Chapter 6
Design Resolution
CHAPTER 6
DESIGN RESOLUTION

Program

A program involves organizing a precise and detailed listing of requirements, both human and environmental.

The program includes:

- Restoring ecological systems and cultivating a sustainable landscape
- Environmental education
  Environmental education must be in places where people live and work. This can be achieved by making ecological processes visible in the landscape.
  Environmental education includes the following:
    - Illustrating techniques of water conservation by reducing storm water runoff from the site
    - Habitat creation
    - Illustrating methods of recycling materials on site.
    - Social gathering areas in a variety of places.
- More secluded spaces for people to study and read
- A public square with outside seating at the newly proposed School of Motion
- Picture Production
- Upgrading the streetscape in Lynnwood Road
- A service road accessible to the majority of buildings
- Pocket parks in existing open land around the site.
- Open green space within the site boundaries
- Centre of Earth Studies which includes a nursery and laboratories for the study of the succession of vegetation within the regional biome.
Users

Primary Users

U.P Students
U.P Lecturers
U.P Press personnel

Secondary Users

The public which will visit the School of Motion Picture Production, which will include the general public as well as school groups from Pretoria Boys High, Pretoria Girls High and Afrikaans Hoër Meisies and Afrikaans Hoër Seuns.

Fig. 6.1   Group of people.
Urban Framework
Urban Framework

Introduction

The urban development framework supports the philosophy and vision statement of “Transforming the University of Pretoria from an isolated fragmented knowledge production institution, to a University City, a city of innovation.” By referring to the framework (appendix 1) it will specifically focus on:

- The removal of physical, social and virtual boundaries which are constraining the University’s growth.
- The university as a village where the exterior spaces act as outdoor rooms for academic discourse and social play.
- The functioning of the university village as a community, working as an inter related whole, a symbiotic relationship of allied unions.

Urban Problems

After a thorough study of the site analysis the main urban problems were identified

- South Campus is not integrated into Main Campus
- Due to the site’s history South Campus is not designed for educational programmes and activities.

Resolutions

- Integrate South Campus back into the urban realm.
- Establish a vision for South Campus where both buildings and landscape can relate to.

Vision for South Campus

Existing locations of art related faculties justify the establishment of an art and culture precinct to generate ease of access between creative departments. Ecology and Technology forms the basis of all educational programmes, enabling the site to become a living laboratory. All academic programmes featured on South Campus by various faculties should include subjects in their curriculum which focus on ecological sustainability within their specific field.

Fig. 6.2 Urban concept.
Campus Design Guidelines

- Common and customary setback lines.
- Visual unity between old and new.
- Design according to human scale.
- Campus buildings should pose a transparency which helps to increase a feeling of involvement.
- Campus should offer a variety of spaces with a variety of activities
- Quality interface between town and campus.
- Landscape should respond to existing buildings.
- Clear and convenient circulation routes.

([www.pp.okstate.edu](http://www.pp.okstate.edu))

Fig. 6.3 – 6.8 Campus design guidelines.
New Functions and footprints

The open pieces of land lying towards the west of the site should be an extension of the site and its activities. This urban gateway is also an introduction to the University precinct.

Fig. 6.9 Urban gateway.
1. Parkade
2. Centre of Electromagnetism
3. Cafeteria
   - Drama Studios
   - Biotechnical lab
   - U.P Press
4. Business Economics
5. Earth Centre
6. Art sculpture studios
   - Motion Picture Academy
7. Water Utilisation
8. Computer and Internet Centre
10. Art History
11. Town and City Planning
12. Art and Architecture intervention
13. Outdoor screen

Fig. 6.10  New site activities.
Building design guidelines for newly proposed buildings

(Refer to figure 3.66 in analysis)

All buildings which are demolished should be demolished in a manner which allows the different building parts to be erected elsewhere.

Building Envelopes
- Building envelopes should where possible consist of prefabricated units and should provide thermal comfort and generally energy efficiency.

Lighting
- There should be controlled distribution of daylight in buildings, using the daylight factor, as a design target.
- Indoor spaces should be grouped with similar luminous requirements
- Reduce consumption of electricity
- Optimize lighting effectiveness
- Visual comfort
- Energy efficiency through appropriate shading devices

Heating
- The use of passive solar heating to control climate and thermal comfort.

Cooling
- Effective cross ventilation for climate control and thermal comfort.
- Night ventilation of thermal mass

Energy production
- The installation of plug loads which represents the electrical consumption potential of all appliances

Water and waste
- Water re use and recycling
- Water catchment systems

(Kwok, G et al. 2007)
Circulation and building access points

Pedestrian movement patterns on the site are determined by primary uses. A parkade on the east and a primary function on the west side will create a vibrant movement of pedestrians east – west across the site. Open areas adjacent to both these structures will allow for public squares. By further accentuating this particular axis the two big open squares on the western and eastern side of the site will be coordinated and better visual orientation is achieved.

The newly proposed bridge across Lynnwood Road will retain spatial continuity; the habitable bridge will become a pedestrian system onto which buildings can be glued.

Fig. 6.16  Circulation and Building access.
Outdoor spaces
Concept

Touchstone project

- Landscape as a stitch

The touchstone project image is an abstract and strong representation of what the project wants to be. The inspiration lies in the simplicity of the design, but the complexity of the detail, networks, transitions and stitches.

