

DESIGN

Introduction to form

There is a radical error, I think, in the usual mode of constructing a story. Either history affords a thesis – or one is suggested by an incident of the day... I prefer commencing with the consideration of an effect. Keeping originality always in view – for he is false to himself who ventures to dispense with so obvious and so easily attainable a source of interest – I say to myself, in the first place, “of the innumerable effects, or impressions, of which the heart, the intellect, or (more generally) the soul, what shall I, on the present occasion, select? (Reiser, & Umemoto 2006: 100)

- Edgar Allen Poe, *On Composition*

THEORY ON FORM:

The search for form has concluded that architectural form making derives from either one or a combination of five different theoretical positions. My conclusion states idea as the most important aim of architecture, that the relationship between form and programme influences/guides/shapes the idea through the design process. (see pages 14 -47)

FORM ON URBAN SCALE:

The first introduction to form was the urban analysis, aiming to preserve, link and enhance open space in the Pretoria Central Business District. The framework restructures the urban fabric through a series of layers, adding new functions to anticipate urban growth and address future needs of uncertain conditions. (see pages 50 -57)

SITE AND FORM:

The site is orientated round Meintjeskop hill. The natural landscape has a history layered with interventions. Of these, the most prominent is the Neo-classicist 1910 Baker scheme. Form on this scale deals with the archaeological, preserving and enhancing the existing context. (see pages 60 -75)

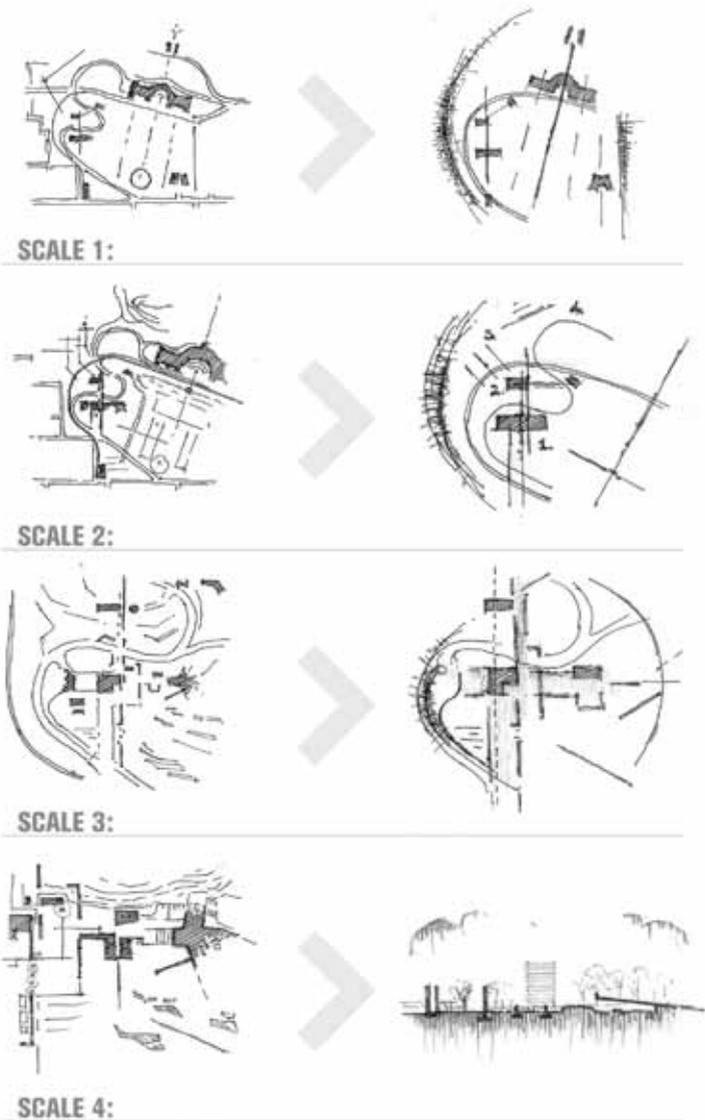
PROGRAMME AND FORM:

The site is historically coupled with nature, while the design of the botanical garden is determined by typography and historic narratives. The site allows the possibility of conveying my own conclusion regarding the relationship between form and programme. The botanical garden is rooted in the idea of architecture for plants, preserving and linking open space on the Union Buildings estate. (see pages 78 -81)

METHOD:

The project deals with immeasurable scale differences, examined in this chapter under various topics. Separate designs are discussed according to difference of scale, arranging the desertion as parts to a whole.

Scale 1: The Union Buildings estate, site development plan for the Neo-classicist Baker scheme.
Scale 2: Elandspoord National Botanical Garden, site plan and organisation strategy.
Scale 3: Entrance Garden, landscape and design development of the botanic garden.
Scale 4: House Vrede and associated exhibition buildings, design and technical resolution.



Fig_68: Order: Diagrams on four scales.

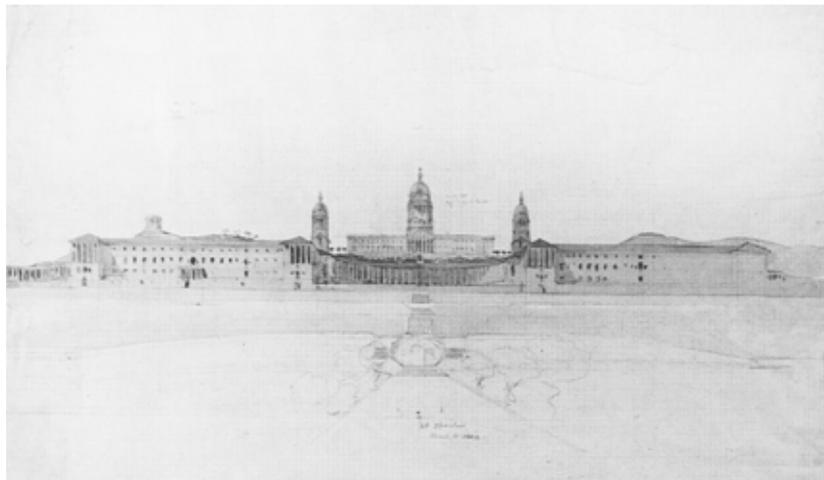
Order

SITE PLAN:

The Union Buildings and its rich political symbolism are the crowning achievement of Sir Herbert Baker's South African career (RENCKEN 1989:1). Based on the premise of reconciliation, the design is a symmetrical plan orientated round a North-South axis transversing Meintjeskop. The scheme is based on a Neo-classicist Renaissance form. A key factor in the development of the design is the association with nature. The Union Building gardens are integrated with the architecture through a series of geometrical relationships. A dominant central axis links terraced lawns with a great flight of stairs. Classicist statuary and clipped hedges adorn the axis, terminating in a colonnaded.

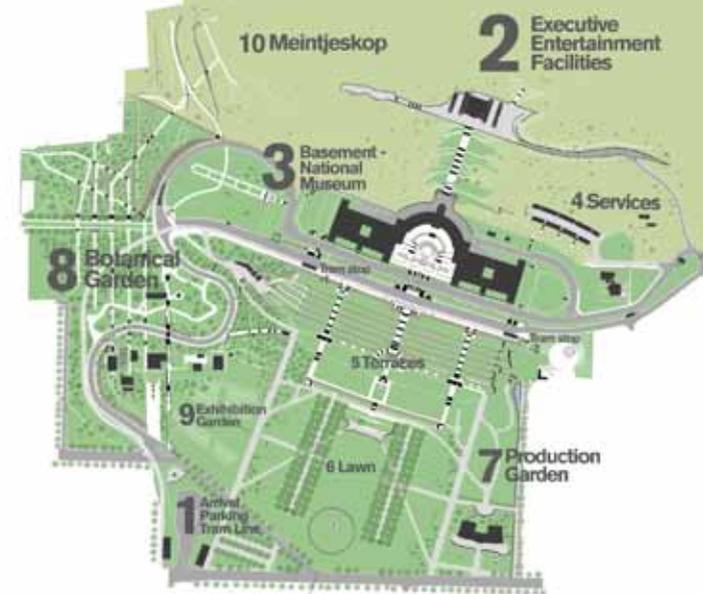
In recent years, the estate has undergone a series of conservation and management schemes, none of which addresses design on a scale equivalent to that of Baker's 1910 vision.

** Figure 70 (Opposite page) is a scheme of the proposed redevelopment plan for the Union Building estate. The site plan incorporates the historic significance of existing form with new programmatic pressures on the premises.*



Fig_69: H. Baker perspective of the Union Building estate

1. Arrival Parking & Tram Line
2. Executive Entertainment Facilities
3. Basement - National Museum
4. Services
5. Terraces
6. Lawn
7. Production Garden
8. Botanical Garden
9. Exhibition Garden
10. Meintjeskop



* The Union Building estate, site development plan for the Neo-classicist Baker scheme.

