Examples of specific areas of need and change include:

- Improved facilities for staff to carry out their duties.
- Modernised and more reliable propagating and holding facilities.
- A relational database to allow efficient cataloguing and retrieval of a wide range of plant related information.
- Dedicated education and improved display facilities.
- A science suite to include an enlarged herbarium, records archiving, library and a seed bank.
- Desk space for visiting professional staff and students, and meeting space.
- Probably new and enlarged retailing and food supply facilities.
- Improved circulation system (paths and driveways), including good pedestrian/vehicle separation.
- Irrigation reticulation.
- Greatly improved, and more extensive, signage and interpretation.

A special year for the Gardens will be 2013, when it celebrates its 150th anniversary. Its establishment year of 1863 is shared with the Dunedin Botanic Garden, making these two the oldest botanic gardens in New Zealand. Within the Australasian Region, the oldest botanic garden is the RBG Sydney (1816), followed by the RBG Tasmania in Hobart (1818), RBG Melbourne (1846) and the Adelaide Botanic Gardens (1855). The Gardens, while not being the oldest, is a relatively long established and, thus historic, botanic gardens. Major development of the Gardens is being targeted early enough so that by 2013 the city will have a proven world class facility that is fully 'botanic', while being an outstanding 'garden'.

CHRISTCHURCH
BOTANIC
GARDENS
EST 1863

PART II:

RESOURCE INFORMATION

Explanation:

This Part describes the current status and structure of the Gardens. It includes some discussion of issues affecting the Gardens (see Part IV for a more detailed assessment of issues).

7. Location and regional context

The Gardens is located in an 'enclave' defined by the Avon River within Hagley Park, less than one kilometre west of Cathedral Square in the city of Christchurch on the east coast of the South Island of New Zealand, latitude 43° 31' 48" S, longitude 170° 37' 13" E.

The Gardens significance to Canterbury is seen in visitor statistics (see Sections 4 and 15). The Gardens' strategic location at the end of the Worcester Boulevard 'amenity linkage', recognised in the City Plan as a link between important public places in the city centre, contributes to its popularity.

The Gardens is one of the three main attractions in the City that overseas visitors specifically ask about and is a major recreational facility for the people of the Canterbury region. It is the City's most important open space for passive recreation.

Hagley Park provides an important setting and 'green' buffer between the city and the Gardens on its northern, western and southern sides. The approach to the Gardens from the Riccarton Road roundabout is especially enhanced with views of the Gardens through Hagley Park. Riccarton Avenue and Rolleston Avenue are the only two roads from which there are outside views of the Gardens.

Access to the Gardens can be obtained from three entrances on Rolleston Avenue and three bridges over the Avon River at the Botanic Gardens Car Park off Armagh Street, the United Car Park off Riccarton Avenue, and opposite the band rotunda near Riccarton Avenue.

8. Legal and planning

Gardens management area

The areas addressed by this management plan (see Figure 8.1 on Page 10) include:

Area 1 Inside the loop of the Avon River.

Area 2 The Daffodil Woodland area, Pinetum and the United Car Park between the Avon River, hospital grounds and the United sports club area.

Area 3 The Avon River corridor, including the northern bank from the United Car Park to the Botanic Gardens Car Park.

Areas 2 and 3, which are legally part of Hagley Park, are included in this plan as they have been managed as part of the Gardens for over forty years and are adjacent to the legal Gardens area. This total area is approximately thirty one hectares.

Legal description of the management area

Legal Botanic Gardens area (Area 1):

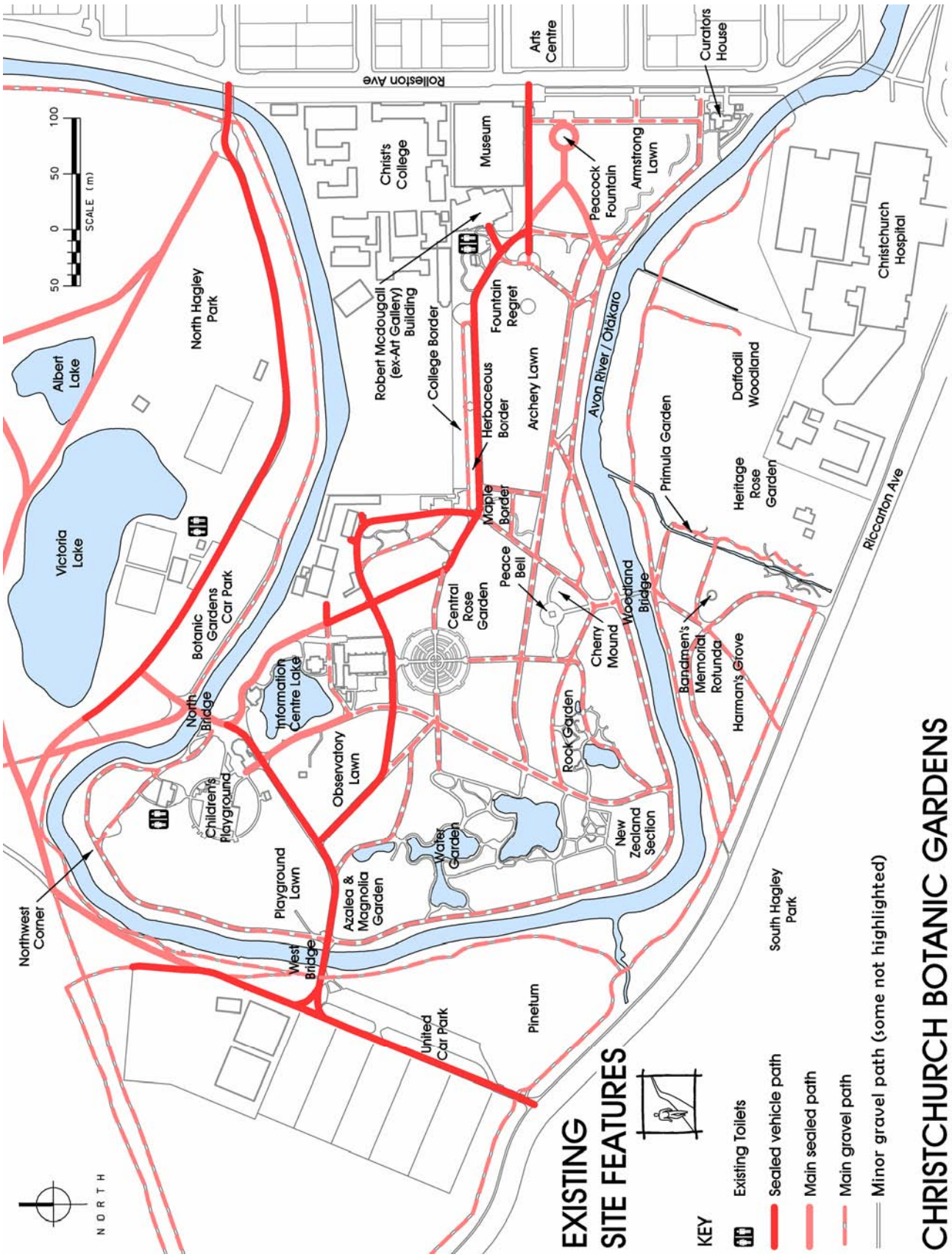
Part Reserve 25 SO 11870 (21.1374 hectares).

Hagley Park area managed as part of the Botanic Gardens (Areas 2 and 3):

Part Rural Section 41181 SO 15235, Part Reserve 24 (Hagley Park) (approximately 12 hectares).

All of the above area is held subject to the Christchurch City (Reserves) Empowering Act 1971. Area 1 is specifically singled out in the Act as being "*vested in the Corporation for an estate in fee simple as a reserve for a botanic garden*".

Figure 8.1: Existing site features



Classification

Under the Reserves Act 1977, Area 1 is classified as Local Purpose (Botanic Garden) Reserve (Section 23 of the Act) (New Zealand Gazette 5 March 1990 p38). Areas 2 and 3 are part Recreation Reserve under the Reserves Act, and are also covered by the Hagley Park Management Plan.