Concept statement

From the theoretical review, site analysis, precedents, design principles and the touchstone project the following concept can be formulated:

The links, which forms networks, are more important than the elements themselves. The site’s rich complex system of patterns and patterns within patterns offer a foundation for equally rich patterns of development. Here lie the means for establishing a living environment which will connect human and natural processes.

Fig. 6.18 – 6.21 Material stitched onto canvas.
**PHASE 1**
- Set up infrastructure for wetland (seeds can be harvested from Pretoria Boys High wetland)
- Establish Earth Centre
- Assemble green houses
- Start with vermi culture

**PHASE 2**
- Buy seeds for the germination of the first planting material on site
- Mulch ground with extracts from vermi culture
- Germination of seeds in the green houses
  1. Stratification
  2. From seed to seedling
  3. Hardening off phase
  4. Establish in the landscape
- Pump water from the natural stream to be used in the green houses and the landscape

**PHASE 3**
- Plant the first batch of seedlings on the site and establish growing guides where applicable
- Thereafter the site will be a host to the continuous processes of seed harvesting, propagation, planting and mulching while succession is reached
- System of ongoing processes will be able to provide for external sources
Concept development

Through the application and networking of the living systems building blocks the site will have the possibility to change from an open to a closed system sustaining itself.
Landscape Framework
Landscape Framework

Introduction

The landscape development framework is necessary as it construes landscape as a process, rather than a product. As a result any project must assume the role of an open ended strategy for setting up future conditions. Thus, by reading the site as a living and dynamic micro organism it enables the designer to incorporate it into the larger field of effects.

Important Edges and Connections

- Northern Edge towards Lynnwood Road

On street parking

The existing on street parking on Lynnwood Road will remain as it is; this greatly minimizes the average speed of driving along Lynnwood Road. The existing Jacaranda trees will remain in place.
The Stramp

A stramp will form the northern edge of the square. The main purpose of the stramp is to ease the flow of circulation into and from South Campus. The newly proposed parkade and art and architecture intervention will have access from the stramp.

- Corners of University and Lynnwood Road

As the new BRT stops will be situated on these edges a proposal has been made for a series of earth mounds which will form part of the green corridor extending from Magnolia Dell. This has led to the decision to close the vehicular service gate along Lynnwood Road. This will have no influence on the traffic circulation on Main Campus as this gate is presently permanently locked.

- The service road

A service road will be built over the existing channel. The road will be accessible from University Road, it will provide a secondary entrance and primary exit to and from the parkade. This road will also be used by delivery trucks to service buildings.

Fig. 6.26 Earth mound.
Materials

- Timber decking
  Timber decking material is used in close proximity of open water or it serves as an edge between water and hard surfaces. It was also considered as a favourable material as it has a low embodied energy.
  - Cobble stones
  - Permeable concrete paving

The in situ laid permeable concrete paving will cover most of the hard surfaces; this offers a method for on site infiltration and combines surface stability with permeability. The series of voids helps to reduce both runoff volume, the concentration of overland flow and allows air to filter through, thus water is directed into the groundwater recharge.

The light colour of the concrete increases the material's albedo performance and reduces its heat absorption capacity, thus creating a more favourable micro climate and reducing heat islands effects, especially during summer months.

Pervious concrete help protect the trees in paved areas as air and water are able to get to tree roots.


- Natural stone finishes.
  The vertical edges of all steps, retaining walls and free standing walls will be consist of natural stone finish. The stone, if possible, should be salvaged from a source close to the site.

- Existing concrete
  Large parts of the site consist of in situ concrete and precast concrete blocks. Some of the existing concrete is arranged into a new pattern of paving, interspersed with planting. This technique reduces the demolition debris which would end up on landfills.
Concrete’s extensive use as a building material means that it is a good candidate for reuse. The only potential for in situ concrete is to crush it and to use it directly for either fill or landscaping.

Existing pre cast concrete blocks can be used in the construction of new buildings including roof tiles, concrete lintels and kerb edgings.

(Addis, B.2007.)

Fig. 6.28 Combination of materials used on site.

Fig. 6.29 – 6.31 Sections showing the sequence of the construction in process.
Vegetation
LOW MAINTENANCE PERENNIAL PLANTING
LUZ LANDSCHAFTSARCHITEKTEN
RIEM LANDSCAPE PARK

The principle of “leading aspect” provides the main foundation for successful design with plantings.

The leading aspect occurs 2-4 times/m²

A few species dominate in every plant grouping

Dominant establishment and self-propagation maintain a design vision over time

The planting effect is exhibiting a dynamic character

(Margolis, L & Robinson, A. 2007.)
Systems
Vegetation

The site vegetation will be a representation of the four, most diverse vegetation types found in the Bankenveld biome. (Bredenkamp, G.J. 2003). Each vegetation type will form its own ecosystem.

The aim of the site’s vegetation is to illustrate the temporal quality of landscape, making visible the change and movement inherent in the medium. Vegetation, where possible, will be established through self-propagation and succession. This will be managed by the newly propose Earth Centre and the Green House on the façade of Lynnwood Road. Plants species will be selected for their attractions to wildlife and physical form.

Each vegetation type should be perceived to be uniform on a large scale with variety on a small scale. The principle dictates dominant species in each plant grouping which creates the “leading aspect” of the vegetation image. The dominant species should occur 2 – 4 times per square meter with companions every square metre or even every 2- 4 square meters.