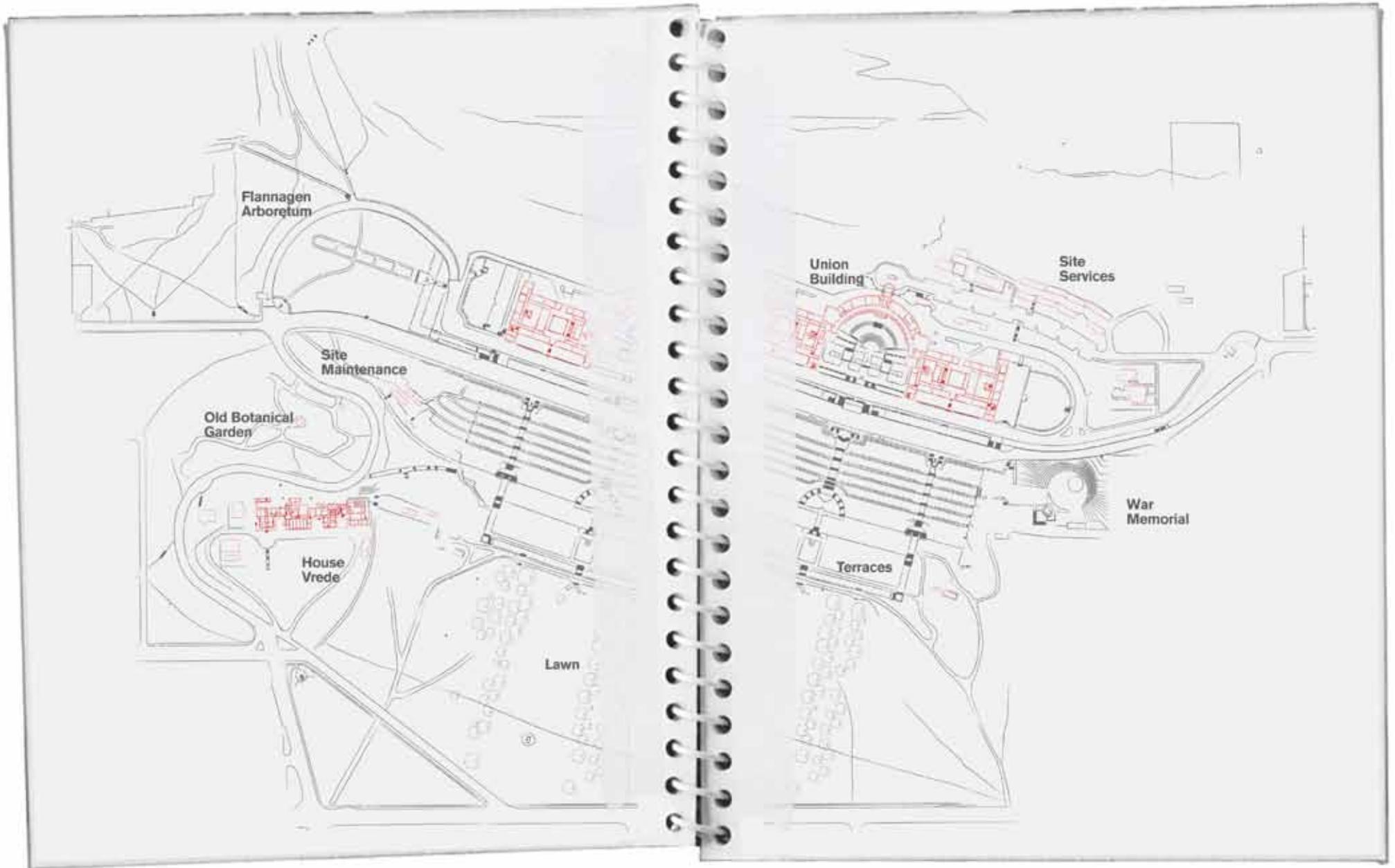
Fig_70: Site Plan of the Union Building Estate.

SITE PLAN

EXISTING



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SITE PLAN NEW



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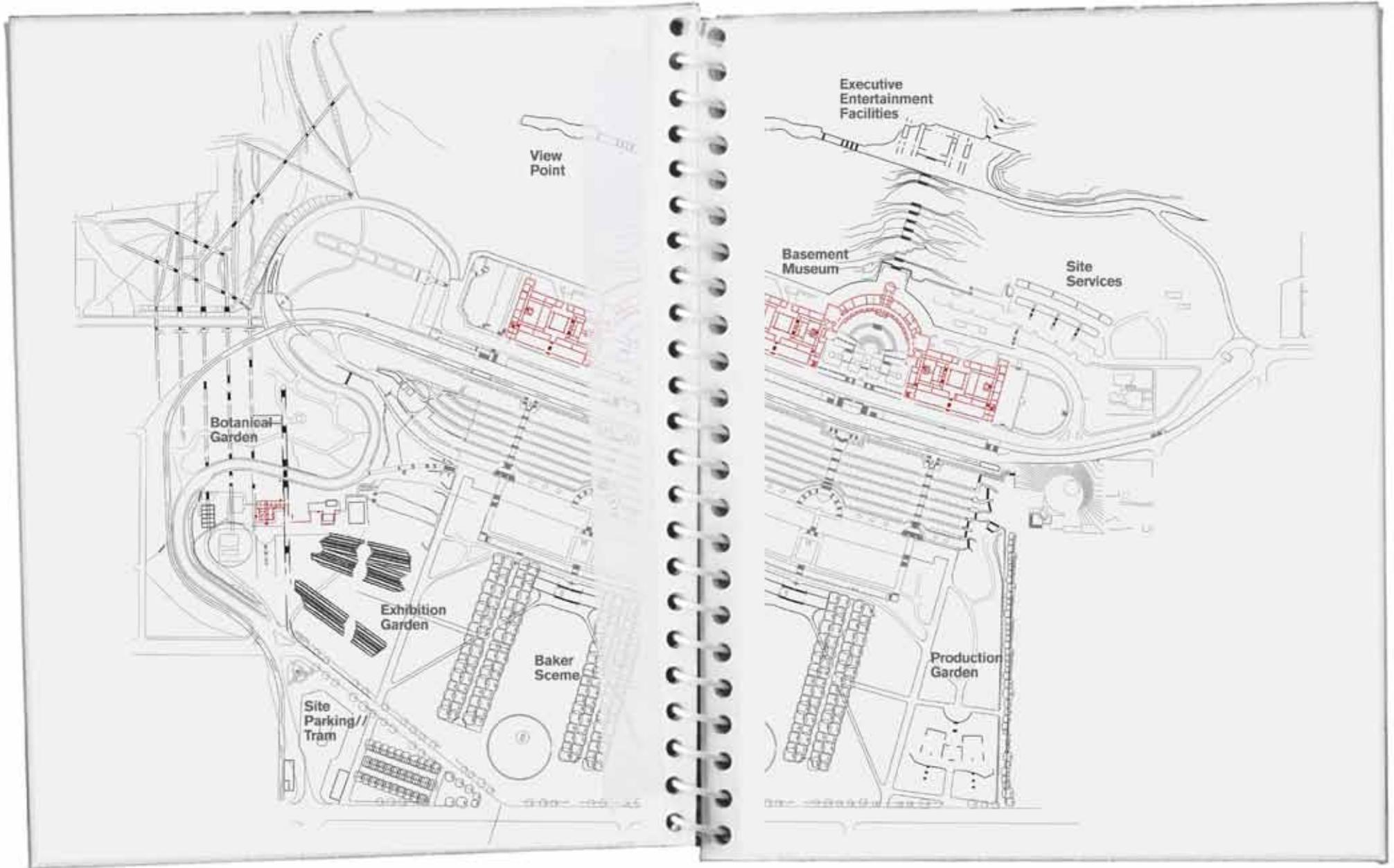


DIAGRAMME DEPLOYMENT:

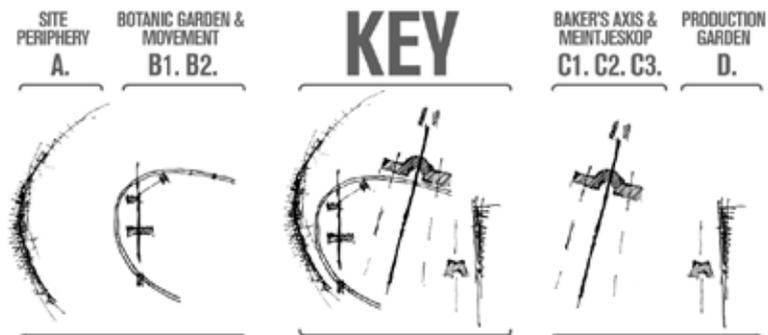
A: LEFT SIDE BOUNDARY - The proposed redevelopment retains the existing character of an open space, linking the site with the city. In changing the existing periphery to become more welcoming, the currently blunt inner-city edge becomes a more active one that engages with its context.

B1: BOTANICAL GARDEN - The National Botanical Garden re-establishes botany as a historic programme. The garden forms the left boundary of the site, curving to define a peripheral green space that links with the city. House Vrede's 1890 axial connection with Church street is exaggerated to connect four separate biomes in the garden. The new botanical axis uses the same organisation as the 1910 Baker scheme, archeologically applying the idea of symmetry to link terraced gardens through a great flight of stairs.

