE LOCATION PLAN

Date: OCTOBER 2005

Scale: 1:1000 @ A2 sheet size

Soil Investigations

for the urban forest

of

HYDE Park Sydney

Prepared for: Council of the City of Sydney

Sydney
Environmental and Soil
Laboratory
Specialists in Soil Chemistry and Agronomy

June 2005

Executive Summary

Hyde Park is based on three types of subsoil materials, buried sandstone derived, yellow earthy clay on the western side, anthropogenic mixed fill down the centre and some peripheral areas, and truncated and buried heavy shale derived clays down the Eastern side.

Topsoils have been extensively modified. The entire park is now covered with a organic sandy loam quite suitable for urban park topsoil. In two areas only, the NE corner and the Southern edge facing Park St, topsoils are heavier textured and show signs of compaction and high density.

While topsoil appears to be well drained, porous and not excessively compacted, except in some localised areas, the subsoil conditions are problematic for large tree development. Throughout the central avenue topsoil is compacted and shallow with subsoil near the surface, and composed of very poorly drained anthropic fill. This, combined with excessive organic matter and inappropriately high moisture content is leading to shallow disease prone root systems for the major *Ficus hillii* plantings.

So poorly drained are the soils supporting the main *F. hillii* avenue that chemical indications of anaerobic conditions are present. Limiting soil oxygen levels are seen as the major stress facing these trees.

Another area of very poor subsoil drainage over heavy wet clays occurs in the South Eastern side. In some locations this clay is actually hydromorphic showing the gleyed colours of anaerobic soil. This would severely limit rooting depth.

Nutritionally, potassium is the main topsoil and subsoil deficiency identified, which could be causing at least subclinical deficiency in tree plantings. Potassium deficiency can leave trees open to increased susceptibility to root disease, slow growth rates and general unthriftiness. Phosphorus also is seen as potentially deficient, most measured levels being below that considered minimal for parks and garden horticulture. Sulphur appears to be very limiting in all soils. These deficiencies are easily corrected with targeted potassium, phosphorus and sulphur additions.

Improvement of soil aeration for existing trees in the main *F. hillii* avenue is seen as the top priority. Significant improvement could occur from some relatively simple measures designed to reduce moisture content and organic matter levels. Suggestions for monitoring this improvement are made. If results from these simple measures are not sufficiently significant, suggestions are made for more interventionist approaches based on manual installation of drainage under existing rootzones. While difficult, such intervention could have profound result on longevity and stability of the trees.

Where replacement of individual or blocks of failed trees in the *F. hillii* avenues is contemplated a complete soil replacement program is recommended. This program involves the installation of sandy rootzone material and subsoil drains to improve aeration and drainage to ensure deeper effective rooting depth and better drainage for future tree development.

Given the poor subsoil conditions in many locations it is imperative that improved techniques for new tree planting be instituted. These involve replacement of soil in and around the planting hole with well drained medium and treatment of rootballs before planting. Such attention to soil modification and planting techniques will be repaid in faster growth rates and better developed root systems.

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1. Background

Hyde Park Sydney is the central urban park of the city used for both passive recreation and for structured events such as markets and fairs. The history of the park stretches right back to the earliest days of settlement and apart from major earthworks associated with the railway tunnels, Park Street cutting, the Anzac War Memorial and Archibald Fountain and connecting main avenue most built structures in the park have been confined to pathways and some minor structured garden areas. As such contours within the park are close to the original ground contours.

Previous soil surveys within the park (Lawrie 1987 and 1990) identified disturbed soils based on jumbled fill along the central spine of the park but either side of this was remnant natural soils at least at depth. Roughly, on the Western side were subsoils indicative of a sandstone based soil, and on the more elevated Eastern side clay based subsoils derived from shales. Significant changes to soil profiles include truncation of the original topsoil, some layers of garbage and fill and importation at some stage of a very sandy loam topsoil.

Soil maps of the area (Chapman and Murphy 1989) indicate Lucas Heights or Gymea soil landscapes on sandstone or Mittagong interbedded shale/sandstone geology for the area. Only to the West around Darlinghurst is the Blacktown soil landscape on shale indicated. The subsoil pedology of Blacktown soils is very characteristic heavy plastic clay of a red to yellow colour with no coarse grained sand whereas those of Gymea or Lucas Heights show yellow sandy clay subsoils with obvious coarse grained sand.

Geology maps of the area (NSW Dept of Mines 1:250,000 Geological) indicate shales of the Wianamatta group. It would seem from this work and that of Lawrie that the boundary between sandstone and shale was actually in a N/S direction about where the present avenue is with sandstone to the West and shale to the East. This geology has profoundly influenced the soil conditions for tree growth.

Poor growth rates of certain trees has long been observed and recent events including the death or decline of a number of large *F. hillii* in the central avenue including more or less severe fungal pathogen infection has given rise to concerns about soil conditions particularly in regard to the Safe Useful Life Expectancy (SULE) of the urban forest.

The purpose of this investigation is to determine the present soil conditions as they relate to the growth and longevity of trees by field description and a program of analysis and to report on the constraints and opportunities that the soil conditions provide for management of the urban forest. Particular emphasis is placed on the possibilities for soil improvement and modification to prolong the SULE of present tree plantings, particularly the main central avenue. Attention is also given to providing recommendations for the growth and development of new tree plantings and replacement programs.

One particular concern expressed by Council officers is that, observations on the failure of three large *Ficus hillii* along the central avenue, showed very shallow root system severely infected with fungal disease. The concern is that other specimens along this avenue may be similarly affected. It is known that nearly the entire length of the central avenue was trenched and disturbed during installation of the underground railways some decades ago.

Lawrie (1990) demonstrated wet and shallow poorly drained soils along the whole length of this avenue.

Our understanding of the growth and function of tree root systems has increased greatly in the last 10 years. It has been shown clearly that the depth of root penetration is governed by the oxygen potential of the soil. Where oxygen concentrations in the soil atmosphere fall below about 12-15% (the atmosphere is 21%) root growth and nutrient uptake (including water) is compromised. Where it falls below 5% all growth ceases and below about 3% roots cannot survive. This understanding has given rise to the concept of the “root plate” in soils with shallow impermeable subsoil and explains why most of the root system of trees is in the surface soil and spreads laterally not vertically. Only in the deepest and best drained sands for example does anything resembling a root ball exist. In most soil types around Sydney a very shallow root plate is the norm with about 90% of all root mass in the surface 200-300mm of porous aerated topsoil.

Anything that compromises oxygen entry into the soil, like wetness, decaying organic matter and compaction results in increasingly shallow root systems. Where events that reduce oxygen entry occur under established trees (like compaction, excessive mulching and watering) the death of previously adapted roots can be predicted.

The nutrient and chemical balance of soils is also important in urbanized soils. Constant removal of leaf and forest fall by park management depletes soils of certain nutrients. This may be balanced by the input of fertilizers and general fallout of human activity (litter, food scraps etc) resulting in increased fertility over time, or may not be resulting in depletion of soil nutrient reserves. Excessive nutrients especially nitrogen can encourage disease, or insufficient nutrients may provide further stress to trees with root systems already compromised by oxygen stress, compaction, etc.

Most park soil management is ad hoc, reactionary, and usually focused on the quality of turf cover not the needs of trees. In general, and fortunately, the very sandy topsoils preferred for turf management in heavily used areas also suit the needs of trees. The issue that usually arises is the quality of subsoil. While this is usually unimportant for turf it can profoundly influence tree root systems.

Many events can occur in park soil management that compromise soil oxygen entry and hence tree root system functioning including-

• compaction by pedestrians of unsuitable topsoil textures
• topdressing and topsoil importation of soils of a texture unsuited to compaction resistance
• layering of soil leading to perched wetting fronts and compromised infiltration
• fertilizer programs or the lack of them, suited to the needs of trees
• turf competition for nutrients and oxygen
• unsuitable supplementary irrigation programs resulting in wet or excessively dry soil
• uncontrolled and ad hoc installation of services cutting through and destroying or damaging root plate structures.

The purpose of this report is to build on the work of Lawrie and establish guidelines that can be followed over time to ensure the best possible conditions for both turf and tree soils in the park.

2. Methods

Inspection and sampling was made on 11th May 2005. In order to minimize damage to root systems hand auguring techniques were used to a depth considered maximal for tree root growth, usually 600 to 800mm at most but depending on the physical properties encountered. Ten locations in Hyde Park North of Park St and 10 in Hyde Park South of Park St were examined at locations provided by City of Sydney staff. There were focused on areas of concern (for example where *F. hillii* had failed or were showing stress) but also had to accommodate the presence of service lines etc. Most locations were well spread out in the park to provide broad information on the variation in soil types for the park as a whole. Locations for the profile inspections are attached as Appendix I.

Care was taken to prevent any further spread of fungal diseases by washing tools between locations in strong hypochlorite solutions.

At each location the following observations were made-

• horizon depth
• colour, texture, structure and inclusions in each profile
• qualitative comment on the presence of roots
• whether the horizon is natural or anthropogenic
• odour where appropriate
• qualitative assessment of moisture.

At each location the following topsoil samples were taken-

• Bulk disturbed topsoil for chemical analysis of pH, EC, Cation exchange, available N, P, K, S, Fe, Zn, Cu, Mn, and phosphate retention index, and physical measurements of particle size analysis and organic matter content.
• Where possible intact clods for waxed block density measurements
• Intact cores of the surface 75mm for permeability and bulk density measurement.

At selected locations subsoil or unusual surface horizons were taken for chemical measurement of pH, EC and cation exchange properties.

Samples were analysed using standard soil science methodology covered by the ISO 9002 certification covering the quality practices of Sydney Environment & Soil Laboratory (SESL). The only exception being that an "in house" trace element extract developed by SESL over 20 years was used for trace element assessment. There is no standard for interpretation of soil results for urban park uses and interpretation is provided based on the experience and judgment of the qualified soil scientists employed by SESL.

Sample location numbers are not sufficient to provide detailed soil maps of the park but wherever possible attempts are made in the subsequent reporting to group similar soils and provide some rational basis for dividing the park into preliminary management units based on soil physical and chemical properties.

3. Field Results

Individual pit logs are provided as Appendix II.

The first and most outstanding feature common to all soils except perhaps S1 is the presence of a well structured dark brown sandy loam A horizon of imported sandy loam. This layer is usually 200-300 mm deep, occasionally 350mm, well structured and highly organic. Generally it is highly porous and full of worm holes and not excessively compacted. Only in desire lines and heavily trafficked corners is compaction and consequent thinning or destruction of turf a problem.