Planning Status

The Gardens is zoned in the City of Christchurch City Plan as Conservation 2[8].

9. Administration

Management

The Gardens is managed by the Botanical Services Operations Team of the Christchurch City Council's Transport and Greenspace Unit, City Environment Group. This team is also responsible for the day to day management of Hagley Park and Mona Vale.

Organisation and staff

See Figure 9.1 on Page 12 for a staff position diagram.

Financial

The cost of services for the Christchurch City Council in 2007/2008 to provide and manage the Christchurch Botanic Gardens so that residents and visitors to Christchurch can enjoy the Gardens' environments and plant collections is given in Table 9.1[9].

Table 9.1: Gardens' Cost of Services 2007/2008

Operating	$4,821,000
Revenue	$169,000

[8] This zone covers a small group of public parks of city-wide significance that help provide the city with its unique scenery and character. Parks with colonial heritage, such as the Botanic Gardens, Mona Vale, and Risingholme Park, historic cemeteries, and other 'garden city' parks are included in the zone.

[9] From: Long-Term Council Community Plan 2006-16, Vol 1, p129.

Friends of the Christchurch Botanic Gardens

On 18 October 1988 a meeting was held for the purposes of exploring the feasibility of establishing a 'Friends of the Gardens Society. Organisations represented included the Canterbury Horticultural Society, Christchurch Beautifying Association, Botany Division of the Department of Scientific and Industrial Research, Department of Horticulture, Lincoln University, New Zealand Nurserymen's Association, Royal New Zealand Institute of Horticulture, New Zealand Institute of Park and Recreation Administration and the Canterbury Botanical Society.

In 1989 the Society was officially registered as an incorporated society and became the Friends of the Gardens Incorporated (from this point on in this plan, the Society will be referred to as the 'Friends').

The inaugural Annual General Meeting was held on 6 November 1989.

The purpose for the Gardens, as stated in the Council's Annual Plan, has been taken as the Friends' aim:

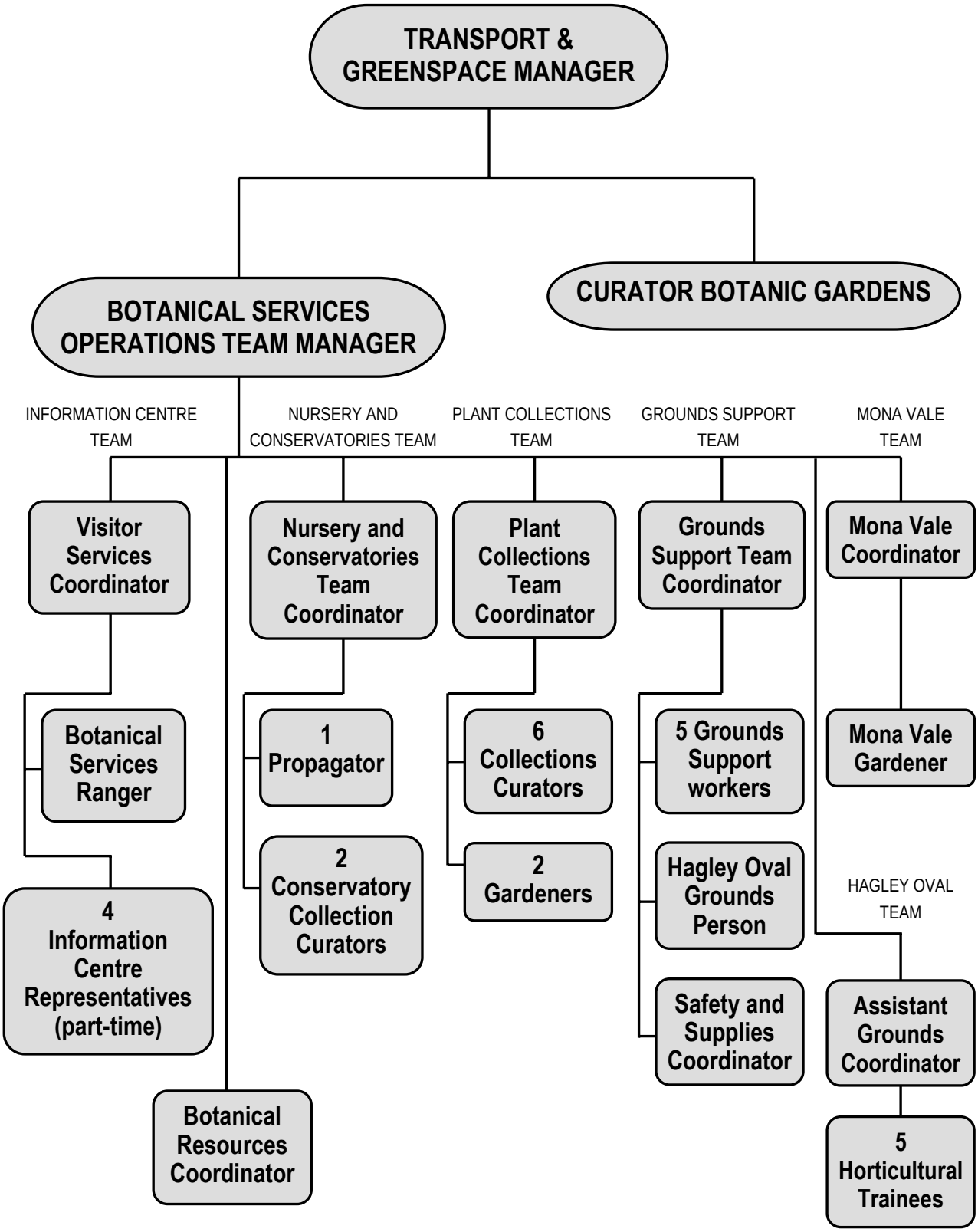
> *"To provide and display representative plant collections from temperate to sub-tropical world regions for public enjoyment, education, research and scientific advancement.*
>
> *To disseminate information to botanical institutions world-wide through exchange of plants and other material and promote international co-operation in the conservation of rare and endangered species".*

The objectives of the Friends are:

a) To promote, support and protect the Gardens for the purpose for which they are established.

b) To promote and support activities consistent with the purpose of the Gardens.

Figure 9.1: Staff positions



c) To encourage public interest in, and appreciation of, plants, including a knowledge of their culture and use.

d) To assist with the Gardens' activities such as lectures, demonstrations and distribution of plants.

e) To assist with the guiding of visitors in the Gardens.

f) To assist with the acquisition of plants, including new introductions and additions to existing collections.

g) To assist in the acquisition of funds and/or assets for special purposes associated with the Gardens.

h) To promote membership of the Friends and support its objectives.

10. Functions and operations

Plant acquisition and propagation

Plant exchange

Plant exchange through a seed catalogue known as the Index Seminum is a very important part of the Gardens' botanical programme. The Gardens currently exchanges seed lists with 200 different institutions from around the world.

The seed exchange is the primary means by which the Gardens can obtain new, unusual or rare plants. Generally, the nursery trade is not a good source of plant material for the Gardens because:

- The range of plants grown is very limited.
- The naming of plants is sometimes suspect.
- Origin of propagation material is often unknown.

However, there are still some specialist nurseries who offer a wide variety of plants of interest to the Gardens.

Nursery

The nursery is an important component for the successful running of the Gardens. Currently, the nursery operates eight glasshouses, a potting shed, cold frames and outdoor beds for growing on of propagated material. Of the glasshouses, four are used for growing on tropical plants and are heated to 18-20^{o}C. The cooler houses are heated to 13-15^{o}C in winter.

Potting shed

The potting shed is a vital part of the nursery operation for the carrying out of specialist propagation work.

Boiler house

Contained below floor level in the potting shed are the boilers that heat the nursery glasshouses.