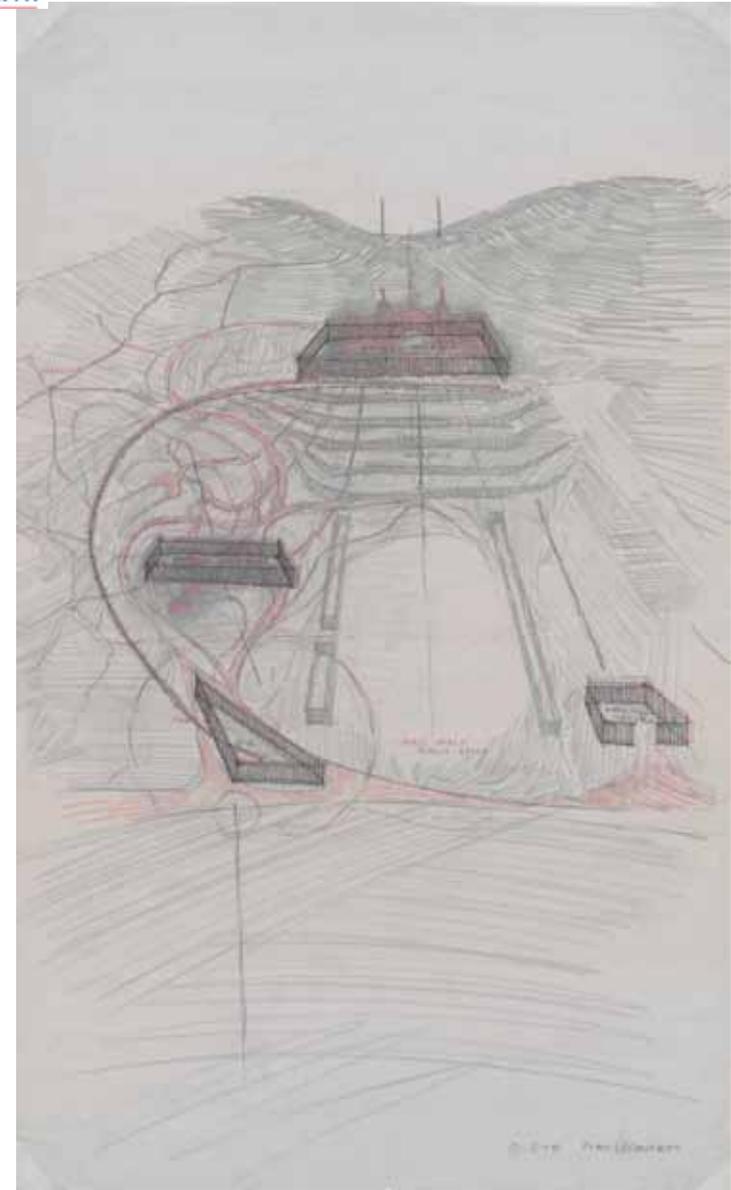
B2: MOVEMENT - Designated as a space for movement, the triangular portion south of the estate is designed as a bus station, parkade and tram line. A new movement strategy restricts vehicular access to roads on the site. The southern island is the predominant gathering space from which most pedestrian activity will disperse on the site. The tram line will run on its old track, designed in 1914, the tram is the primary way of moving people up the site.

C1, C2 & C3: BAKER'S AXIS & MEINTJESKOP - The form reinstates Baker's 1910 vision. An entertainment facility on Meintjeskop is proposed to serve the dual purpose of completing the 1910 Neo-classicist Renaissance axis and provides facilities for presidential functions.

D: EAST EDGE - The Augustan style production gardens draw on the vision of classical Roman landscapes. The form uses the programme of agriculture to establish the Eastern edge of the site. The garden displays the productive aspect of gardening to the public, providing the estate with vegetables and plants.



Fig_73: Diagramme of Site Plan.

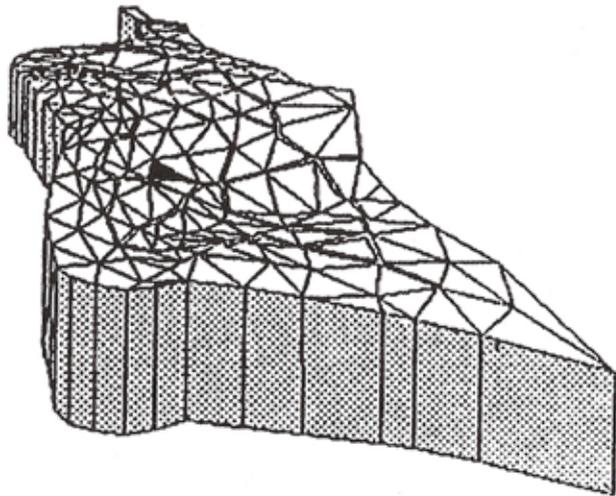


Fig_74: Perspective of the 2010 site development plan.

Botanic garden

TYPOGRAPHY - ORGANIZATION OF CONTOURS:

* Barcelona Botanic garden.
Barcelona, 1999
Carlos Ferrater, Bet Figueras and Jose Luis Canosa.



Fig_75: Ferrater's vision of the 'fishnet stocking' concept for the Botanic garden in Barcelona.

The design is based on a taut net. Stretched to cover the slope of the site, project architect Carlos Ferrater imagined the design as "some sort of fishnet stocking going over the land". Different slopes are reflected in the triangular geometry of the net, giving structure to the layout. The sizes of the net holes establish different slopes and areas in the botanic garden. The lattice is emphasized by three meter wide paths and retaining walls of concrete and cor ten steel (CROFT 2004:188).

The Barcelona's Botanical garden was designed by an interdisciplinary team of architects, landscape designers, horticulturists and biologists. Located on the Montjuic, a green headland in Barcelona the size of the garden is 1.2 hectares. The project was completed in 1999 on a derelict rubbish tip. (http://www.jardibotanic.bcn.es/11_eng.htm#inici)

The garden contains plant collections from the five Mediterranean regions. Plants are exhibited according to their ecological affinity, recreating landscapes as they are found in their natural environments.

SETTING - ORIENTATION AND TYPOGRAPHY:

* Walter Sisulu Botanical Gardens.
Johannesburg, South Africa.



Fig_76 & 77: View of the 40 m waterfall and meandering river, Walter Sisulu botanical garden is organized around a meandering river. Water is used as organizing element.

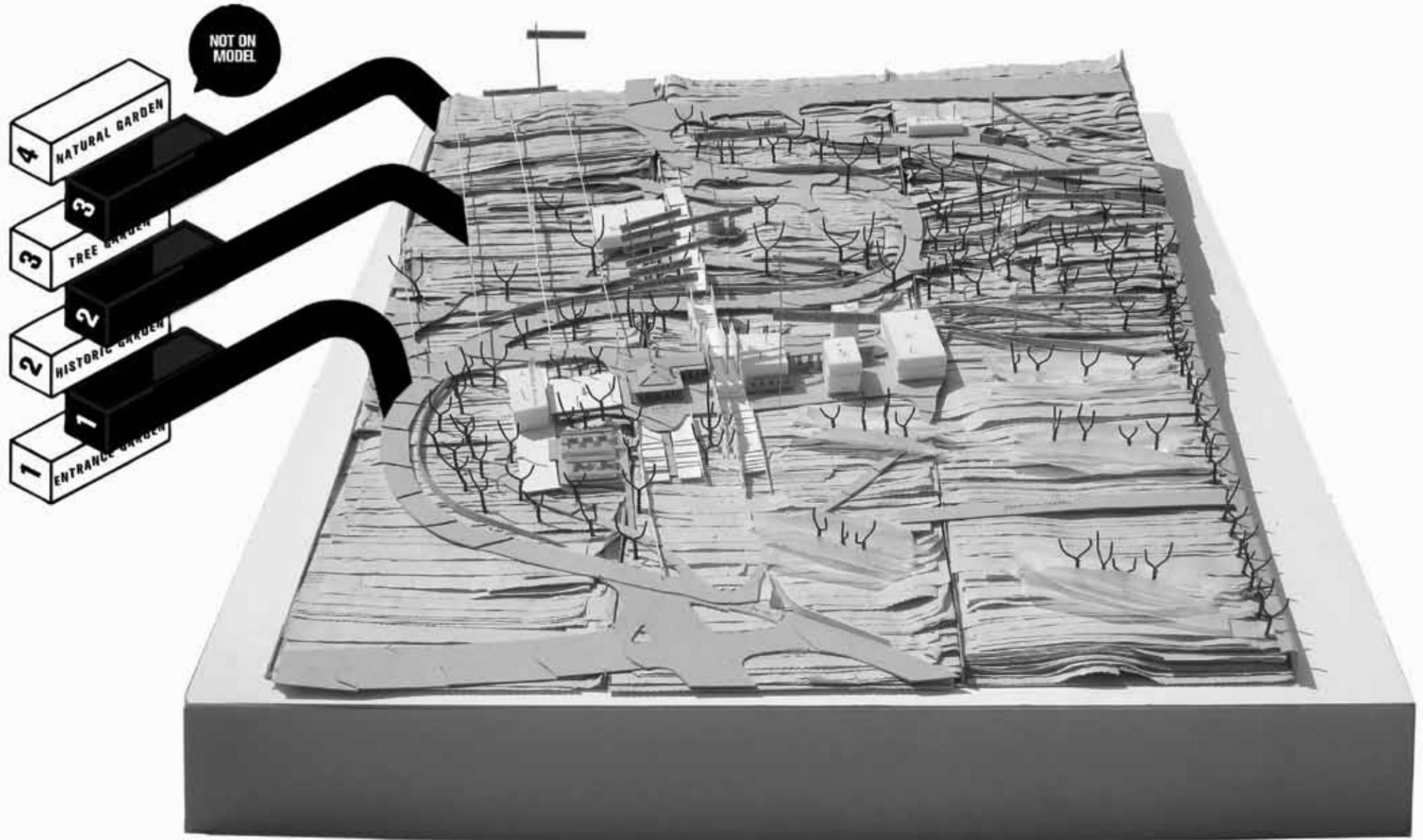
Walter Sisulu botanical garden is located on the West boundary of Johannesburg. It is positioned in a spectacular valley surrounded by hills. Designed around the meandering river, natural geometry is used to organise and familiarise people in the garden. Visitors are guided to the source of the river, the main attraction in the garden, a 40 m high waterfall.

ELANDSPOORT BOTANICAL GARDEN

CONCEPT MODEL



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FOUR GARDENS:

The botanical garden stretches across a steep 1.3 hectare portion of land, west of the Union Buildings. An strategy was needed to provide a logical organisation on the site. Layered by different designs, five prominent programmes make up the current garden form (House Vrede, the old botanic gardens, site maintenance buildings, Flanagan's arboretum and Meintjeskop hill).

Modelled on various precedents, the schematic proposal for the new garden (visitors centre and historic gardens) divides the site into four parts.

PART 1 - ENTRANCE GARDEN:

The intermediate scale garden uses House Vrede's (1890) axial connection with Church street. The historic axis is extended into the landscape to create the organising geometry of the first two gardens. The garden will showcase a series of permanent and temporary plant exhibitions.