The vegetation types:

- River Drainage
- Grassland
- Rocky dry exposed slope
- Mountain kloof

Stage 1: Establishment pioneer and climax species (mixed)
Stage 2: Canopy closure and thinning
Stage 3: Onward mature climax

Managed succession

Fig. 6.35  Topographical section.

Fig. 6.36  Managed succession.
Fig. 6.37  Strategic location of vegetation types.
# List of primary species

## Grassland

### Grasses

<table>
<thead>
<tr>
<th>Botanical name</th>
<th>Common name</th>
<th>Height (m)</th>
<th>Links with animals and insects</th>
</tr>
</thead>
<tbody>
<tr>
<td>Themeda triandra</td>
<td>Red grass</td>
<td>0.3 - 1</td>
<td>Birds use grass to make their nests. Seed eating birds play an important role in the dispersal of these seeds. Many insect species use grasses for food as well as shelter.</td>
</tr>
<tr>
<td>Cymbopogon plurinodis</td>
<td>Narrow leaf turpentine grass</td>
<td>0.5 - 1.7</td>
<td></td>
</tr>
<tr>
<td>Eragrostis curvula</td>
<td>Weeping love grass</td>
<td>0.3 - 1.2</td>
<td></td>
</tr>
<tr>
<td>Heteropogon contortus</td>
<td>Spear Grass</td>
<td>0.2 - 1</td>
<td></td>
</tr>
<tr>
<td>Aristida congesta</td>
<td>Tassle three – awn</td>
<td>0.3 - 0.9</td>
<td></td>
</tr>
<tr>
<td>Hyperrhenia hirta</td>
<td>Common thatch grass</td>
<td>0.3 - 1.5</td>
<td></td>
</tr>
</tbody>
</table>

*(van Oudtshoorn, F. 2006.)*

### Shrubs

<table>
<thead>
<tr>
<th>Botanical name</th>
<th>Common name</th>
<th>Height (m)</th>
<th>Links with animals and insects</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mundulea sericea</td>
<td>Cork bush</td>
<td>2 - 5</td>
<td>Two specie of butterfly (Natal Barred Blue, Common Blue) breed on this tree.</td>
</tr>
<tr>
<td>Vungueria infausta</td>
<td>Velvet wild meddler</td>
<td>2 - 8</td>
<td>The leaves are eaten by bush babies and squirrels. The flowers are visited by butterflies.</td>
</tr>
<tr>
<td>Zanthoxylum capense</td>
<td>Small knobwood</td>
<td>4 - 7</td>
<td>Mouse birds and barbets eat the fruit.</td>
</tr>
<tr>
<td>Ehretia rigida</td>
<td>Puzzle bush</td>
<td>2 - 4</td>
<td>Fruit are favoured by most birds.</td>
</tr>
<tr>
<td>Grewia flava</td>
<td>Velvet raisin</td>
<td>1 - 4</td>
<td></td>
</tr>
</tbody>
</table>

### Trees

<table>
<thead>
<tr>
<th>Botanical name</th>
<th>Common name</th>
<th>Height (m)</th>
<th>Links with animals</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ziziphus mucronata</td>
<td>Buffalo thorn</td>
<td>3 - 10</td>
<td>The larvae of many butterfly feed on this tree. The fruit are eaten by the Green Pigeon.</td>
</tr>
<tr>
<td>Acacia karroo</td>
<td>Sweet thorn acacia</td>
<td>4 - 15</td>
<td>Many bird and insects are attracted to the flowers. Roots increase the fertility of the soil.</td>
</tr>
<tr>
<td>Rhus pyroides</td>
<td>Fire – thorn karee</td>
<td>2 - 9</td>
<td>Fruit is eaten by birds such as starlings.</td>
</tr>
<tr>
<td>Acacia robusta</td>
<td>Brack thorn acacia</td>
<td>8 - 15</td>
<td>Flowers attract bees and butterflies.</td>
</tr>
</tbody>
</table>
Flowering Time

Fig. 6.38 Tassel
Three awn (Aristida congesta).

Fig. 6.39 Narrow leaved turpentine grass.

Fig. 6.40 Spear grass (Heteropogon contortus).

Fig. 6.41 Cork bush (Mundulea sericea)

Fig. 6.42 Puzzle bush (Ehretia rigida) fruit.

Fig. 6.43 Brack thorn (Acacia robusta) flowers.

Fig. 6.44 Buffalo thorn (Ziziphus mucronata) fruit.

(Thomas, V. & Grant, R. 2002.)
# MOUNTAIN KLOOF

## Shrubs

<table>
<thead>
<tr>
<th>Botanical name</th>
<th>Common name</th>
<th>Height (m)</th>
<th>Links with animals</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Dodonela angustifolia</em></td>
<td><strong>Sand olive</strong></td>
<td>2 – 4</td>
<td>Birds such as bulbuls and mousebirds eat the fruit.</td>
</tr>
<tr>
<td><em>Carissa bispinosa</em></td>
<td><strong>Forest num – num</strong></td>
<td>1 – 4</td>
<td>Fruit are eaten by the speckled mousebird.</td>
</tr>
<tr>
<td><em>Grewia oxidentalis</em></td>
<td>Crossberry raisin</td>
<td>2 - 6</td>
<td></td>
</tr>
</tbody>
</table>