Plant records and identification

Plant records

Plant record keeping is an important function of the Gardens. A comprehensive indexing system, involving three different numbering methods is operated:

- All plants propagated receive an accession number placed on a label with the plants. The number is obtained from an accession book, which notes the plant name and cultural information.
- When a plant is settled in its fixed location, it receives a polycarbonate label which is inserted in front of the plant. The label notes the plant name, family and country of origin. On the back of the label is the stock number.
- An interim spreadsheet record of plant information is entered. This will eventually be transferred to a plant database.

(Note: The efficient running of a botanic garden hinges on the correct naming of the plants within its area).

Herbarium

The Gardens possesses two herbarium collections:

1. Armstrong Herbarium - dating from the 1880s.

2. The Gardens Herbarium (CHBG), with about 2,500 specimens.

The Armstrong herbarium is a valuable collection of New Zealand plants of great historical interest. It is currently housed on long-term loan at Landcare Research Lincoln, in lieu of satisfactory storage space being available at the Gardens.

The 'Metcalf' collection is housed in the Gardens library in boxes. It is indexed and available for staff use, although its presentation and storage is far from satisfactory. Little has been added to this collection over recent years.

The Gardens is currently listed on the New Zealand National Herbarium Network as CHBG. There are thirteen registered herbaria in New Zealand. (Note: A 'working' herbarium is an essential part of the running of a botanic gardens for the purposes of plant identification, research and teaching).

Plant display and maintenance

Plant display is one of the primary functions of the Gardens. The way in which the displays are organised is critical to public understanding and appreciation of the role of the Gardens in its promotion of the world of plants. Access to specialist botanical advice enables the Gardens to provide interesting and accurate display information to visitors.

Specialised skills and maintenance techniques are required to maintain many plant species. The Gardens' maintenance contributes to the best use of the Gardens' financial resources. If the specialist care is removed, the work of years can be lost very quickly due to ignorance about plants cultural needs and significance.

Science and research

Scientific research is one of the areas in which botanic gardens play an important role. From the first decades of European colonisation the Gardens was the main centre for botanical work in Canterbury with respect to plant introduction and acclimatisation (see Section 11 (History), Page 16).

In the 1870s, due to interest in growing better grass species in New Zealand, a collection of grasses from Vienna was reared by J.F. Armstrong for investigation by a committee of the Philosophical Institute of Canterbury.

Father and son, J.F. (John) and J.B (Joseph) Armstrong brought into cultivation a large collection of little known South Island plants and described more than eighteen new species. J.B. Armstrong also described the new genus *Corallosparticum*. The Armstrongs wrote nine scientific papers.

In 1871 J.F. Armstrong published the first list of naturalised plants of Canterbury. He was also instrumental in establishing the first Gardens' herbarium, a collection of national importance.

More recently, when Dr O.H. Frankel and Dr J.B. Hair were conducting their important research on the chromosomes of New Zealand *Hebe*, their collection of type plants was grown in the Gardens.

Little research has been done since the 1930s, when Mr W.B. Brockie collected and published many accounts of native plants. Some valuable work has been done with cultivars of *Hebe* and *Leptospermum* under Mr L.J. Metcalf, but has not been published.

This lack of research is, in part, due to the lack of a defined research function or formal association with educational, research and conservation organisations.

Education

Education is a key ingredient in the successful development and use of the Gardens and an important reason for their existence.

There are three main groups of people who make use of education opportunities in the Gardens:

a) Casual visitors.

b) Specialist garden groups.

c) Schools, including universities, the Polytechnic and horticultural apprentices.

Educational materials

A guide map was first produced in 1963 and recently updated. A Gardens' general information brochure was printed in 1987, and publications are under continual review. The first of a series of self guiding brochures on the different sections in the Gardens was produced in 1989.

A second major aspect of public education is having all plants correctly identified and labelled. To help the Gardens' visitor find a particular section or plant, information stations have been installed at various points to show special features, new developments and general directions.

Lectures / Guided Tours

Since the early 1900s talks, lectures and guided tours have been given by Gardens' staff to the general public and specialist interest groups. Subjects covered have included plant propagation, bedding, natives, herbaceous perennials and pruning.

Staff currently are engaged in monthly talks, and the Friends are active in providing guided walks.

Information Centre

Construction of the Information Centre in 1987 was a significant step forward for the Gardens. For the first time, lectures could be held in the Gardens indoors, static displays could be used and brochures and information materials displayed.

Issues with the Information Centre

- The building has to double as both an information/display centre and retail outlet, and previously as a lecture hall, which is now no longer available.

- Space is taken up by sale items in the information centre, such as posters and paintings.

Lack of space however limits further expansion. The Information Centre was not designed as a retail outlet and lacks sufficient shelving and display areas.

Comment

The botanical basis of the Gardens provides considerable scope for educational programmes. Programmes can range in scope from basic horticultural to detailed propagation techniques at polytechnic/university level. The most appropriate means of assisting each group in their appreciation of the Gardens needs to be investigated. Assistance from educational institutions should be encouraged.

There is a lack of space for the following needed facilities:

- Education centre, incorporating classrooms and lecture hall.

- Study annex.

- Housing for the herbarium.

- Library.

- Permanent displays and exhibitions.

Currently, there is little scope for expansion in the Gardens to cater for the above functions.

Opportunity exists at the Gardens for considerable expansion of commercial activities. It is interesting to note that both the Australian National Botanic Gardens at Canberra and the Sydney Botanic Gardens have a bookshop selling botanical and horticultural books and souvenirs.

A most urgent need is for the updating of the information systems in the Gardens. Accurate and fast information access is a critical ingredient in the running of any institution and is essential if the Gardens are to be easily assist the public or exchange information on matters such as conservation with overseas botanical institutions.

The Gardens have research opportunities based on the diversity of plants grown. Research carried out at the Gardens could have commercial application for the nursery trade or amenity horticultural industry. Other programmes would have value in the conservation and management of New Zealand native plants in cultivation. Associations with the universities and other institutions should foster further research programmes in the future.

The current herbarium needs to be up to standard to increase its usefulness for plant identification. The potential size of the herbarium could be much greater than presently exists (2,500), such as up to 20,000 specimens.

Current relationships with other scientific institutions have major advantages for the Gardens. For example, these can assist with:

a) Talks, lectures and tours of the Gardens.

b) Exchange of, and access to, plant material.

c) Writing tour guides for the Gardens.

d) Plant identification and classification.

e) Conservation of rare and endangered plants.

f) Access to national and international herbaria.

Revenue generation

The Council, under the Reserves Act 1977, is able to grant leases or licences for the carrying on of any trade, business, or occupation in Recreation Reserves, provided the land is vested in Council and the lease or licence is in conformity with an approved management plan. The lease or licence must be necessary to enable the public to further benefit from and enjoy the reserve. The Section 23 classification of the area that is legally the Gardens gives Council far greater discretion in this area.

There are currently two significant commercial concessions in the Gardens:

1. The Gardens Café.

   The Gardens Café has been previously known largely as the Tea Kiosk. The original kiosk was built in 1910, but because of a fire was replaced in the 1920s.

2. Curator's House Restaurant.

   The Curators house on Rolleston Avenue frontage is currently used as a restaurant. There is a site for the demonstration of culinary skills and gardening in the adjacent curators garden.

11. History

Pre-European history

The landscape of the Christchurch area developed during the post glacial formation of the Waimakariri River delta. This resulted in the formation of multiple layers of gravels interspersed with impervious layers of sediments which supported aquifers. Water feeding through the upper aquifers from the Waimakariri River led to the formation of the Avon River which flows around the Gardens.

The prehistoric vegetation patterns formed on the soil mosaic of the Waimakariri River flood plain probably varied from podocarp – hardwood forest, dominated by kahikatea, totara and matai on the imperfectly drained Kaiapoi soil series, to short tussock grassland on the drier Waimakariri soils. Swamps occurred on the poorly drained sites. Evidence of an ancient forest was recently discovered in Riccarton (Mandeville Street) where logs thought to be 3000 years old were excavated. The incidence and severity of floods and natural fires, combined with the prevailing climate, would have led to a changing vegetation matrix varying from forest to swamp to grassland on each site over many thousands of years.