PART 2 – HISTORIC GARDEN:

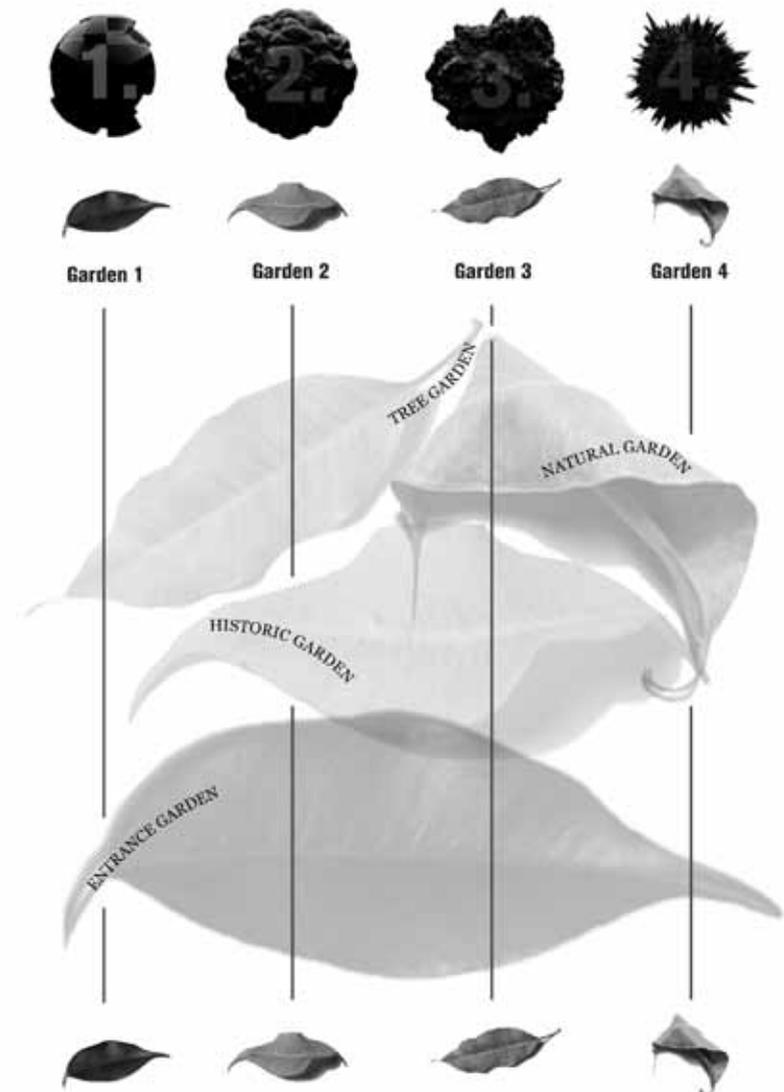
The larger scale garden uses a series of ramped and inclined plains to manage the slope of the site. Designed to display the grand collections of the old botanic garden, triangular steel and concrete planters are used to guide visitors to and from the axially organised entrance garden. A prominent feature of this area is a pine tree plantation that was planted as part of the 1910 Baker scheme.

PART 3 – TREE GARDEN:

Flanagan's arboretum (planted in 1920) houses more than 50 indigenous trees. The character of the garden is open, creating an environment to view and appreciate trees. Pathways through the pine forest connect the relatively isolated site with the historic and entrance gardens.

PART 4 – NATURAL GARDEN:

Meintjeskop forms the natural backdrop to the Union Buildings. Currently overgrown by alien plants, the garden re-establishes the site as part of the Magaliesburg mountain range. Cycads, aloes, and other South African plants will replace the overgrown thicket. The garden is linked to the arboretum with footpaths that zigzag the koppie.



Fig_79: Diagramme illustrating the organization of the four gardens on Elandsport National Botanical Garden.

WEST SITE PERIPHERY BEFORE



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NDSAPOORT BOTANIC GARDEN AFTER

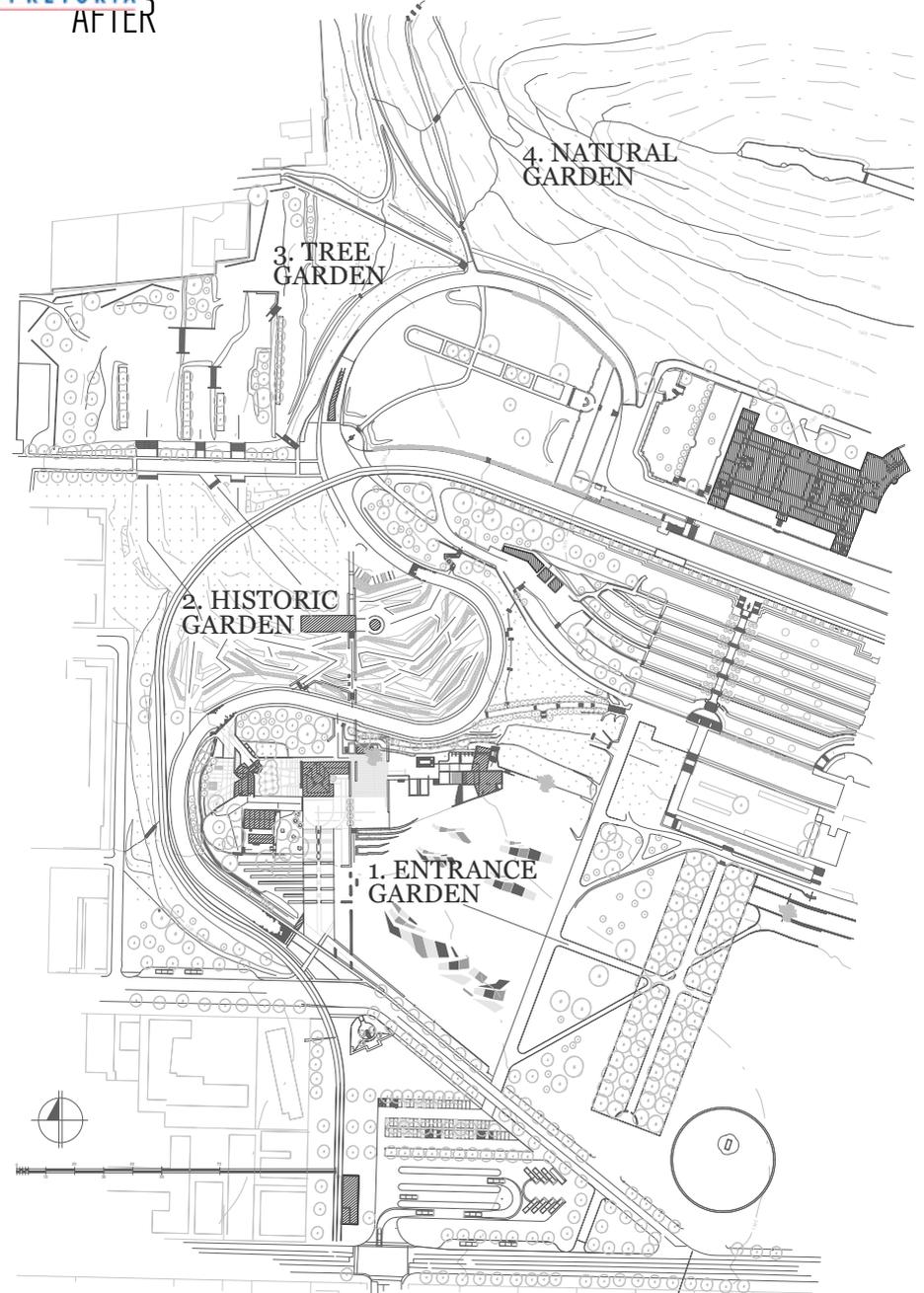
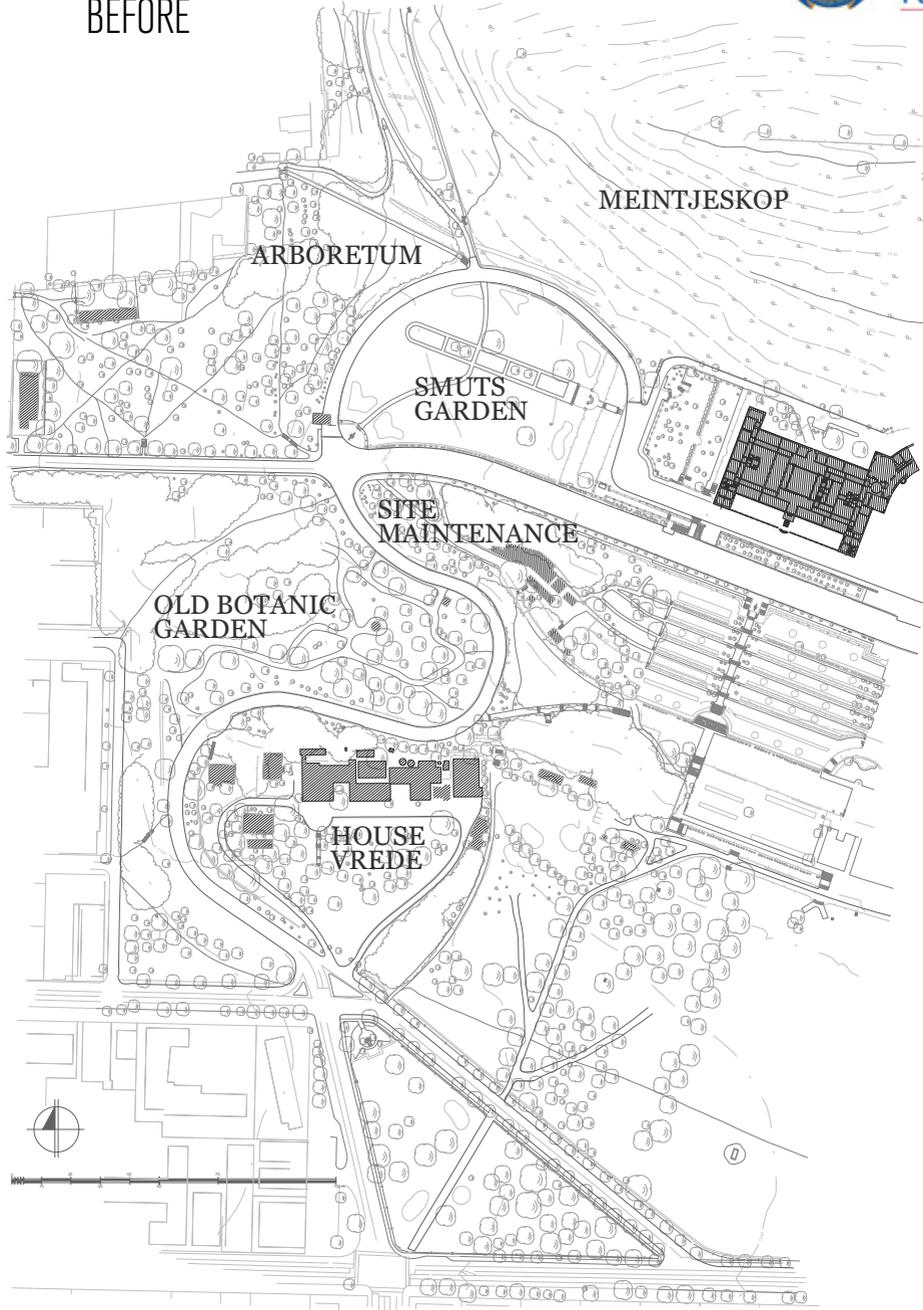