At the *F. hillii* avenue locations (N5, N8, N9, and S3) the sandy loam topsoil is layer obscured by very highly organic almost peaty layers on the surface. At S1 and S2 sand is not so prevalent and the texture is more a loam than a sandy loam. At S8 which appears to be recently reconstructed the layer is loamy sand.

While significant uniformity exists in the surface 200/300mm significant variability exists in the subsoil morphology of each profile. Subsoil morphology often determines effective exploitation depth for tree roots so it is important to attempt some grouping of profiles based on subsoil conditions. This is attempted in Table 1.

Table 1. *Soil Groupings based on Subsoil Condition*

Subsoil Conditions	Profiles by number
Deeper phase (>600mm to impermeable layer) mixed anthropic fill of sandy, clayey and stoney matrix	N1, N7, N10, S4, S6, S8.
Shallower Phase (<600mm to impermeable layer) mixed anthropic fill of sandy, clayey and stoney matrix	N5, N8, N9, S2, S3, S5, S7,
Clear indications of intact Blacktown clay subsoil	N2, N3, N6, S10
Possible indications of intact Blacktown clay subsoil	S2, S7
Deep anthropic sandy loam B horizon	S1
Clear indications of intact yellow sandy clay Lucas Heights or Gymea subsoil	N4

A tentative soil map is provided on the next page. This map is adapted from Lawrie (1987) and added to from the findings of this survey. The soil map is based on subsoil conditions and boundaries between areas should be taken as indicative only.

While soil classification and mapping is not the purpose of this exercise soils showing a Blacktown heavy clay subsoil or intact yellow earthy clay subsoil could be described as Scalpic Cumulic Anthroposols indicating a natural soil that has lost is topsoil (scalped) and then had it replaced by human means (cumulic). The rest of the profiles could be described as Urbic Anthropic Kurosols (man made soils in urban environments showing a strong texture contrast between A and B horizons ie a sandy loam A horizon and clayey fill B horizon. In the Fig tree avenues the prefix “hortic” could be attached to indicate unusual accumulation of organic matter and nutrients. This attempt at classification broadly follows the system of Isbell (1996) for the description of anthropic soils.

An outstanding finding that adds to those of Lawrie is that most of the soils along the Eastern side of the park show intact remnant clay B horizons or C horizons typical of Blacktown Podsolic soils. These are heavy clay based soils showing reddish B horizons in well drained positions, yellowish in less well drained positions and variously gleyed or mottled white and gley colours in poorly drained positions.

The fact that the NE side shows more reddish and yellowish colours and the SE side more gley and white colours indicates poorer drainage in the SE especially on the very flat areas. At S7 there are actual indications of gleying, or hydrophilic conditions.

QuickTime™ and a
TIFF (LZW) decompressor
are needed to see this picture.

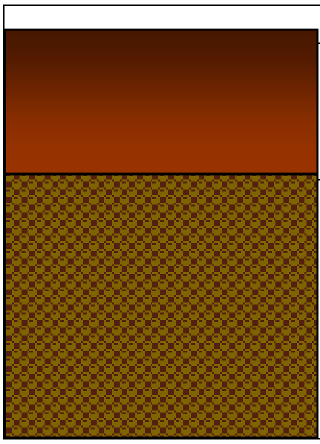
The only other profile in this survey showing some intact subsoil characters is N4 on the NW side and this is most definitely a subsoil of the Hawkesbury sandstone type sandy clay of a dull yellow colour as noted by Lawrie (1987). There is even a remnant of sandstone topsoil here showing a fine sandy loam character and dull yellowish brown colour.

Human activity leading to total destruction of the natural soil profile can be predicted to have occurred at all other locations shown as anthropogenic stony sandy clay. Its geology is not consistent and is jumbled. These broadly coincide with the route of the underground railway and the major building works associated with the Anzac War Memorial to Archibald Fountain "spine" of the park, kiosks and walkways and possibly the intrusion of Park St and filling of retaining walls along College St. It is possible the remnant soils occur deeper in some locations but identifying these is not within the scope of this report.

While minor garbic inclusions are seen throughout the disturbed soils (mostly glass, pottery etc with little or no plastic and more modern inclusions) nowhere were intense garbic accumulations seen. As such contamination with slags, ashes and other such material that can contain phytotoxic contaminants is not expected to be a major problem.

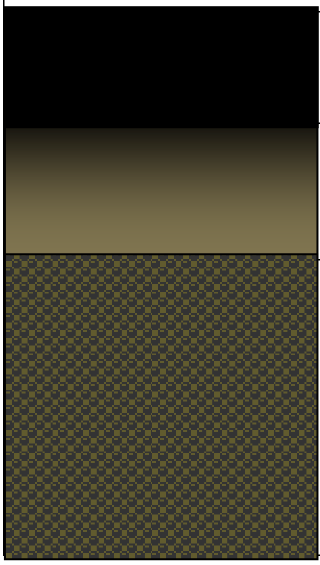
The typical profile form of the Hyde Park Urbic Anthropic Kurosol is given in Figure 1 in schematic form.

Figure 1. *Profile typical of Urbic Anthropic Kurosol in turf areas*



Depth mm	Description
200-300 mostly 200	Dark brown sandy loam usually lighter with depth. strong crumb structure. Highly porous. The very surface may be compacted mostly not at depth. Mostly good grass cover. Much tree root activity, worms.
300-600/700	Mixed and variable fill. Sandy loam to sandy clay loam, clay lumps, much sandstone, lenses of sand. Root activity more prevalent if sandier. Sometimes intact subsoil at around 500mm.

Figure 2. *Typical profile of the Hortic soils under the Fig Avenues*



Depth mm	Description
50-150mm	Dark brown to black humic layer, well structured and porous, much worm activity. Much roots at the boundary to layer below
50/150 to 200/350	Dark greyish brown sandy loam. Compact with little structure. Little porosity. Moist to wet with some “off” odours. Much tree root activity mainly in the surface.
200/350 to 600/700	Mixed and variable fill of dark grayish brown. Sandy clay loam, clay lumps, much sandstone. Little root activity more prevalent if sandier. Usually damp or wet with “off” odours.

Figure 3 (see following page) provides a photograph of the excavated profile from N5 location where *F. hillii* was previously removed.

4. Physical Properties

Appendix 10 gives the full chemical and physical test results for all sampling locations. For the purposes of subsequent discussion, pertinent or unusual properties are selected and summarized in the following text.

4.1 Topsoil Properties

A layer of around 200 to 300 mm deep of dark brown coloured sandy loam topsoil was present throughout the park in most locations. Its permeability, density and moisture content are given in Table 2.

Some important conclusions arise from these comparisons-
• Organic matter levels are significantly higher than almost any natural soil indicating high cation exchange capacity and all the other beneficial properties associated with organic matter. The relatively low coefficient of variation shows they are uniformly high OM contents.
• Densities are not excessive for the most part and show a very low coefficient of variation. These are the true bulk densities of saturated soil. The waxed block density figures are not treated here but are always higher as they are performed on shrunken

dry clods. A mean of 1.2 g/cm^3 is a remarkably low density for an urban park and is a testament to the quite suitable particle size relations.

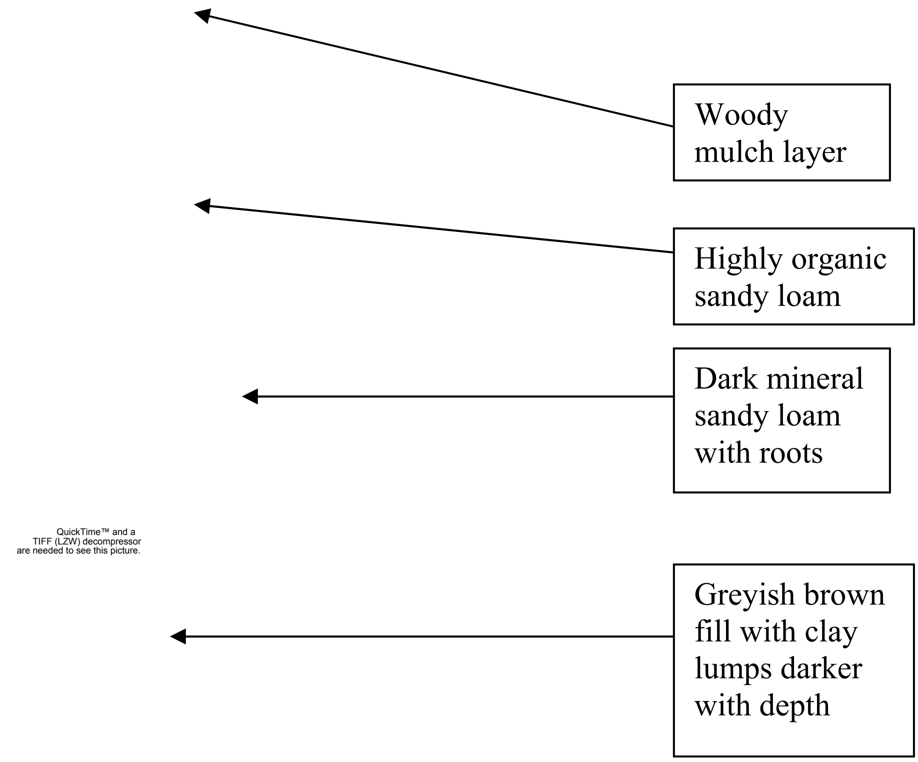


Figure 3. *Profile at N5. Note very shallow topsoil layer to clayey fill.*

Table 2. *Selected Physical properties of the sandy loam topsoil.*

Sampling Location	Organic Matter %	Density of cores g/cm3	Ksat cm/hour of cores	Silt plus Clay content %	Silt + clay minus OM
N1	6.97	1.23	3.4	16.3	9.3
N2	7.90	1.24	1.80	22.8	14.9
N3	7.30	1.11	6.5	18.7	11.4
N4	9.37	1.34	0.60	20.7	11.3
N5	8.54	1.57	0.24	22.8	14.3
N6	6.78	1.25	1.70	14.5	7.7
N7	6.97	1.30	6.24	19.3	12.3
N8	3.83	1.49	1.40	10.1	6.3
N9	2.22	1.61	10.4	9.0	6.8
N10	6.23	1.17	21.5	14.6	8.4
S1	10.74	1.18	10.1	23.4	12.7
S2	6.80	1.23	4.7	34.2	27.4
S3	21.4	0.72	33.5	6.1	NA
S4	7.81	1.29	4.60	23.8	16.0
S5	10.3	1.16	20.0	16.2	5.9
S6	6.80	1.30	2.46	16.5	9.7
S7	9.90	1.19	2.60	19.6	9.7
S8	7.11	1.31	24.6	9.2	2.1
S9	8.71	1.02	14.7	25.0	16.3
S10	8.18	1.09	6.72	24.4	16.2
Means [1] n= 16	**7.99** sd= 1.41	**1.21** sd= 0.089	**8.26** sd= 7.72		**11.9** sd= 5.68
CV %	17.6	7.3	93.5		47.7

1. Excludes S3, N5, N8, N9 which are the fig trees sample locations. These will bias the stats as they are unusual in having high OM and low densities.

