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

A suitable open space to be used by art students for drying sculptures.

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.

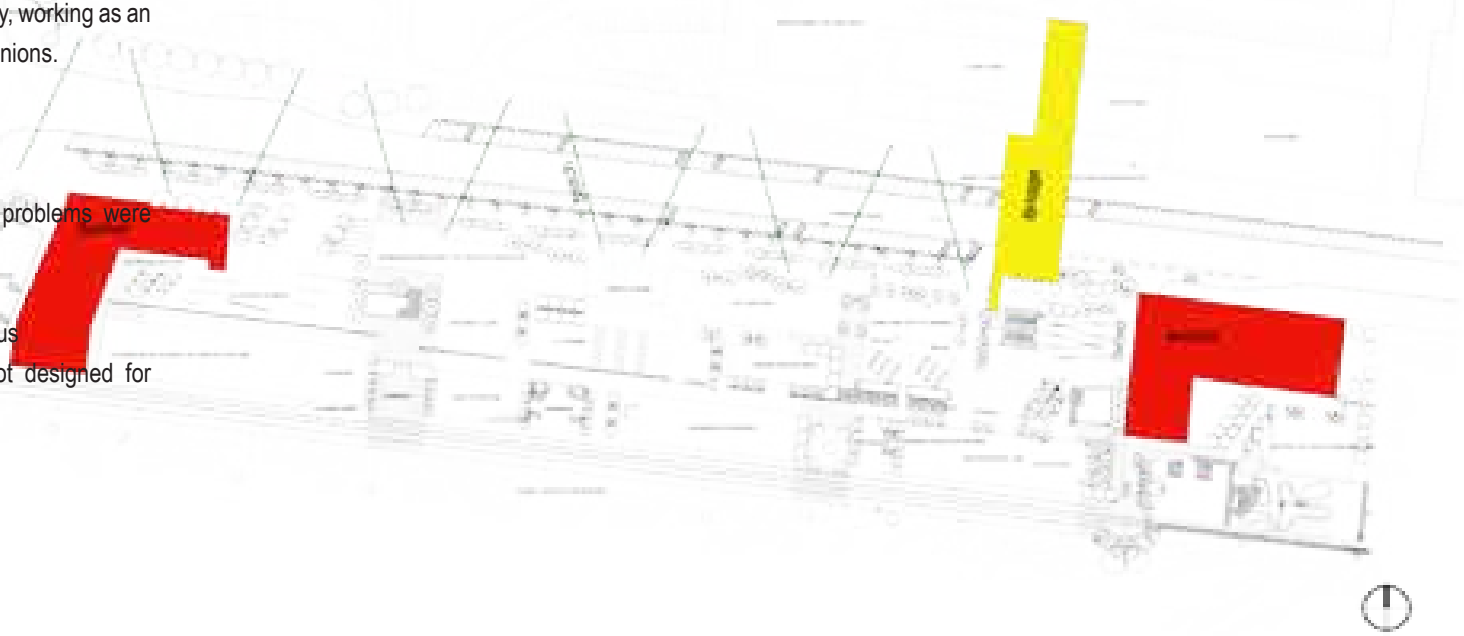
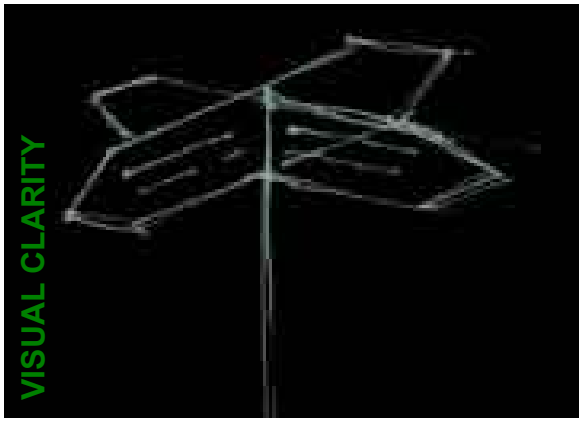


Fig. 6.2 Urban concept.

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)



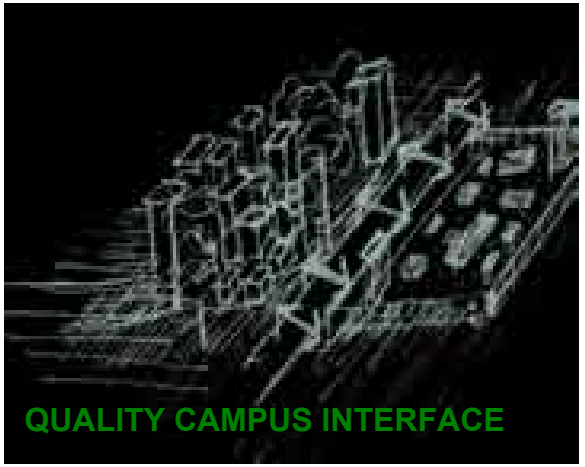
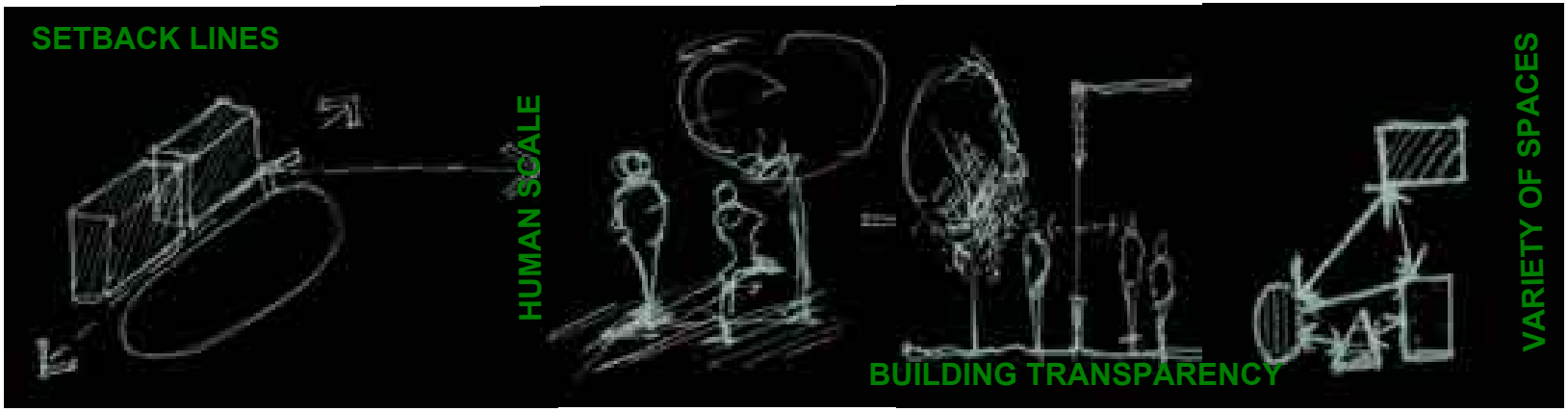


Fig. 6.3 – 6.8 Campus design guidelines.



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
9. U.P Press
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

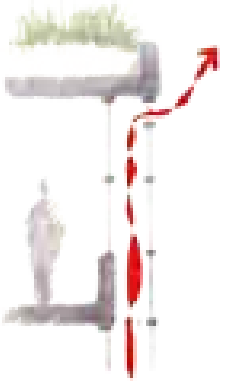


Fig. 6.11 Building envelope.

Fig. 6.12 Lighting.

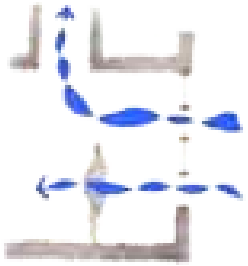


Fig. 6.13 Cooling.

Fig. 6.14 Energy.

Fig. 6.15 Water and Waste.

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.

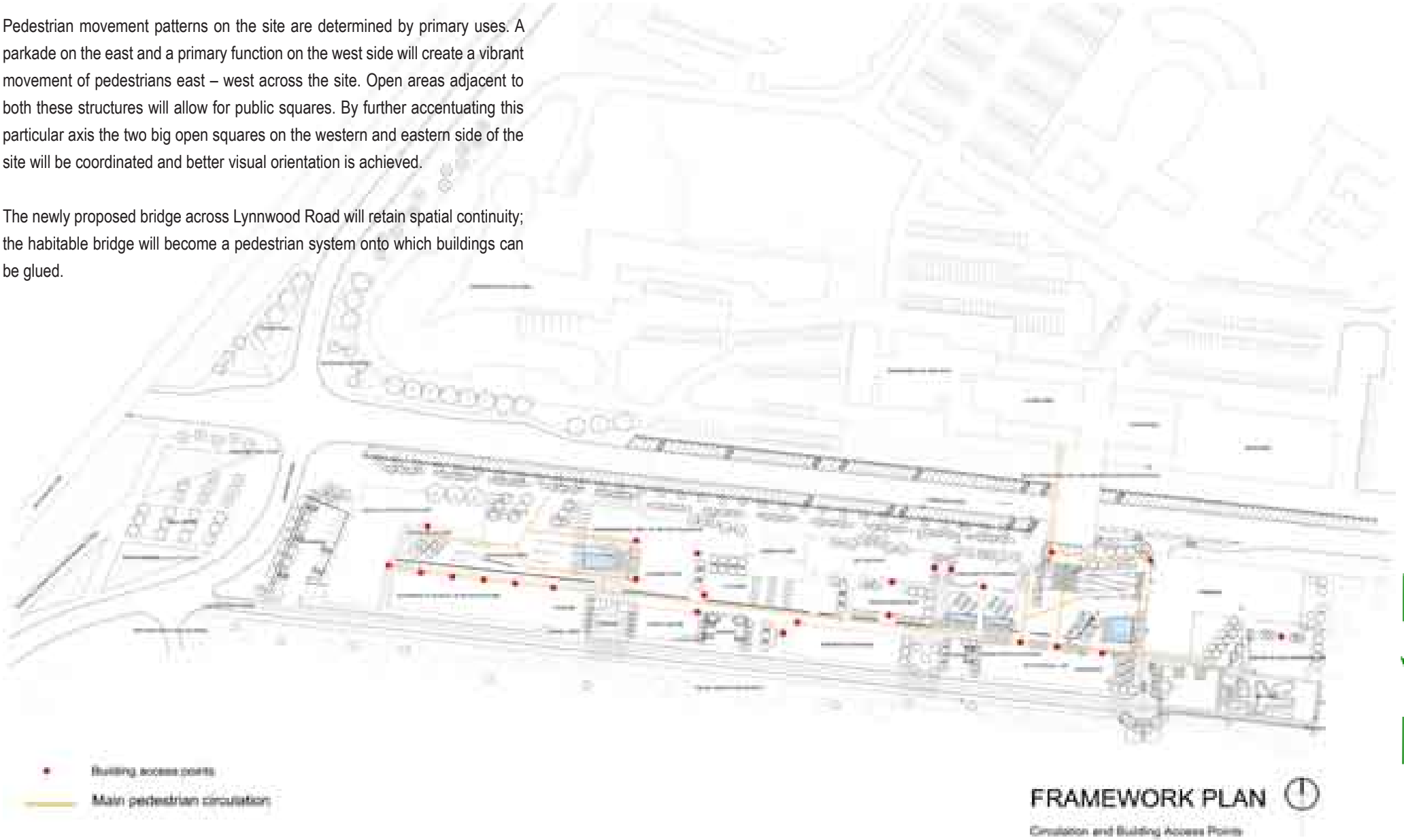


Fig. 6.16 Circulation and Building access.

Outdoor spaces

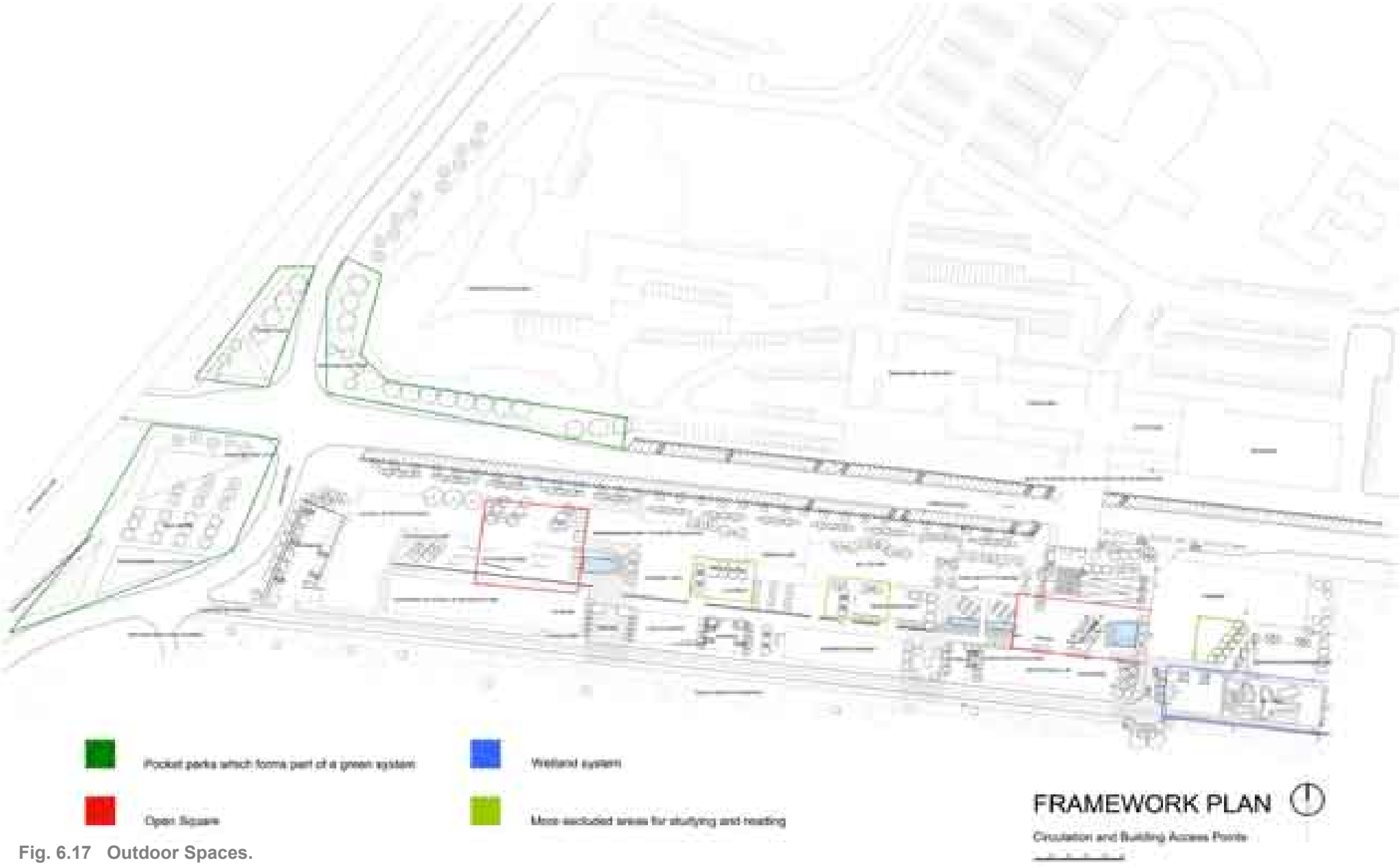


Fig. 6.17 Outdoor Spaces.

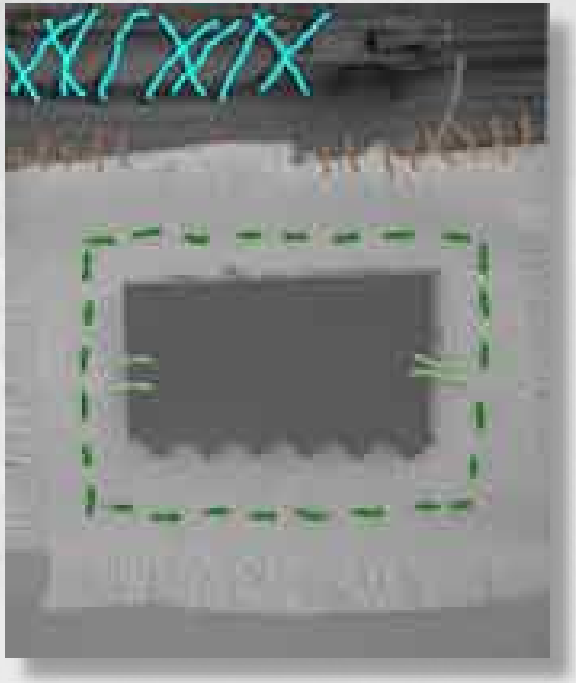
CONCEPT

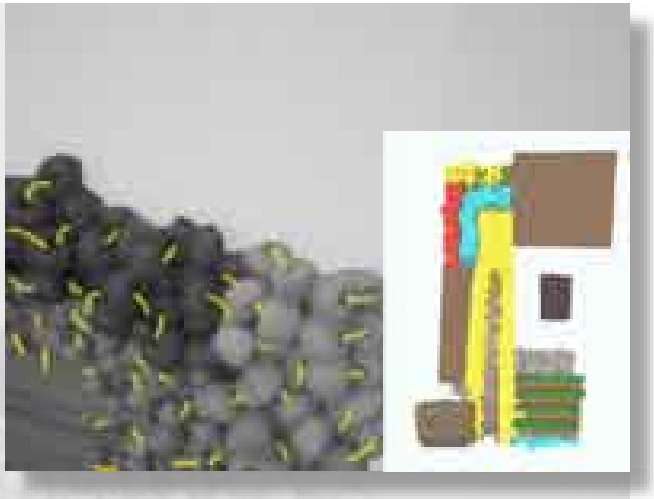
Concept

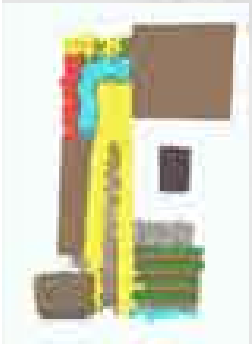
Touchstone project

- Landscape as a stitch

The touch stone 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 touch stone 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 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
- There after the site will be a host to the continious 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.