Early Maori occupation of Canterbury probably saw an increase in large fires on the plains which would have affected vegetation of the Hagley Park area. By 1848, there were nine pas, two villages, three kaingas and several whares within a 12.8 kilometre radius of Cathedral Square. Whares were located at Settlers Corner across the Avon River from the Gardens at its northernmost extent. The Gardens were included within an area known as Putaringamotu by the Ngāi Tahu people. Putaringamotu means 'Place of an Echo'.

European settlement and the Gardens establishment

The vegetation in the vicinity of the Gardens at the time of European colonisation in the 1850s was characterised by short tussock grassland. A large swamp was situated in 1897 where Victoria Lake is today and the Avon River was thickly vegetated. An account of the Deans brothers first journey to Riccarton Bush up the Avon River gives an indication of the riverine vegetation in the Gardens area.

> *"…a Maori canoe conveyed the party to the bend in the river close to the present Riccarton Road. During the whole river journey the canoe had to be forced through a thick growth of vegetation by pulling on the flax and niggerheads. When the little party left the river a path had to be made through the dense "entanglement of fern, tutu, tussock, bramble, Spaniards, and other native growth, nearly breast-high."*

In 1864 eighty eight native plants were listed as growing in Hagley Park and the Domain by Mr J.B. Armstrong.

One of two areas rich in New Zealand native plants was a large swamp, which was transformed into what is now Victoria Lake in 1897. The other is southern sandy shoulder of the lake. Another list compiled in 1918 by Professor A. Wall records thirty five native plant species growing in the Park and Domain, a reduction of fifty three from that recorded during the 1864 survey by Armstrong.

The exact reasons for the setting aside of Hagley Park as a public recreation area are unknown, however, by 1855, the superintendent of the Province was given authority to set aside what land he thought fit for plantations and gardens. A Reserves ordinance passed in 1856 declared that:

> *"the land commonly known as Hagley Park, shall be reserved forever as a public park and shall be open for recreation and enjoyment of the public."*

Nothing official was done in the Government Domain, though, until 1864. Yet, an oak was planted on 9 July 1863 to commemorate the marriage of Prince Albert Edward to Princess Alexandra of Denmark. This tree, an English Oak (*Quercus robur*) recorded as the Albert Edward Oak, is regarded as the foundation date of what was a short time later to become the Gardens.

On 10 May 1864 a public meeting was held in the Town Hall for the purpose of forming the Canterbury Horticultural and Acclimatisation Society. It was decided at the meeting that Hagley Park was a good site to establish a botanic gardens.

A commission was set up by the Provincial Government to advise the Superintendent of the Province on the cultivation and planting of the Government Domain that was compatible with the objects of the Acclimatisation Society. A vote of $1000 was made toward establishing the Gardens. The work was supervised by the Government Gardener, Mr Enoch Barker.

Enoch Barker was responsible for establishing much of the landscape character of early Christchurch. His first undertaking in the Domain was to establish a provincial nursery on a site nearly the same as that of the present Gardens nursery. Trees from this earlier nursery were used for general city planting including sections of the Avon River in 1862 and Fitzgerald Avenue in 1863. It is probable that trees for the outer belts of Hagley Park were also grown in this nursery.

Early last century

The Archery Lawn

Present day

Major developments carried out by Enoch Barker, until his resignation in 1867, included:

1. Supervision of the Acclimatisation Society's garden development between the Domain and Riccarton Avenue, and adjacent to the public hospital, in 1864.

2. Trenching of the Armstrong Lawn area approximately as far as the Pine Mound.

3. Development of flower beds and a shrubbery between the Pine Mound and the nursery.

4. Development of a linear grass walk, with shrub beds backed by a whitethorn hedge, on the inner side along the Avon River. Trees, including *Pinus pinaster*, blue gum and Weeping Willow, were planted on the river bank. This river walk is still in existence today. Altogether, Barker's developments were estimated to have cost 2,000 pounds.

During Barker's time the Domain was extensively used for the extraction of gravel for the city's streets. It is possible that the present design of the Archery Lawn arose because of the need to provide access for gravel carts in and out of the Domain.

Enoch Barker was also responsible for planting many of the older trees found in the Gardens, including the Albert Edward Oak of 1863.

In 1872 the first Christchurch Domains Board was established, pursuant to the Canterbury Domains Act 1872. Unfortunately, in 1876, all grants to the Domain were withdrawn due to the abolition of the Canterbury Provincial Council. The Board's activities were then needing to be wholly financed by rents, grazing fees and donations. In spite of the lack of funds, between the years 1870 to 1882, a total of 763,034 trees were distributed to public bodies in Canterbury from the Acclimatisation Society grounds. This was situated south of the Avon River near the public hospital.

This work was largely the result of the activities of Mr J.F. Armstrong (curator 1867-1889) and his son J.B. Armstrong. He is estimated to have introduced and acclimatised over four thousand different plant species. Most of these plants arrived in New Zealand by sailing ship, a voyage of three to six months. They were packed in wooden cases and on arrival were plunged into the river behind the nursery to revive. Many failed to recover. The Armstrongs were enthusiastic collectors of native plants. One of their notable achievements was the establishment of the native section, which was originally sited in the vicinity of the present Herb Garden. Material from this section was used by many noted New Zealand botanists including Petrie, Cheeseman and Cockayne.

J.F. Armstrong was succeeded by Mr A.L. Taylor (curator 1889-1907). Trained at Kew Gardens in England, he had worked under Sir Joseph Paxton as head gardener at Chatsworth and was head gardener and estate manager to Baron Rothschild. However, the severe shortage of funds at this time severely reduced his ability to undertake many improvements. For example, in 1898, the Board's total income was 548 pounds but the wage bill alone was 573 pounds. In spite of this, he was still responsible for planting many trees and shrubs.

Various means were used to reduce costs, including use of prison labour in 1877 and personnel from the Charitable Aid Board. Revenue was also gained from sales of firewood, hay and shingle.

At this time watering of plants was a constant problem over the summer months due to the light texture of the soil and the restriction of the water supply in the Gardens to the Curators and caretakers houses. The young Edgar Taylor (son of the curator) records carrying water in four gallon tins some 300 yards (274 metres) to water young conifers in the Arboretum.

In 1900 a Magnetic Observatory was erected and a small section of the grounds fenced around it.

The modern era

Mr James Dawes replaced A.L. Taylor in 1907, but resigned a year later. He was succeeded by Mr James Young (curator 1908-1933). Several buildings and structures were erected during this time including:

1910 Tea Kiosk - The first tea kiosk was constructed on the current kiosk site near the northern entrance to the Gardens. It was destroyed by fire and replaced in 1923 and again badly damaged in 1979.

1911 Peacock Fountain - The fountain originated from a bequest by the Hon. John T. Peacock and a donation from the Christchurch Beautifying Association and located on the Archery Lawn. Due to maintenance problems it was removed in 1949. In 1996 the fountain was restored and relocated to a new site at the eastern end of the Armstrong Lawn near the entranceway to the Gardens off Rolleston Avenue.

1914 Townend House - The original Townend House stood in the grounds of Holly Lea. It was purchased with funds offered from the deceased estate of Mrs A.Q. Townend of Mona Vale. It was replaced by the current house in the 1950s.

1923 Cuningham House - The result of a bequest by Mr C.A. Cuningham in 1915, it is the most notable building in the Gardens.

1923 Bandsmen's Memorial Rotunda - The Rotunda was erected in honour of the Canterbury bandsmen killed in World War I. It is sited south of the Avon River in the woodlands.

1932 The Robert McDougall Art Gallery.

James Young created a new rose garden in 1909, an extensive herbaceous border, various shrub collections, the children's play area and a water garden in the old shingle pits on the south west side of the gardens. From 1914 through to 1930, garden fetes were held every year to raise money for the Domain Board. In 1917 the lime avenue known as Beswicks Walk was planted. In 1928, the Canterbury Acclimatisation Society relocated to Greenpark near Lake Ellesmere.