## Trees

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<thead>
<tr>
<th>Botanical name</th>
<th>Common name</th>
<th>Height (m)</th>
<th>Links with animals</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Podocarpus falcatus</em></td>
<td>Small – leaved yellowwood</td>
<td>10 - 30</td>
<td>The female cones are eaten by pigeons and bats.</td>
</tr>
<tr>
<td><em>Olea europaea</em></td>
<td><strong>African olive</strong></td>
<td>2 - 10</td>
<td>The fruit is eaten by birds such as Pied starlings and Rameron Pigeons.</td>
</tr>
<tr>
<td><em>Pappea capensis</em></td>
<td><strong>Jacket – plum</strong></td>
<td>4 - 10</td>
<td>Fruit is eaten by a wide variety of birds particularly Green Pigeons.</td>
</tr>
</tbody>
</table>

- Fig. 6.45  Small leaved yellowwood (*Podocarpus falcatus*) fruit.
- Fig. 6.46  Jacket plum (*Pappea capensis*) fruit.
- Fig. 6.47  Jacket plum (*Pappea capensis*) flowers.
- Fig. 6.48  African olive (*Olea europaea*) flowers.
Flowering Time

Fig. 6.49 Forest num – num (Carissa bispinosa) flowers.

Fig. 6.50 Cross berry raisin (Grewia occidentalis) flowers.

Fig. 6.51 Forest num – num (Carissa bispinosa) fruit.

Flowering Time

Fig. 6.52 Cross berry raisin (Grewia occidentalis) flowers.

(van Wyk, P & van Wyk, B. 1997.)

(Thomas, V. & Grant, R. 2002.)
**ROCKY BUSHVELD**

### Grasses

<table>
<thead>
<tr>
<th>Botanical name</th>
<th>Common name</th>
<th>Height (m)</th>
<th>Links with animals</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aristida Stipitata</td>
<td>Long awned grass</td>
<td>0.2 – 1.5</td>
<td>Birds use grass to make their nests. Seed eating birds play an important role in the dispersal of these seeds. Many insect species use grasses for food as well as shelter.</td>
</tr>
</tbody>
</table>

### Shrubs

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<th>Common name</th>
<th>Height (m)</th>
<th>Links with animals</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rhamnus prinoides</td>
<td>Dogwood</td>
<td>2 - 7</td>
<td>The flowers attract bees while the fruit is eaten by fruit eating birds such as mousebirds.</td>
</tr>
<tr>
<td>Diospyros lycioides</td>
<td>Bluebush</td>
<td>2 - 7</td>
<td>The hanging growth of the tree makes it a good hiding place for animals</td>
</tr>
</tbody>
</table>

### Trees

<table>
<thead>
<tr>
<th>Botanical name</th>
<th>Common name</th>
<th>Height (m)</th>
<th>Links with animals</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acacia caffra</td>
<td>Common hook thorn acacia</td>
<td>5 – 10</td>
<td>Good fodder tree</td>
</tr>
<tr>
<td>Rhus lancea</td>
<td>Karree</td>
<td>4 - 9</td>
<td>Bulbuls and francolins eat the ripe fruit</td>
</tr>
<tr>
<td>Rhus dentate</td>
<td>Nana – berry</td>
<td>1 - 6</td>
<td>Fruit is eaten by bulbuls and guineafowl</td>
</tr>
<tr>
<td>Aloe marlothhi</td>
<td>Mountain aloe</td>
<td>2 - 6</td>
<td>Sunbirds and weavers feed on the nectar rich flowers</td>
</tr>
<tr>
<td>Leucosidea sericea</td>
<td>Oldwood</td>
<td>1 - 9</td>
<td>Not applicable in urban areas</td>
</tr>
<tr>
<td>Diospyros whyteana</td>
<td>Bladdernut</td>
<td>2 - 5</td>
<td>Not applicable in urban areas</td>
</tr>
<tr>
<td>Celtis Africana</td>
<td>White stinkwood</td>
<td>7 - 12</td>
<td>Not applicable in urban areas</td>
</tr>
<tr>
<td>Olea europaea</td>
<td>African olive</td>
<td>2 - 10</td>
<td>The fruit is eaten by pied starlings and Green pigeons</td>
</tr>
<tr>
<td>Acacia xanthophloea</td>
<td>Fever tree</td>
<td>5 - 12</td>
<td>Not applicable in urban areas</td>
</tr>
<tr>
<td>Cussonia paniculata</td>
<td>Highveld cabbage tree</td>
<td>4 - 6</td>
<td>Good fodder tree</td>
</tr>
</tbody>
</table>

*(van Wyk, P & van Wyk, B.1997.)*

*(Thomas, V. & Grant, R. 2002.)*
Flowering time

Fig. 6.53   Fever tree (Acacia xanthophloea) flowers.

Fig. 6.54   Dogwood (Rhamnus prinoides) fruit.

Fig. 6.55   Fever tree (Acacia xanthophloea) fruit.