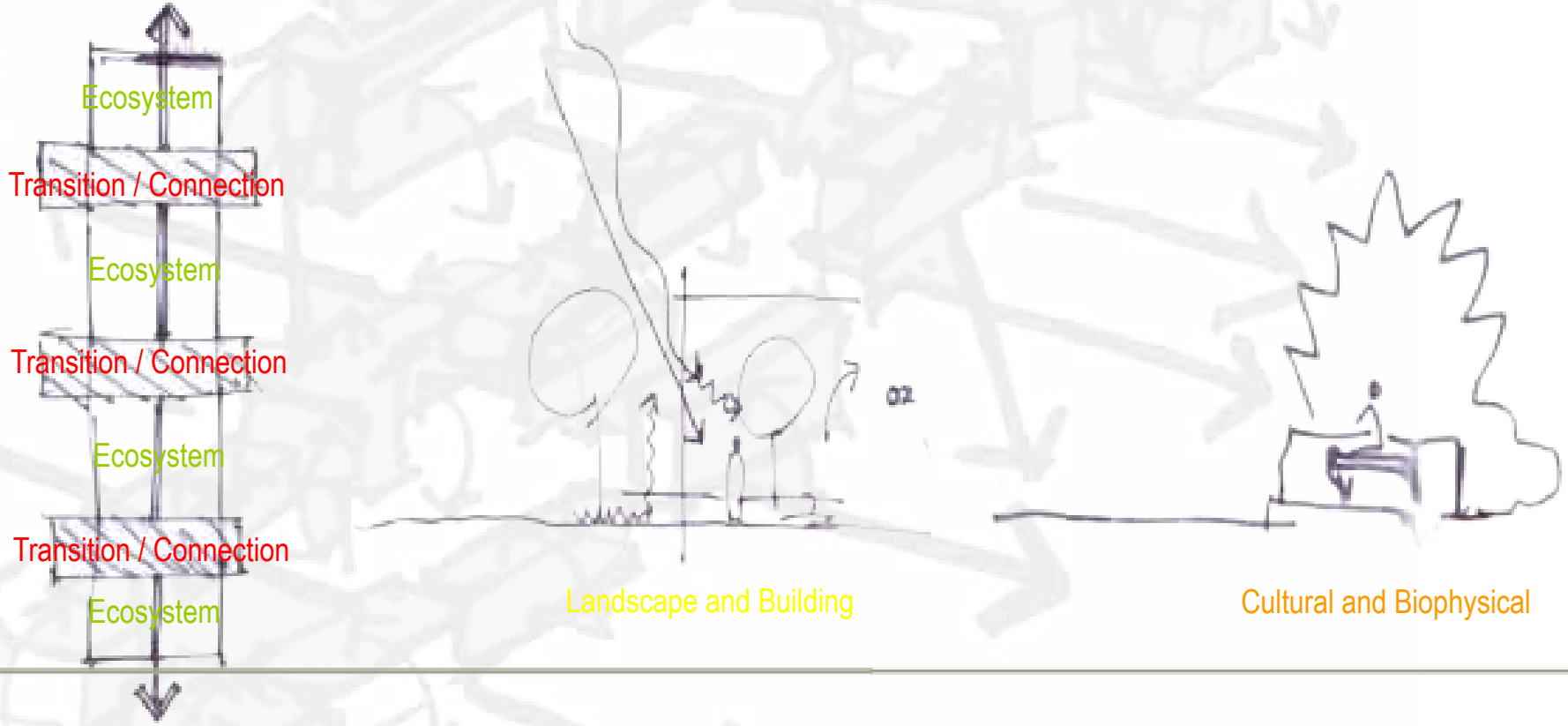


Fig. 6.22 – 6.24 Conceptual illustrations of different connections.

6 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.

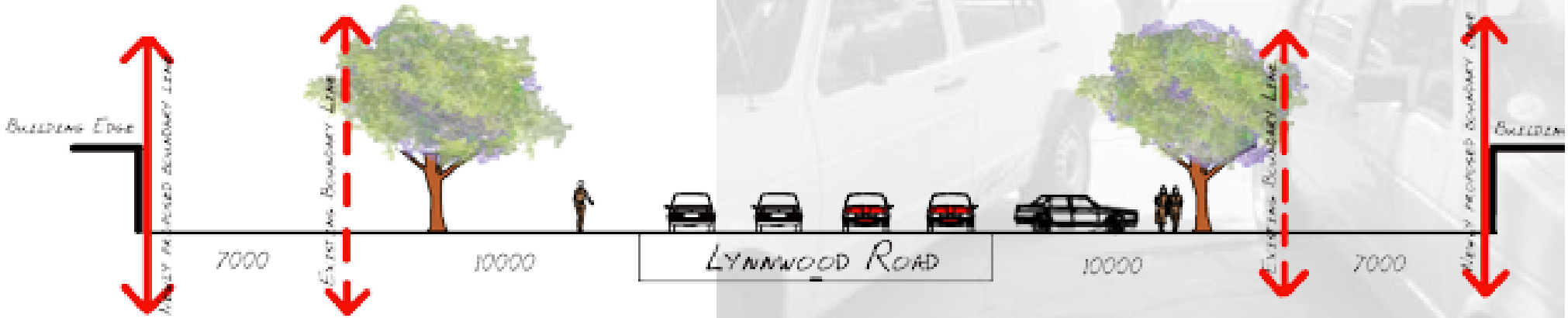


Fig. 6.25 Modification of boundary lines along Lynnwood Road.

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.

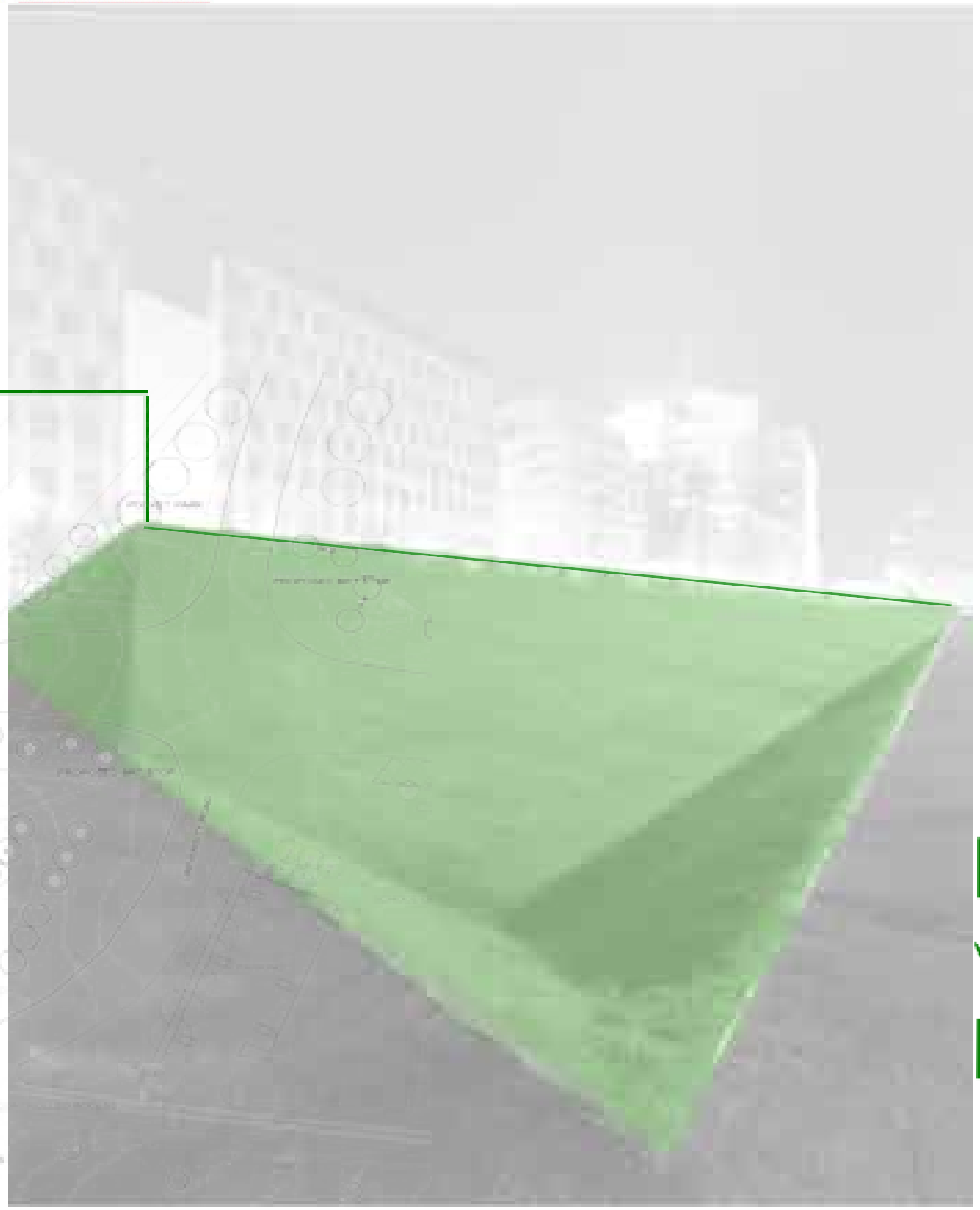


Fig. 6.26 Earth mound.

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.

(Thompson, J.W. & Sorvig, K. 2000)
(www.perviuospavement.org)

- 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.

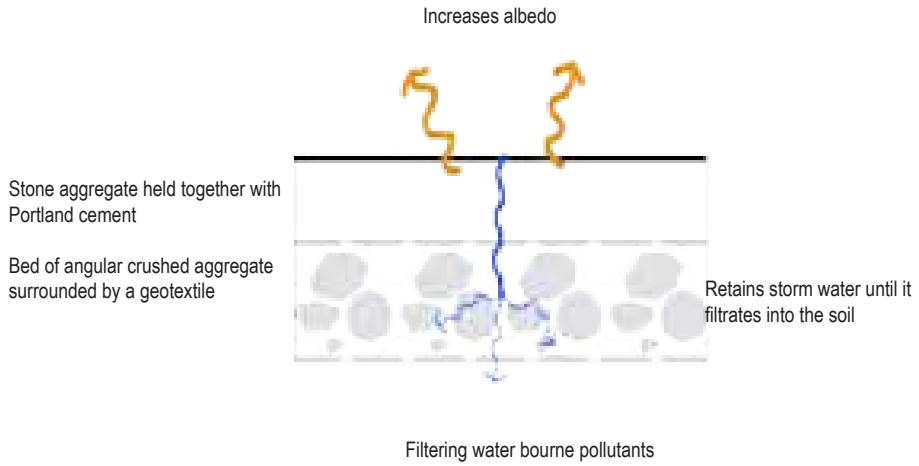


Fig. 6.27 Functioning of pervious concrete.

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.

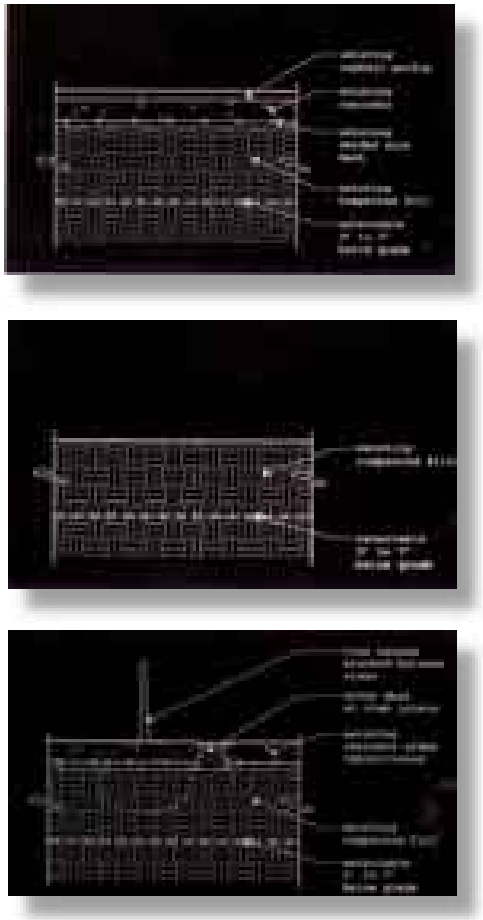


Fig. 6.29 – 6.31 Sections showing the sequence of the construction in process.

6

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/ m^2

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.)

Fig. 6.34 Mulching of plantings.

Fig. 6.32 Shrub meadow.

Fig.6.33 Distribution of topsoil.

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

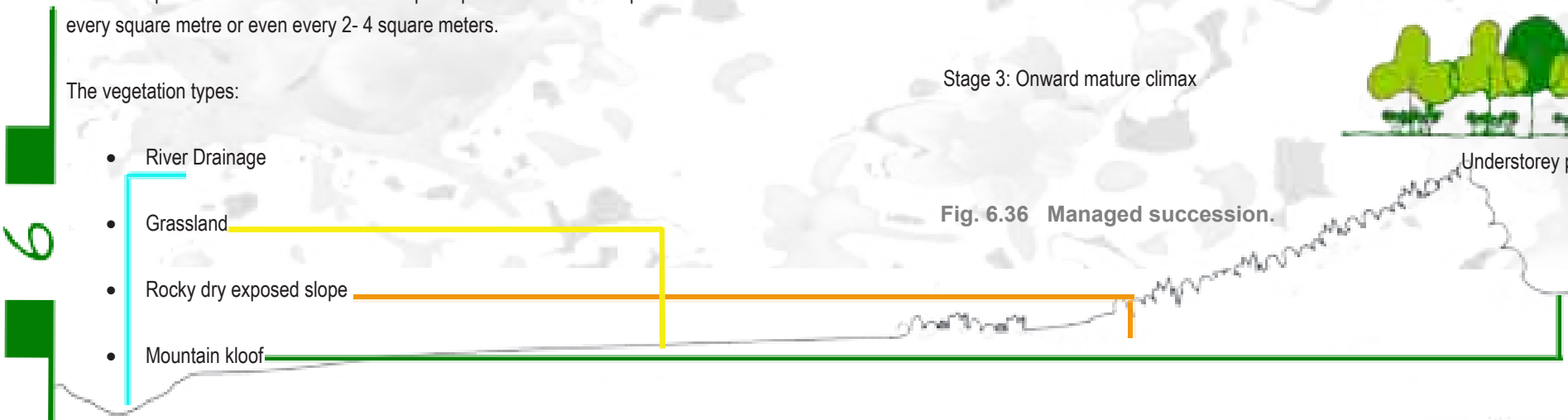


Fig. 6.35 Topographical section.

Managed succession

Stage 1: Establishment pioneer and climax species (mixed)

Stage 2: Canopy closure and thinning

Stage 3: Onward mature climax

Understorey planting

Fig. 6.36 Managed succession.

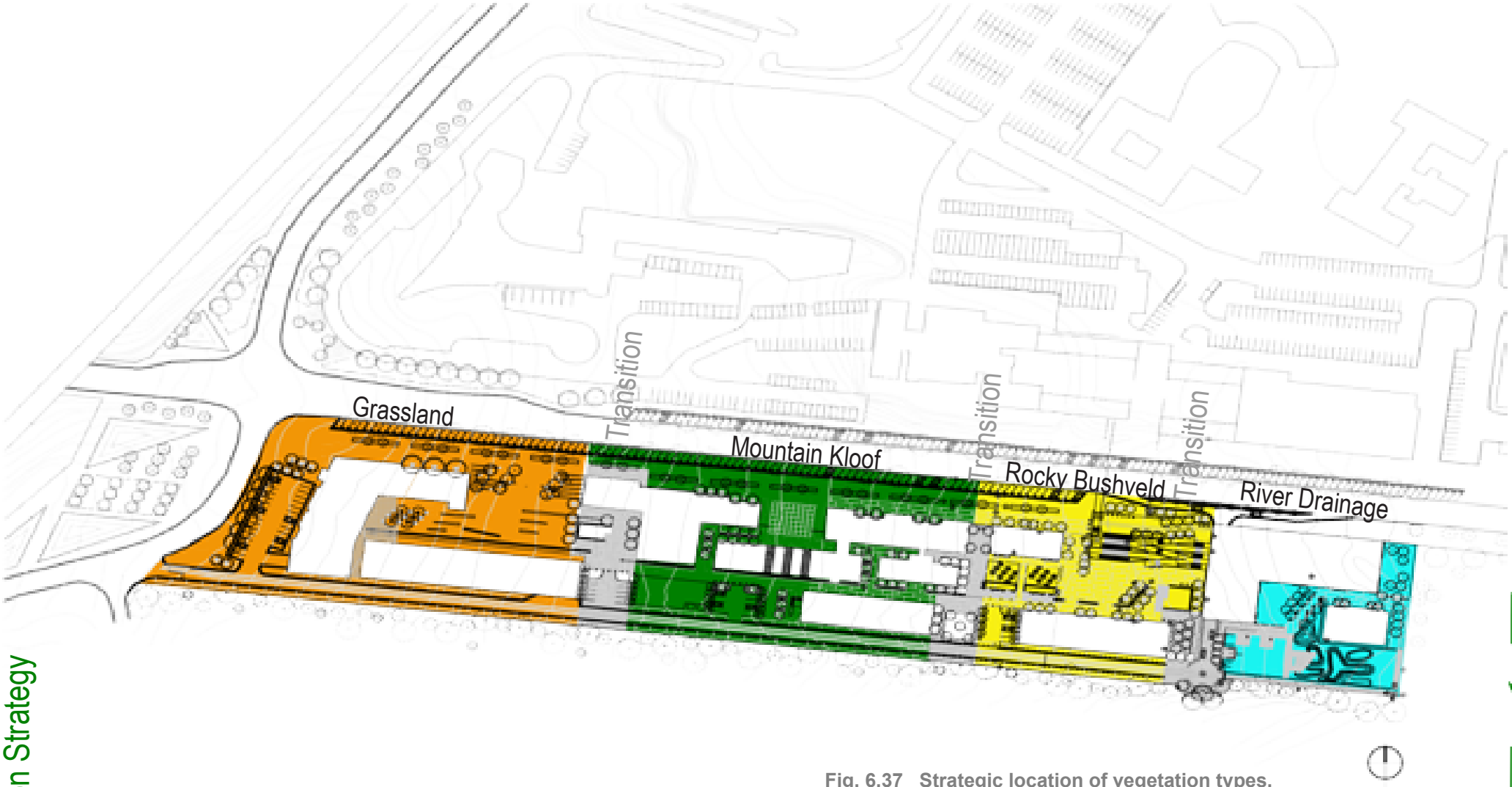


Fig. 6.37 Strategic location of vegetation types.