DIAGRAMME DEPLOYMENT:

A: WEST BOUNDARY – The western boundary of the botanic garden is planted with a forest of *Pinus pinaster* trees. Characterised by tall pine trees, the design of the sloped area was shaped by the tramway passing through the site.

B: BOTANICAL GARDEN – The organising principles of High Renaissance gardens developed by Baker for the Union Buildings, uses a central axis to integrate building and landscape. The botanical garden reinterprets House Vrede's 1890 axial connection with Church Street. Programme, movement and smaller gardens are disposed in relation to the axis.

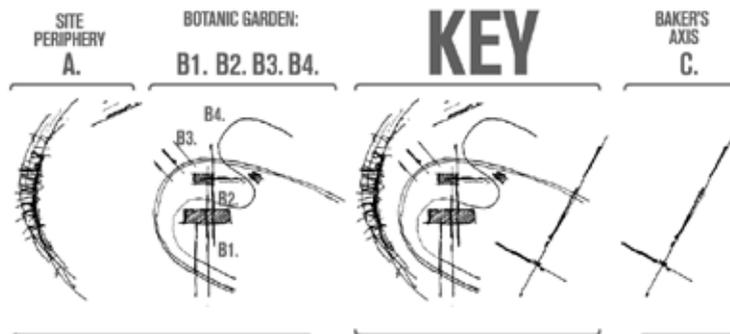
B1: ENTRANCE GARDEN - The importance of movement and drama (characteristics of Mannerist gardens) underline the key principles in the entrance garden design. Buildings are displayed as ornaments in an outdoor composition.

B2: HISTORIC GARDENS - The garden design uses a Post-Modern response to the site. A new layer of geometry introduces fractured triangles over the historic 'landscape garden'.

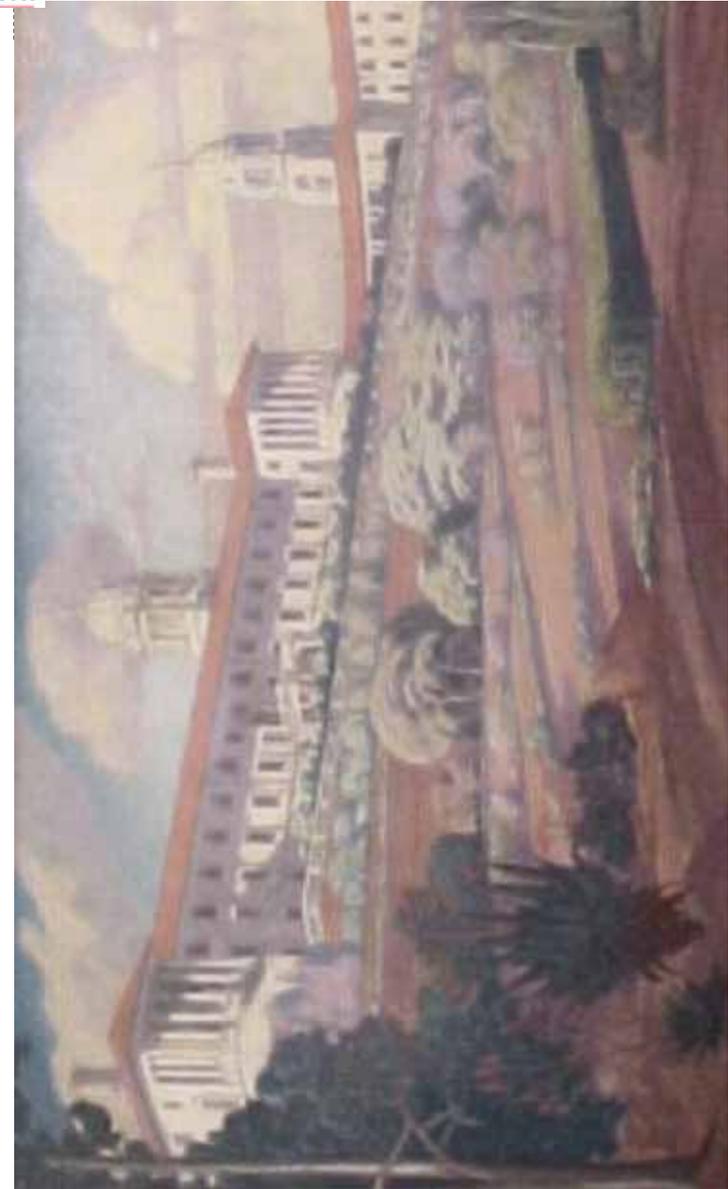
B3: TREE GARDEN – The typography is used to display woods, grassland and the existing arboretum. Connected by a series of paths, trees are grouped to form enclosed spaces. The grove exhibits trees in an outdoor sanctuary.

B4: NATURAL GARDEN – Planning of Meintjeskop re-establishes indigenous vegetation on the hill. Greenways on the site are designed for recreation, hiking and nature conservation.

C: BAKER'S AXIS – The Renaissance garden's projected axis brings the mountain, landscape and the Union Buildings into one composition. A line of view is introduced to the design, the avenue (on the lower lawn) connects the axial geometries of the Baker scheme and the Botanical garden.



Fig_82: Diagramme of botanic garden.



* 1915 Painting by Pierneef.

Fig_83: Perspective of Union, building, with old botanical garden in foreground.

Entrance garden

NATURE AS INSPIRATION FOR ARCHITECTURAL FORM:

Architecture and organization principles of what it might be, has (for the past five hundred years) viewed nature as principal source of inspiration.

- Adrian Forty on Nature

(FORTY 2000:220).

Plants in architectural design is used as decorative elements in buildings e.g. trellis and pergola. If used to control light and temperature in the built environment the foliage on these structures can adapt to seasonal change in winter and summer (JEKOT 2008).

Plato's concept of nature is based on the idea that nature is constructed out of rationally defined geometrical proportions (FORTY 2000:220). Viewed in the Baroque as the source of beauty and in the 19th century as the origin of architecture, nature significantly influenced architectural theory.

My premise is based on the idea that architectural form should express its programme. Architecture has derived form from nature as a geometrical relationship that satisfies aesthetic criteria for buildings. The entrance garden proposes the idea of architecture for plants. Buildings deal with the programme of nature, used not merely in a geometrical sense but as part of the architectural envelope.

** Nature as the origin of architecture:*

Essai Sur l'Architecture, illustration by Marc-Antoine Laugier. Architecture points to the natural building, and instructs humanity in its principles. (The supposed form of the first architecture, primitive man built huts from tree trunks)



** Fig_ 84: Essai Sur l'Architecture, illustration by Marc-Antoine Laugier.*

POLYCHROME EFFECTS ON PLANTS:

* Colour and light transmittance through protective covers.

North West University, South Africa.

Prof. Leon van Rensburg.

Plants have inherent adaptive characteristics both in terms of light quality and quantity. Plant growth and development can be altered with protective covering.

- Prof. Leon van Rensburg on protective covers.

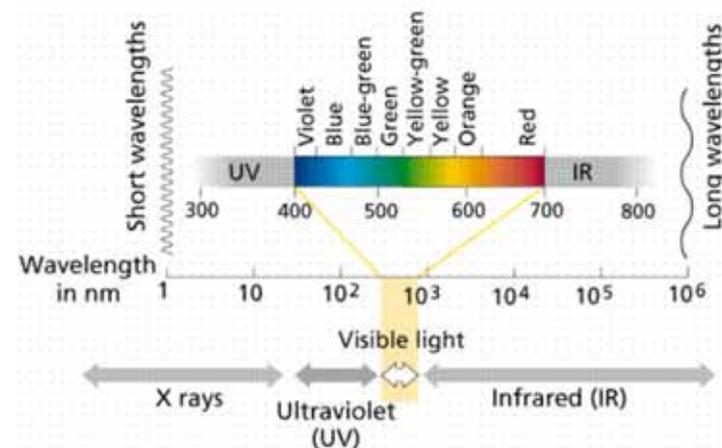
(VAN RENSBURG. 2007)

Prof. Leon van Rensburg studied the effect of light on plants. By manipulating the quality and colour of light one can speed up the process of plant growth. Case studies on grapes and apples examine the process of photosynthesis, whereby plants are exposed to different environments of light (intensity and quality). His research provides different colours for covered netting that can be woven to speed up plant production (VAN RENSBURG. 2007). Although the colour theory focuses on the agricultural value of plant production, the possibility of colour and polychrome covers for greenhouses are limitless.