NA: Not applicable, OM and particle size samples not from the same depth.
CV : Coefficient of variation = sd/mean x 100.

• Particle size relations as shown in the silt plus clay content are mostly suitable for urban park use and correlate with field textures. The heavier soils, for example N2 and S2 correspond to the more loam topsoil textures. S9 and S10 are interesting in showing higher silt and clay but lower densities. These particular locations appear to take less traffic than some others which may explain the low density in an otherwise unsuitable texture. S8 which is newly constructed loamy sand profile clearly shows the lowest silt and clay and correspondingly high permeability.

• Surface soil permeability (Ksat) results are on average quite acceptable for a heavily used park. They compare favourably with the Australian Standard AS 4419 requirement of 2 to 100cm/hour and with SESL criteria of a minimum of about 20 cm/hour for new soils mixes with a view to obtaining a minimum of 10 cm/hour in long term use.
• Mean silt and clay contents (adjusted by subtracting organic matter) generally appear to be within the normal range for sandy soils recommended for compaction resistance. Importantly the wide coefficient of variation indicates some samples, and areas that show excessive silt and clay contents. These are the area around S2 and S4, including S1 to some extent where a heavier loam exists, and the area around N2. Field descriptions point to heavier textures here also. The area around S2 was noted as particularly heavy, wet and gleyed. All of these areas are showing wear from compaction.

The Fig tree avenue samples were kept out of the statistical treatment since they show anomalous results and horizons that do not correspond to normal topsoil. For example the S3 sample shows very high organic matter and correspondingly very low density and remarkably high permeability. While this might be true for the surface highly organic layer the N5 sample taken lower down in the true mineral horizon shows high density, low permeability and high silt and clay. The picture is one of a highly permeable, friable and organic A_0 horizon overlying a dense impermeable mineral A_1 horizon.

Aggregate stability classes (Emerson Aggregate Class) fall within the highest two categories Class 7 and Class 8. These are highly stable aggregate classes and are almost certainly due to a combination of lack of sodicity and high exchangeable calcium levels as well as high organic matter contents. This is an ideal class type for urban soils.

The results for the park as a whole, excluding the Fig avenue samples, show topsoil layers of suitable depth, good physical structure, remarkably low density and acceptable permeability.

By analysing moisture content data more closely some trends emerge. These are given in Table 3.

Ideally moisture tensions should be used to compare samples but this is difficult to measure. By converting moisture contents to a volume basis we can at least eliminate the variability of density and better compare samples. Nevertheless some important comparisons can be made-
• The dry locations at N2 and N9 stand out clearly
• These can be further extrapolated by taking the mean of all samples on the Eastern side of the avenue in Hyde Park North and comparing it with the mean of all on the Western side. The East side mean is 16.4% v/v and the West side mean is 26.6%, a

significantly higher figure. Such trend is not obvious on the South end due some anomalously wet samples (eg S2).

Table 3. *Moisture and density relations of the topsoils.*

Sampling Location	Field MC w/w	Density of cores g/cm^3	Field MC by volume %
N1	19.0	1.23	28.9
N2	8.7	1.24	**11.8**
N3	17.5	1.11	23.5
N4	14.3	1.34	22.4
N5	16.5	1.57	30.9
N6	10.3	1.25	14.4
N7	15.4	1.30	23.8
N8	15.3	1.49	27.0
N9	6.5	1.61	**11.1**
N10	14.1	1.17	21.2
S1	11.6	1.18	15.5
S2	24.4	1.23	39.6
S3	44.1	0.72	56.9
S4	10.8	1.29	15.6
S5	11.1	1.16	14.5
S6	15.9	1.30	24.6
S7	13.9	1.19	19.2
S8	11.6	1.31	17.3
S9	17.2	1.02	21.2
S10	14.3	1.09	18.2

Notes: topsoils described as dry in field notes are coloured brown and soils with greater than 25% moisture blue for highlighting purposes. *F. hillii* avenue samples are in BOLD.

• The wetness of most of the other fig tree avenue sample locations (in bold) apart from N9 is immediately apparent. Differences between the samples are due to textural differences.
• The significant wetness of S2 stands out in field notes also. This area showed a gleyed subsoil indicative of past or present hydromorphic (swamp soil) conditions.

4.2 Hydraulic Conductivity and Bulk Density Curves

Results, known as Hydraulic Conductivity and Bulk Density Curves (HCBD) are given in Appendix 10.4.

These test results are specifically designed to demonstrate how a soil will behave in playing field or heavily trafficked conditions. Bulk samples are packed into a series of 6 tubes and subjected to increasing amounts of compaction right up to about 90% compaction levels then its hydraulic conductivity and density measured. Results should correlate with field permeability measurements but are usually higher than the field results. This is due to the inevitable sorting and plugging of the surface of field soils that occurs under rainfall.

Taking the minimum permeability reading from the HCBD curve (usually the maximum compaction levels but not always) we find a mean of 15.6 cm/hour for the repacked HCBD curves and 8.89 cm/hour mean for the field cores. If the minimum target permeability were say 5cm/hour (a reasonable compromise) for park soil, then it can be estimated that about 1/3 of the soils will fail this. Interestingly none will fail the minimum requirement of 2cm/hour from AS 4419 even when fully compacted.

Permeability is closely related to texture. For locations N2, S1 and S2 where soil texture is heavier, giving loam fine sandy textures, the curves drop off steeply giving minimum permeabilities of 5 to 10 cm/hour. If puddled and abused when wet it is conceivable that these soils would fail the minimum 2cm/hour from AS 4419.

Other curves, for the sandy loams, are flatter showing less reduction in permeability for increasing density. S8 with its very sandy texture is a classic example of the behaviour of sandy material and a good example of why sandy textured soils are so important in heavily used parks.

Generally the results again indicate a good quality topsoil of a very sandy nature with high organic matters leading to stable structures. The triangular blocks around around N2, S1, and S2 are probably of most concern combining as they do heavier textures with very high pedestrian traffic loads.

Physically topsoil samples for the most part are not excessively compacted and of a suitable texture. The only exception here is along the Park St front of Hyde Park South where more silty and heavy loam textures combine with high pedestrian traffic levels to produce excessive densities.

The moderate density levels mostly give rise to reasonable surface permeability levels within the requirements of AS 4419. Repacked permeability results give higher permeabilities than intact cores indicating surface plugging of pores resulting from silt and clay sorting. This does not occur where grass cover is good as this prevents such sorting.

Only in very heavily used "desire lines" could excessive density and compaction be seen as limiting for the growth of tree roots in general. Where tree roots were encountered they were almost universally in the surface 250/300mm of sandy organic loam topsoil.

5. Chemical Properties

A range of chemical test results relevant to general agronomic performance were undertaken. These are given in Appendix 10.3. These included a standard package of-
pH and Salinity
Cation exchange properties
Available phosphate and phosphate retention index
Available nitrogen and sulphate
Extractable or notional "available" trace elements iron, zinc, copper, manganese, and boron.

A range of other tests were performed on selected subsoils including pH, salinity and cation exchange properties. Some additional tests for organic matter on some very high organic matter samples found in the *F. hillii* avenues were included also.

5.1 Topsoil Properties

In general the soils are reasonably well balanced chemically and show no salinity or gross abnormality that would be associated with acute stress and demise of trees. The exceptions are where physical conditions have lead to obviously elevated iron and manganese levels as discussed below and also some identifiable nutrient deficiencies.

Under the following headings are discussed the chemical conditions likely to be most limiting to the growth, development, and longevity of the tree cover.

pH and Exchangeable Ca

The normal pHs and ratios of exchangeable cations for healthy productive soils are fairly predictable as are the anomalies and pathologies associated with human interference in soil systems. Such interference in an urban context is quite predictable and occurs as a result of deliberate additions of fertilisers and ameliorants (eg manures, lime and gypsum), or accidental additions such as from dust and, very commonly, cement and concrete contamination of soils.

The accumulation of excess calcium and a rise in pH to neutral or alkaline levels is the most common form of anthropic contamination in soils and occurs from the widespread use of cement, mortar, plaster and other lime containing materials. Such soils often show in excess of 80% exchangeable calcium and pHs well above the normal for the regional soils.

In their natural state it would be expected that the soils of Sydney and any soils imported for topsoiling purposes would have a pH of below 7. Any pH above 7 would be considered most unusual and almost certainly a result of anthropic activity. Table 4 qualitatively divides the soils into groups based on pH and exchangeable calcium percentage.

Table 4. *Summarised pH and Calcium Conditions*

1	2	3	4
Acidic and Ca deficient in the subsoil	Mildly acidic and not calcium deficient	Near neutral to Alkaline but not highly calcic	Alkaline and Calcic throughout the profile
S2, S9, S10, N2	S1, S4, S6, S7, S8, N1 (subsoil calcic), N3, N4, N6, N7, N10	N5, S3,	S5, N8, N9.

As can be seen the largest population of soils falls into category 2 which is the optimal range for most plant material. Interestingly S10 and N2 are two of only four profiles to show natural soil features at depth. The severe acidity and calcium deficiency of the subsoils at N2 and S10 are good evidence supporting the conclusion of natural subsoil. Category 3 soils may have been altered to some extent and category 4 soils have definitely been contaminated with calcium and alkali either accidentally or deliberately.

An important conclusion is that all of the category 4 soils are in the *F. hillii* avenue. This effect may be a result of the massive disturbance following trenching for the railway tunnel where no doubt large amounts of cement dust and washings may have contaminated the soils, or could be a result of the accumulation of calcium from the imported topsoil and/or use of fertilizers and organic matters.

Fortunately the *F. hillii* avenue soils are not so alkaline and severely calcic that dire predictions of trace element and other deficiencies could be made.

The severe acidity of subsoils at N2 and S10 may need some consideration.