GRASSLAND

Grasses

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

(van Oudtshoorn, F. 2006.)

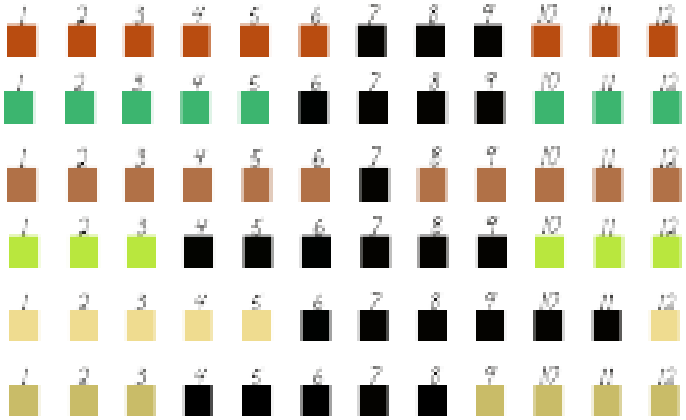
Shrubs

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

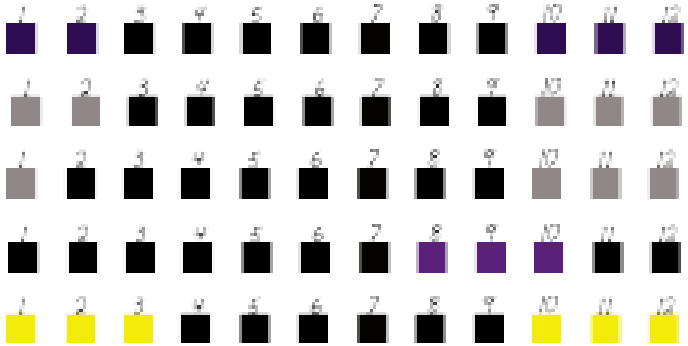
Trees

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

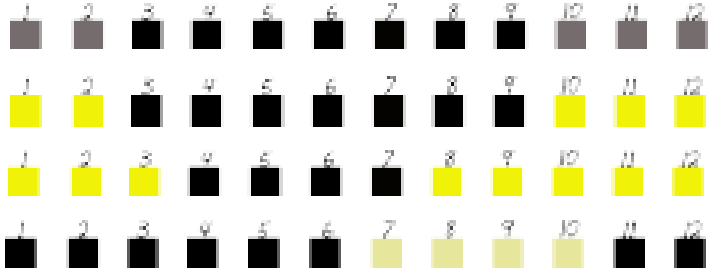
Flowering Time



Flowering Time



Flowering Time



(Thomas, V. & Grant, R. 2002.)

Fig. 6.38 Tassel Three awn *(Aristida congesta).*

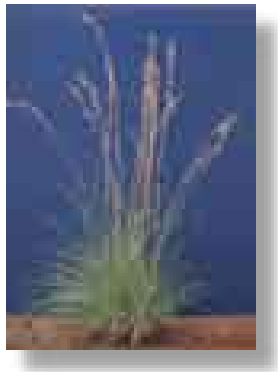


Fig. 6.39 Narrow leaved turpentine grass.

Fig. 6.40 Spear grass *(Heteropogon contortus).*

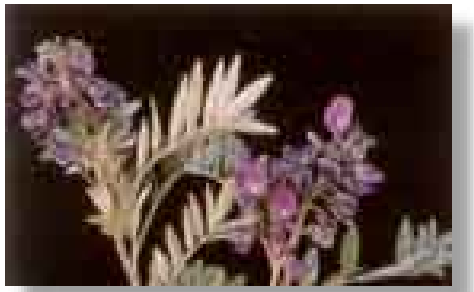


Fig. 6.41 Cork bush *(Mundulea sericea)*

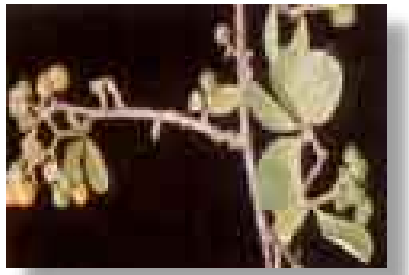


Fig. 6.42 Puzzle bush *(Ehretia rigida)* fruit.

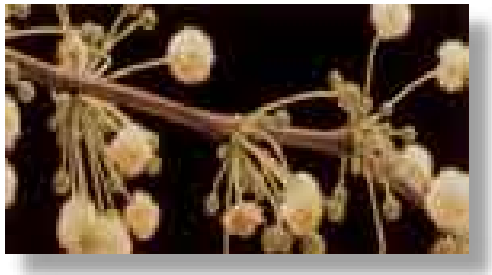


Fig. 6.43 Brack thorn *(Acacia robusta)* flowers.

Fig. 6.44 Buffalo thorn *(Ziziphus mucronata)* fruit.

MOUNTAIN KLOOF

Shrubs

Botanical name	Common name	Height (m)	Links with animals
Dodonea angustifolia	Sand olive	2 – 4	
Carissa bispinosa	Forest num – num	1 – 4	Birds such as bulbuls and mousebirds eat the fruit.
Grewia oxidentalis	Crossberry raisin	2 - 6	Fruit are eaten by the speckled mousebird.

Trees

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

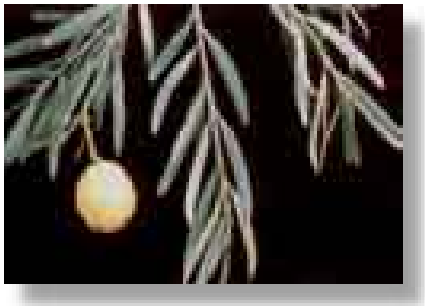


Fig. 6.45 Small leaved yellowwood *(Podocarpus falcatus)* fruit.

Fig. 6.46 Jacket plum *(Pappea capensis)* fruit.

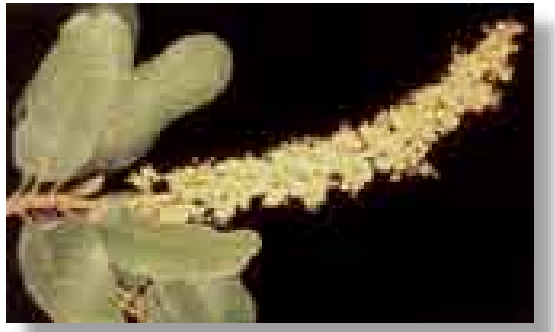
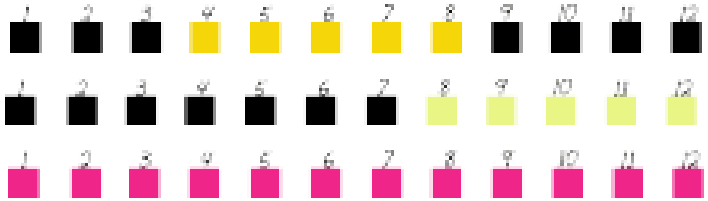


Fig. 6.47 Jacket plum *(Pappea capensis)* flowers.

Fig. 6.48 African olive (*Olea europea)* flowers.

Flowering Time



Flowering Time

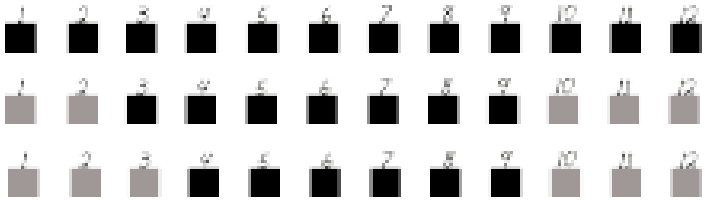


Fig. 6.52 Cross berry raisin *(Grewia occidentalis)* flowers.

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

(Thomas, V. & Grant, R. 2002.)

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.

ROCKY BUSHVELD

Grasses

Botanical name	Common name	Height (m)	Links with animals
Aristida Stipitata	Long awned grass	0.2 – 1.5	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.

Shrubs

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

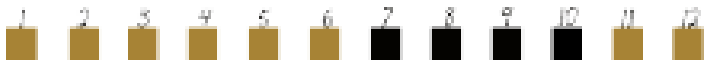
Trees

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

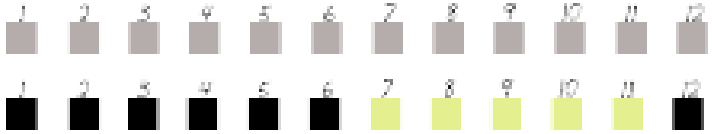
(van Wyk, P & van Wyk, B.1997.)

(Thomas, V. & Grant, R. 2002.)

Flowering time



Flowering time



Flowering time

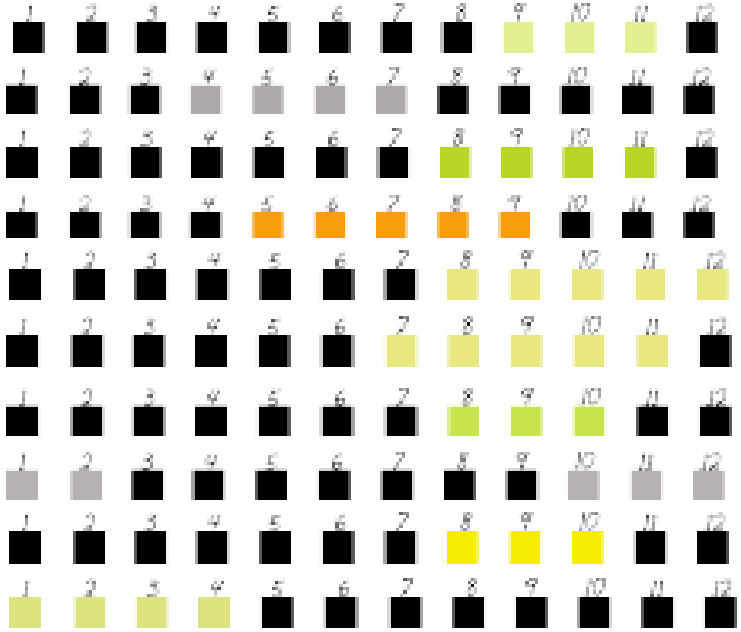


Fig. 6.56 Long awned grass. *(Aristida stipulate)*

Fig. 6.55 Fever tree *(Acacia xanthophloea)* fruit.

Fig. 6.53 Fever tree *(Acacia xanthophloea)* flowers.

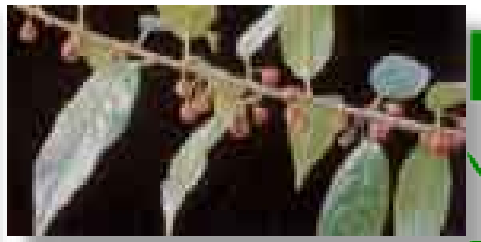


Fig. 6.54 Dogwood *(Rhamnus prinoides)* fruit.

RIVER DRAINAGE

Shrubs

Botanical name	Common name	Height (m)	Links with animals
Rhoicissus tridentata	Cape Bushmen's grape	Creeper	The fruit is eaten by birds.
Grewia occidentalis	Crossberry raisin	2 - 6	The fruit is eaten by the speckled mousebird.

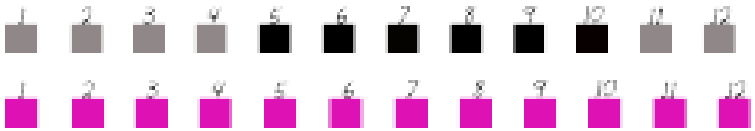
Trees

Botanical name	Common name	Height (m)	Links with animals
Celtis africana	White stinkwood	7 - 12	Not applicable in urban areas
Combretum erythrophyllum	River bushwillow	5 - 15	Fruit is eaten by pied barbets

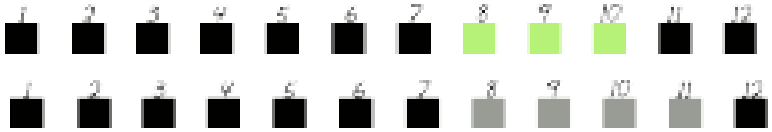
Wetland species

Botanical name	Common name
Berula erecta	Taro
Colacasia esculanta	Papyrus
Cyperus papyrus	Dwarf papyrus
Cyperus prolifer	
Cyperus textilis	Red hot pokers
Kniphofia sp.	Waterweed
Lagarosiphon major	
Ludwigia adscandens	Blue lotus
Nymphaea caerulea	
Nymphoides indica	
Nymphoides thunburgiana	Common reed
Phragmites australis	
Potamageton pectinatus	
Schoenoplectus corymbosus	Bullrush
Typha capensis	Cape Reedmace
Aponogeton distacyos	Water hawthawn

Flowering time



Flowering time



(Thomas, V. & Grant, R. 2002.)

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

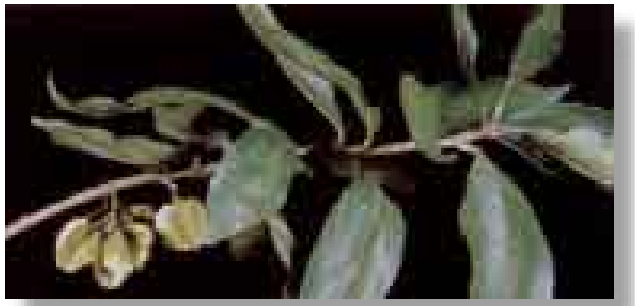
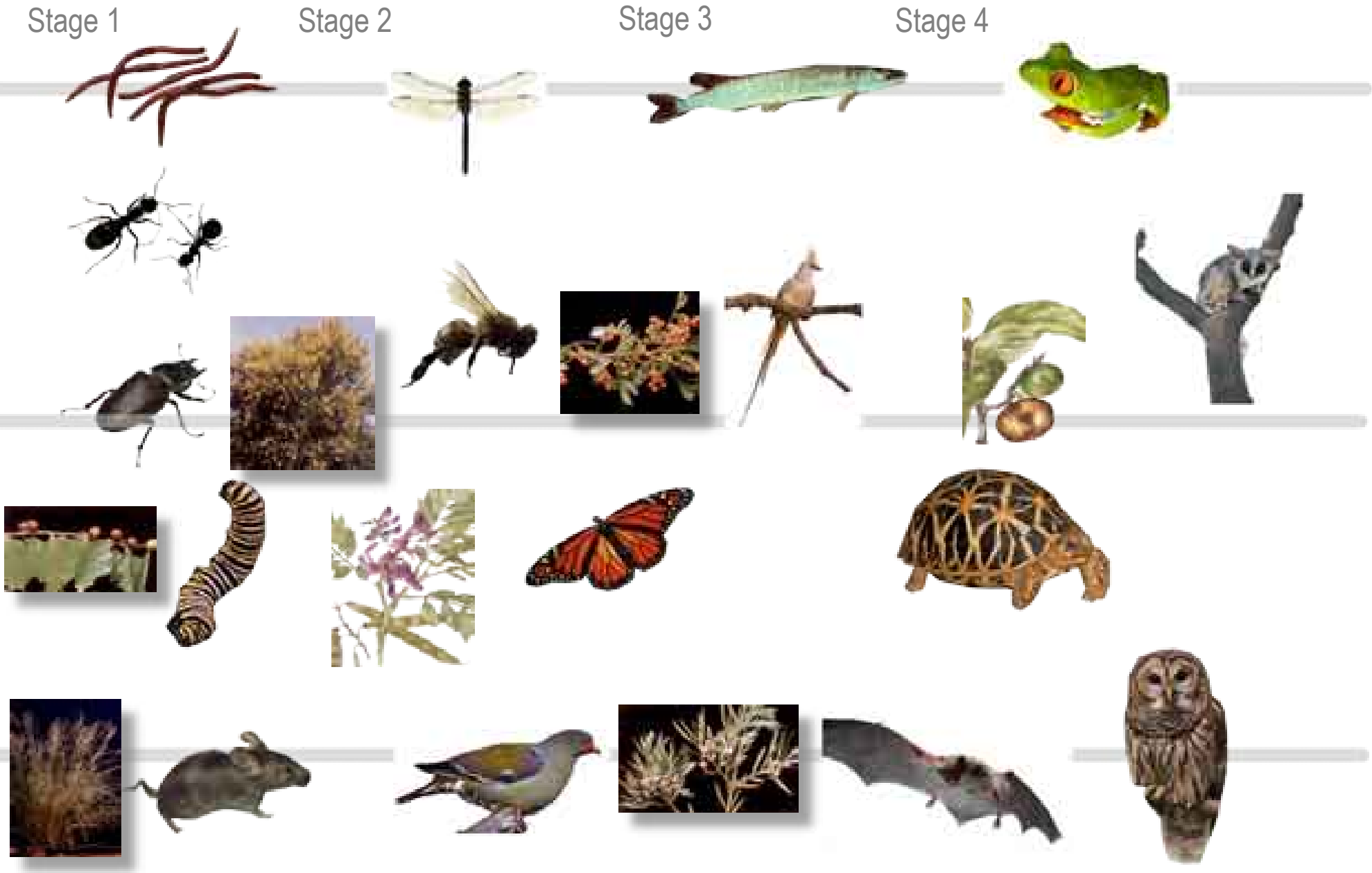


Fig. 6.57 River bushwillow *(Combretum erythrophyllum)*

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

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

WILDLIFE



Specie diversity through adaptive management

Fig. 6.61 Specie Diversity

6

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 extend 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.globalworming.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)

Fig. 6.62 Phases in vermiculture.