Mr James A. McPherson was the first New Zealand born curator of the Gardens 1933 to 1945. His contributions included the re-designing of the Rose Garden and the extension of the New Zealand Section including the memorial dedicated to Dr. Leonard Cockayne. He was instrumental in the plantings of thousands of daffodils in the woodlands. McPherson was also responsible for the introduction of training horticultural apprentices.

In 1945 Mr Brendon P. Mansfield became curator, a position he held until 1948. The Christchurch Domains Board was disbanded by Act of Parliament in 1946 and Hagley Park and the Gardens came under the control of the Christchurch City Council. Mr Morris J. Barnett became director of Botanic Gardens, Parks and Reserves and was later followed by Mr H. Gilpin curator 1949-55. Improvements during this period included establishment of a rose species garden south of the Avon River, a new Townend House and a fernery.

Mr Lawrence J. Metcalf followed Gilpin as curator in 1955. He was responsible for redeveloping the Cockayne Memorial Garden, reforming the Erica Garden, extending the irrigation system, redeveloping the dwarf conifer garden, constructing the Rose Species and Primula Gardens. Metcalf also organised an education service for schools. His most important contribution was the introduction of a sequential numbering system for all incoming plant accessions, the cataloguing and tracking of them, and the redefining of plant label information.

Mr Alan G. Jolliffe was appointed curator from 1977 to 1979.

Mr Warwick J. Scadden was appointed as curator in 1982. Major developments in his time included the building of the Information Centre and development of herb and fragrant gardens and redesigning of the children's play area.

Dr David Given was appointed as Curator in 2003, after short tenures by Craig Oliver and Barry Samson, following Scadden's departure for another position. At the time of appointment of Dr Given as curator, Jeremy Hawker took the position of Botanical Services Operations Team Manager. Given was a key contributor to the development of new plans to guide the Gardens into the future, but passed away at the end of 2005, in the midst of this work.

Patterns of change

The Gardens today have developed as the result of the varying design inputs of the different curators, influenced by political and public initiatives, values, new plant introductions and fashion.

An analysis of changes to the circulation network illustrates the considerable degree to which the Gardens have changed over the last 135 years. An 1877 map shows that by this stage the path framework for the Avon River perimeter, Armstrong Lawn, Archery Lawn and the old New Zealand Section was fundamentally the same as the 1993 pattern. However, the central core of the Gardens at the earlier time had an entirely different circulation network that focused on an arboretum. By 1917 significant changes had taken place, with the central core completely redesigned to incorporate a large rectangular rose garden. The paths at the west end of the Archery Lawn were realigned, a bridge was built to connect the Gardens with North Hagley Park, the western bridge was shifted further north and the nursery shifted back to its original position.

By 1927 the central core had again been completely redesigned with the exception of the rose garden. Many of the major paths such as Beswicks Walk (Lime Walk) and the route from the existing western bridge to the Tea Kiosk were created in this period under the direction of James Young. The Gardens' three major ponds were also excavated in this period.

The next significant change to the Gardens design occurred in 1935 when James McPherson redesigned the rose garden into the circular shape still in existence today.

Utilisation of part of Hagley Park for botanic gardens purposes started in the 1930s with the planting of the Daffodil Woodland. The area between the Avon River and Riccarton Avenue slowly expands to include the Primula Garden and Heritage Rose Garden. A large number of ornamental cherries were also planted. From a 1958 map, the area of the Gardens was approximately 62 acres, ten acres more than the area later recognised as the Gardens under the Christchurch City (Reserves) Empowering Act 1971.

Changes since the Christchurch City Council took over administration of the Gardens in 1946 have generally been less obvious. The circulation network shown on the 1958 map has remained largely unchanged. Although change has been less noticeable, it has included a number of significant events, including:

- Removal of the Magnetic Observatory in 1960.
- Upgrading and redesign of the children's playground and Tea Kiosk area in the 1970s, 1980s and 1992.
- Removal of the Clematis Garden and replacement with a Herb Garden in 1985.
- Building of an alpine house later named Foweraker House.
- Building in 1960 of the Garrick and Gilpin Houses.
- Building of the Information Centre in 1987.
- Fragrant Garden – a 1990 project.

In addition, many trees have been removed from the Gardens, mostly due to death or ill health, and other trees planted. As trees have matured, and more and more lawn areas have been infilled with planting, 'open space' has been slowly reduced. New plant collections have been installed and others upgraded or removed.

Main points of change

1. The Gardens was subject to significant modification and periodic design change from its inception in 1864 till when it came under Council management in 1946.
2. Only part of the circulation system dating from the 1870s remains. This is along the Avon River margin and in the vicinity of the Archery Lawn, Armstrong Lawn and the old New Zealand Section.
3. The bulk of the circulation system has remained largely unmodified from 1946 to the present day.

4. Utilisation of part of Hagley Park for Gardens purposes dates from the 1930s.

5. Many of the current plant collections have plants originating from previous plant collection types still growing in their midst.

6. Changes to plant collections have occurred throughout the entire history of the Gardens. Overall planting and tree growth has infilled most areas of the Gardens to create a dominantly woodland aspect, thus reducing areas where higher light requiring plants can grow well. Tree root competition for water has produced localised dry spots.

Historical perspective and conclusions

The early design of the Gardens was strongly influenced by Victorian/Edwardian era park/garden design styles. This was a natural consequence of the English and Scottish garden estate training of most of the early curators. The evidence of these influences can be clearly seen in the following Garden features:

1. Expansive lawns with large numbers of specimen trees.

2. Extensive shrub borders.

3. Closely mown lawns punctuated with formal carpet bedding.

4. Specialist feature gardens such as water rose and rock gardens and the herbaceous border.

5. The over-riding motivation for amassing plant collections in the Gardens appears to have been horticultural interest although a few curators, such as J.F. Armstrong and L.J. Metcalf, were also interested in plant collection for scientific reasons. However, there was never particularly strong botanical emphasis, such as given in some Australian gardens with the presence of a state botanist.

A major influence on the nature of plant collections in the Gardens has been the requirement for the planting of commemorative trees. This has led to considerable duplication of tree species in the Gardens and diversion of resources for the growing of plants for mass display and some general parks use.

Overall, there has been tendency to avoid a strong botanical and indigenous emphasis in favour of amenity and exotic horticultural plants being the main features of its displays. The institutional side of the Gardens has never developed the strong scientific function that is evident in some overseas botanic gardens, such as in Canberra or Kew. In spite of this, the Gardens is a significant botanic garden in the Australasian region and a crucial one in New Zealand, in terms of the range of its exotic plant collections. Overseas gardens have, however, developed a significant range of new functions and roles over the last thirty years in a search for modern relevance. This has not been mirrored to any degree with the Christchurch Gardens. Rather, there has been more of a response to local demands and values rather than to world trends. This is partially due to New Zealand's relative isolation from the rest of the world and the cost of sending staff to visit overseas botanic gardens and to attend international conferences. A lack of public understanding of the roles and functions of a botanic gardens has also had a major effect on the way the Gardens have developed.

12. Site structure and character

Existing environment

The Gardens constitute a large complex site continuously modified for over 140 years. In its present state, the main physical components are the:

- natural topography
- pattern of vegetation
- buildings and structures
- network of paths and driveways

The interaction of these elements provides the basis for the Gardens functioning and future planning. It also provides the framework within which visitors orient themselves and identify the visual character and botanical contents.

This section describes the main characteristics of this environment and analyses their inter-relationships. More detailed information on

specific features is provided in the following sections.

Topography

Prior to their development the Gardens was sited on low sand hills, extensive shingle beds and some swampy areas. The more prominent sand hills were situated near Rolleston Avenue, one on the site of the Museum, one where the Pine Mound is today and one in between.

Later, shingle pits occupied several areas in the Gardens including where the Armstrong Lawn and Water Garden are now sited. Shingle from these pits was used to build many Christchurch Streets.