Phosphate

Phosphate levels vary considerably but, interestingly for such an old park with a long history of horticulture, are more usually on the low side of optimal and in only one position (S8 which is obviously a very new turf installation), excessive. This can be illustrated by taking averages of various areas from the results as in Table 5.

Table 5. *Available Phosphate by Area*

Sample population	Whole Park Mean n=20	All *F. hillii* n=4	All Non Ficus n=16	All Non Ficus rejecting new turf n=13
Available P mg/kg	23.7	40.4	19.6	10.1

These simple statistical treatments show that the high phosphate levels are definitely concentrated along the *F. hillii* avenue samples taken and in areas such as S8 and N6 where recent turf renovation has occurred, likely accompanied by fertilizer use.

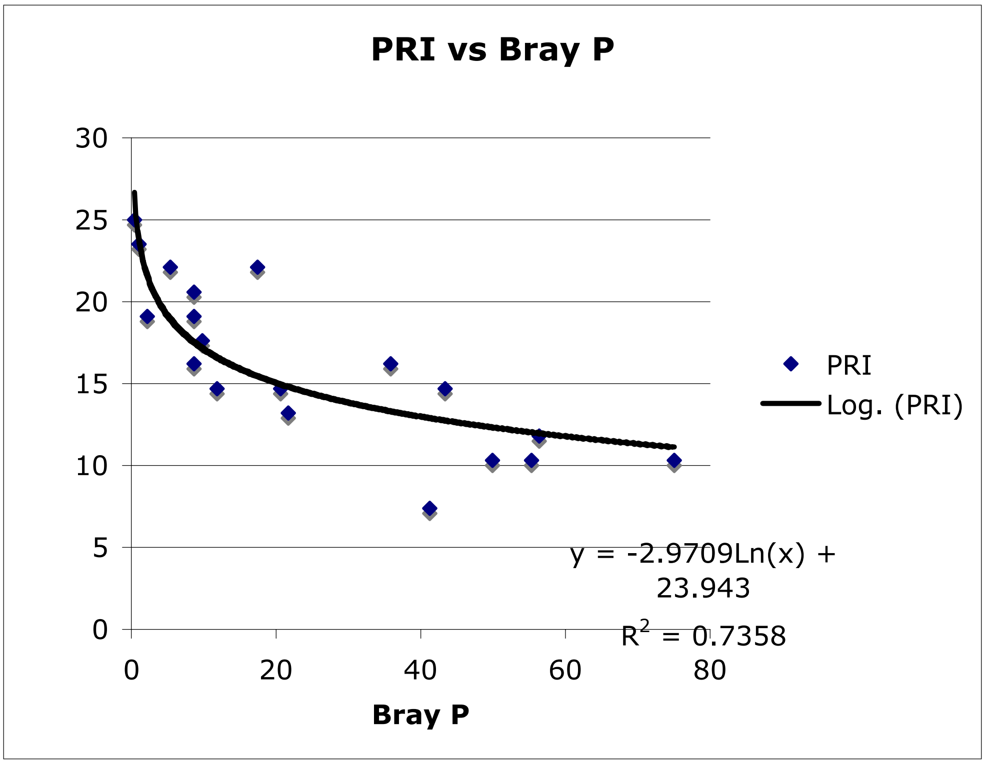
It should be recalled that the mean of 10.1mg/kg for the “old” turf surfaces means that half the samples will be below this level. In advisory work we would generally recommend 20-30 mg/kg for a high use turf and garden situation. On that basis it is possible to say with only two or three exceptions that most of the park shows deficient P levels for good turf vigour. Given that turf competes so avidly with trees the conclusion could be even worse for mature trees.

These simple statistics clearly illustrate the higher P levels under the *F. hillii* avenue where mulches, fertilisers and perhaps composts and soil improvers may all have contributed to increased P levels. Also obvious is the overall low P level for soils in most areas if we attempt to reject those few spots which may have been subject to recent soil works or fertiliser additions.

The results illustrate that phosphorus deficiency is more likely to be causing stress on vegetation than phosphorus excess. The exception is the Fig avenue where P levels are about right and neither deficient nor excessive. The results contrast with those of Lawrie (1987) which showed much higher P levels. Lawrie suggests this might be due to recent use of P fertilizer at the time of his survey.

Another indicator of low available P levels is the Phosphate Retention Index. In this test soil is shaken with a known phosphate solution and the reduction in solution phosphate measured. Soils that greatly reduce solution P levels are likely to cause significant phosphate deficiency. Soils already "saturated" with phosphate show little P retention thus the two are inversely correlated. This can be seen in Figure 4 which shows a reasonably significant inverse logarithmic correlation (R^2=0.74).

Figure 4. *Logarithmic Correlation of Bray Available P vs Phosphate Retention Index*



Iron and Manganese

The availability of iron and particularly manganese is determined largely by the redox potential (degree of oxidation vs reduction in the soil) which is controlled mainly by the amount of oxygen in the soil atmosphere. pH is also an important availability determinant but more so for iron than for manganese. Thus the amount of extractable manganese is often closely related to the redox potential and degree of aeration of the soil. If anything limits oxygen entry into soils, such as being compacted, too wet, or having excessive organic matter levels that cause oxygen depletion, raised manganese extractability is commonly seen.

Iron and manganese availability is summarised in Table 6.

Table 6. *Iron and Manganese Availability*

	"Available" Iron	"Available" manganese
Mean of "damp" *F. hillii* topsoils n=3	399	37.9
Mean of all other "dry" topsoils n=17	365	10.8

F. hillii avenue soils showing damp or wet conditions (all avenue positions except N9 which was quite dry and well drained) show a marked increase in available manganese. The increase is less marked for the iron result although iron certainly appears slightly higher in the damp positions. The fact that Iron solubility is more strongly influenced by pH than manganese possibly explains the observation as these soils were also alkaline, reducing Fe solubility.

The observations of higher available manganese coincide with profile observations which showed a damp profile often with "off" odours or "steely" odours, grey colours with lack of any red oxide piping or mottling and a complete lack of structure, and high densities in the subsoil. Grey colours and "off" odours are indicative of reducing conditions. Red or rusty coloured staining especially down cracks and voids and old root pipes is evidence of oxygen diffusing down these larger pores and cracks. Their absence and the uniform steel grey colour of the soil indicates the absence of oxygen. The lack of roots in these grey and compacted layers and indications of roots growing only above about 200mm are strong indications of anaerobic conditions.

Anaerobic conditions at shallow depth in soils are caused by the following factors-
• excessive organic matter causing a biological oxygen demand (BOD)
• low total pore space (compaction and lack of structure)
• lack of macropores (poor soil structure)
• water filled instead of air filled pore space (excessive soil moisture excluding air)

In the case of most of the *F. hillii* avenue it appears that a combination of all four factors are occurring resulting in a very severe inhibition of rooting depth. Fig tree roots need high soil oxygen levels and are very intolerant of oxygen stress. The trees respond to such soils by developing very shallow root systems up in the aerated zone. Such trees can develop and grow very well but a number of disadvantages to tree longevity occur-
• increased susceptibility to fungal pathogens, a number of which (Phytophthora and Pythium for example) are known to favour low soil oxygen levels and high moisture status.
• increased activity of saprophytic fungi in any dead wood exposed as a result of cambium damage, damage to the stele (root bark) by trenching for services, pathogen intrusion, etc.

• generally reduced structural stability of a larger tree with very shallow root system especially if combined with pathogenic and saprophytic fungal intrusions.

An “overmature” tree in such a situation would be at increased risk of instability since the very shallow rooting depth results in a “top-heavy” structure prone to catastrophic damage.

Potassium

The other outstanding chemical property is low exchangeable potassium content. Expressed as a % of the cation exchange capacity (exchangeable potassium percentage) we would normally recommend 5 to 15% exchangeable potassium, the lower figures for heavy clay soils. Where soils are sandy and light textured our general recommendation is for least around 7% exchangeable potassium.

Table 7. *Exchangeable Potassium Levels*

South	**Deficient <3.0**	**Marginal 3-5**	**Sufficient >5**
Topsoil means	**2.20**	3.37	5.88
Samples included	S1, S2, S3, S4	S5, S8, S10	S6, S7, S9
All Subsoil mean n=6	**1.18**		
North			
Topsoil means	**2.97**	4.15	6.20
Samples included	N2, N3, N8, N10	N4, N9	N1, N5, N6, N7
All Subsoil mean n=4	**1.12**		

The results strongly suggest that potassium is deficient to marginally deficient in most soils with only 7 out of 20 samples showing sufficient levels. All subsoils are highly potassium deficient. There does not seem to be any particular spacial trend to the deficient potassium levels except perhaps that of the *F. hillii* positions only one out of four shows sufficient levels and two out of four show clearly deficient levels the remaining position (N9) being marginal.

One cause of such deficiency may be that over time, with the constant removal of leaf litter and forest fall to maintain appearances in a park setting, it is possible that a net loss of potassium occurs from the system which is not being made up by fertilizer inputs. Examining records of fertiliser use could throw some further light on this aspect.

Where potassium levels are deficient in soils increased susceptibility of crops (including some tree crops) to Verticillium and Fusarium wilts has often been demonstrated (Jones Engelhard and Woltz 1989 and Pennypacker 1989). Glendenning (1999) states that there is much evidence in crop research work that potassium has a beneficial effect on the incidence of root diseases.

Extrapolating these findings for crop fungal diseases to the root rot diseases that affect trees may not have a sound basis in research but given the widely differing genera of crop plants in which this has been demonstrated, the low cost of making a potassium application to an urban park and the lack of any likely adverse effect from applying potassium it is certainly worth correcting the deficient potassium levels.

Potassium deficiency was noted by Lawrie (1987).

Nitrogen

The soil tests performed measure only the pool of mineral nitrogen readily available for plant uptake. These are ammonium and nitrate nitrogen, woody plants usually preferring the nitrate form. Mean nitrate N content is 10.4 mg N/kg soil with results varying from a minimum of 4.1 to a maximum of 25.

Nitrogen availability data is not readily interpreted for the needs of woody perennial plants, most experimental data having been gathered for annual crop plants. For crop plants recommendations vary from around 10-20mg Nitrate N/kg being considered the bottom limit for certain grain cropping and 60mg/kg being considered excessive for maximum Lychee plantation yield (Strong and Mason 1999).

On the basis of comparison with the needs of agricultural crops it would appear that nitrate levels are generally low. Such a conclusion must be carefully assessed in regard to the needs of trees. Maximum growth rate or “yield” is not necessarily the aim of park tree management and stimulation of growth by nitrogen fertilizer application can be undesireable if it leads to excessive canopy growth. In comparison with natural forest and pasture soils that SESL have measured over many years a mean of 10.4mgN/kg exceeds most expectations.