Fig. 6.56   Long awned grass. (Aristida stipulate)
## RIVER DRAINAGE

### Shrubs

<table>
<thead>
<tr>
<th>Botanical name</th>
<th>Common name</th>
<th>Height (m)</th>
<th>Links with animals</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rhoicissus tridentata</td>
<td>Cape Bushmen's grape</td>
<td>Creeper</td>
<td>The fruit is eaten by birds.</td>
</tr>
<tr>
<td>Grewia occidentalis</td>
<td>Crossberry raisin</td>
<td>2 - 6</td>
<td>The fruit is eaten by the speckled mousebird.</td>
</tr>
</tbody>
</table>

### Trees

<table>
<thead>
<tr>
<th>Botanical name</th>
<th>Common name</th>
<th>Height (m)</th>
<th>Links with animals</th>
</tr>
</thead>
<tbody>
<tr>
<td>Celtis africana</td>
<td>White stinkwood</td>
<td>7 - 12</td>
<td>Not applicable in urban areas</td>
</tr>
<tr>
<td>Combretum erythrophyllum</td>
<td>River bushwillow</td>
<td>5 - 15</td>
<td>Fruit is eaten by pied barbets</td>
</tr>
</tbody>
</table>

### Wetland species

<table>
<thead>
<tr>
<th>Botanical name</th>
<th>Common name</th>
</tr>
</thead>
<tbody>
<tr>
<td>Berula erecta</td>
<td>Taro</td>
</tr>
<tr>
<td>Colacasia esculanta</td>
<td>Papyrus</td>
</tr>
<tr>
<td>Cyperus papyrus</td>
<td>Dwarf papyrus</td>
</tr>
<tr>
<td>Cyperus prolifer</td>
<td></td>
</tr>
<tr>
<td>Cyperus textilis</td>
<td>Red hot pokers</td>
</tr>
<tr>
<td>Kniphofia sp.</td>
<td>Waterweed</td>
</tr>
<tr>
<td>Lagarosiphon major</td>
<td>Blue lotus</td>
</tr>
<tr>
<td>Ludwigia adscandens</td>
<td></td>
</tr>
<tr>
<td>Nymphaea caerulea</td>
<td>Common reed</td>
</tr>
<tr>
<td>Nymphoides indica</td>
<td></td>
</tr>
<tr>
<td>Nymphoides thunburgiana</td>
<td></td>
</tr>
<tr>
<td>Phragmites australis</td>
<td></td>
</tr>
<tr>
<td>Potamageton pectinatus</td>
<td></td>
</tr>
<tr>
<td>Schoenoplectus corymbosus</td>
<td></td>
</tr>
<tr>
<td>Typha capensis</td>
<td></td>
</tr>
<tr>
<td>Aponogeton distacyos</td>
<td></td>
</tr>
<tr>
<td>Aponogeton distacyos</td>
<td></td>
</tr>
</tbody>
</table>
Flowering time

Fig. 6.57  River bushwillow (*Combretum erythrophyllum*)

Fig. 6.58  Cross berry raisin (*Grewia occidentalis*) fruit.

Fig. 6.59  Bushman’s grape (*Rhoicissus tridentate*) fruit.

Fig. 6.60  Cross berry raisin (*Grewia occidentalis*) flowers.

(Thomas, V. & Grant, R. 2002.)
WILDLIFE
Stage 1 Stage 2 Stage 3 Stage 4

Specie diversity through adaptive management

Fig. 6.61 Specie Diversity
Soil
Soil

Decomposers and detritivores are important in the formation of soils, especially in urban environments. Earthworms aerate, till and fertilize the soil, breaking down organic waste into plant available forms. This improves the soil structure and nutrient and water holding qualities of soil. Organic waste, produced by humans, can to some extent be used in the process of soil restoration. The goal of soil restoration is to produce a soil with chemistry and fertility similar to those found in healthy regional soils.

(www.globalwarming.co.za)
(www.earth911.org)

Soil on the site will be fertilized by earth worms, also known as vermicompost. The worm castings produce odourless compost and help plants to thrive. Worm compost can be harvested within three months.

(www.fullcycle.co.za)
Hydrology and Air
Hydrology

The hydrological system on the site is not going to significantly enhance the water quality of the hydrological system on a large scale but should rather be seen as an example of how water can be handled on an urban site.

Air

A tree buffer will be planted along the northern edge of the site to decrease air pollution from heavy traffic along Lynnwood Road.
Design Development
Design Development

Initial design concepts

- Squares

From an urban point of view, the spaces in front of the proposed anchors (refer to figure 6.2) should become public (west) and semi public (east) squares. Due to the positioning of the existing buildings and the newly proposed School of Motion Picture, the northern edge of the western square should form an open window from Lynnwood Road.

The northern edge of the eastern square connects the pedestrian bridge and South Campus. This gave me the opportunity to design a living edge which will also facilitate the physical movement of pedestrians.

- Axis

The axis was important to maintain as this lends the site its distinct character it also physically connects the two squares. As one moves along the axis it becomes an intricate display of daily shadows and yearly seasons.

Fig. 6.64 – 6.66 Conceptual diagrams.
• Buildings

Buildings are not seen as barriers but connecting tissue, this enhances the concept of vertical landscapes.

• Linking the biophysical and cultural environment

The visual link between the biophysical and cultural environment are facilitated through the movement of water. The physical transition space between these two environments become important.