Soil enrichment

6

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.

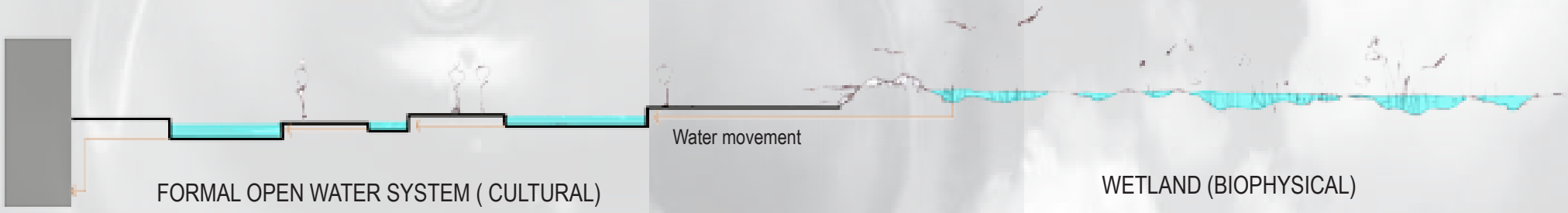


Fig. 6.63 Systemic section through hydrology.

6 DESIGN DEVELOPMENT

Design Development

Initial design concepts

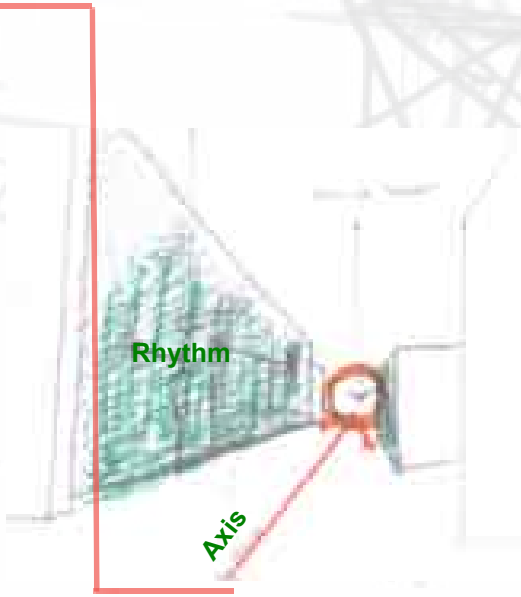
- Squares

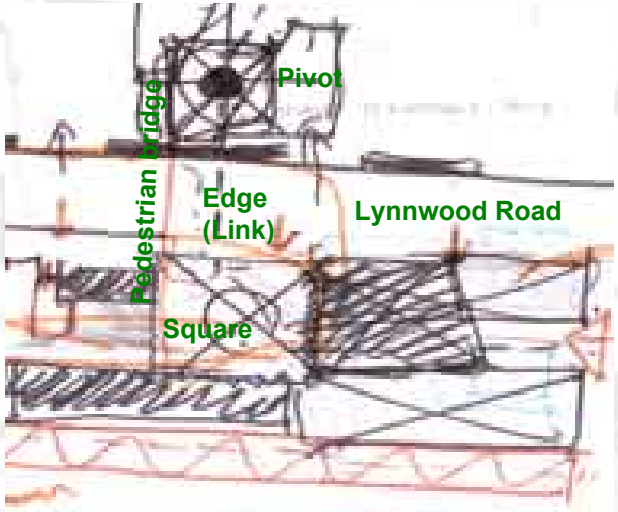
From an urban point of view, the spaces in front of the proposed anchors (refer to figure 6.2) should become public (west) and semi public (east) squares. Due to the positioning of the existing buildings and the newly proposed School of Motion Picture, the northern edge of the western square should form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





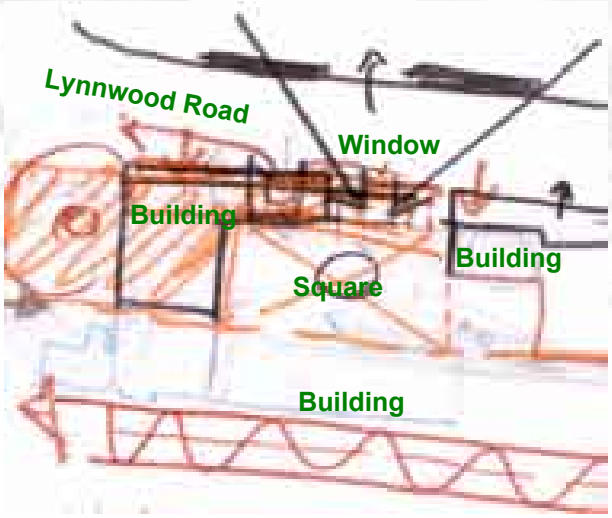


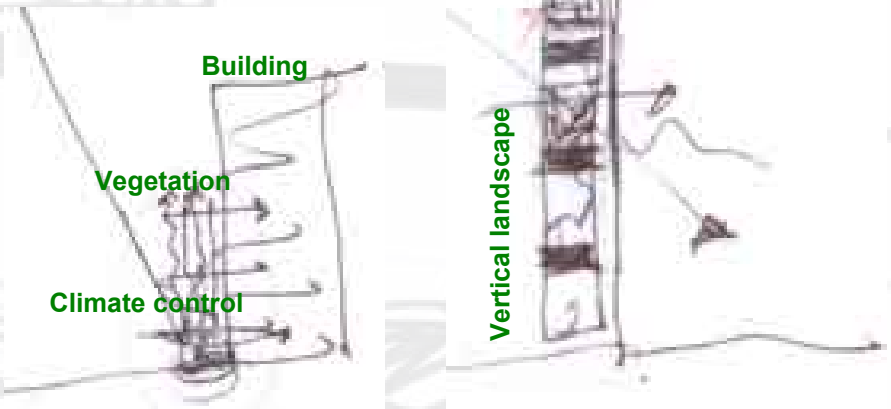
Fig. 6.64 – 6.66 Conceptual diagrams.

- 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.



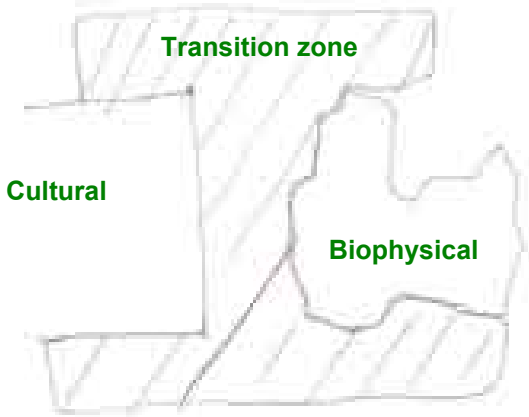


Fig. 6.67 – 6.69 Conceptual diagrams.

SKETCH PLAN

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


SKETCH PLAN

6 LAYERS


SKETCH PLAN
soft surfaces and vegetation

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.

12 AM March Afternoon

Fig. 6.70 Orientation key.

Fig. 6.71 Space infront of the Drama practice rooms.

12AM June Afternoon

Fig. 6.72 Orientation key.

Fig. 6.73 Boulders.

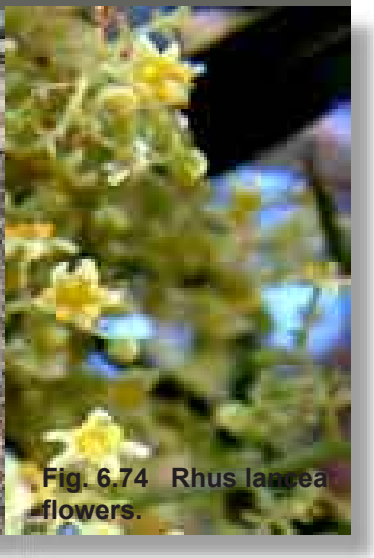


Fig. 6.74 Rhus lancea flowers.

Fig. 6.75 Space infront of the Drama practice rooms.

12AM October Afternoon

Fig. 6.76 Orientation key.

Fig. 6.77 Water channel.

Fig. 6.78 Water channel.

Fig. 6.79 Space infront 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.

SUMMER MORNING

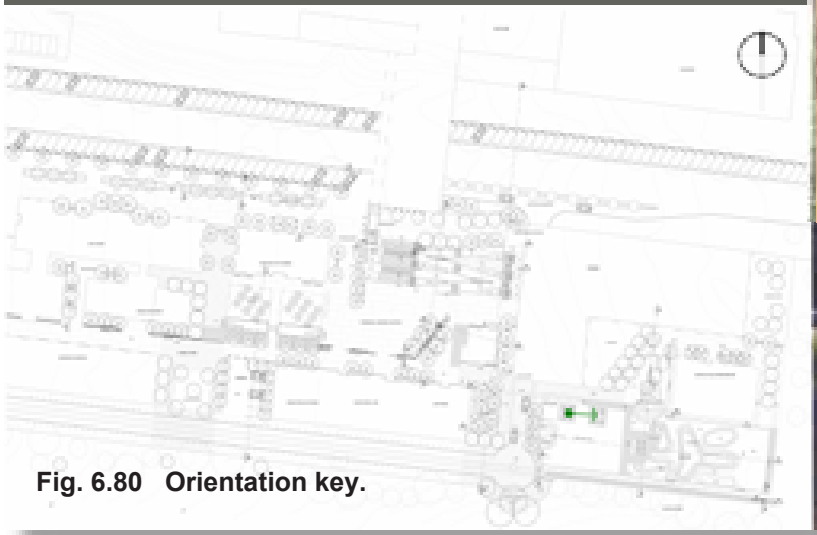


Fig. 6.80 Orientation key.

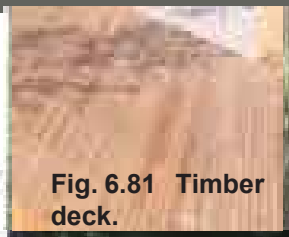


Fig. 6.81 Timber deck.

Fig. 6.82 Wetland species.

Fig. 6.83 Tree top view.

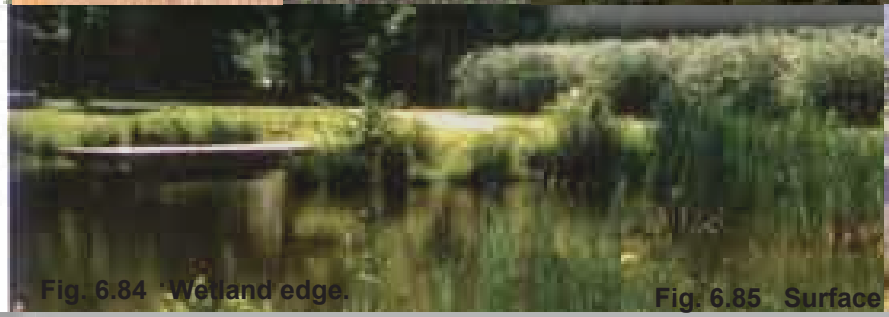


Fig. 6.84 Wetland edge.

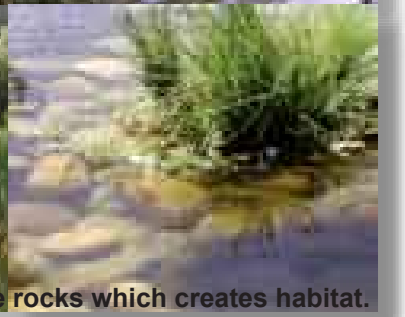
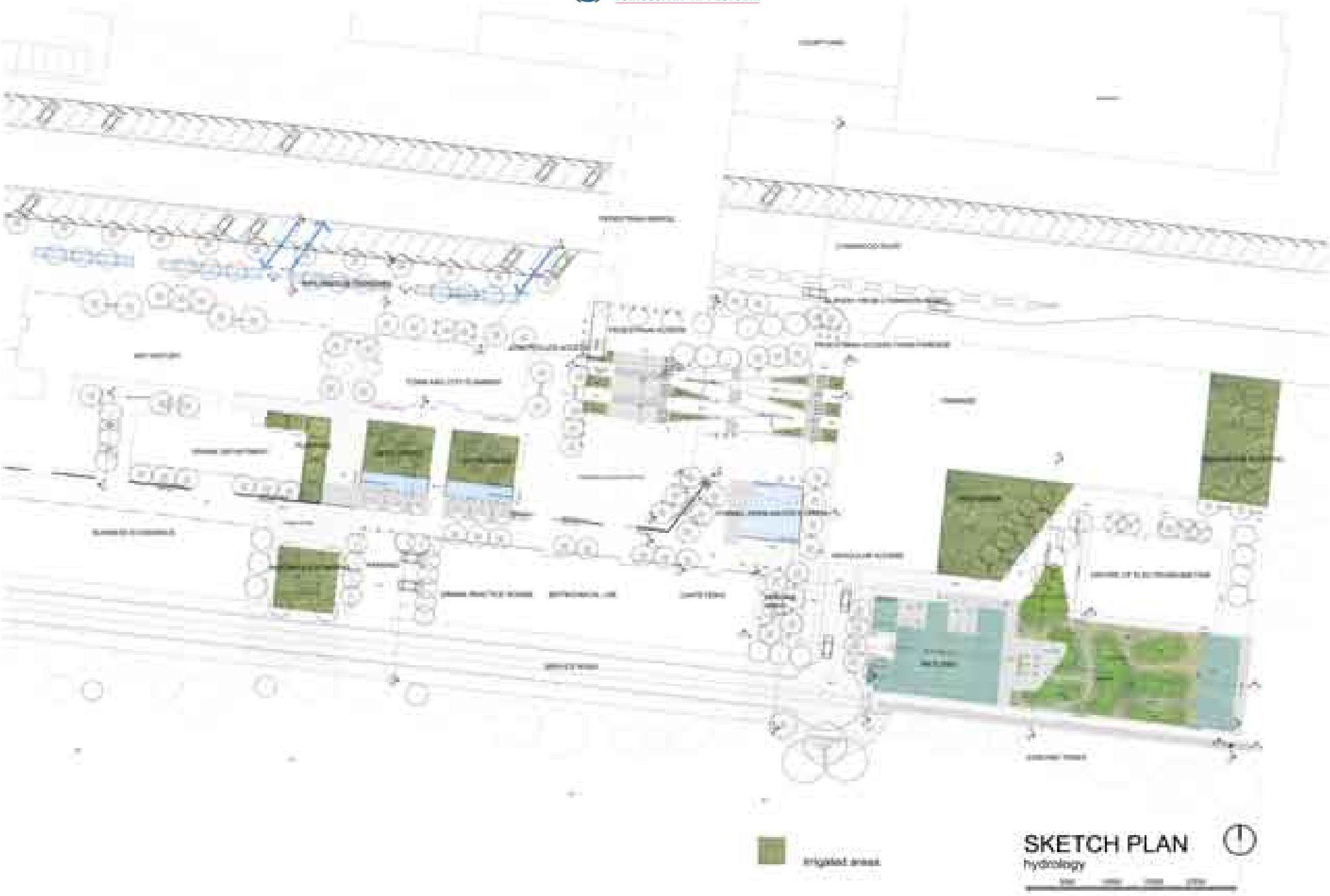
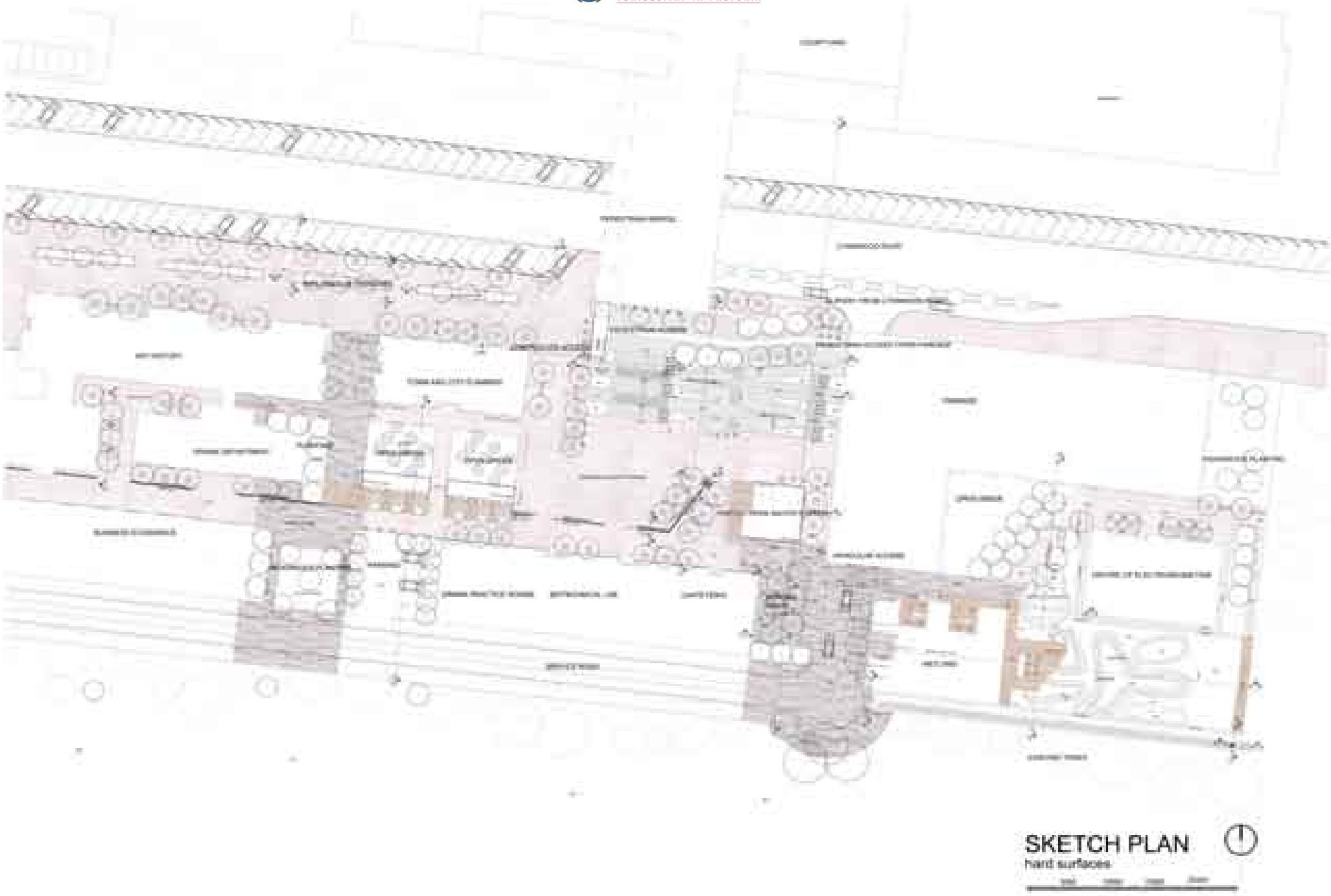