Lawrie (1987) noted that given the high organic matter levels in most soils (as found here also) nitrogen was unlikely to be severely deficient. This arises because one of the determinants of long term nitrogen supply is the C/N ratio. Where soils have a large C pool they are also likely to have a large N pool.

Since no correlation exists between phosphate and nitrate levels there appears to be no immediate connection between high phosphate and high nitrogen availability. This could also be related to drainage and soil aeration. It is known that in waterlogged soils N is lost by denitrification. One of the early effects of poor soil aeration is nitrogen deficiency. N8 for example, in a highly humic and damp soil in the *F. hillii* avenue, shows only 2 mg/kg of ammonium and 4.1 mg/kg of nitrate, very low levels.

It is also possible that highly competitive turf grasses actually deprive trees of what nitrogen is in available form. It is also possible that what fertilizer use has occurred has focused on the needs of turf rather than that of trees.

Sulphur

Sulphur is similar to nitrogen in that most of the soil S reserves are tied up in organic forms and not seen as sulphate S in soil tests. Nevertheless some mineral sulphate S should always be present and the low and in most cases very low levels of available S (in most soils less than the detection limit of 5 mg/kg) give rise to a concern that S is on the whole deficient for rapidly growing or stressed plants.

Trace Elements

It can be stated with certainty that iron, manganese, and certainly zinc and copper are not limiting in these soils. In fact zinc and copper levels are higher in most cases than would be expected in non urbanized natural soils. Zinc often accumulates in urban soils from a range of human induced practices and of all the trace elements zinc is the one most likely to produce toxicities. Only in two places, N8 and N9, *F. hillii* locations, could zinc and copper be considered low. This is obviously not unique to the *F. hillii* avenue as a whole since S3 and N5 do not show low levels.

In at least 1 location, N9, zinc is verging on levels (86.3 mg/kg) that have produced toxicity symptoms in woody vegetation in our experience.

Boron in the hot water soluble extract is considered to be adequate for the needs of most crop plants at 0.5 to 1.0 mg/kg. In only one location, the new sandy rootzone soil at S8 was a lower level than this found. Boron toxicity can occur in susceptible crop plants at a hot water soluble concentration of 3-5 mg/kg (Srivastava and Gupta 1996). In only one location at S3 *F. hillii* avenue was a concentration exceeding 3.0 mg/kg (3.6mg/kg at this location) found.

In general it can be concluded that boron is neither deficient nor toxic in the park as a whole. Certainly a conclusion of severe boron deficiency or widespread toxicity, could not be supported.

5.1.2 Summary of Physical and Chemical Properties

Loamy sand to sandy loam textures are the most resistant to compaction and are usually chosen in heavily trafficked situations for the purposes of better turf management. Incidentally, such porous materials also are advantageous for tree root growth and where such root growth was encountered it was most prevalent in the A horizons. Loams such as at S1 and N2 are more prone to compaction. The fact that sandy loams dominate the surface and show remarkable similarity across the park is beneficial.

General cation exchange capacity, pH and salinity balance are reasonably favorable for turf and park tree growing conditions. The only exceptions are the acidic subsoil conditions in many soils along the east side of the whole park. These were also identified by Lawrie (1987). pH and calcium conditions are excessive in most of the *F. hillii* avenue soils due to the presence of some limey materials but these would not warrant predictions of severe problems in *F. hillii*. From the past growth and condition of trees it would seem that they are tolerant of mildly alkaline soils. Excessive calcium may however lead to a gradual loss of potassium displaced from the cation exchange capacity and leached or removed in tree litter.

Organic matter contents are generally high and this is seen as favourable except in the surface 50-100mm of the *F. hillii* soils where organic matter is so high as to justify the horizon code Ao to denote an organic A horizon. Excessive organic matter contents can disrupt aeration and trace element availability.

Potassium deficiency is widespread in the park with no particular spacial trends except that the *F. hillii* avenue soils are mostly low. Levels are possibly not low enough to see acute potassium deficiency symptoms but are certainly low enough in some areas to result in subclinical symptoms of reduced growth rates, susceptibility to fungal disease and reduced root growth. The only *F. hillii* location showing apparently sufficient levels was N5. This may be a result of the use of green waste mulch which is known to be high in potassium. Since this mulch is no longer to be used and net export of potassium in grass clippings, prunings, and leaf fall continues, a potassium improvement program is indicated. No potassium levels seen could be described as excessive.

A similar picture emerges for phosphate with possibly 1/2 to 2/3 of samples showing lower phosphate availability than could be considered adequate for high use parks. Phosphate retention index measurements show significant P retention by all soils indicating that by no means are the soils “saturated” with P and that vegetation must work fairly hard to exploit the soil P reserves. The only exception is the *F. hillii* avenue which generally shows adequate levels and lower P retention. Thought should be given to strategic increases in soil phosphate levels.

Nitrogen is generally present in all samples as both ammonium and nitrate. It is unlikely that specific targeting of trees with nitrogen is required to overcome deficiency. It is also unlikely that distress symptoms in several trees are due to acute N deficiency. It could be unwise to stimulate excessive foliage growth by fertilizing trees with nitrogen.

Sulphur levels on the whole are low to very low in all locations and sulphate is an important nutrient for turf appearance and vigor and for leaf growth.

The trace elements iron and manganese are normally adequate but in the damp organic soil of the *F. hillii* avenue elevated iron and manganese levels may correlate with slightly or strongly anoxic soil.

In only two locations (N8 and N9 of the *F. hillii* avenue) zinc and copper are more than adequate if not slightly excessive. Why zinc and copper are low under locations N8 and N9 is not known, the rest of the avenue is certainly not deficient. The high levels in the majority of samples can be explained by urban pollution and long use of fertilizers. The need for trace element is often greatly exaggerated in commercial fertilizers and annual use can result in the build up of excessive levels. A general program of controlling further trace element input to the landscape is to be recommended.

Boron is not likely to be at either deficient nor toxic levels in the park as a whole.

All toxicity index results (bioassay using radish seed root length from AS 4419) show uninhibited root growth in all topsoil samples.

5.3 Subsoil Properties

The most important finding relevant to tree growth and longevity is the identification of compacted impermeable subsoil leading to wet conditions under most of the *F. hillii* avenue plantings. This was also identified by Lawrie (1987 and 1991). During Lawrie's survey, following heavy rain, the subsoil was actually ponded with a perched water table showing in many holes including those of the Fig tree avenue. Despite this sprinklers actually came on during the rain (Lawrie pers comm.). The other area of concern, also identified by Lawrie (1987) is an area of grey or gleyed clay on the Eastern side of Hyde Park South.

While subsoil conditions over the park as a whole are often not ideal and are likely to restrict rooting depths, particularly along the eastern side where heavy acidic clay underlie the area, there is little that can be done about this for existing plantings. For new plantings there are many practical interventions involving modification of the subsoil that will lead to a better developed root system.

Rectification of subsoil drainage along the existing Fig tree avenues provides some challenging technical difficulties.

6. Conclusions

While the purpose of this report is not to provide a soil survey, data collected here can be added to that of Lawrie (1987 and 1991) to provide a fairly complete picture of the soil landscape of the park. Soil profiles can be mapped based on the properties of subsoil.

Topsoil physical conditions are generally seen as favourable for an urban park of this type. Permeabilties are not severely low and densities are not excessively high. The two exceptions are the very North East corner and the section of South Hyde Park facing Park St where loams rather than sandy loams show some compaction and wear.

Some clearly identifiable physical and chemical problems for trees can be identified-

• The most difficult subsoil conditions are provided by the “anthopic fill” and “grey clay” subsoil types. Both of these severely limit downward movement of water and lead to frequent ponding and wet conditions.

• Of particular concern is the very poorly aerated soil profile under virtually the entire *F. hillii* avenue. Subsoil here is tightly packed anthropogenic mixed fill. In such soil rainfall and irrigation will pond in the topsoil leading to acute anoxic stress. Aeration is further limited by-
- excessive organic matter levels leading to a high oxygen demand
- excessive irrigation
- unsuitable topsoil of a sandy loam nature but poorly structured and dense
- lack of any slope leading to ponding and lack of run off of incident rainfall
- poor internal drainage in the soil profile.

• A range of clearly identifiable chemical problems have been identified in Hyde Park –
- severe calcium deficiency and acidity in the subsoils of the eastern side coincident with the extent of shale based clay profiles
- significant areas of subclinical potassium deficiency.
- significant areas of subclinical phosphorus deficiency
- virtually universal sulphur deficiency.

7. Recommendations

7.1 Species selection

Adapting tree species and plantings to the particular soil problems posed by the site is one way of avoiding the need for costly soil modification. While sounding attractive this can severely limit choices. For example it may not be acceptable to replace trees in areas of poor subsoil drainage (*F. hillii* avenues and South East Quadrant) with those tolerant of poorly aerated soils such as *Melaleauca* and *Casuarina*. By looking wider, for example Swamp Cyprus (*Taxodium distichum*), acceptable species for the soil conditions may be found.

It is recommended that "heritage lists" do not confine plantings to those simply unsuitable for the soil condition. No matter how "heritage" the species may be there is little point perpetuating lists that grow poorly and have a shortened life span.

7.2 Nutrient Levels

Some very simple and important corrections can be made to nutrient levels to eliminate any possibility of deficiencies causing additional stresses on the trees. Ideally the efficacy of these additions should be checked, most usefully by foliage analysis before and after the additions are made.

Potassium and Sulphur

A single application of sulphate of potash is recommended to correct potassium and sulphur levels as well as an examination of fertilizer use in the park to ensure long term balance. Since there are no definable areas of particular deficiency and since excess potassium has little or no consequence, the entire park including all turf, shrub beds and garden beds, should be treated. Indications are that roots have colonized the entire park topsoil and there is no basis for treating only those areas near trees.

Calculations show that to bring the lowest potassium topsoils up to sufficient levels will require about 70g/sqm of sulphate of potash. This heavy application should be reduced to say 50g/sqm since not all topsoils are so low. Along the *F. hillii* avenue this should be increased to the full 70g/sqm.

These are rather heavy rates and should be applied in one or other of the following methods-

1. During the cooler months of low heat and evaporative stress and where soil moisture levels are high apply the entire amount followed within hours by hosing or rainfall to wash salt crystals off turf foliage.

2. If soil moisture levels are not high, temperatures are high or if watering is not available apply as a split application (applying half the amount at one application) at least one month apart.