The topography of the Gardens is generally flat, with a maximum height above sea level of 6.7 metres. The only significant topographical features are the steep banks of the Avon River, two old sand dunes (the Pine Mound between the Archery Lawn and Armstrong Lawn, and another pine mound in the northwest corner of the Gardens) and a river levee stretching from the Rock Garden to the Armstrong Lawn. A steep rise also occurs in a semi-circle to the south of the Bondmen's Memorial Rotunda near Harman's Grove in the Hagley Park part of the Gardens.

Soils

The soil in the Gardens proper is the Waimakariri fine sandy loam. It is also found under a small area of land south of the Avon River in the area of the Daffodil Woodland. Topography formed on Waimakariri fine sandy loam usually is flat with small ridges and hollows. The soil is fertile and free draining and retains moisture well, although it is subject to drying out during droughts. In the playground area, gravel has been found at a depth of forty centimetres below the surface. The potential of this soil for plant growth is increased with irrigation and incorporation of organic material and mulching. The part of Hagley Park treated as part of the Gardens, including the Pinetum, Harman's Grove and Daffodil Woodland areas, is situated on Kaiapoi fine sandy loam. The Kaiapoi soil series has its origins in the post glacial alluvium and occupy an intermediate position in the landscape between Waimakariri soils on the present and former river levees and the Tai Tapu soils in the low-lying basins. In its natural state, Kaiapoi find sandy loam is very free draining, fertile with adequate moisture in most seasons and has a high water table after rain and in winter.

Within this overall soil pattern, there are many local variations based on topographical features and the amount of soil improvement that has been undertaken. Dense areas of trees tend to create drier conditions due to strong competition for water.

Climate

(*Statistics are from the Christchurch Botanic Gardens Meteorological Station (others are from other stations in Christchurch)).

*Air Temperatures (1969-1998):

Mean daily minimum (Jan):	12.2 °C
Mean daily minimum (July):	1.7 °C
Mean daily maximum (Jan):	22.5 °C
Mean daily maximum (July):	11.3 °C
Lowest temperature (August 1980):	-7.1 °C
Highest temperature (7 February 1973):	41.6 °C

*Mean Annual Sunshine Hours: 2,000 hours

*Mean Annual Rainfall (1969-1998): 635.00 mm

*Snow: Occasional falls are experienced, but generally they do not lie on the ground for more than a few hours. The heaviest snowfall recorded was 269.5 mm (14 July 1945).

*Frost (1969-1998): Average number of days of screen frost (with a minimum air temperature of less than 0°C) is 29 per annum.

Average Relative Humidity:

Jan:	3.00 am - 83%	July:	3.00 am - 88%
	3.00 pm - 57%		3.00 pm - 70%

Wind:

Average number of days with gusts reaching 63 km/h or more is 55 per annum.

Average number of days with gusts reaching 96 km/h or more is 2.5 per annum.

Generally, the climate is conducive to the growing of a wide range of plants of temperate zone origin. The only constraints are the possibility of summer drought and the occasional high velocity wind and/or snowfall, which may damage trees.

Wildlife

Hagley Park and the Gardens, with their abundant vegetation, form an important refuge for wildlife in the inner city. During the year, up to forty species of birds visit or reside in the Gardens.

Some interesting aspects of the Gardens avifauna are:

1. The Gardens probably supports the largest breeding population of New Zealand Pigeon in the Christchurch metropolitan area.

2. Acorns from oak trees provide a source of food for the ducks.

3. Many of the ducks breed in trees, some of them well above (nine to twelve metres) the ground!

4. There are high numbers of blackbirds and thrushes.

5. There is a very high duckling mortality – the duck population is bolstered with ducks from elsewhere.

Other forms of wildlife living in Hagley Park include rats, possums and wasps. Stray cats and dogs are also sometimes evident and, when captured, are taken to the SPCA or dog pound.

The invertebrate fauna of the Gardens has been recorded in a twenty four hour Bio Blitz. This needs to be ongoing.

Avon River

The Avon River was originally a small stream that meandered through dense growths of flax and sedges. By the 1870s the river was cleared of much of its former vegetation. Public bathing (for men) was popular with the official bathing area opposite the propagating sheds. Thinning out of the trees and formation of a path along the banks put a stop to this practice. Swimming suits apparently were not commonly used. The Avon River is a major feature of the Gardens. Its tree lined banks are attractive throughout the year.

The Avon River defines the shape of the Gardens by its loop and at no point is any part of the Gardens more than 180 metres from the river bank. The river is by far the most important natural physical feature of the Gardens site, adding greatly to its aesthetic, recreational and environmental value. The three bridges over it provide attractive views up and down stream and are, in themselves, important as landmarks and entry-points. The most extensive view of the river is obtained from the high bank above the bend adjoining Riccarton Avenue.

Though accessible almost everywhere, the attractions of the river bank are somewhat diminished by its height and steepness, artificially maintained in some places. This disadvantage is emphasized by the river bank walk which clings rigidly to the river alignment, leaving little level ground for seating, picnicking or group planting.

The steep river bank profile also inhibits establishment of a natural riverine vegetation character. Concrete block retaining walls have been built to help stabilise the edges where river erosion has occurred.

This erosion can be attributed to the natural dynamics of river flow combined with the lack of stabilising vegetation along the banks and boating activities. While the walling of the river edges is satisfactory in some areas, it is unfortunate that the natural banks are being lost.

With its change in direction of flow, the river provides varying microclimates – the north facing bank slopes are warmer, drier and sunnier and the south facing slopes generally cooler.

Hydrology

The Avon River flowing around the Gardens proper is well contained by generally high banks. The river varies in width from approximately twelve metres at its narrowest to 23 metres at its widest. Its depth ranges from ankle deep to over a metre deep.

Water flows vary from a normal low flow discharge of approximately 1.5 cubic metres per second (1.5m^3/sec) to 20m^3/sec during floods. A flood discharge of 25m^3/sec is likely to be the maximum flow expected in the river (pers. comm., D Carver 1990). A 20m^3/sec flood could be expected to raise the water level above the half metre high river edge and onto the grassed banks which slope up to the first river levee. Deposition of river silt on the banks is likely to be the greatest consequence of flooding on the Gardens. River velocities are not sufficient to have a serious affect on bank stability, although undermining of rockwork along Addington Brook has occurred (see below for more description of Addington Brook). Although overall water flow in the Avon River has probably increased over the last century, due to increased urbanisation, peak flows are relatively stable. Design constraints in the river's catchment restrict the peak discharge volume entering the river.

The possibility of a flood from the Waimakariri River reaching the Avon River, as it did in 1868, is very remote. With current river protection works in place, a flood of the magnitude required (5,500m^3/sec with a probable return period of 1 year in 3000) is unlikely to occur. A proposed ten year programme of secondary protection works will further reduce any chance of this type of flooding occurring.

Two main tributaries flow into the Avon River through Hagley Park. These are Riccarton Stream and Addington Brook. Riccarton Stream enters the Avon River near the river's southern bend. The Riccarton Drain, which joins Riccarton Stream at Deans Avenue, has a maximum discharge of 7m^3/sec. Addington Brook enters the Gardens near the public hospital.

The general quality of water in the Avon River is very good. However, samples taken in Addington Brook and Riccarton Stream in 1984 show that occasional high levels of faecal coliform bacteria can occur at times. These mostly appear to occur after storms.

Fauna and Flora

The only relatively unmodified gravel bottom occurring close to the Gardens is in a section of the Avon River between the Armagh Street Bridge and the North Bridge. This provides a greater diversity of habitats than the muddy river bottom that is prevalent along other stretches of the river in the vicinity of the Gardens.

Spatial structure

The Gardens are nominally structured with a series of lawns separated by belts of trees or shrubbery. Tree growth and planting have, over many decades, encroached on these lawns to the point where most of them comprise semi-closed or closed canopy woodland rather than open space. Of the dozen or so named lawns, only the Archery Lawn maintains a coherent structural character, enhanced by the impressive specimen trees bounding it. The Armstrong Lawn retains a flavour of Victorian formality by virtue of the clearly defined building and street boundaries rather than the disposition of trees. On a smaller scale, the Rose Garden has a geometrical shape identifiable only from within. The north-south axis of this, aligned with the Cuningham House, creates a tentative structural feature in the centre of the Gardens, but has not been integrated with the main traffic flows.