Fig. 6.67 – 6.69 Conceptual diagrams.
My strategy for the sketch plan was to divide it into layers showing the following:

- Vegetation and soft surfaces
- Hydrology
- Paving and hard surfaces
- Spatial rooms
- Lighting
LAYERS
Soft surfaces and vegetation

The largest areas of soft surfaces are located along the eastern and southern side of the parkade. These areas will mainly consist out of lawn with trees. The soft surface on the southern side of the parkade stretches through to the wetland area. The vegetation in the square itself will only consist out of a variety of tree species. The two large soft surfaces in front of the Town and City planning department forms a “front yard” to the building. The physical design of this space has been determined by the symmetrical façade of the building. The soft surfaces on the southern side, (which borders the service road), the green space next to the Drama practice rooms will be an area and the soft areas on the stramp will consist out of rocks at ground level and a variety of shrub and tree species.
Fig. 6.71  Space infront of the Drama practice rooms.
12AM June Afternoon
Fig. 6.75 Space infront of the Drama practice rooms.
12AM October Afternoon
Fig. 6.79  Space in front of the Drama practice rooms.
Hydrology

The wetland on the southern side of the site is constructed to cleanse water which is pumped from the channel. (Refer to Technical Resolution, Wetland system and existing channel) From there on it flows to the square in more formal shapes. Water ponds are designed in spaces where people will sit, congregate and meet; this allows water to “pause” before being carried away in an open channel until it reaches the end of the system.
Fig. 6.86 Western view from the wetland.
Paving and hard surfaces

The largest areas on the site will consist out of permeable concrete. Cobble stones will form the surface treatment at transition areas, these transition spaces are identified through a physical change in level or a change in vegetation type. Timber decking is used as it defines the space and forms a strong contrast between the concrete and cobble stone surface material.
Fig. 6.90   Space next to the cafeteria.
1 PM February Afternoon
Fig. 6.93  Space next to cafeteria.
5 PM FEBRUARY AFTERNOON

Fig. 6.94 Orientation key.

Fig. 6.95 Tree shadows.

Fig. 6.96 Bollards.
Fig. 6.97 Space next to the cafeteria.
Spatial rooms

Different spatial rooms were allocated in conjunction with the main site circulation and site activities. Each room will have a specific spatial quality and character which is made up out of the tree canopy, surface material, physical form and adjacent activities.

Fig. 6.98 Orientation key. Fig. 6.99 View through tree canopies.
Fig. 6.100  View towards Town and City Planning.
1 PM Winter Afternoon

Fig. 6.101  Orientation key.
Fig. 6.102  Concrete pots with water plants.
Fig. 6.103  Concrete seating rings.
Fig. 6.104  Grass and water interface.
Fig. 6.105 View towards Town and City Planning.
Lighting

Lighting during the night is mainly concentrated around major spaces, the ramp and axis running through the site.

Fig. 6.106 Orientation key.

Fig. 6.107 Aloe marlothii.

Fig. 6.107 Stone wall.
Fig. 6.109  Ramp access.
Fig. 6.110  Orientation key.

Fig. 6.111  Stramp lights.
Fig. 6.112  Ramp access.
January Afternoon

Fig. 6.113 Orientation key.
Fig. 6.114 Concrete surface.
Fig. 6.115 Glass panels.
Fig. 6.116  View from parkade access.
June Afternoon

Fig. 6.117 Orientation key.

Fig. 6.118 Boulevard of trees.
Fig. 6.119  View from parkade access.
**Technical Resolution**
Wetland
The hydrological system on the site will consist of 3 parts:

- The wetland at the eastern corner of the site.
- The formal open water system running through the length of the site in an east west direction.
- The infiltration trenches in Lynnwood Road.

New approaches to wastewater treatment are a result in a change of perspective, a perspective based on a total ecosystem approach. Water is a valuable source of nutrients on which ecologically wetlands can subsist. The only treatment which occurs in natural systems is biological treatment.

There were two options available for intercepting and transporting water from a lower to a higher level. The first option was either to build a weir further upstream. The second option was to place a sump with a pump (which will be operated by solar panel batteries) in the existing base of the channel. The second option was considered as it drastically minimises the potential for flooding and does not decrease the area of the existing channel. Water pumping also offers one of the most efficient uses for solar electricity. The final aim is for the wetland system to function as a self sustaining ecosystem, supported by and supporting other ecosystems.

Due to the urban nature of the site the water quantities are controlled through a solar pump which will pump a maximum volume of 110 m³ water per day.
Existing Channel

Total Area 3.58 m²
Catchment Area 160 ha (Refer to Chapter 3, figure 3.17)

Average speed of natural stream flow in channel 0.2 m/s
Time of concentration 37 minutes

Q values

Base flow from natural stream 0.002 m³/s
Q2: 0.0053 m³/s
Q10: 0.008 m³/s
Q20: 0.097 m³/s
Q50: 0.014 m³/s
Q100: 0.016 m³/s

Amount of water effectively treated through wetland

L x W x D x 0.2
Length x Width x Depth x 0.2
65 x 17.3 x 0.5 = 552.5 m³
552.5 m³ x 0.2 = 110.5 m³ water effectively treated per day (Maximum during summer months)

Average flow from natural stream during summer months (0.002 m³/s)

2 litres/second x 86400 s (24h) = 172 m³/day
172 m³/2 (12 solar hours) = 86.4 m³ water/day (Average during summer months)

Average flow from natural stream during winter months (0.0004 m³/s)

0.4 litres/second x 86400 s (24h) = 34.56 m³/day
34.56 m³/2 (12 solar hours) = 17.28 m³ water/day (Average during winter months)

For Q2 (0.0053 m³/s)

5.3 litres/second x storm duration (Avg 30 min)
= 5.3 litres x 9540 seconds
= 50562 litres in total