Do not apply within 3 weeks of any other fertilizer application.

Following these applications soils should be re-analysed after 6-12 months for available potassium levels and foliage analysis used to check for positive responses. Further additions or corrections should be made as indicated by this testing.

The effectiveness of this application could be monitored by foliage analysis of good and poor specimen trees before and after the application.

Phosphorus

Except around any specimen or mass planting of species known to be sensitive to phosphorus toxicity (eg any member of the Proteacea or Rutaceae) and except along the *F. hillii* avenue a single corrective application of phosphorus is required to alleviate any possibility of phosphorus stress.

Apply Triple Superphosphate at 25 grams per square metre. Apply only in the cooler months when soil moisture levels are high and preferably wash off foliage of grasses to avoid any possibility of foliage burning. Ideally apply before rainfall is expected or during rainfall events. Do not apply within 3 weeks of any other fertilizer application.

7.3 Physical Improvements

The major source of stress for these trees is limiting soil oxygen levels brought about by an unsuitable soil profile having impermeable clay layers at remarkably shallow depth. This is exacerbated by inappropriate irrigation scheduling. Lawrie (pers comm.) informed me that when he was surveying in rain in 1991 holes filled with water and sprinkler systems actually came on while it was raining. Irrigation may be required occasionally but cannot be programmed via an inflexible schedule.

Three options are provided short of total removal and replacement of trees and soil. These range from some relatively simple steps aimed at shedding surface water, better controlling irrigation requirements and generally obtaining some drying out of the soil profile. With more certainty these steps could be combined with the installation by hand of strategically placed subsoil drains.

Before committing to any one particular program it is strongly advised that some trial work be carried out to assess the effectiveness of the three options on exiting trees. A simple technique for monitoring soil oxygenation levels is given by Hodge and Knott

(1993) where bright steel rods are driven into the soil to 600mm depth and left for some weeks or months. When the rod is extracted the presence and type of rust occurring on the rod is a reliable guide to effective rooting depth. Fundamentally if the rod does not rust oxygen levels are too low for root growth.

This technique could be used to assess the effectiveness of a trial period involving one or other of the suggested treatments before one uniform treatment were decided upon for the avenue as a whole. The trial should also involve assessment of tree responses and certain soil properties (eg pH, moisture content, perhaps Redox potential).

If, for example, the simplest treatment results in significant improvement in soil aeration and root/shoot response great cost could be avoided while still providing effective improvement of the rootzone conditions. It would be ideal if at least one highly stressed tree showing disease and decline symptoms could be included with a view to seeing if an effective turnaround in the conditions of such tree can be achieved.

The present shallow depth to impermeable or otherwise unsuitable subsoil is seen as the major impediment to root system development in the park. Improving such conditions for the *F. hillii* avenue plantings is seen as the highest priority but the same techniques suggested for them could be applied to any individual tree.

Emphasis is also placed on the preparation of planting holes for new tree plantings.

While turf care is not the purpose of this report, the type of topdressing and rooting medium provided for turf has an impact on tree roots also. A general recommendation is that all topdressing, coring, slitting or repair work employ Specification 1. Topdressing medium. Soil must never be used.

7.3.1 Rootzone Improvement and Planting Techniques for New Plantings

When new tree plantings are contemplated the opportunity exists to modify subsoil conditions to improve the root structure and function of the new planting. This can be done with individual specimen planting or in a trench type planting. The area to modify is open to some judgement but should in no case be less than 2m by 2m. The larger the mature form of the tree the bigger the area treated should be. For example with *F. hillii* or *F. macrophylla* planting an area 5m by 5m may be appropriate.

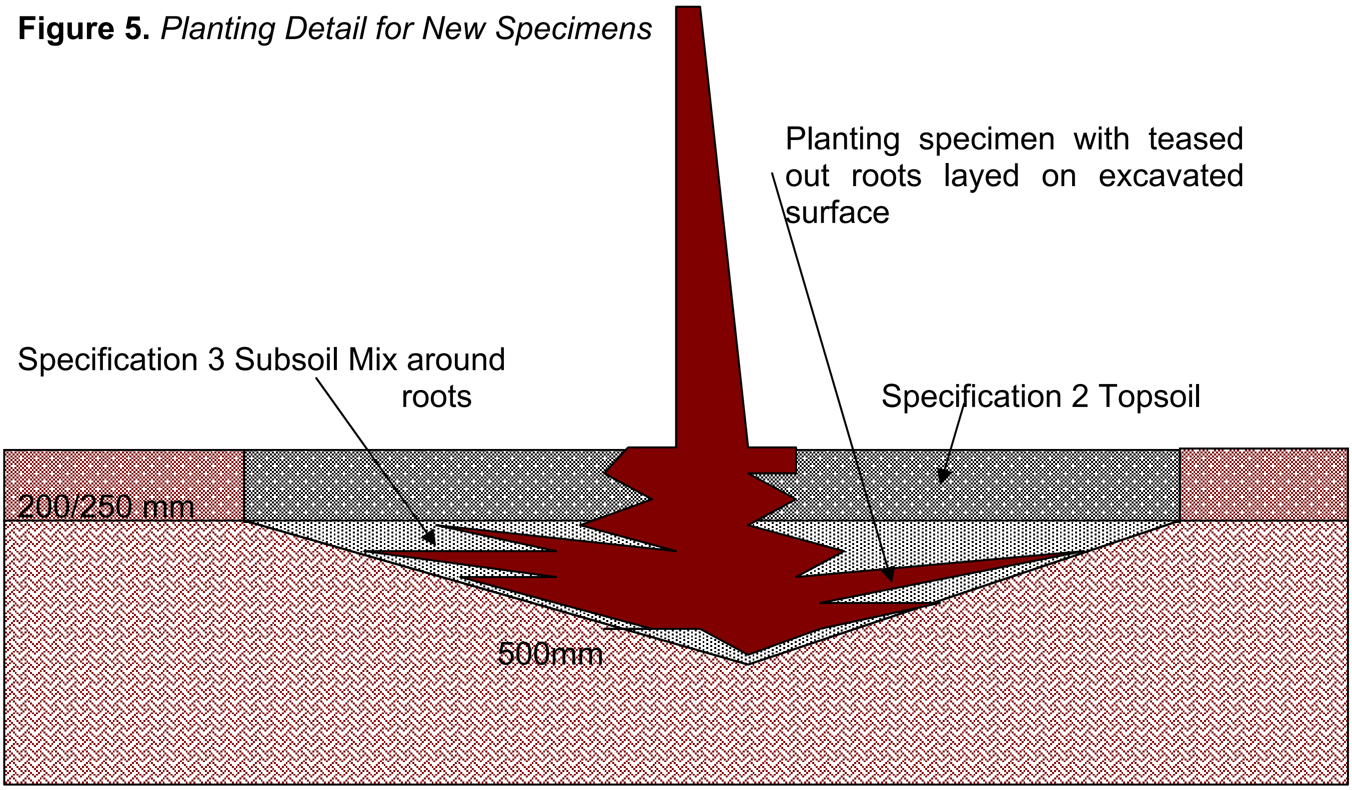
Refer to Figure 5 for planting detail. The method is as follows-

- remove the entire surface topsoil down to fill (usually 200-300mm) and keep aside.

• remove compacted wet or stony fill to at least 500mm from surface feathering toward the edges to meet the undisturbed area. Discard this fill.
• prepare the rootball of the tree by teasing roots out and reducing rootball depth to no more than 500mm (the depth of the planting hole)
• place plant in position and lay out teased roots evenly and as straight as possible spreading out away from the trunk to form a “star” or “cross” shape. • Stake the tree if required and hold firmly in position with the base of the trunk exactly at the finished ground level.
• Apply a long term slow release fertilizer at 50g/sqm of open excavated soil surface. This should preferably be a Nutricote product with an NPK ratio approximating 15:6:10 and at least 18 month release rate.
• Backfill the planting hole to within 250mm of the surface using Specification 3 subsoil medium hosing soil into the gaps under and around roots.
• Finish to current ground surface using Specification 2 Topsoil mix.
• Turf or mulch the finished surface as required. Preferably keep the surface area within 1-2m of the trunk free of turf and mulched for the first two years.

Also note the importance of teasing out root systems and spreading out roots prior to applying soil to prevent root girdles. It is not acceptable to simply place a pot with its circling roots into a planting hole. Planting holes must be wide and shallow, a small round hole combined with undisrupted root circling is disastrous to tree root systems in the long term.

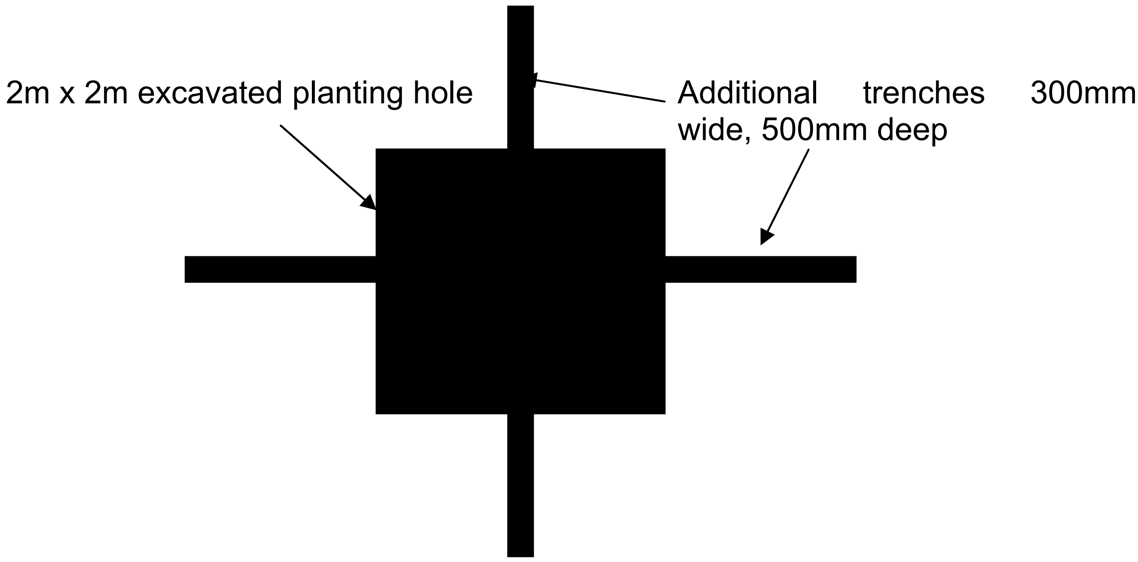
Figure 5. *Planting Detail for New Specimens*



Exiting sandy topsoil   Existing subgrade

Where subsoil is very heavy red or mottled grey clay as will be encountered on the North Eastern side of the park both north and south modify the planting hole by trenching using a small backhoe or “ditch witch” type of machine in four cross shaped lines extending a further 2m and 500mm deep away from the opened square hole (see Figure 6). Treat the cut clay surface with lime at 300g/sqm before planting and backfilling. Backfill using the two layered soil mixes as specified in Figure 5.