Fig. 6.85 Surface rocks which creates habitat.

Fig. 6.86 Western view from the wetland.


irrigated areas
SKETCH PLAN
hydrology


SKETCH PLAN
hard surfaces

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.

9 AM FEBRUARY MORNING

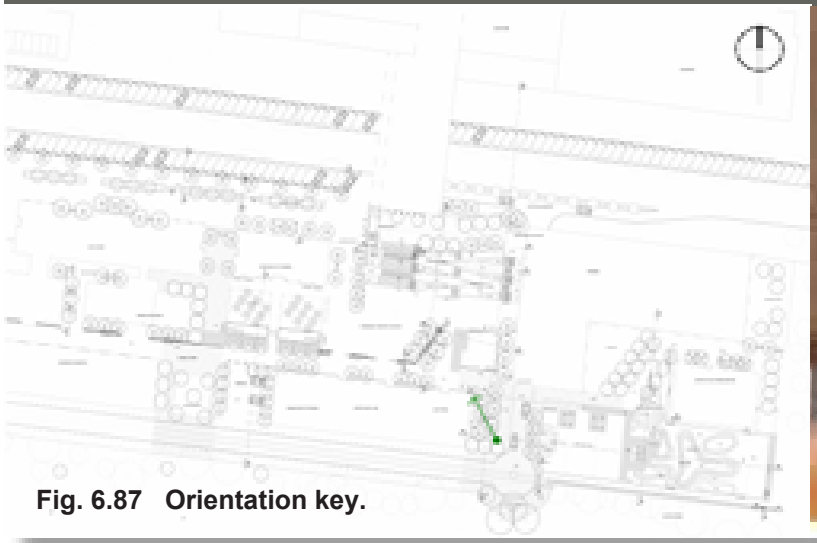


Fig. 6.87 Orientation key.

Fig. 6.88 Seating blocks.

Fig. 6.89 Cobble stone.

Fig. 6.90 Space next to the cafeteria.

1 PM February Afternoon

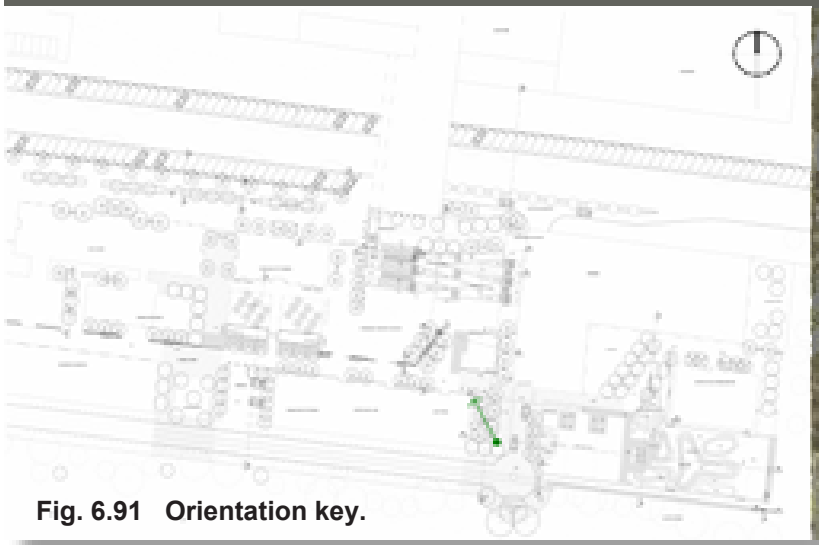


Fig. 6.91 Orientation key.

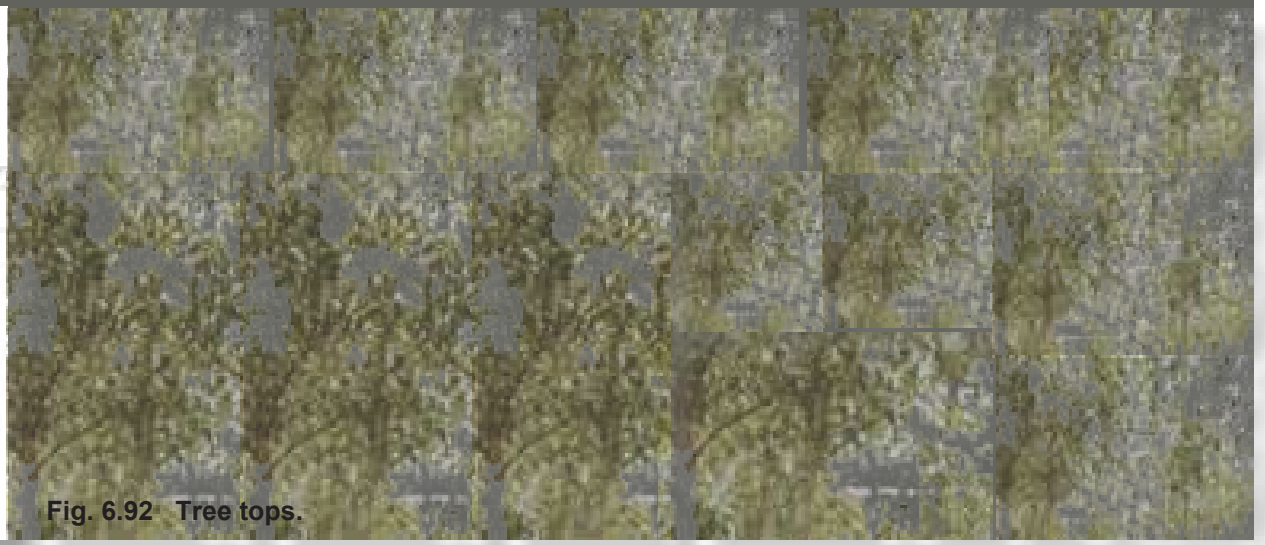


Fig. 6.92 Tree tops.

Fig. 6.93 Space next to cafeteria.

5 PM FEBRUARY AFTERNOON

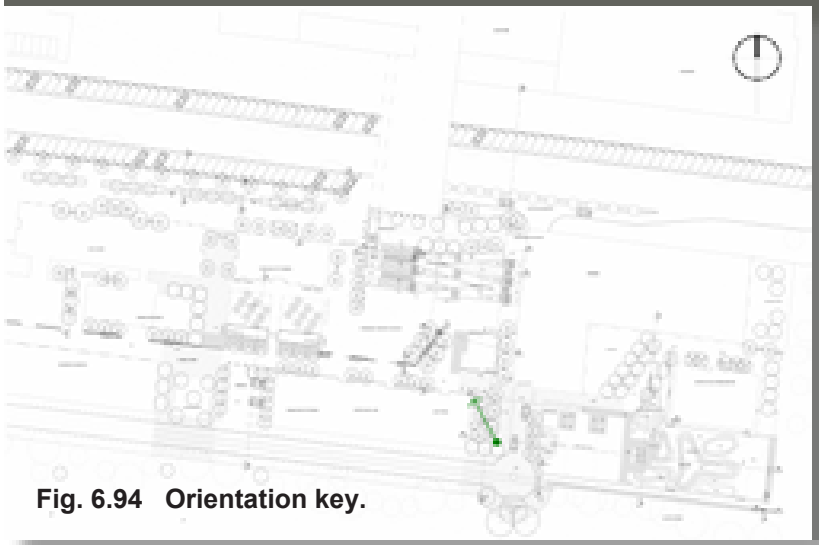


Fig. 6.94 Orientation key.

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.

1 PM Summer Afternoon

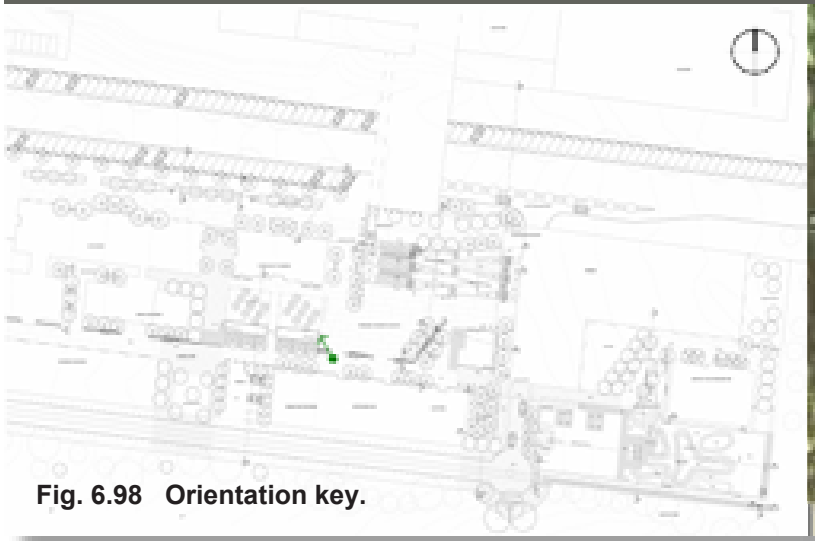


Fig. 6.98 Orientation key.

Fig. 6.99 View through tree canopies.

Fig. 6.100 View towards Town and City Planning.

1 PM Winter Afternoon

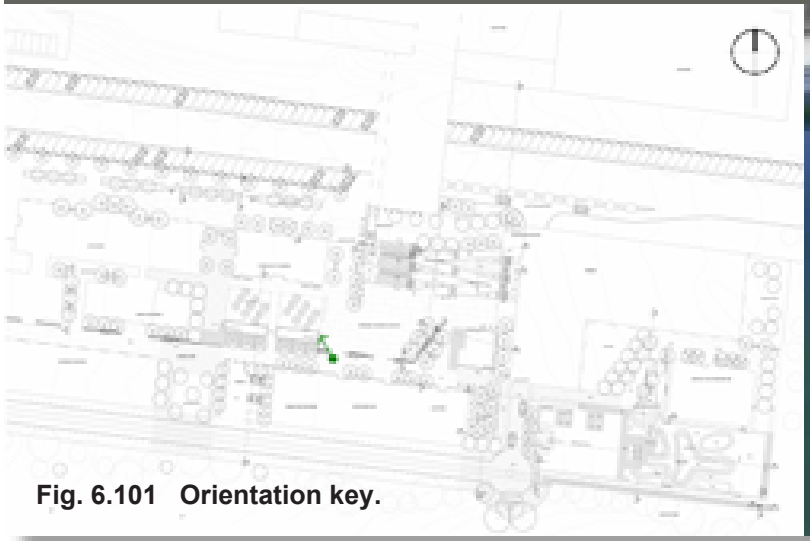


Fig. 6.101 Orientation key.

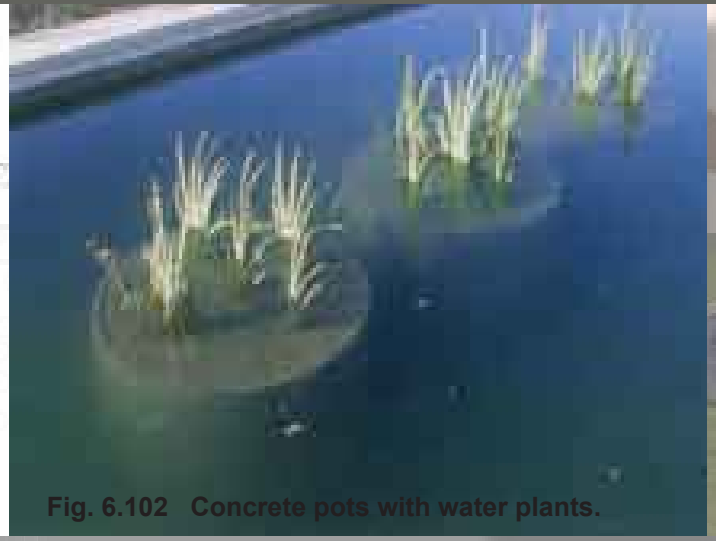


Fig. 6.102 Concrete pots with water plants.

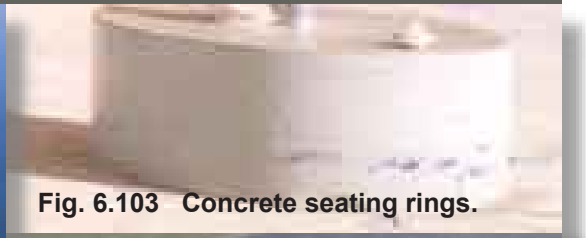


Fig. 6.103 Concrete seating rings.