The conclusion can be made that the maximum volume of water the wetland will be able to treat will be 100% from the natural stream flow and 50% of rainfall for a storm which have a 50% chance of occurring in the given catchment area. The rest of the water will be channelled to Walkerspruit in a culvert underneath the service road.
WETLAND SYSTEM

MAX SUMMER 110.5 m³ / DAY
AVG SUMMER 86.4 m³ / DAY
AVG WINTER 17.28 m³ / DAY

Fig. 6.122 Flow diagram.
Water storage and usage

55 %

WATER STORAGE IN BUILDING BASEMENT

45 %

WATER STORAGE FOR IRRIGATION

Fig. 6.123  Flow diagram.
Water quality

The storm water entering the constructed wetland system will have a very low level of pathogens as this water mainly consists of runoff from the street and the nearby sport fields. As water moves through the system the biological oxygen demand will be reduced, particles will be filtered out and the roots of aquatic plants will help reduce nitrogen and phosphorous levels. *(Landscape Architecture, January 2004.)*

Estimated pollutant removal capability

Nitrogen 50%
Heavy metals: 40 – 70%
*(www.mckenziewaterquality.org)*

Plant species

Local indigenous planting ensures that plants are adapted to local environmental conditions.
When plants are established, their roots provide a habitat for beneficial bacteria to transform effluent. The substrate and roots act as reactors, which support microbes which prey on nutrients, and converting them into a form which plants can use. Plants also add air to the system through capillary action. The whole system forms a commensal relationship.

Fig. 6.124  Commensal relationship of wetland species.
Materials

- Bentonite clay

The wetland’s bottom lining will be constructed with Bentonite which is natural clay. When it is mixed with soil, compacted and placed in water it swells more than five times its volume. As a result of this it forms a sealant greatly reducing the water’s ability to pass through. The clay is not harmful to fish and birds. (www.clay.co.za)

- Reno mattress and Gabions

The existing channel’s bottom surface will be lined with Reno mattresses and its edges will be slightly widened to accommodate a gabion structure. The Reno mattresses will be filled with a silt substratum favourable to moisture loving plants. This is the most suitable material as the permeability of both these structures allows for natural vegetation growth and maximizes biological growth and biomass. This process favours the formation of micro organisms.

Wetland establishment sequence

For the system to start operating sufficiently an initial amount of municipal water needs to be added into the wetland. This will only be necessary until the water has reached a certain level, after this the system will be able to support itself.

The area should be cleared and contoured to its final shape. The top layer is loosened and water is added to the required moisture level and Bentonite is spread over the top surface in 1m x 1m blocks and mixed into the soil.

The area is further hydrated by wetting the surface thoroughly; this allows the clay to swell between the open soil particles. (www.clay.co.za)
Nursery stock is transplanted or seeds from the Pretoria Boys High wetland can be harvested.

Subdivide no more than half of the wetland area into separate planting zones. The entire wetland should be covered within a period of 3 years.

A hydroseed mix should be used to establish permanent vegetative cover around the buffer area of the wetland. ([www.stormwatercenter.net](http://www.stormwatercenter.net))

Flow paths from the inlet to the outlet of the reed bed area are maximized. This is done by creating islands which enhances the micro topography and provides for ecological diversity as well as visual amenity.

To promote greater nitrogen removal a rock bed are used as a permeable membrane between the forebay and the reed bed area. ([www.stormwatercenter.net](http://www.stormwatercenter.net))

To reduce the levels of phosphorous wetlands require periodic harvesting, before the onset of summer. ([Landscape Architecture, January 2004.](https://www.landscapearchitecture.org))

**Maintenance**

Consideration has been given to the ease of maintenance. The intention of the grid is to act as a litter trap for coarse organic matter, allowing simple collection by maintenance staff. The pump in the channel will also be accessible through this grid in the base of the channel. (Refer to section E-E.) An access ramp on the eastern side of the wetland will allow for easy maintenance to pipes.

Reno mattress will be placed in the base of the channel; this will allow for excess soil and organic matter to be captured before entering the system. The pump can be switched off when it’s necessary for critical maintenance to the wetland.

Fringe vegetation needs to be harvested and discarded periodically in order to expose excess nutrients taken up by vegetation.
Fig. 6.127  Orientation key.
Formal open water system
Formal open water system

The controlled amount of water, pumped from the existing channel into the wetland system and is then gravity fed to an open body of water situated at the eastern side of the square. 45% amount of the water will then be channelled to tanks and 55% amount of the water will be channelled to another body of open water situated on the western side of the site. Water leaving this open body of water will then flow into the basement of the School of Motion Picture. (Refer to figure 6.121)

Small channel running through the site

- Flow speed

Total Area: 0.15 x 0.3 = 0.0045 m²
Q value 0.002 m³ / s
Q= V x A
= 0.44 m/s

Water quantities

- Maximum total volume of water in the channel
  274.3 m x 0.0045 m² = 1.234 m³

- Maximum total volume of water in the open formal bodies of water
  24 m³ + 22.94 m³ + 24.96 m³ = 71.9 m³

Total maximum volume of water in system 73.134 m³

During summer months the volume of water in the wetland is 15 – 33% higher than the volume of water in the formal open water system. This excess amount of water compensate for evaporation.

- Percentage of total volume of water which should be diverted to the tank system for landscape irrigation.