Figure 6. *Plan of Planting holes in heavy clay subsoils (Eastern Side)*



In the South Eastern quadrant of the park where soils are particularly poorly drained subsoil drainage may be required in addition to the above soil modifications. This presupposes that a stormwater access can be located to shed drainage water.

7.3.2 Improvement of F. hillii avenue rootzones, existing plantings

Losses of trees along the avenue in recent times, gives cause for concern about the appearance of the avenue. Planting young trees in gaps is often not satisfactory as they either do not grow or always remain stunted by the large trees around them. Horticulturaly the maintenance of tree avenues that are aging provides some real difficulties. It is understood that wholesale replacement of the Fig avenues is the least desireable option. Some alternative options are-

1. The cultivation of super advanced stock in nurseries or transplanting of large specimens to replace lost avenue plantings combined with the complete soil modification suggested below. This method could result in continued maintenance of the desired appearance of the avenue. It may need to be combined with judicious top-pruning of neighboring trees to provide space for the new one and reduce competition for light.

2. Removal and replacement in "blocks" of say 6 trees at a time, 3 each side of the avenue. This could be useful if groups of failing or sick trees occur together and should be combined with complete soil replacement as discussed below. If super advanced stock or large transplants were used the severe impact of removal could be mitigated.

Given the poor subsoil physical results and the obvious chemical problems in the *F. hillii* avenue there is every prospect of soil improvement works resulting in improved health and extended SULE of these trees.

Soil improvement work around existing plantings is not simple and must usually be done with great care by hand digging to avoid damaging roots as far as possible.

The following range of options is given in order of increasing certainty of improvement and of increasing cost.

"Soft" Option. The simplest option that should be instituted immediately involves better irrigation and surface water management and improvement in soil chemistry. The following point form analysis can be further detailed if required-

a. apply the sulphate of potash as detailed above
b. Remove underplanting and mulch to improve soil drying
c. Cease irrigating by predetermined program and move to supplementary irrigation strictly as indicated by soil inspection.
d. Install open grate drains close to the central pathway but in the garden beds to remove surface ponded water. These can probably be connected to existing drainage of the pathway.

"Harder" Option. With greater certainty of improving aeration conditions in the rootzone follow a to d above then-

e. Dig by hand two ditches about 300mm wide and 500mm deep about 2m either side of the trees, avoiding cutting any roots greater than 20mm diameter. Discard all excavated soil.
f. Install a 100mm slotted and socked ag drain in the bottom of the drainage trench terminating in a stormwater outlet at around 50m intervals.

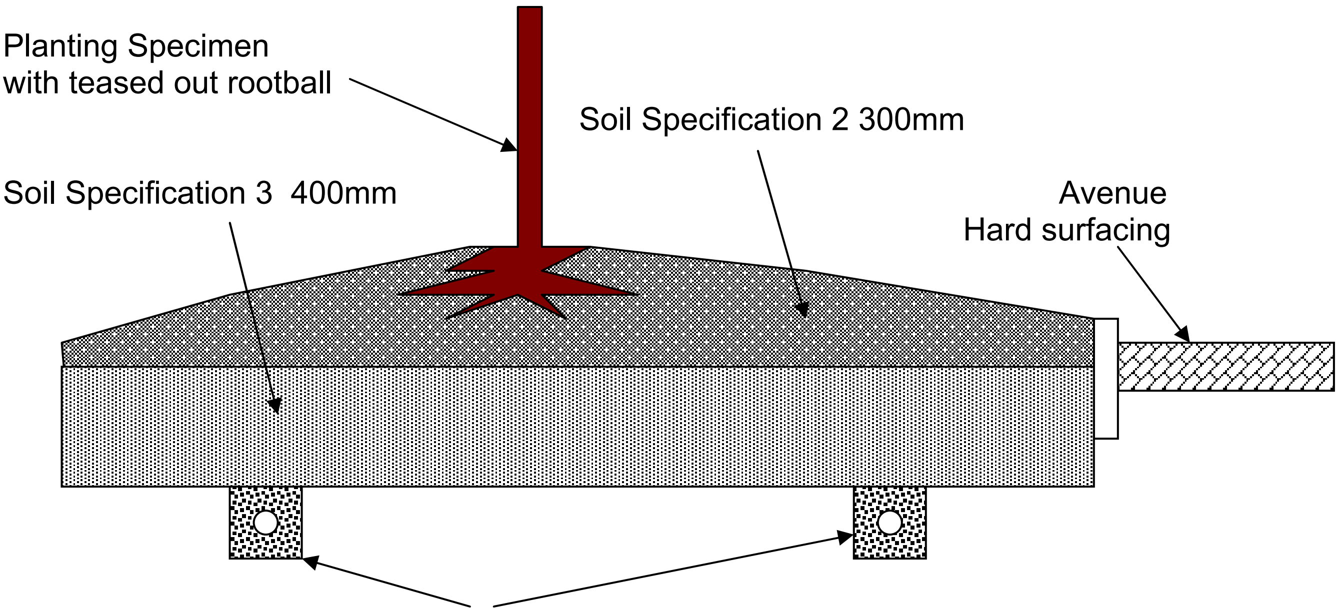
g. Backfill drainage trench and pipe with Specification 3 subsoil mix bringing the medium right up to the present finished surface.

"Hard" Option. In addition to all the above treatments explore the possibility of underboring the entire rootzone at say 700mm depth and installing major trunk drains. The sand filled drain discussed in e-g. above must then be connected to this major trunk drain at around 2m intervals. In addition further lateral sand trench drains should connect the to main parallel sand trench drains in a ladder rung type fashion in the interval between trees. Aeration holes to 400mm should be made using hand auguring techniques again backfilled with sandy soil. Great care must be taken to avoid severing any root above 20mm diameter.

7.3.3 Replacement of F. hillii avenue rootzones, new plantings

While a range of options is given below to attempt improvement of the existing *F. hillii* avenue soil conditions there is little doubt that complete removal and soil replacement is the only perfectly satisfactory option. The soil replacement detail given here should be used prior to replanting individual failed specimens or blocks of specimens whether they be super advanced, transplants or smaller potted stock. Physical soil conditions under these trees are the worst in the park and will likely deteriorate further with time. There is no point replanting without such soil modification.

Figure 6. *Soil specification for replanting*



100mm Slotted Ag drains in 20mm gravel

Note especially that the new soil profile should be mounded slightly and brought up to the levels of the curb surround to allow shedding of excess water. The surface can be finished with a composted mulch initially until leaf fall provides adequate coverage.

Subsoil drainage must be provided. Two main trunk drains are pictured in Fig 6 which need to be connected to a stormwater system. The purpose is to allow all excess ponded water to escape quickly.

This soil replacement program should be further detailed and specified in discussion with landscape designers to provide perfectly clear specifications for tendering.

8. General Comments

8.1 Services and Installations

It would appear that service installation has been done in a somewhat haphazard and uncontrolled manner. Trees have needs and such service installation poses threats to established trees (severance of structural roots) and to new plantings (restricted rootzones). It is strongly recommended that all service installation be vetted and controlled by parks and arborist staff. The shortest run of a service installation may not be the cheapest if the useful life of trees is diminished and repair work to soil profiles is factored in.

8.2 Events

There is some evidence that the event programs along the avenue have caused soil conditions to deteriorate by compacting the only effective rootzone, the surface 250mm of sandy loam and highly organic sandy loam.

While barriers are a blanket recommendation to prevent pedestrian access to tree rootzones in practice they are difficult to police. One effective method of preventing traffic from compacting soil is to lay geotextile fabric over the rootzone and place 100mm of woody mulch such as pine bark or woodchip. This effectively spreads the pressure of feet and wheeled traffic out, reducing compaction. This mulch layer should then be removed after the event and if clean enough could be kept for repeated use.

8.3 Compacted Areas

The compacted areas around N2 and S1 and S2 show heavier loam soils than the remainder of the park. Generally, sand slitting and coring backfilling with Specification 1 Topdressing mix combined with a topdressing with the same mix will greatly improve this.

However, pedestrian management is also important. A persistent pedestrian desire line occurs through N2. Either this must be blocked off or a pathway built to accommodate it. Currently works along Park St frontage of South Hyde Park appears to be directing pedestrian traffic along the heavier loam soils around S1 and S2. Methods of redirecting such traffic along pathways should be explored.

Experience has shown that sand slitting and coring will significantly improve the resistance of these turf areas to hard use.

9.0 Soil Specifications

9.1 Specification 1. Topdressing Mix

Description: Topdressing mixes are very sandy loose materials containing some organic matter. Usually a 90% by volume of a suitable sand with 10% of a fine compost is used. The sand should comply with the following requirement-

Size Fraction	% by weight
> 2mm	< 2%
1-2mm	<5%
0.5-1mm	40-60%
0.25-0.5mm	20-40%
0.1-0.25 mm	10-20%
< 0.1 mm	<8%

Note: The particle size distribution of topdressing sand is critical and must generally be coarser than the underlying soil.

pH should be within the range 5.5 to 7.0 and salinity should not be present.

9.2 Specification 2. Topsoil Mix

This is a sandy well drained mix designed to provide aeration and nutritional as well as water holding benefits to a range of plant species. The particle size distribution provides a specification basis for the mineral soil component. To obtain the chemical properties about 10-20% by volume of compost must be added and fertilizers dependant on the type of compost used. A nutrient rich compost, may not need any fertilizer added.

Particle Size Distribution-

Size Fraction	% by weight
> 2mm	< 5%
1-2mm	<10%
0.5-1mm	20-40%
0.25-0.5mm	30-50%
0.1-0.25 mm	20-30%
< 0.1 mm	<12 %

pH	5.5 to 6.8
EC 1:2	<1.0
Hydraulic Conductivity	20-50 cm/hour
Exchangeable Na %	<5
Exchangeable K %	5-15
Exchangeable Ca %	65-75
Exchangeable Mg %	15-25
Available P (Bray)	30-70 mg/kg
Ammonium N	< 50 mg/kg
Nitrate N	20-50 mg/kg
Organic matter	5-10% w/w

9.3 Specification 3. Subsoil Mix

This is a sandy well drained mix designed to provide aeration at depth and nutritional as well as water holding benefits to a range of plant species. The particle size distribution provides a specification basis for the mineral soil component. To obtain the chemical properties some soil must be present as sands will not have sufficient cation exchange capacity.