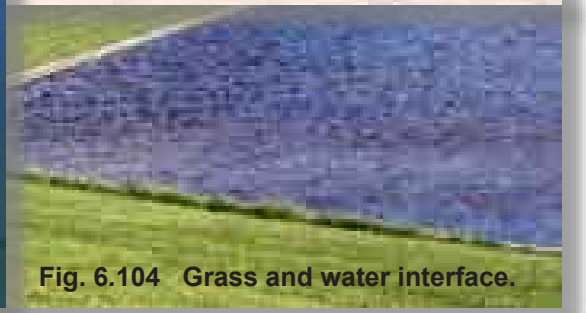
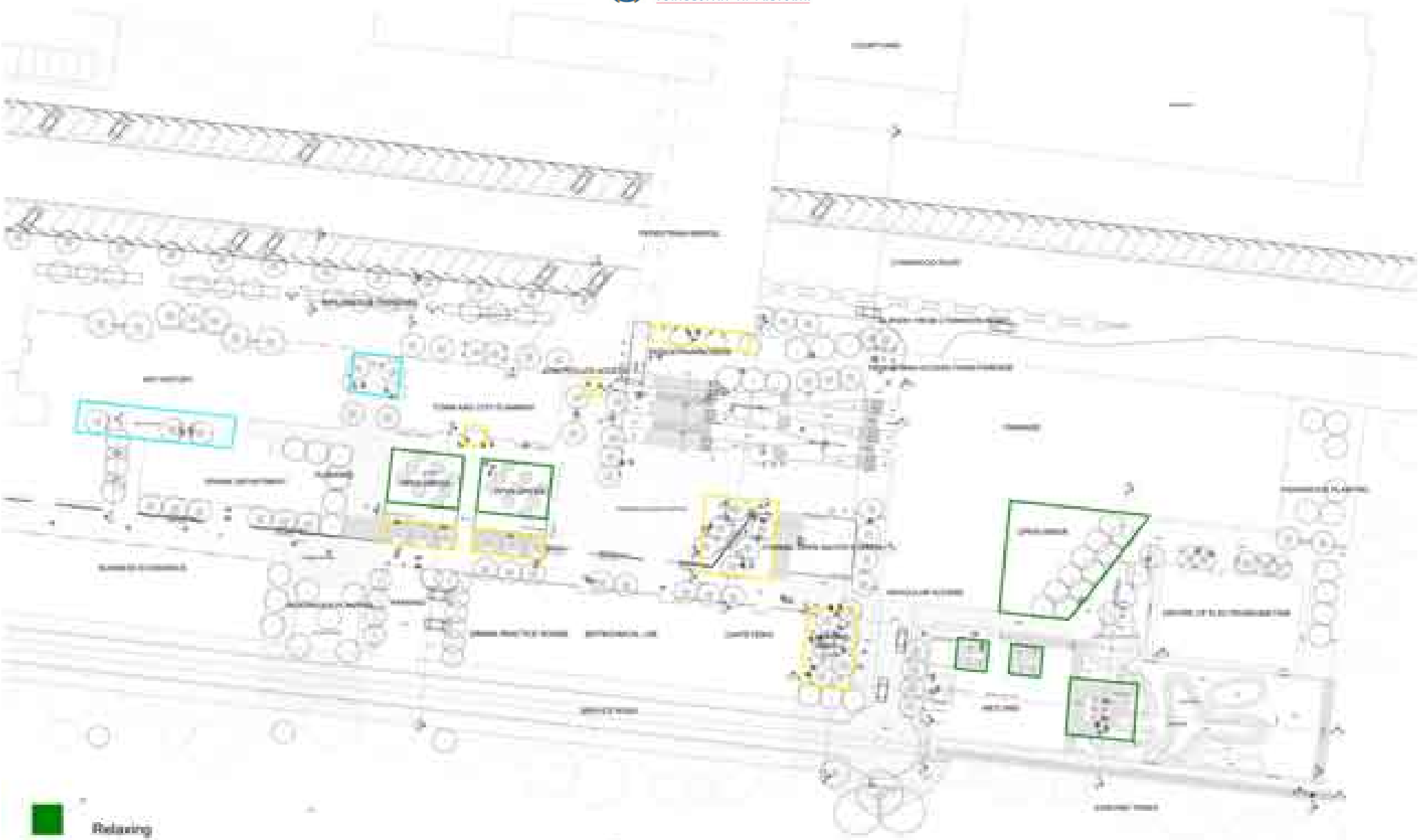
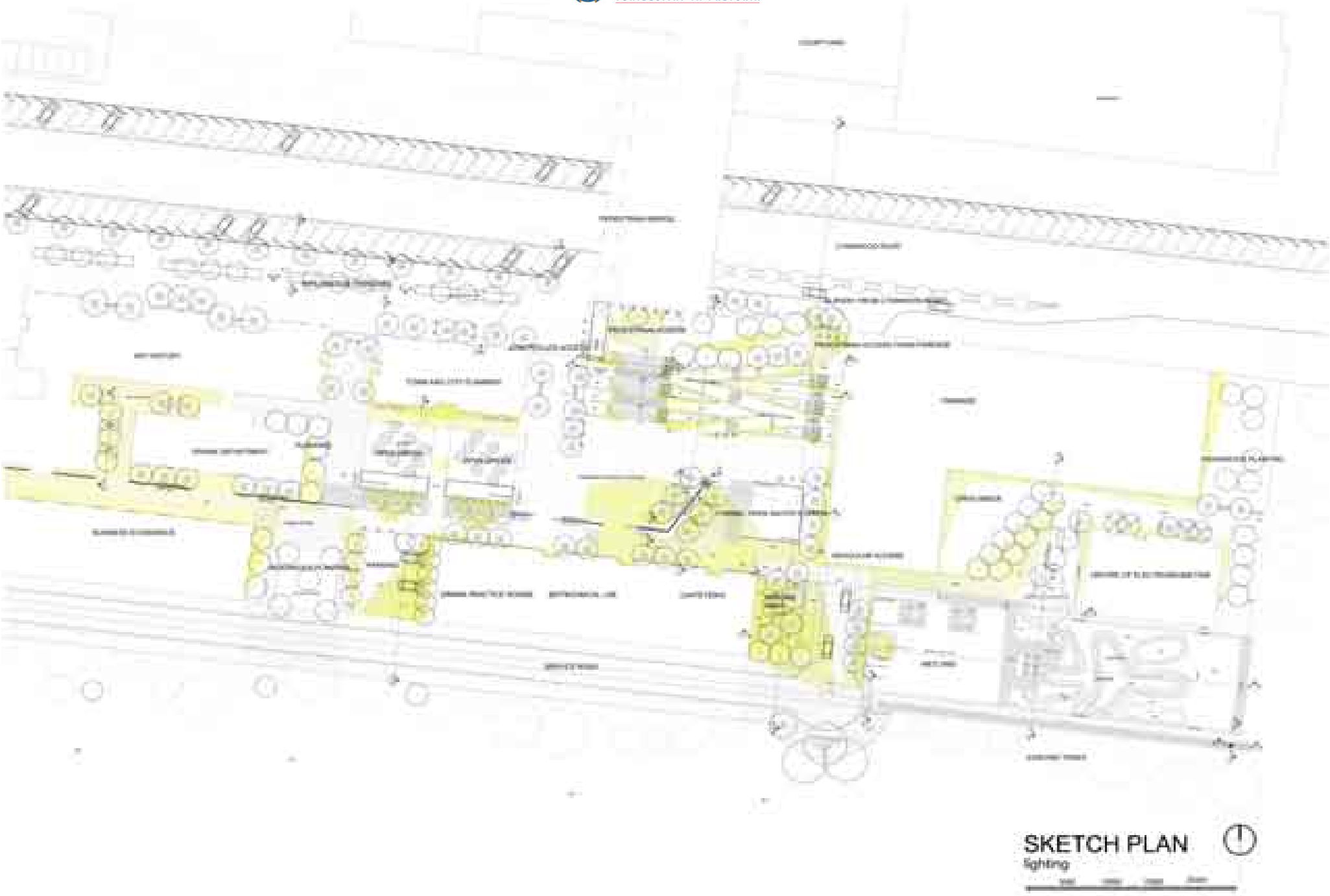


Fig. 6.104 Grass and water interface.

Fig. 6.105 View towards Town and City Planning.


Relaxing
Gathering
Studying and Reading
SKETCH PLAN
spatial rooms


SKETCH PLAN
lighting

Lighting

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

DAY

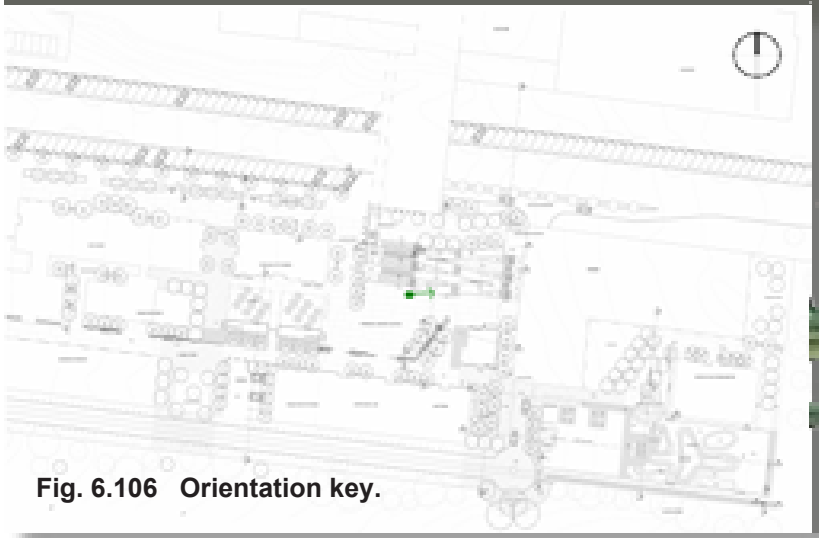


Fig. 6.106 Orientation key.

Fig. 6.107 Aloe marlothii.

Fig. 6.107 Stone wall.

Fig. 6.109 Ramp access.

NIGHT

Fig. 6.110 Orientation key.

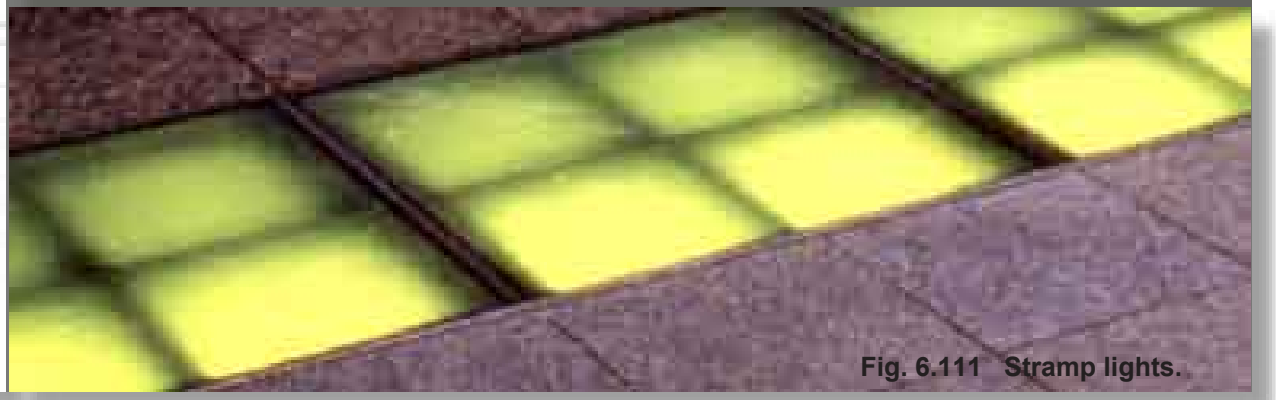


Fig. 6.111 Stramp lights.

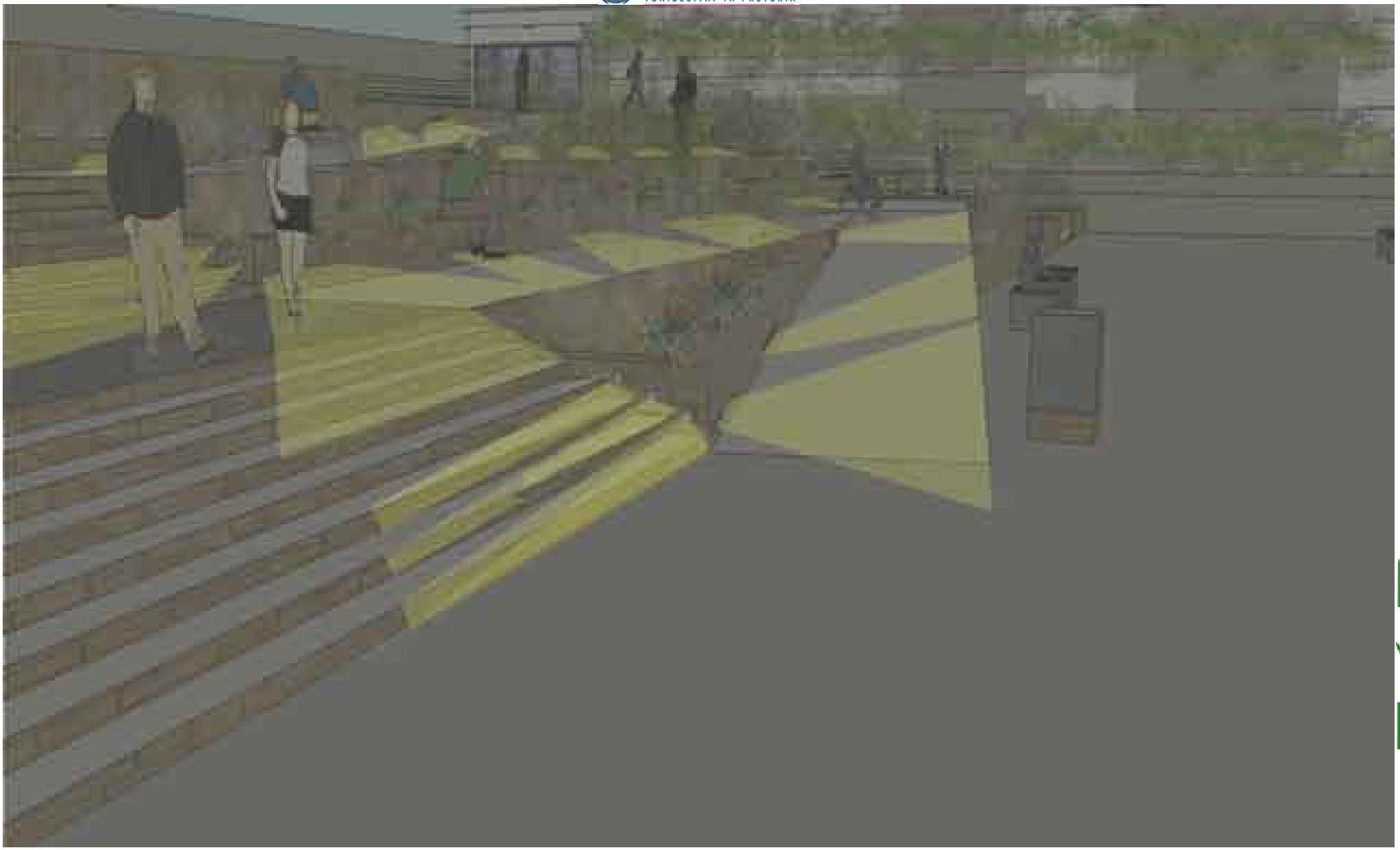


Fig. 6.112 Ramp access.

JANUARY AFTERNOON

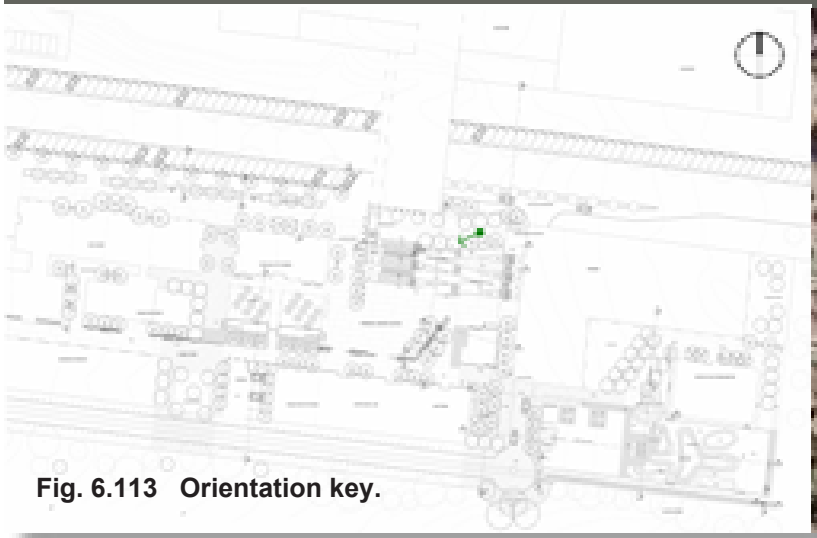


Fig. 6.113 Orientation key.

Fig. 6.114 Concrete surface.

Fig. 6.115 Glass panels.

Fig. 6.116 View from parkade access.

JUNE AFTERNOON

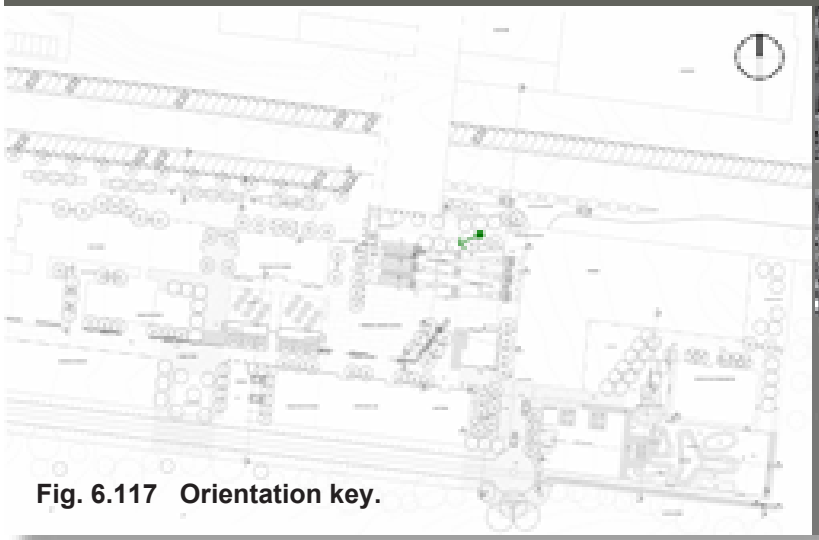


Fig. 6.117 Orientation key.

Fig. 6.118 Boulevard of trees.

Fig. 6.119 View from parkade access.

6 TECHNICAL RESOLUTION

6

WETLAND

Technical Resolution

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.

Wetland system and existing channel

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.

Design intend

The surface wetland is designed primarily to illustrate the cleaning of storm water runoff in an urban environment. A secondary objective include the creation of habitat and on a tertiary level the wetland system also poses to have educational value as interpretive signage will be erected to explain its role in the treatment of storm water.

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.

Water quantities

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 m^3 water per day.