0.03 m x 1270 m² of soft planting = 38.09 m³

Water quality

The water entering the system from the wetland will be “tertiary treated effluent” this means that the water will be clean enough for human contact or can be used for landscape irrigation, thus holding no danger for humans and wildlife.

Materials

- Enviromat

The surface of the open water system will consist of enviromat topped with two layers of gravel. Enviromat is the most suitable material as aquatic plant roots are able to penetrate through the material. The plant roots serve as a food source, habitat and nesting material for various birds and animals. Thus it helps to increase biodiversity.
Fig. 6.129  Orientation key.
Stramp

Edges

- Materials

Concrete Retaining Blocks L13

The edges of the stramp are important as it is also viewed as a system, around and through which plants can grow. The vertical green wall cuts heat and glare, traps air pollutants, hold or slow rainwater and process CO₂ while providing food and shelter for wildlife. The green wall also ensures a comfortable micro climate which creates opportunity for informal seating spaces and lingering points.

Geotextile

Geotextile made of natural fibre is used as a transitional stabilization system. This material prevents erosion from flowing water, while trapping sediment, creating a protected and well aerated and hydrated growing zone for plants.

The material has a high water holding capacity, releasing moisture slowly back into the ground. It reduces the amount of root pathogens, while promoting strong root systems.

Fig. 6.130 Concept section.
• Vertical landscape

A vertical landscape is proposed on the façade of the parkade. A scaffolding framework enables a modular planting strategy. All plants will be watered by means of a simple drip irrigation system. The porosity of the scaffolding structure allows water and wind to assist the migration of flora and fauna between the levels.

Terraces

The plants in the terraced areas of the stramp will have an adequate irrigation system; drainage will be provided at the lowest points.
Fig. 6.133 – 6.135  Stramp model.

Fig. 6.136  Concept of vertical garden.
Fig. 6.137 Orientation key.
Infiltration trenches
NETWORKED SIDEWALK STORM WATER SYSTEM
PORTLAND BUREAU OF ENVIRONMENTAL SERVICES

Storm water runoff from the street are distributed through a sequence of infiltration trenches

The planters are designed to handle 60% of the street’s runoff.

Planters are filled with an equal mix of sand, compost and loam.

The infiltration basins are cleaned from sediments periodically.

The project compresses hydrological performance through a network and the system forms part of the streetscape.

*(Margolis, L & Robinson, A.2007.)*

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Fig. 6.138  Cut in the curb channel.

Fig. 6.139  A wide street section accommodates stormwater treatment.

Fig. 6.140  Storm water flow.
Storm water infiltration trenches in Lynnwood Road

Design intend

Storm water runoff from Lynnwood Road is distributed between a series of infiltration planters. The infiltration trenches in Lynnwood Road will not significantly enhance the quality of water on a macro scale, but this will serve as a model for how storm water can be treated in urban areas.

The runoff from catchment area 2 (refer to figure below) flows along the existing kerb until it reaches the first planter which collects runoff up to a 150 mm and infiltrates this at a rate of 10.16 cm/hr. If this height is reached, water then exits into the existing storm water inlet.

Runoff from catchment area 3 also flows along the existing curb until it reaches filtration trench 2 and once maximum capacity is reached it flows through the rest of the trenches until it reaches the existing storm water inlet at the corner of University and Lynnwood Road.

Water quantities

- **Catchment Area 2**
  
  Total Area: 0.326 ha / 2 = 0.163 ha
  Roughness coefficient: 0.02
  Flow path: 315m
  Average slope: 1:44

- **Catchment Area 3**
  
  Total Area: 0.32 ha / 2 = 0.16 ha
  Roughness coefficient: 0.02
  Flow path: 236 m
  Average slope: 1:44

Time of concentration 22.6 min

- Q values

  Q2 (25mm/h) = 0.01 m³/s
  Q10 (50mm/h) = 0.02 m³/s
  Q20 (65mm/h) = 0.029 m³/s
  Q50 (85mm/h) = 0.038 m³/s
  Q100 (100mm/h) = 0.045 m³/s

Time of concentration 19.8 min

- Q values

  Q2 (25mm/h) = 0.011 m³/s
  Q10 (50mm/h) = 0.022 m³/s
  Q20 (65mm/h) = 0.028 m³/s
  Q50 (85mm/h) = 0.037 m³/s
  Q100 (100mm/h) = 0.044 m³/s

Fig. 6.141 Catchment area.
Percentage of water treated

Maximum allowable water volume per trench: $0.15 \times 18.26 \times 1.5 = 4.1 \text{ m}^3$

For catchment area 2

Infiltration trench 1 and 2
Total volume 8.2 m$^3$

For Q2:
10 litres / s x 1356 s
= 13560 litres
= 13.56 m$^3$ x 2
= 27.12 m$^3$

Thus the conclusion can be made that Infiltration trench 1 and 2 will be able to handle 66% of rainfall for a storm which have a 50% chance of occurring.

For catchment area 3

Infiltration trench 3–11
Total volume 36.9 m$^3$

For Q2:
11 litres / s x 1188 s
= 13068 litres

For Q10:
22 litres / s x 1188s
= 26136 litres

For Q 20:
28 litres /s x 1188s
= 33264 litres

For Q 50:
37 litres/s x 1188 s
= 43956 litres

Infiltration trench 3-11 will be able to handle an estimated 80% of the rainfall for a storm which have a 2% of occurring.
Fig. 6.143  Orientation key.