* Opposite page: Figure 85 illustrates the typical transmittance spectrum of light. Strawberries are grown under and the transmittance spectrum of 58% red Knitpol® shade netting.

TROPHOBIOSIS:

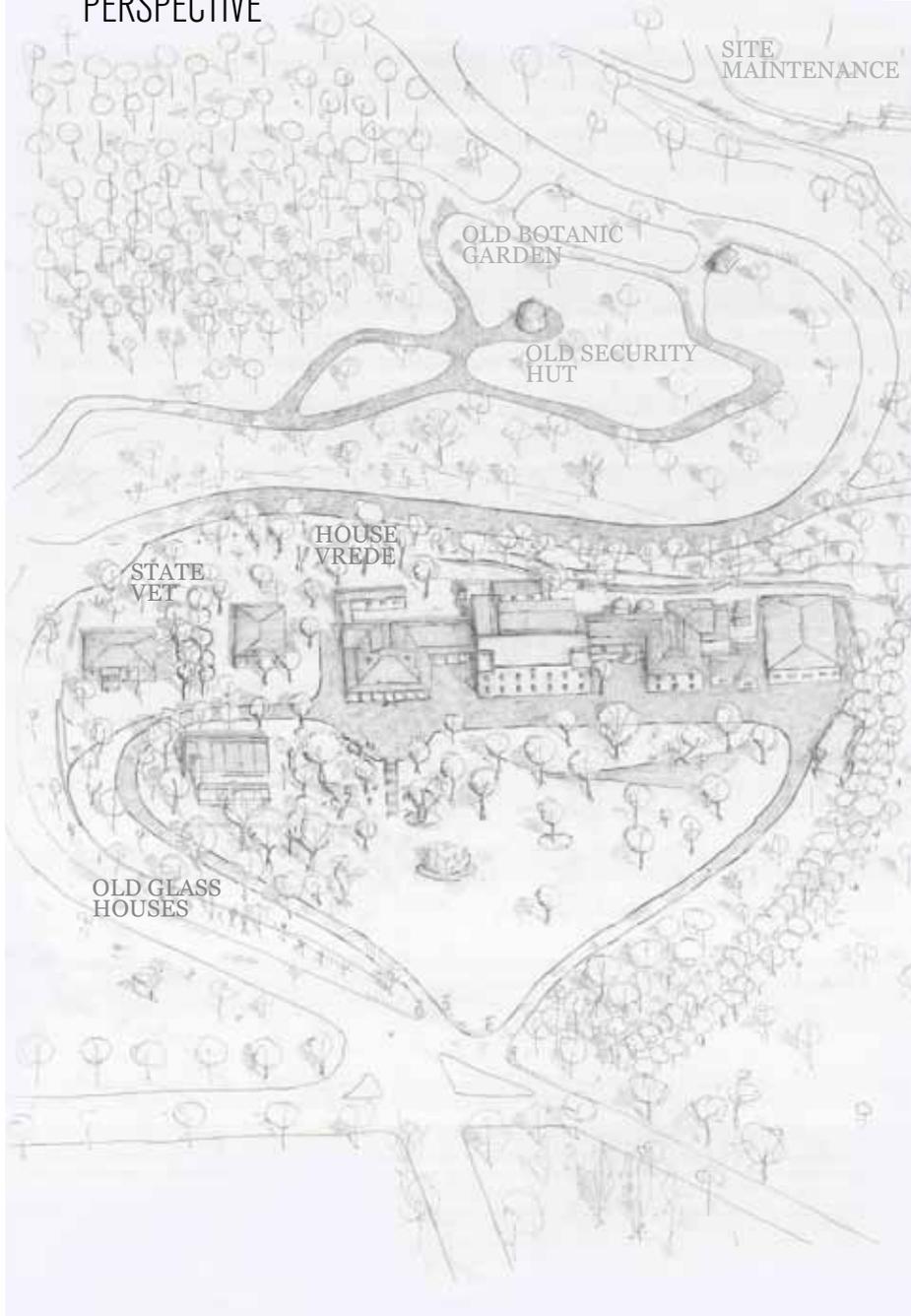
There is the common experience that pesticides used on crops lose their efficacy after a few applications. Developed by French botanist Francis Chaboussou, the theory of trophobiosis explains the reason why. Plants have the natural ability to be disease free. Ironically the chemical warfare against pesticides in effect progressively weakens plants. Weakened by the pesticides, plants become imbalanced, not being able to manage their own nutrients. Imbalanced plants tend to destroy themselves. The only way for a plant to do this is by providing pests or insects with nutrients to speed up the process. Essentially trophobiosis is the process whereby a plant deteriorates to a state of suicide (PAULL 2007:22-24).



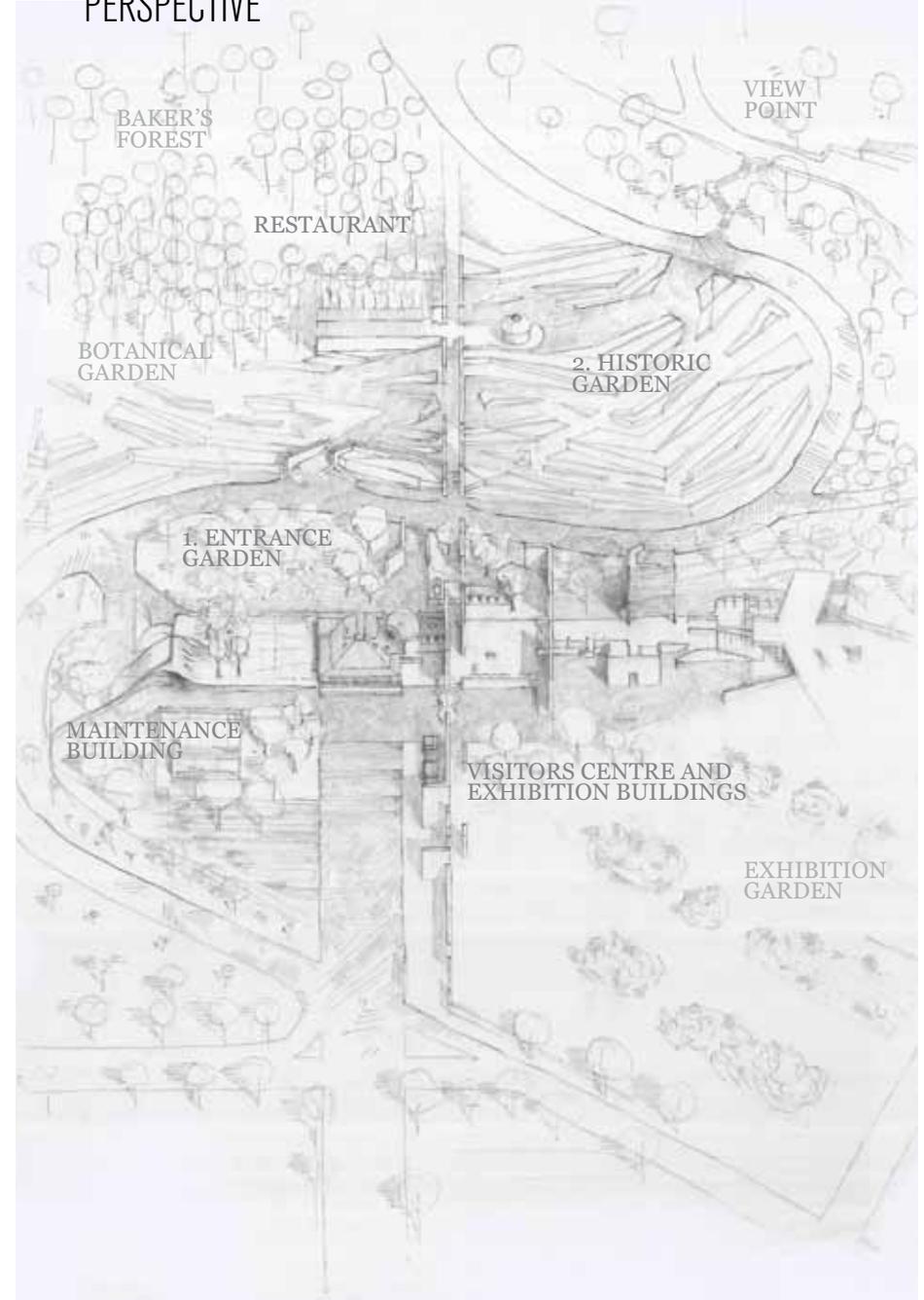
Fig_85: $\text{Light} + 6\text{H}_2\text{O} + 6\text{CO}_2 = \text{Photosynthesis}$.