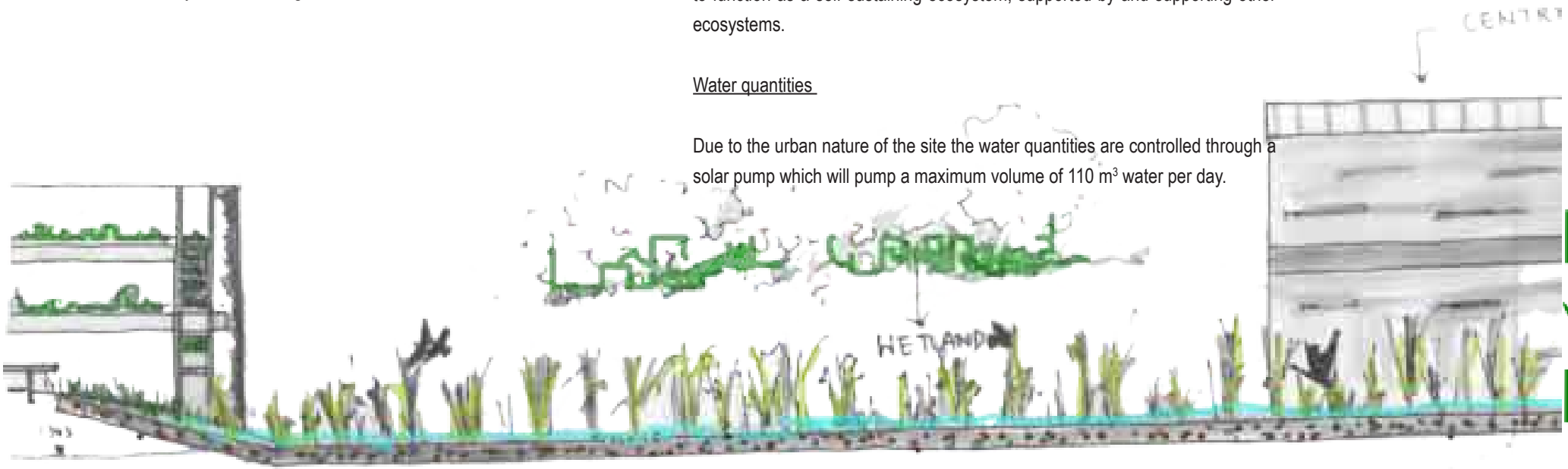


Fig. 6.120 Concept section.

Existing Channel

Total Area 3.58 m^2
Catchment Area 160 ha (Refer to Chapter 3, figure 3.17)

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

Q values

Base flow from natural stream 0.002 m^3 / s
Q2: 0.0053 m^3 / s
Q10: 0.008 m^3 / s
Q20: 0.097 m^3 / s
Q50: 0.014 m^3 / s
Q 100: 0.016 m^3 / 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 m^3
552.5 m^3 x 0.2 = 110.5 m^3 water effectively treated per day (Maximum during summer months)

Average flow from natural stream during summer months (0.002 m^3 / s)
2 litres/ second x 86400 s (24h) = 172 m^3 / day
172 m^3 / 2 (12 solar hours)
= 86.4 m^3 water / day (Average during summer months)

Average flow from natural stream during winter months (0.0004 m^3 / s)
0.4 litres/second x 86400 s (24h) = 34.56 m^3 / day
34.56 m^3 / 2 (12 solar hours)
= 17.28 m^3 water / day (Average during winter months)

For Q2 (0.0053 m^3 / 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.

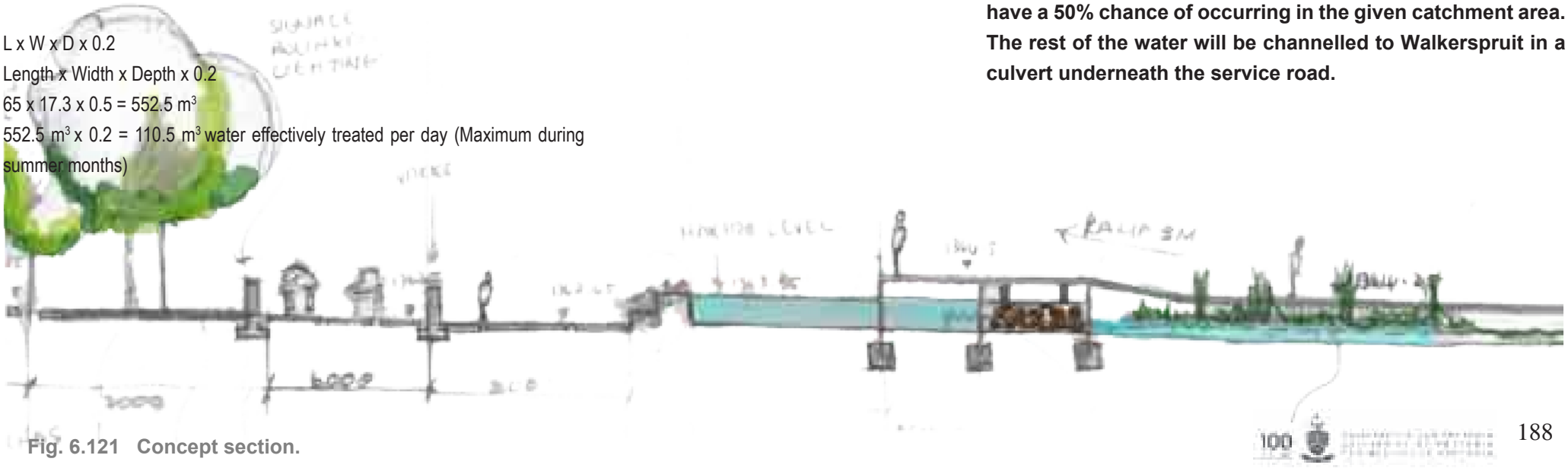


Fig. 6.121 Concept section.

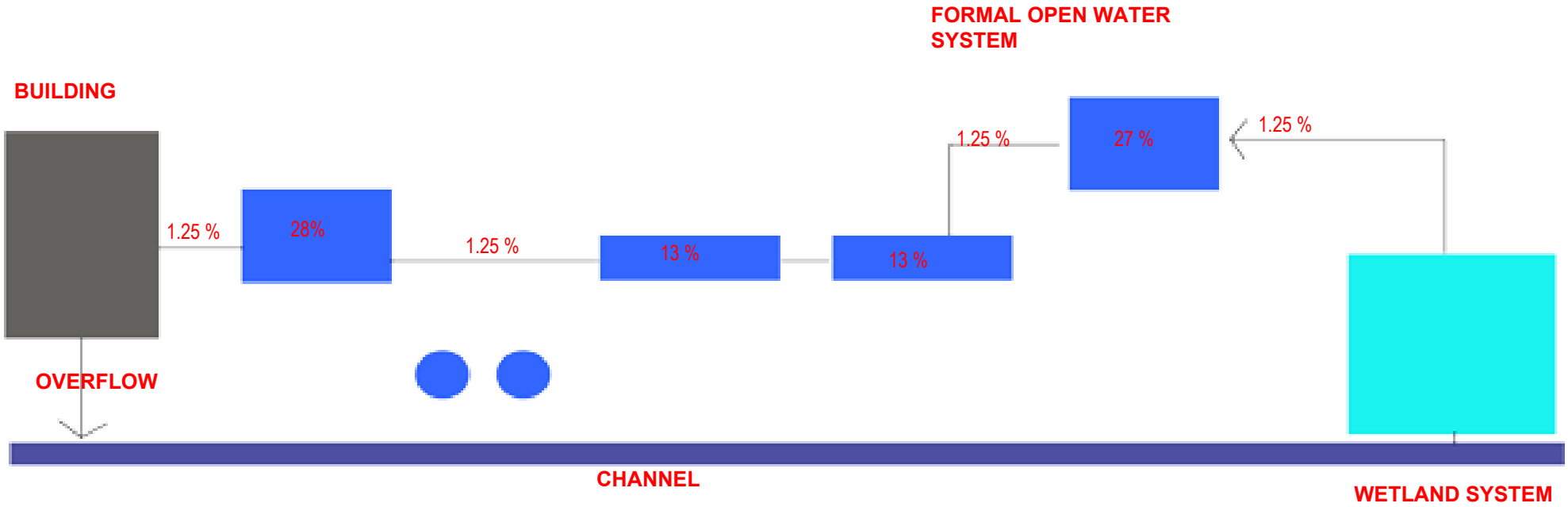


Fig. 6.122 Flow diagram.

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.

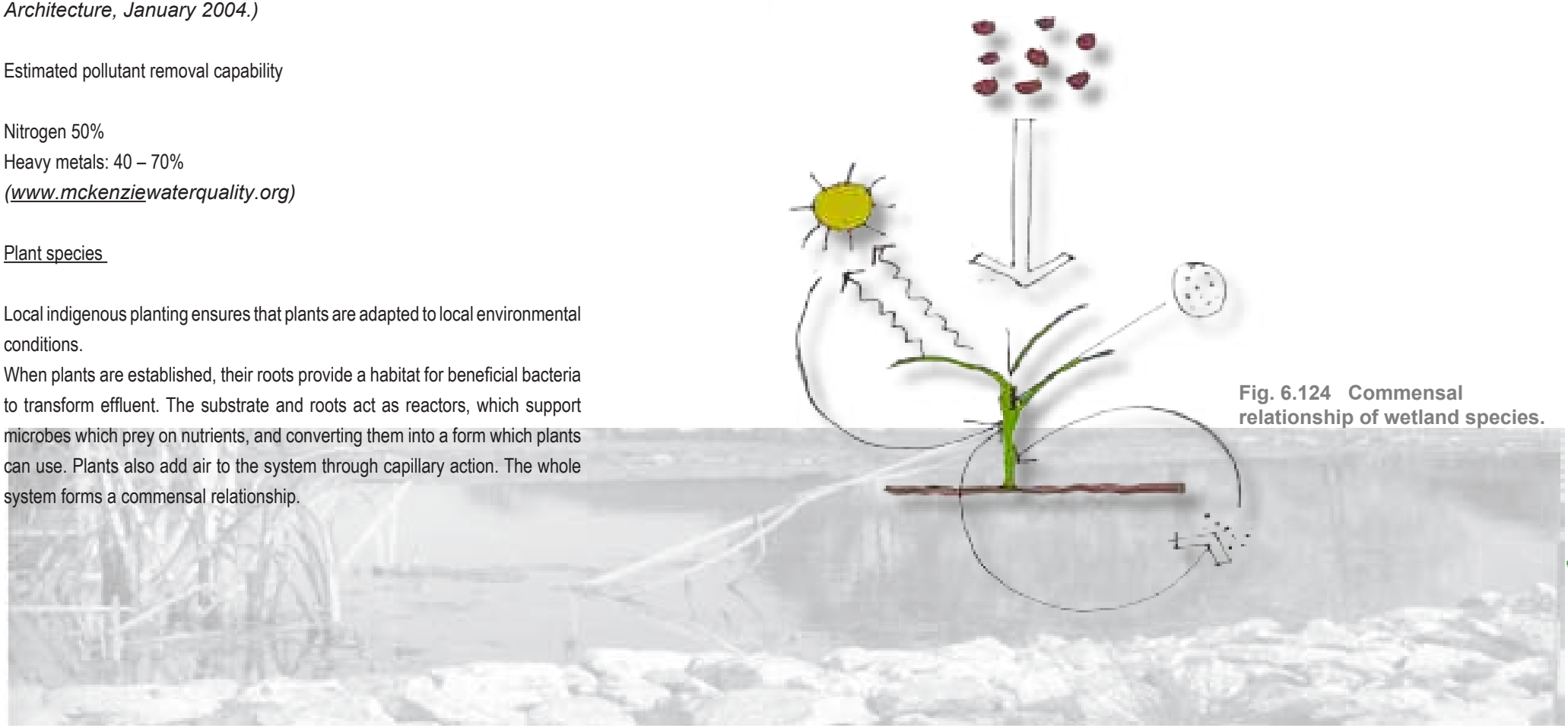


Fig. 6.124 Commensal relationship of wetland species.

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)*

Fig. 6.125 Bentonite clay.

Fig. 6.126 Bentonite clay.

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)*

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)*

To reduce the levels of phosphorous wetlands require periodic harvesting, before the onset of summer. *(Landscape Architecture, January 2004.)*

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 of excess nutrients taken up by vegetation.

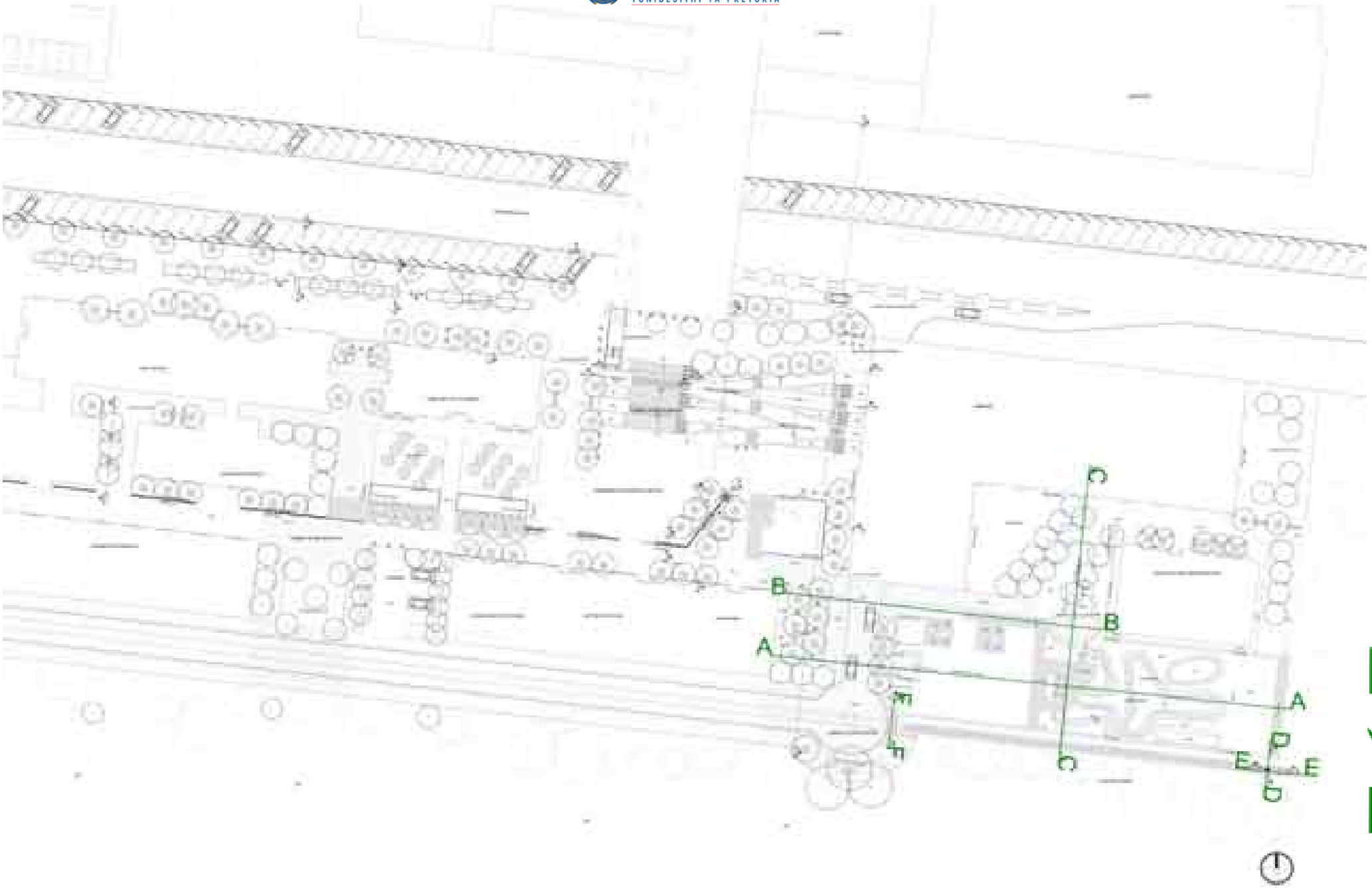


Fig. 6.127 Orientation key.

6

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 m^2
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 m^2 = 1. 234 m^3
- Maximum total volume of water in the open formal bodies of water
  24 m^3 + 22.94 m^3 + 24.96 m^3 = 71.9 m^3

Total maximum volume of water in system 73.134 m^3

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 m^2 of soft planting = 38.09 m^3

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.