Ponds provide another category of open space. The lily pond near the southwest corner of the Gardens is the only one not enclosed by shrubbery and complements the Rock Garden and Harper Lawn to form a very attractive area of the Gardens. Elsewhere, the confining fringe of vegetation tends to neutralise the potential contribution of the ponds to visual structure and orientation. This applies, for example, to the main pond by the Gardens Café. The water surface here provides a focus for the northern entry area, but is effectively invisible from elsewhere in the Gardens.

With the exception of the Archery Lawn and Beswicks Walk, tree groupings do not generally form identifiable features, although individual trees do serve to identify particular locations and thus aid orientation. Spatial form is largely determined by the disposition of shrubby vegetation at and above eye level. Such vegetation is at its densest in three main areas - at either end of the Archery Lawn and in an extensive western belt that includes the native section. Where the path network is uncoordinated, these are the zones

most likely to create confusion and disorientation for visitors.
Given that the essential purpose of the Gardens layout is to allow its contents to be seen and understood, open space is required in order that vegetation groupings and dimensions can be appreciated. It is important that shrub areas do not become so wide that specimens in the centre become invisible and inaccessible. Similarly, very tall trees grown as individual specimens require open space of corresponding proportions if their size and character are to be readily apparent. Some parts of the present layout, particularly in the central parts of the Gardens, are unsatisfactory in this respect. Future planting programmes must be designed to achieve a better three dimensional balance and a more appropriate setting for important individual specimens or groups.

Landmark features

Even if the existing pattern of vegetation was reorganised to provide a more systematic layout in botanical terms, this would not necessarily create a clear visual and spatial order. There are however, other components of the landscape that can serve to aid visitor orientation. As noted previously in this management plan, the Avon River corridor is the most important of these, particularly where intersected by access routes at the three bridges. Other features serving as identifiable landmarks include buildings and other artefacts visible from a distance, particularly those defining an axis or associated with a major open space. The following list records the major landmarks in the present structure of the Gardens.

Rolleston Avenue Frontage

The street frontage links the Gardens with the street grid of the city centre, emphasized by the placing of the three 'founding fathers' statues to terminate the east-west street vistas. The transparent metal fence enhances the effect, allowing the street space and Armstrong Lawn to register as one, framed by the solid stonework of the Museum and Arts Centre.

Peacock Fountain

See Page 43 for information on this.

Robert McDougall (ex-art gallery) building

Though oriented at an awkward angle unrelated to its surroundings, the previous Art Gallery building serves to identify the transition zone between the Armstrong Lawn and Archery Lawn. The nearby Eveleyn Couzins Memorial serves to reinforce the landmark value of the area, but is not integrated into the path system.

Cuningham House

Of the central complex of conservatory and service buildings, the Cuningham House dominates by virtue of its height. Its north-south axis, extended towards the rose garden, forms a focal point in the generally east-west alignment of the Gardens paths. Its landmark value is reduced by the lack of any adjoining major open space.

Gardens Café (Tea Kiosk)

Apart from its function and location, this building's distinctive shape identifies it as a focal point in the Gardens.

Paddling Pool/Playground

Located in a major open space, this complex is a significant focal point.

Bandsmen's Memorial Rotunda

The circular shape and discreetly formal character of this structure in North Hagley Park effectively creates a landmark, though it is one that is well integrated into its surroundings. It is significant in being the only one in the Gardens/Hagley Park area that is clearly visible from Riccarton Avenue.

Rock Garden

The intrinsic visual interest of the Rock Garden is greatly enhanced with the exploitation, to maximum advantage, of the modest difference in level along a river terrace.

Curators House Café and Restaurant

The Curators House, which is the refurbished original 1920s residence of the Gardens curator, became a restaurant and demonstration fruit and vegetable garden in 2000. See Page 42 for more information.

The path system

Significance

Pathways normally mark the most convenient route between two fixed points. A path may link a number of points in a predetermined sequence, and may also serve to define a boundary or margin.

The network of paths in the Gardens is required to meet all of these criteria and, in addition, provide the basic framework for use and physical ordering of the Gardens. Due to the Gardens' size and complexity, and because visitors are not confined to the paved routes, the path network's function of allowing easy physical assess is less important than its role as an intelligible grid of guidelines and orientation points by which the visitor can navigate.

Structure

The present path layout is the end result of a series of major re-arrangements imposed on the Gardens during the first eighty years of its existence. Since passing into the management of the Christchurch City Council only minor adjustments have been made to the path system, notably around the Gardens Café/Tea Kiosk. The main elements of the network are (from east to west):

- A formal grid reflecting the street network, which dissolves into irregular curves in the zone between the museum and the river.
- A riverside walk closely following the bank from the Armstrong Lawn to the North Bridge.
- The parallel paths framing the Archery Lawn.
- In the central area, a complex of mainly straight routes that have no discernible logic, apart from the axis through the Rose Garden.
- In the south-western pond zone, a labyrinth of narrow twisting paths following the shorelines threading through the native section.
- Paths on the south side connecting Riccarton Avenue to the Woodland Bridge (the Pinetum area has no formed paths).

A significant feature of the system is the river boundary, which effectively controls access to the central area. Apart from the Rolleston Avenue gates, traffic is channelled across the bridges, and internal movement originates at those points.

Traffic patterns

Visitor movement tends to reflect the east-west alignment of the river loop. Heaviest pedestrian traffic concentration is on routes between Rolleston Avenue and the North Bridge (which serves the Botanic Gardens Car Park), giving access on the way to the conservatories and the Gardens Café. Less use is made of the Woodland Bridge as an entry point to the core of the Gardens, but the West Bridge and adjoining United Car Park attract significant visitor numbers.

Most people travel to the Gardens by private car (58%). The second largest group walk (24%), 12% travel by taxi.[10]

The following table shows preferred parking location in order of preference.

[10] Opinions Market Research Limited Visitor Audit and Profile Exercise Botanic Gardens 2004.

%	Location
49.0	Botanic Gardens Car Park (off Armagh Street entrance to North Hagley Park)
22.2	Rolleston Avenue
15.9	United Car Park
10.6	Worcester Street Car Park
2.0	Riccarton Avenue
	(B.G. Rooke 1985)

The path network must also accommodate service traffic, including routine maintenance operations and delivery vehicles.

Deficiencies

Given its crucial role in providing an intelligible structure for the Gardens as a whole, the present path network is seriously deficient in several respects.

- It has no overall structure, but instead comprises a patchwork of uncoordinated routes laid out at different times for different purposes.
- It does not adequately reflect either the current patterns of public use or probable future needs, particularly in the width, alignment and surfacing of paths.
- It is extremely complex and disorienting for visitors unfamiliar with the layout. Confusing junctions, arbitrary alignments and inconsistent path sizes, surfaces and details all contribute to the general incoherence.
- It provides no clearly identifiable routes by which a visitor with limited time can quickly see what he or she wishes to see.
- The entrances to the Gardens are either poorly located, functionally inadequate or require visual upgrading (Note: The northern entrance has been upgraded).

Some specific examples of path network failings:

- Beswicks Walk is the most impressive pathway in the Gardens - a formal avenue occupying a twenty metre swathe near the centre. The alignment, though, is unrelated to any existing feature and the avenue tails off uncertainly at either end.
- Gardens vehicle movement focuses on the service yard, which is poorly located for external access. The lack of a vehicle entrance across the river near the depot results in service vehicles driving through the centre of the Gardens from the West Bridge to get to the depot at the back of Christ's College. Thus, the current pattern of sealed routes tends to reflect vehicle circulation rather than visitor movement.
- At the western end of the Archery Lawn, where the Gardens are at their narrowest, vegetation screens the view ahead for visitors proceeding westward and confusion is created by arbitrary path alignments. The only path carrying through in a straight line (that on the south side) shows no identifiable goal other than another distant screen of vegetation.
- Though the site has an attractive frontage of over two hundred metres on Rolleston Avenue, the effective main entrance is squeezed against the corner of the Museum, suggesting that the Gardens are merely the backyard of that institution.
- Apart from the area near the Gardens Café, nowhere in the Gardens is there adequate paved access to the waters edge allowing space for seating as well as uncongested traffic movement. By following the river bank too closely the riverside walk also inhibits the use of the riverbank for picnicking, grouped seating and a variety of planting arrangements.