Particle Size Distribution-

Size Fraction	% by weight
> 2mm	< 5%
1-2mm	<10%
0.5-1mm	20-40%
0.25-0.5mm	30-50%

0.1-0.25 mm	20-30%
< 0.1 mm	<10 %
pH	5.5 to 6.8
EC 1:2	<1.0
Hydraulic Conductivity	20-50 cm/hour
Exchangeable Na %	<5
Exchangeable K %	5-15
Exchangeable Ca %	65-75
Exchangeable Mg %	15-25
Organic matter	<2% w/w

Simon Leake
Principal Soil Scientist

Charlotte Moore
Soil Scientist

Date ______________________________

9. References

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10. Appendices

10.1 Sampling Plan

10.2 Pit Logs

Profile Description Sheet

Title of survey: Hyde park (North)
Profile No: N1
Position and Vegetation: Kikuyu lawn, healthy growth

Depth (mm)	Texture	Colour	Structure	Comments
0-150	Organic sandy loam	10YR very dark brown	Well structured, Earthy, highly porous	
150-300	Sandy loam	10 YR very dark greyish brown	Very weak crumb, earthy fabric, not porous	
350-600	Very sandy clay loam	10 YR brown (dark sandstone)		Anthropic material present, Iron rich Mottles of yellowish brown
650	ROCK			Cannot auger

Profile Description Sheet

Title of survey: Hyde park (North)
Profile No: N2
Position and Vegetation: Edge of garden beds, under trees, adjacent to wear worn footpath.

Depth (mm)	Texture	Colour	Structure	Comments
0-200	Sandy loam	7.5YR 2.5/2 (very dark brown)	Strong granular structure, becomming gravelly with depth	
200-300	Gravelly light clay	7.5YR 5/8 (strong brown) with mottles 7.5 YR 2.5/8 (bright red)		- Transition layer of platy Ironstone - 30-40% Ironstone gravel
300-500	Medium clay	mottles of 7.5 YR 5/8 with 5YR 7/8 (yellowish red) matrix	Fine strong polyhedral	- some indurated Ironstone - no gravel
500	Medium clay	50% 2.5YR8/2 (pinkish white) and 50% 2.5YR4/8		- slickensides present - Some roots present

Notes: Intact Blacktown subsoil?

Profile Description Sheet

Title of survey: Hyde park (North)
Profile No: N3
Position and Vegetation: Kikuyu lawn, healthy growth, near phytophthora-infected trees

Depth (mm)	Texture	Colour	Structure	Comments
0-300	Spongy sandy loam at surface, becoming sandier with depth	5YR 3/1 (very dark grey	Strong crumb	Some anthropic matter ie. stones
300-500	Medium clay	Brown matrix with 5YR 4/6 yellowish red and 7.5 YR 5/6 mottles	Strongly pedal	

Notes: Intact Blacktown B horizon?

Profile Description Sheet

Title of survey: Hyde park (North)
Profile No: N4
Position and Vegetation:

Depth (mm)	Texture	Colour	Structure	Comments
0-250	Loose sandy loam	Dark brown	Weak crumb	
250-400				- some roof - intense gravel
400	Loam fine sandy becoming more clay with depth. Final texture sandy clay			Possible Buried Profile - some roots present - possible the remnant of a sandstone profile

Notes: Intact buried sandstone soil?

Profile Description Sheet

Title of survey: Hyde park (North)
Profile No: N5
Vegetation: Under fig trees on main avenue, moist soil

Depth (mm)	Texture	Colour	Structure	Comments
0-100				AO-horizon: heavy decaying leaf litter
100-150				Transitional layer, less organic matter, much root activity.
150-475	Sandy clay loam	Dark brown	weak	- many roots
abrupt boundary to:				
475 - 500	Stony plastic clay			
500	Sandy clay loam			- lumps of clay throughout - mixed clay/ sandy clay fill

Profile Description Sheet

Title of survey: Hyde park (North)
Profile No: N6
Vegetation:

Depth (mm)	Texture	Colour	Structure	Comments
0-250	Sandy loam	Very dark brown	Weak, almost massive	
250-500	Loose sand	Light grey		
buried soil profile				
A1 500-800	Clay loam	5YR 3/2 (dark reddish brown)	Strong fine polyhedral	
A2 800-900		Brown		
B 900+	Medium clay	5YR 4/4 (reddish brown)		

Notes: Intact Blacktown B horizon

Profile Description Sheet

Title of survey: Hyde park (North)
Profile No: N7
Vegetation: Kikuyu lawn, good condition

Depth (mm)	Texture	Colour	Structure	Comments
0-250	Sandy loam	Brown	Strong fine polyhedral	- loose, porous - much worm activity
250-450	Gravelly clay	5YR7/2 (pinkish grey)		- FILL material
450-650	Sandy loam	7.5YR6/8 matrix with 2.5yr5/6 (dark red) mottles		- sandstone origin - coarse sand mixed with darker soil
650	Sandy with ashy matrix			- anthropic - some ash
700	ROCK			

Profile Description Sheet

Title of survey: Hyde park (North)
Profile No: N8
Position and Vegetation: Main avenue. Location where fig tree fell over

Depth (mm)	Texture	Colour	Structure	Comments
0-150				A-O horizon decaying leaf litter
150-350	Sandy loam	Very dark brown		- very moist
350	Sandy clay loam			- pieces of sandstone and clay - very moist - some dark brown organic staining - very stony with depth

Profile Description Sheet

Title of survey: Hyde park (North)
Profile No: N9
Position and Vegetation: Main Avenue, near fig trees

Depth (mm)	Texture	Colour	Structure	Comments
0-150	Organic soil			- less organic matter present than in previous sampled locations along avenue
150-350	Sandy loam	Dark yellowish brown	massive	Drier than N8
350	Sandy loam (becomes more stoney/fill with depth)	Dark yellowish brown	granular, weakly pedal	Stoney anthropic materials
450	Sandy shale becomes gravelly clay loam	Greyish brown		

Profile Description Sheet

Title of survey: Hyde park (North)
Profile No: N10
Position and Vegetation: Lawn, near park boundary

Depth (mm)	Texture	Colour	Structure	Comments
0-350	Sandy loam	Dark brownish black	Weaky structured	
350-450	Sandy clay loam			- stones, clay lumps = FILL
450-600	Clay loam matrix (becoming stonier with depth)		Loose matrix	- contains clay and sandstone lumps
600	Very stony			

Profile Description Sheet

Title of survey: Hyde park (South)
Profile No: S1
Position and Vegetation: Lawn, very poor grass growth. Very dry soil

Depth (mm)	Texture	Colour	Structure	Comments
0-150	loam		Well structured, strongly pedal crumb	- dry
150-600	sandy loam	Greyish brown		- some anthropic materials, rubbish, glass etc.

Profile Description Sheet

Title of survey: Hyde park (South)
Profile No: S2
Position and Vegetation:

Depth (mm)	Texture	Colour	Structure	Comments
0-150	Loam, fine sandy	Dark brown, black	Strong fine polyhedral	
150-500	Fine sandy clay loam	Greyish brown		Lumps of rock
500	Clay	Grey/olive/ drab		- Strong smell – anerobic - Heavily gleyed - Does not appear to be anthropic - ~20% yellow mottles (2.5YR7/4)

Profile Description Sheet

Title of survey: Hyde park (South)
Profile No: S3
Position and Vegetation:

Depth (mm)	Texture	Colour	Structure	Comments
0-50				Wood Mulch
50-350	Sandy loam			
350-500	Sandy loam matrix (stony)			
500	Clay	Pinkish white		- some tree roots down cracks

Profile Description Sheet

Title of survey: Hyde park (South)
Profile No: S4
Position and Vegetation:

Depth (mm)	Texture	Colour	Structure	Comments
0-150	Loam fine sandy	Dark yellowish brown		- many tree roots - dry
150-300	Clay loam			- some stones, gravel
300-600	Clay	Yellow brown matrix		- anthropic material = FILL

Profile Description Sheet

Title of survey: Hyde park (South)
Profile No: S5
Position and Vegetation: Patchy grass, some areas soil appears to be compacted

Depth (mm)	Texture	Colour	Structure	Comments
0-150	Sandy loam		Weak crumb	
150-450	Sandy loam matrix with sandstone fragments	Light grey/brown		- many stones
450-500	Decomposed sandstone			
500	ROCK			

Profile Description Sheet

Title of survey: Hyde park (South)
Profile No: S6
Position and Vegetation: Centre of turf patch. Healthy grass

Depth (mm)	Texture	Colour	Structure	Comments
0-250	Sandy Loam	Dark blackish brown	Very weak crumb	
300-600	Clay Loam matrix with some yellowish loam fine sandy soil			- Stony anthropic fill, stone, glass - Moist throughout profile

Profile Description Sheet

Title of survey: Hyde park (South)
Profile No: S7
Position and Vegetation:

Depth (mm)	Texture	Colour	Structure	Comments
0-200	Sandy Loam		strong crumb	
200-350	Stony sandy loam with some clay lumps			
350-400	Clean sand			
400 +	Hydromorphic clay	Dull Yellowish Brown		

Profile Description Sheet

Title of survey: Hyde park (South)
Profile No: S8
Position and Vegetation:

Depth (mm)	Texture	Colour	Structure	Comments
0-200	Loamy sand		Apedal	
200-300	sand			
300-600	sandy clay loam	Dark brown		contains some stones and fill material

Profile Description Sheet

Title of survey: Hyde park (South)
Profile No: S9
Position and Vegetation:

Depth (mm)	Texture	Colour	Structure	Comments
0-200	loam	Dark brown	Strongly pedal	Highly porous
200-600	Clay loam (fill)	Dark brown		Many stones

Profile Description Sheet

Title of survey: Hyde park (South)
Profile No: S10
Position and Vegetation:

Depth (mm)	Texture	Colour	Structure	Comments
0-250	Loam	Dark brown	Strong granular	
250-500 (natural profile A horizon)	Silty loam	Greyish brown	Weak crumb	
500-800 (natural profile B horizon)	Light clay	Light grey	Fine polyhedral	Roots in cracks

10.3 Chemical and Physical Test Results

10.4 Hydraulic Conductivity and Bulk Density Curves