HOUSE VREDE - EXISTING PERSPECTIVE



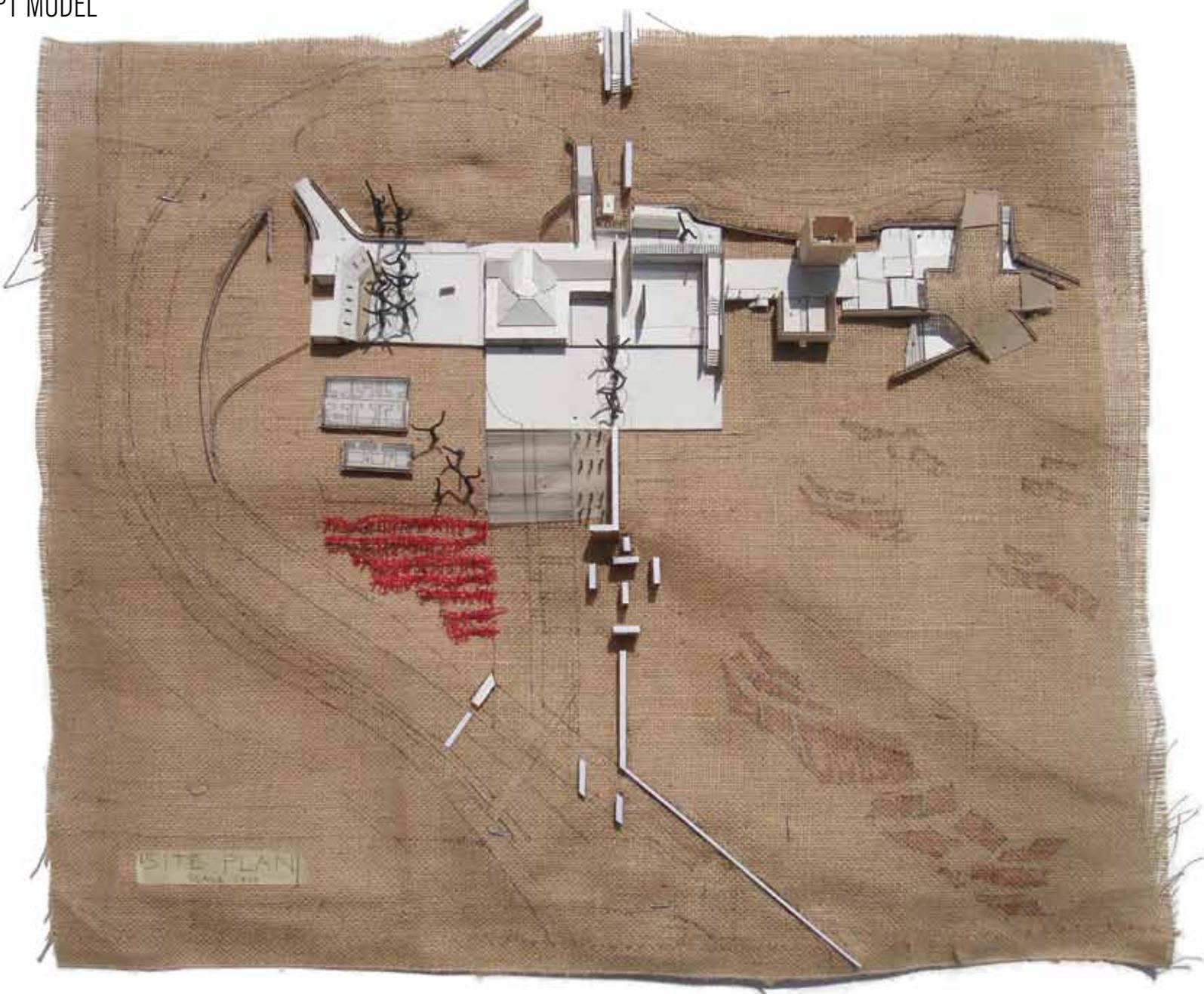
RANCE GARDEN - NEW PERSPECTIVE



ENTRANCE GARDEN CONCEPT MODEL



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SITE PLAN

ENTRANCE GARDEN

BAKER'S PINE FOREST,

FOREST WALK

2. HISTORIC GARDEN

FERN GARDEN

CLIVIA WALK

RESTAURANT

OUTSIDE SEATING - 100

ADMIN OFFICE
OLD SECURITY HUT

FRAGRANCE GARDEN

SANBII OUTPOST GARDEN

ALOE GARDEN

ALOE GARDEN

ALPINE GARDEN

SUCCULENT GARDEN

ANNUALS

YVIGIES

KOETSWEGPAD

MAGALIESBURG
KRANS

SERVICE ACCESS

SERVICE ACCESS

ADMIN PARKING

A • ADMINISTRATION
BUILDING

GLASSHOUSE

GREENHOUSE (1914)

OLD POTHOUSE

ANTE-GRADEN
HORTICULTURAL PROPAGATION

E • PERM. EXHIBITION,
TIMBER FOLLY

THE COLEMAN HERBARIUM
TEMPORARY EXHIBITION SPACE

EXHIBITION BUILDING COMPLEX

OLD - PLANT PATHOLOGY
BUILDING // LILLY POND

B • HOUSE VREDE &
ARRIVALS

C • TEMPORARY
EXHIBITION SPACE

D • PERM. EXHIBITION,
LILLY POND

ARRIVAL COURT

ENTRANCE WALK

FIGUS GARDEN

PLANTED
GREEN WALL

1. ENTRANCE GARDEN

EXHIBITION GARDEN

KOETSWEGPAD

HISTORIC AXIS

SECURITY POINT

BUS STOP

TO PARKING

20

40

60

80

100

120

140

160

180

200

220

240

260

280

300



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TO U.B. LAWN

100 m

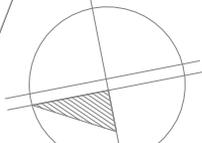


DIAGRAMME DEPLOYMENT:

A: SITE PERIPHERY – The entrance garden is closed off on its west boundary by Koetswegpad. Planned by Baker, the movement route winds up the hill to the presidential wing of the Union Buildings. The difference in level created by the road forms an edge for the site.

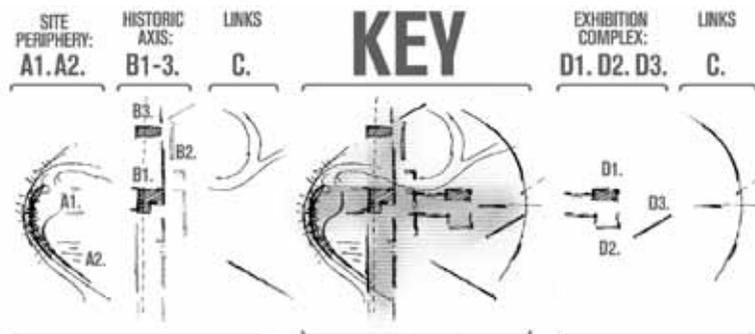
A1: ADMINISTRATION – Located next to the koetswegpad, vehicular access on the western edge of the site provides the opportunity for programmatic functions dealing with production. Based on the idea of displaying activities of production, the concept for the administrative building is designed to exhibit processes of production.

A2: HORTICULTURAL PROPAGATION – Plants propagated in agricultural environments are usually grown in tunnels. The propagation garden, next to the garden entrance is designed as a series of exhibition tunnels. Coloured netting will be used for solar control.

B1-3: HISTORICAL AXIS – Gardens surrounding House Vrede resemble the Picturesque style. A sweeping lawn (in front of House Vrede) is encircled by trees and a perimeter driveway. The axis from Church Street to House Vrede is extended to the koppie. Neoclassical geometry is used to connect three programmes on the site (Exhibition at House Vrede, a restaurant and viewing point).

C: LINKS – The Eastern part of the site was used as a nursery for the Union Building gardens. The only remnants of the nursery are historic terraces and old pathways. The site is designed with the idea to open up the space, connecting it with the rest of the site.

D1-3: EXHIBITION COMPLEX – Forming part of a East-West axis that intersects the North West botanic movement, three exhibition buildings are designed on the footprints of the old herbarium and plant pathology buildings.



Fig_90: Diagramme of the entrance garden.



Fig_91: Concept models: Exhibition garden and shade netting for the horticultural propagation tunnels.