Comment

A botanic gardens is, amongst other things, a living museum. The value of any museum depends not only on the nature of its contents, but on their accessibility and on how well they are

displayed. A visitor should without difficulty be able to:

- identify where any particular item is displayed.
- be able to find it.
- identify it when found.

In the case of the Gardens, the last of these three requirements is essentially a matter of labelling. The other two depend primarily on a rational layout in which plant collections, access paths and other features form a coherent intelligible pattern, analogous to the rooms and corridors of a museum building.

At present the Gardens, as a whole, do not exhibit a basic structure of this kind. While many of the individual plant collections are skilfully designed, the overall pattern is essentially haphazard, being the product of piecemeal development in the past. Similarly, the path network over much of the Gardens is arbitrary and confusing, bearing little relationship to current facilities and traffic patterns. Even when aided by a map, visitors to the Gardens are likely to become disorientated and frustrated when seeking a particular item of interest.

A fundamental aim of the management plan is to address this problem by mapping out a spatial structure in which every component of the Gardens can be given a logical place. The creation of such a structure is necessarily constrained by what exists on the ground at present; nevertheless the aim must be to ensure that future physical changes, whether planned or otherwise, serve to clarify, rather than confuse, the logic of the Gardens layout.

Future development should include consideration of how the existing circulation and spatial structure might be integrated with Garden features. It must also address the problem of creating greater intelligibility in the large areas not related to existing landscape features that can aid orientation. This may require strategic location of new structures or features, careful disposition of new planting, adjustment to the network of paths, or some combination of these measures. Adjustment to the path system is the easiest to achieve in the short term and is, in any case, required due to its current deficiencies noted above. Further bridges are required to encourage greater public use of underutilised parts of the Gardens and to facilitate improvements to vehicle circulation patterns.

Due to its essentially flat topography, the Gardens lacks any high viewing point to enable visitors to gain an overall impression and pick out the strategic features. Guide maps do not entirely address this deficiency since many people have difficulty in interpreting maps. Identifiable landmarks are therefore essential and must form a network covering the whole Gardens site.

13. Plant Collections

The Gardens contain one of the most important collections of exotic and indigenous plants in New Zealand. These include many shrubs, trees and herbaceous plants not commonly seen in commerce or private gardens.

Trees

The single most important factor contributing to the character of the Gardens is the large number of mature trees that occupy most areas. Many of these trees are now over 115 years old with the oldest recorded specimen now approximately 145 years old. Some of these trees are of national significance due to their large size and or rarity. Many more are of regional significance. For example, the alpine ash, *Eucalyptus delegatensis*, growing behind the Rock Garden, with a trunk diameter of 2.79 metres, is the largest of its species in New Zealand and, due to its trunk size, probably one of the largest of its type anywhere (Burstall, 1984). A Westfelton yew, *Taxus baccata 'Dovastoniana'*, situated on the Central Lawn, now over 110 years old, is one of only two of this variety recorded in New Zealand. It is already large and visually significant and can be expected to live for a considerable time (Burstall, 1984). In addition, many of the trees were planted by members of the British Royal family, Governor Generals, Presidents of Rotary International and other distinguished people.

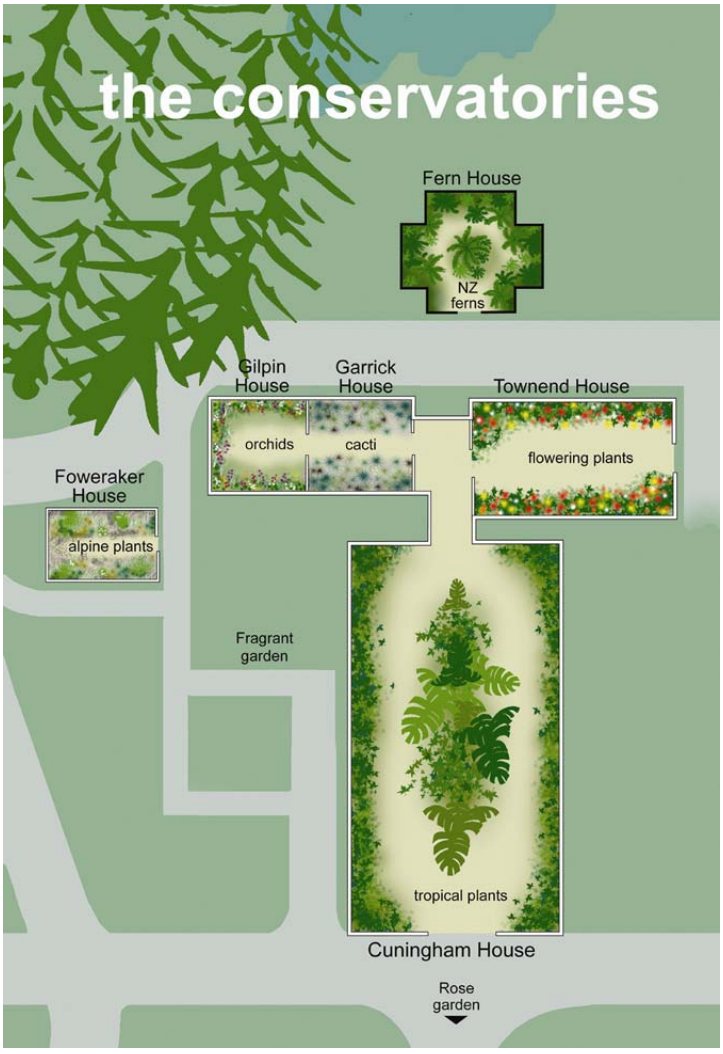
However, as the large trees have matured several problems have emerged. Many of the trees are planted quite close together and, as root systems have expanded to support the growth of the tree, severe competition for water and nutrients has arisen.

The relatively shallow depth of soil in some parts of the Gardens, being over gravel layers, compounds this problem. With many of the large trees, feeding roots extend for considerable distances beyond the crown of the tree. As a result of these factors, many of the large trees in the Gardens are now in a stressed state, which makes them especially vulnerable during periods of drought and possibly less resistant to disease. The current Gardens irrigation system is not adequate to compensate for very dry periods with the watering of the trees.

The relatively even age of most of the larger Gardens specimens, which range from 90-130 years in age, will probably mean many of these trees will eventually die within a short space of time of each other. This would result in large gaps being created over many areas of the Gardens as there are still few semi-mature trees to take the place of the mature specimens. It is only in recent years that replacement trees have been planted in larger numbers. However, their growth is often hampered by root competition and shade from existing trees.

The optimum solution for replacement planting would be to prune back or remove existing trees to create light gaps for the young trees, yet this has not been an acceptable option to date. The life expectancy of exotic trees in New Zealand is still not fully understood, as most existing large trees are part of the first generation to be planted. Experience in Hagley Park and around the city however indicates that tree life expectancy may be much lower than the maximums experienced in their natural habitats.

Within the Gardens, there is still the opportunity to plant a greater number of different species as there is currently considerable duplication of tree species in the range of mature and semi-mature trees.



Cuningham House *(Collection category – Tropical Plants)*

The main tropical plant collection is housed in the Cuningham House, which was opened in 1923. It was built as a result of a bequest by Mr C.A.C. Cuningham.

The Cuningham House is divided into two main sections - a lower house on the ground floor and an upstairs gallery. High light requiring tropical plants are grown on the upstairs gallery, while those requiring lower light levels grow on the ground floor. The central ground floor portion also allows growth of the taller species.