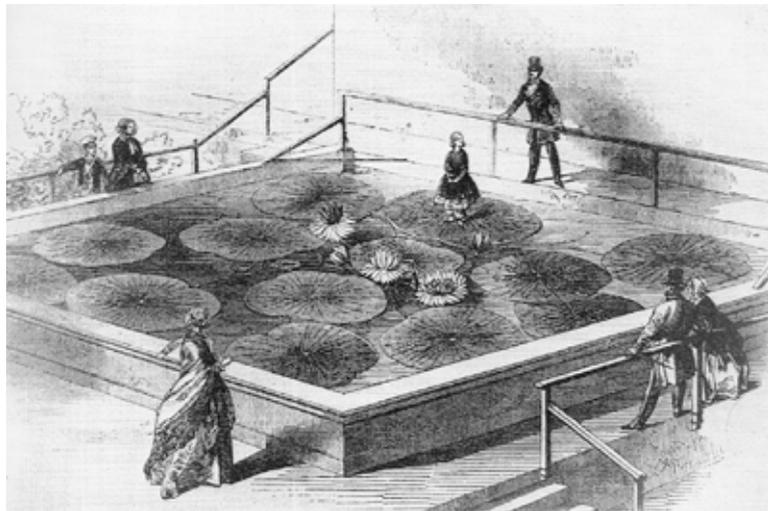
Exhibition Buildings

SIR. JOSEPH PAXTON

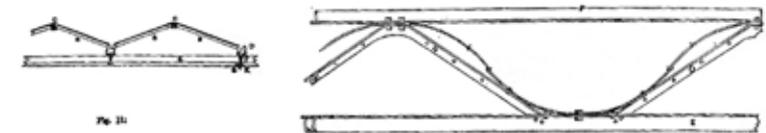
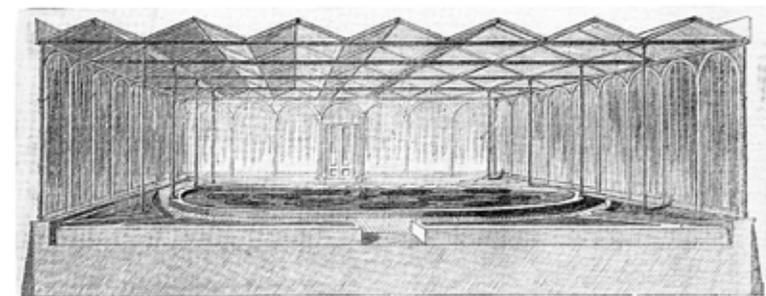
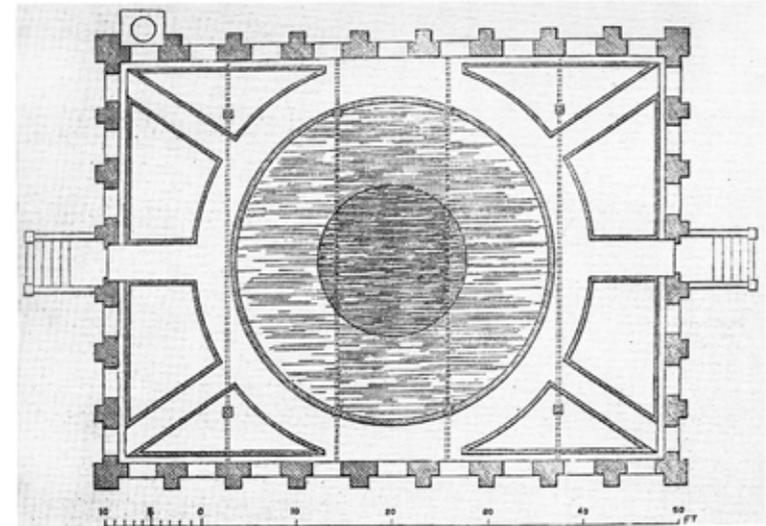
* The Great Conservatory at Chatsworth.
Chatsworth Park, England 1841
Joseph Paxton.

Trained as a gardener, Paxton had a pioneering approach to the architecture of glass houses. The chief innovation attributed to him was the approach to structural framework and glass. At Chatsworth, the conservatory was designed for the propagation of the tropical *Victoria regia* water lily.

Paxton developed a curvilinear ridge and furrow roofing system with a cast iron support frame to achieve the span for the large specimen (CHADWICK 1961:79). Although the form of the Great Conservatory was determined by pragmatic issues of techtonics, it is important to note that the building form (designed for a *Victoria regia* lily) is influenced by its relationship to nature i.e. the elliptical plan and large span interior space.



Fig_92: *Victoria regia* at Chatsworth: Paxton's daughter Anne on a leaf.



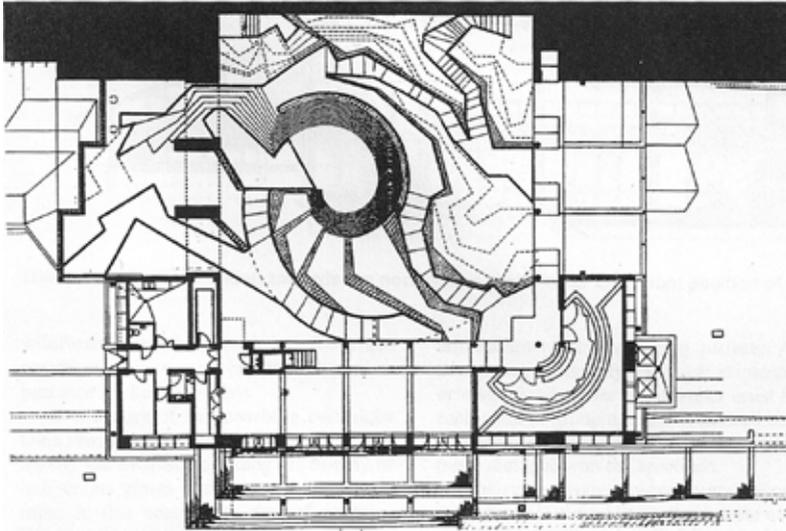
Fig_93: *Victoria regia* lily house, Chatsworth. Plan, interior and roof detail.

FOUR CHAPELS AND A CATHEDRAL:

* Kirstenbosch Visitors' Centre.
 Cape Town, South Africa 1997
 GAPP Architects & Urban designers, David Lewis Architects

The schematic proposal for the conservatory at Kirstenbosch was developed by architect Julian Elliot. Cut into the sloping site, the building's relationship to the site is dominated by a three-part pyramidal roof. The form of the building is profiled by the landscape, relating to the open character of the surrounding gardens at Kirstenbosch.

The plan layout of the central garden spirals around a large baobab tree. Connected to the permanent central exhibition space are four corner display rooms for specific plant collections. There are two movement routes in the building, both follow a gradual rise towards the rear of the space. Visitors can use the spiral path in the central area or move along the square layout of the periphery ambulatory (DE JAGER 1997).



Fig_94: Plan of the central garden: the path system as originally planned in 1994.

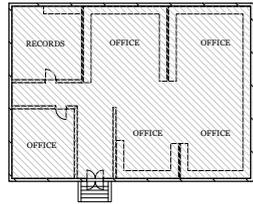


Fig_95: View from entrance: central garden and interior space.

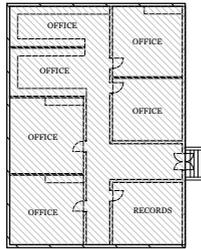
HOUSE VREDE - EXISTING BUILDING PLAN



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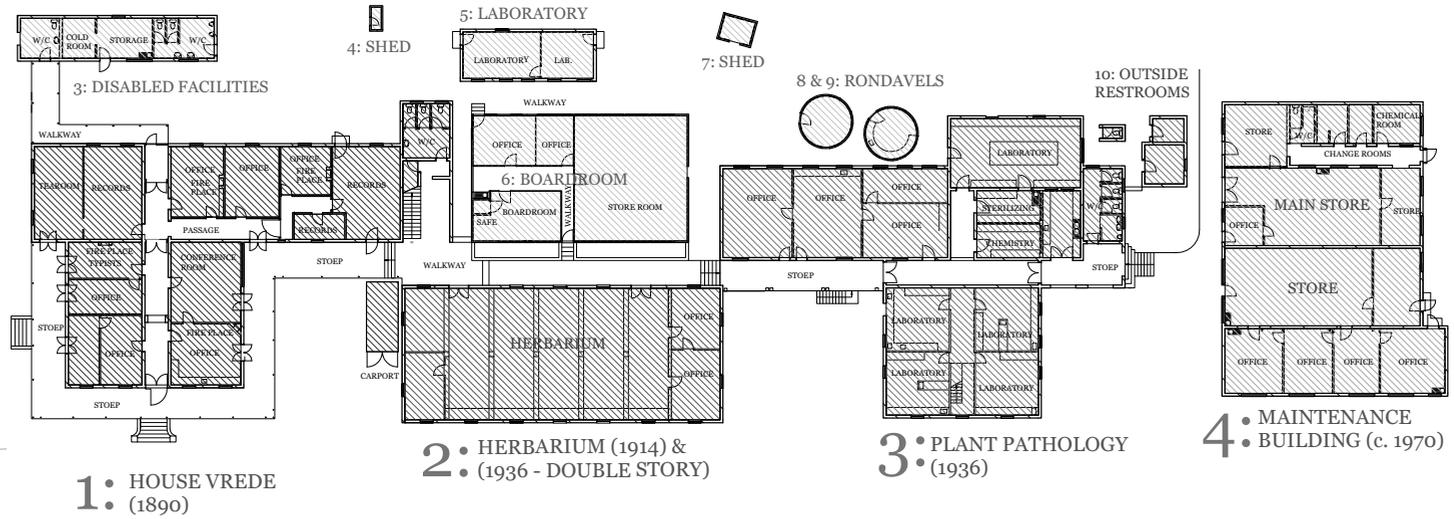


1: WOODEN SHED 1



2: WOODEN SHED 2

5-10:
MISCELLANEOUS
BUILDINGS





EXISTING STRUCTURE:

In fact, all architecture proceeds from structure, and the first condition at which it should aim is to make the outward form accord with the structure.

- Viollet-le-Duc on Structure

(Forty 2000: 276)

Designed as a lavish estate for Eddie Meintjes's wife, the first buildings adjacent to House Vrede included six stables, a cowshed, a coach house, a tennis court, croquet lawns and large flower gardens. After the 1910 Baker proposal the boundaries were changed to a circling tree belt with a perimeter carriageway (CULTMATRIX & UBA 2005:159).

After its appropriation by Pole Evans, the structure on the estate has seen the addition of haphazard buildings. The form of House Vrede's farm-house typology currently shares its structure with ten other buildings (see figure 98, previous page). The overall arrangement shares blends of Classical architecture.

Due to the extreme dilapidated condition, most of the buildings are structurally unsound. House Vrede has a high historical and architectural value, even though the many alterations of the structures around the building render it of low historical value (CULTMATRIX & UBA 2005:163).

** Figure 98 (previous page): Plan of the buildings on the site. Indicating their significance, the buildings are numbered from one to ten.*

** Figure 99 – 103 illustrates photographs of the structures' history: residential in 1889, appropriation by Pole Evans (department of Plant Pathology and Herbarium) in 1914 and extensions done from 1914 to 2010.*

NEW STRUCTURE:

New structures on the site are governed by two overlapping geometries, the North-South botanic axis (House Vrede's exaggerated axial connection with Church Street - 1890) and the existing East-West podium created by structures on the site. The existing programmatic functions (of the ten hap-hazard buildings) are redesigned to form a coherent experience of the site. Located on the footprints of the old structures new buildings on the East-West connection are informed by the archeological i.e building placement, proportion and height.

** Figure 104 (next page): Concept model for the proposed redevelopment of the administration and exhibition buildings.*



Fig_99: House Vrede, 1913.



Fig_100 & 101: Old Herbarium 1918 & 2008.



Fig_102 & 103: House Vrede c. 1932 & 1947.

** Historical images of buildings at House Vrede.*