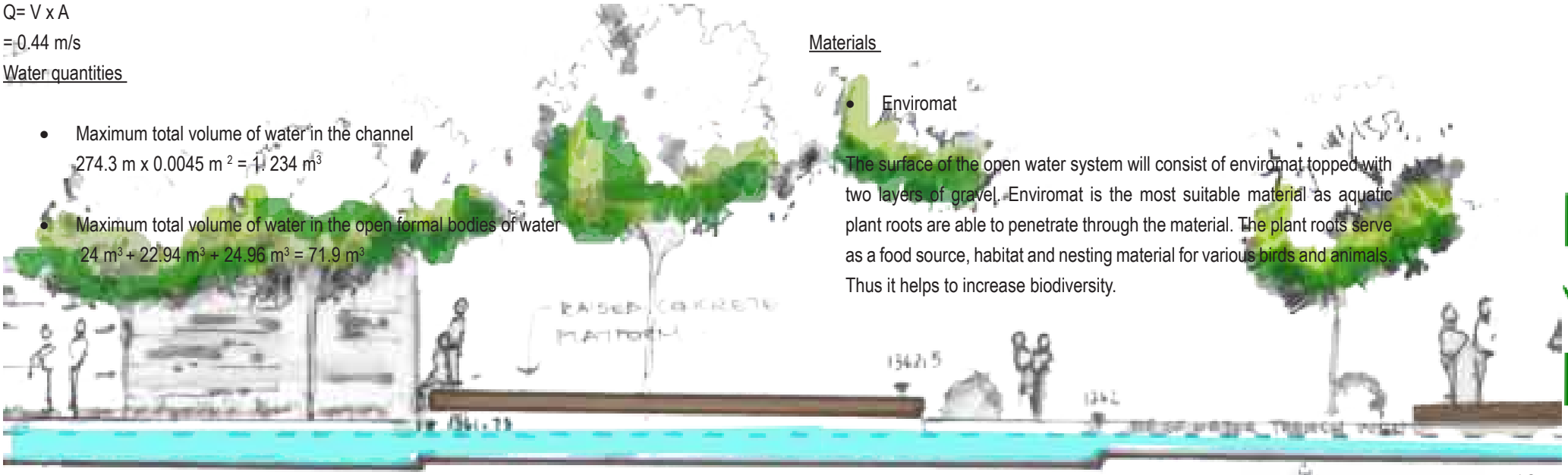


Fig. 6.128 Concept section.

Fig. 6.129 Orientation key.


6
STRAMP

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 CO^2 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.

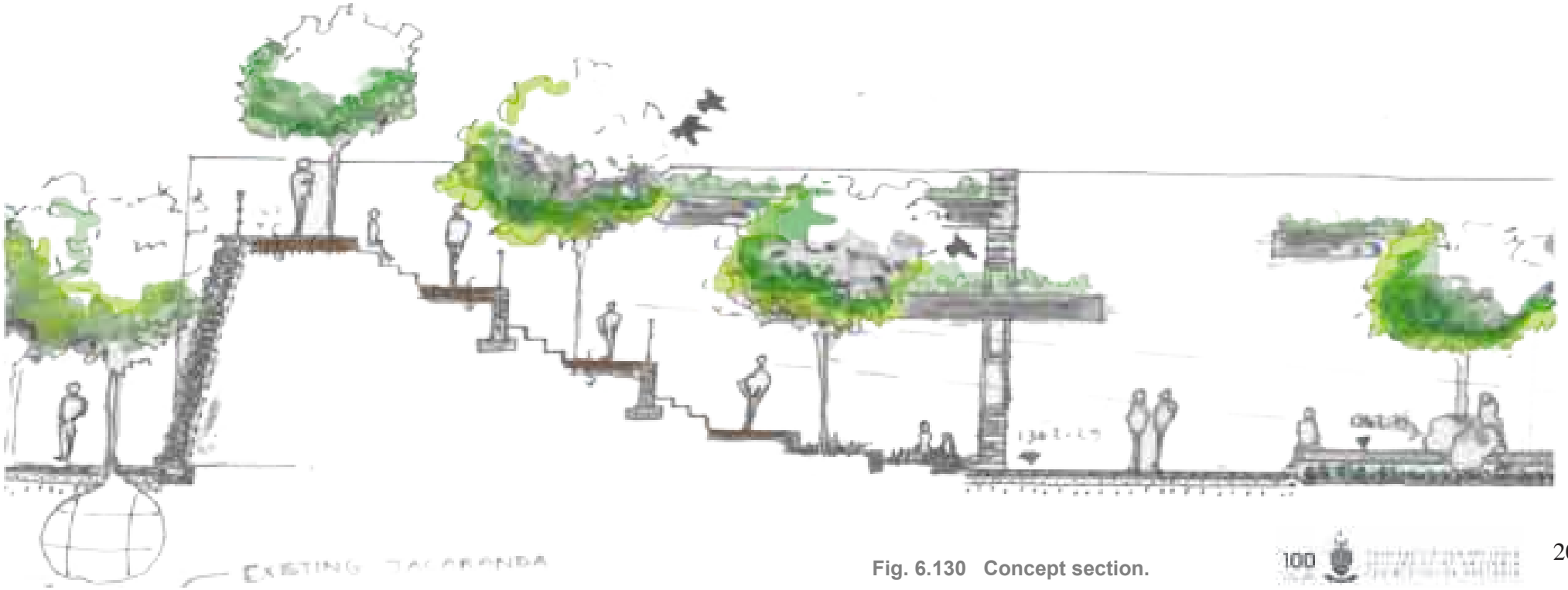


Fig. 6.130 Concept section.

- 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.

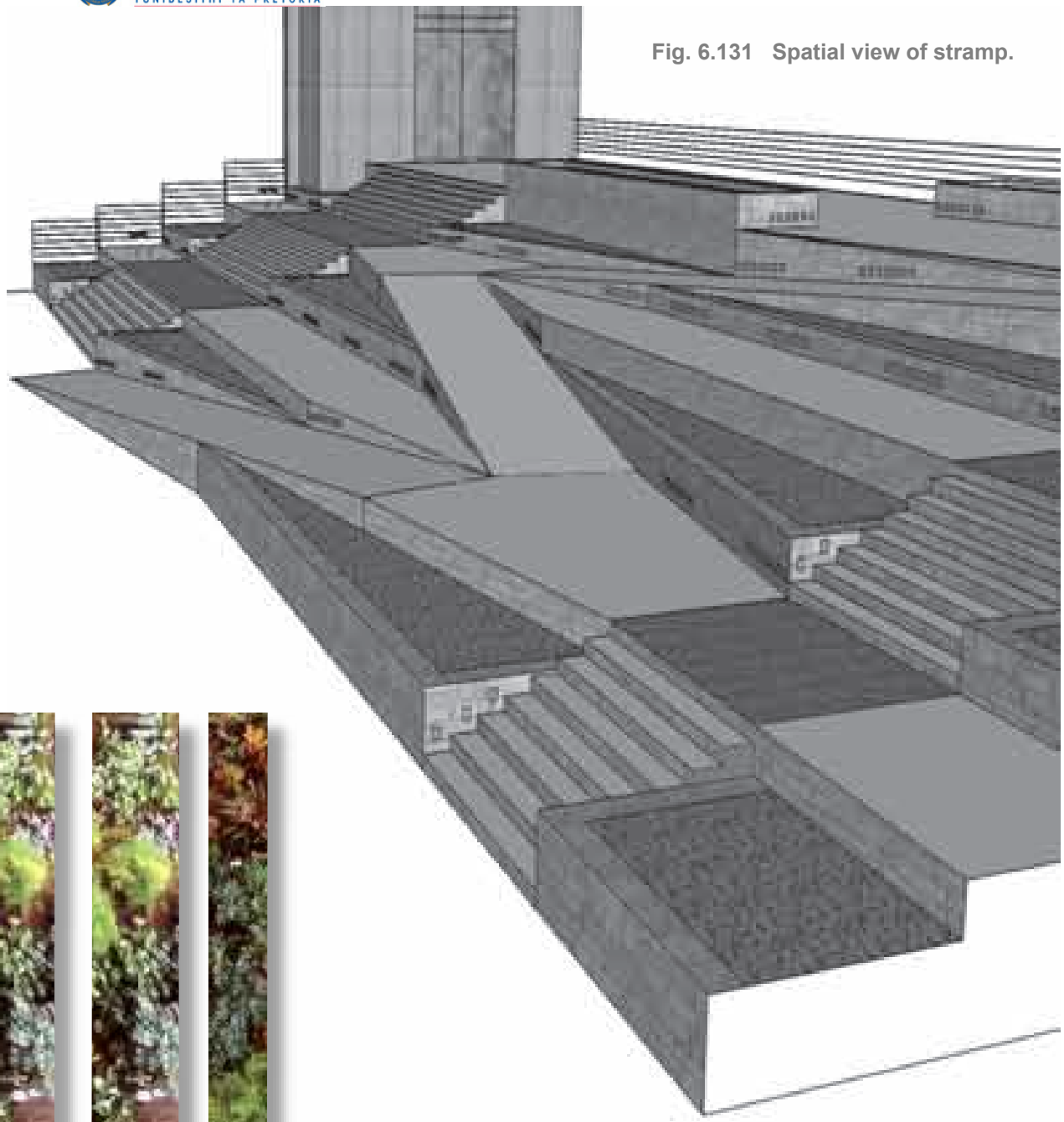
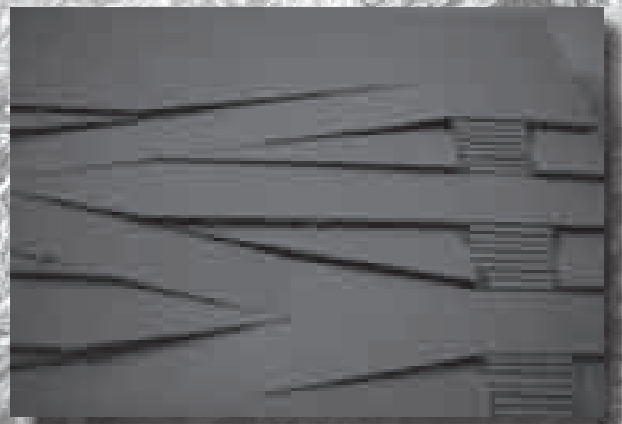


Fig. 6.131 Spatial view of stramp.

Fig. 6.132 Concept of vertical landscape. [100]



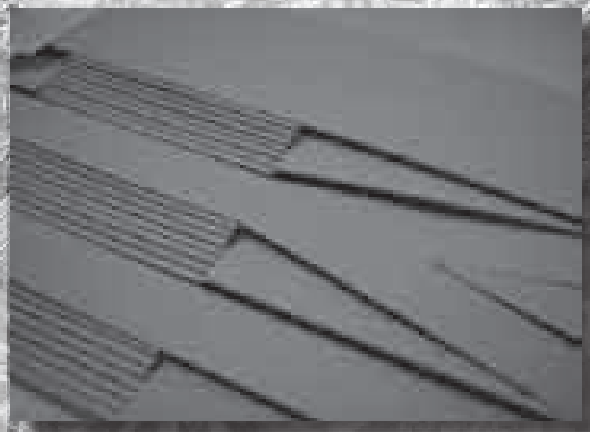


Fig. 6.133 – 6.135 Stramp model.

Fig. 6.136 Concept of vertical garden.

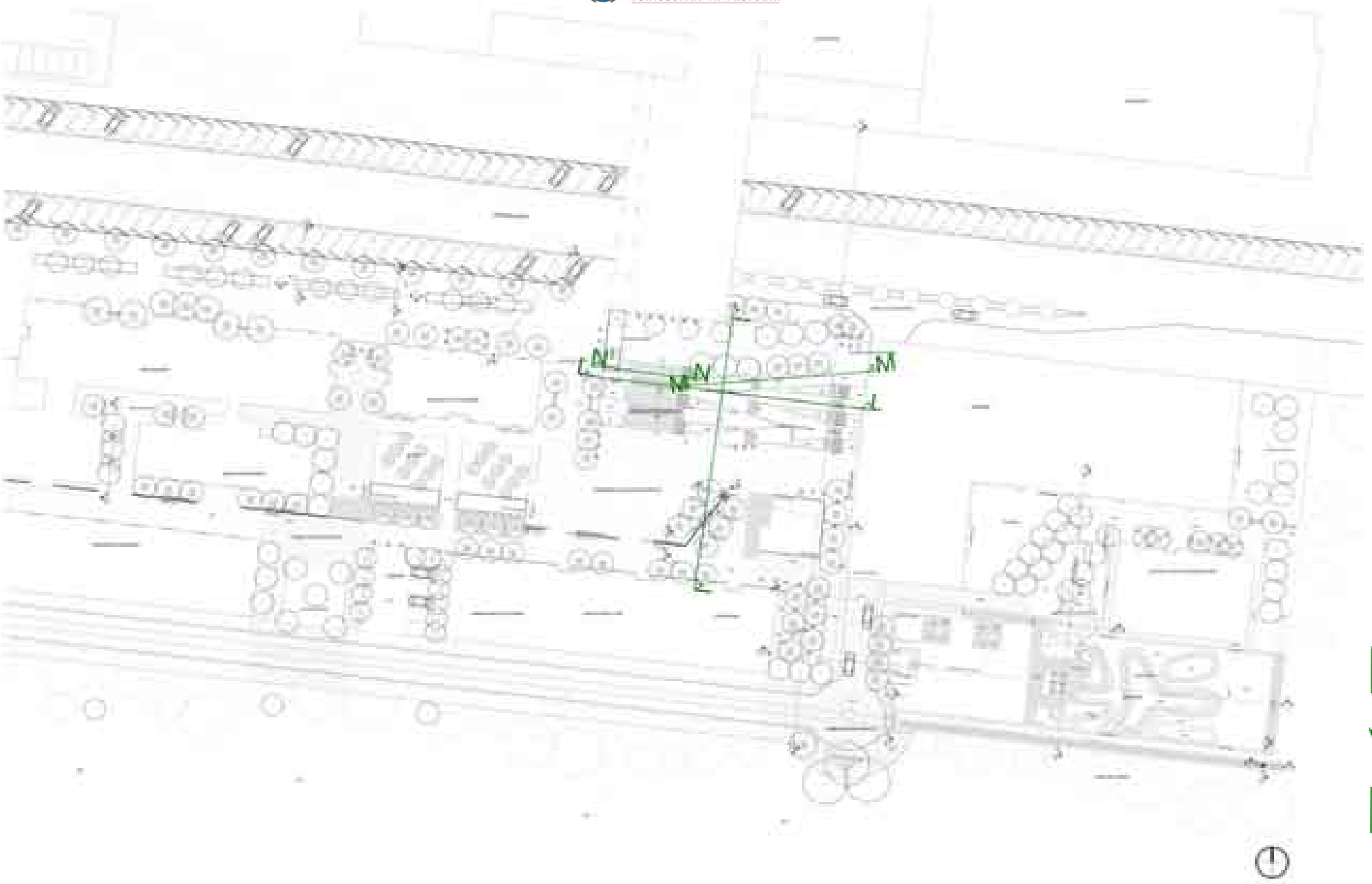


Fig. 6.137 Orientation key.

6

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.)

Fig. 6.138 Cut in the curb channel.

Fig. 6.139 A wide street section accommodates stormwater treatment.

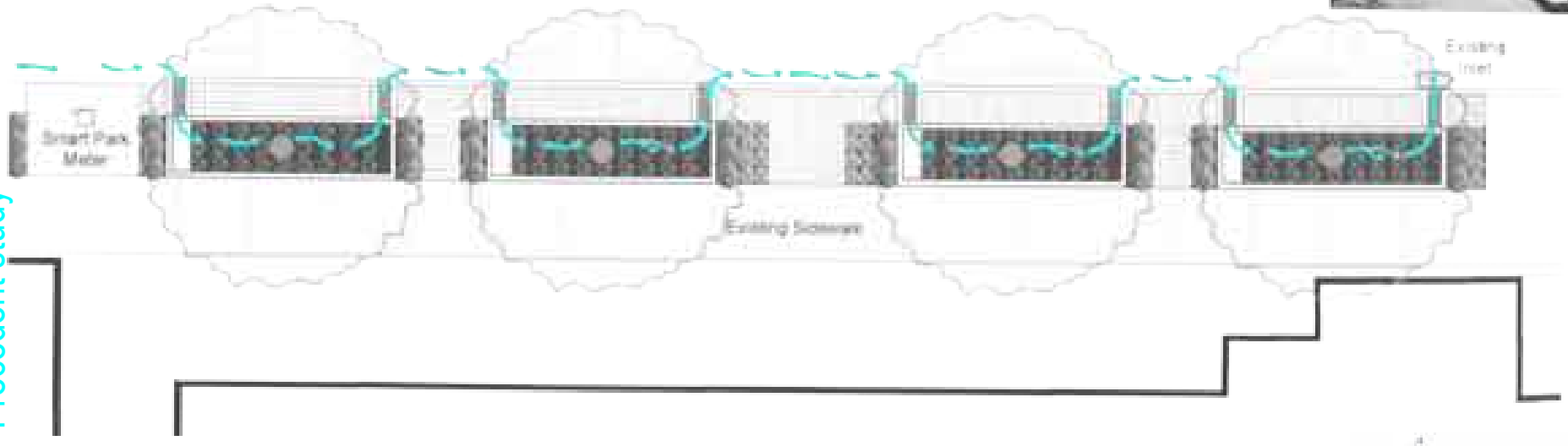


Fig. 6.140 Storm water flow.

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

Time of concentration 22.6 min

- Q values

Q2 (25mm/h) = 0.01 m^3/ s
Q10 (50mm/h) = 0.02 m^3/ s
Q 20 (65mm/h) = 0.029 m^3/ s
Q 50 (85mm/h) = 0.038 m^3/ s
Q100 (100mm/h) = 0.045 m^3/ s

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 19.8 min

- Q values

Q2 (25mm/h) = 0.011 m^3/ s
Q10 (50mm/h) = 0.022 m^3/ s
Q 20 (65mm/h) = 0.028 m^3/ s
Q 50 (85mm/h) = 0.037 m^3/ s
Q100 (100mm/h) = 0.044 m^3/ s

Fig. 6.141 Catchment area.

- Percentage of water treated

Maximum allowable water volume per trench: 0.15* 18.26 * 1.5 = 4.1 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.

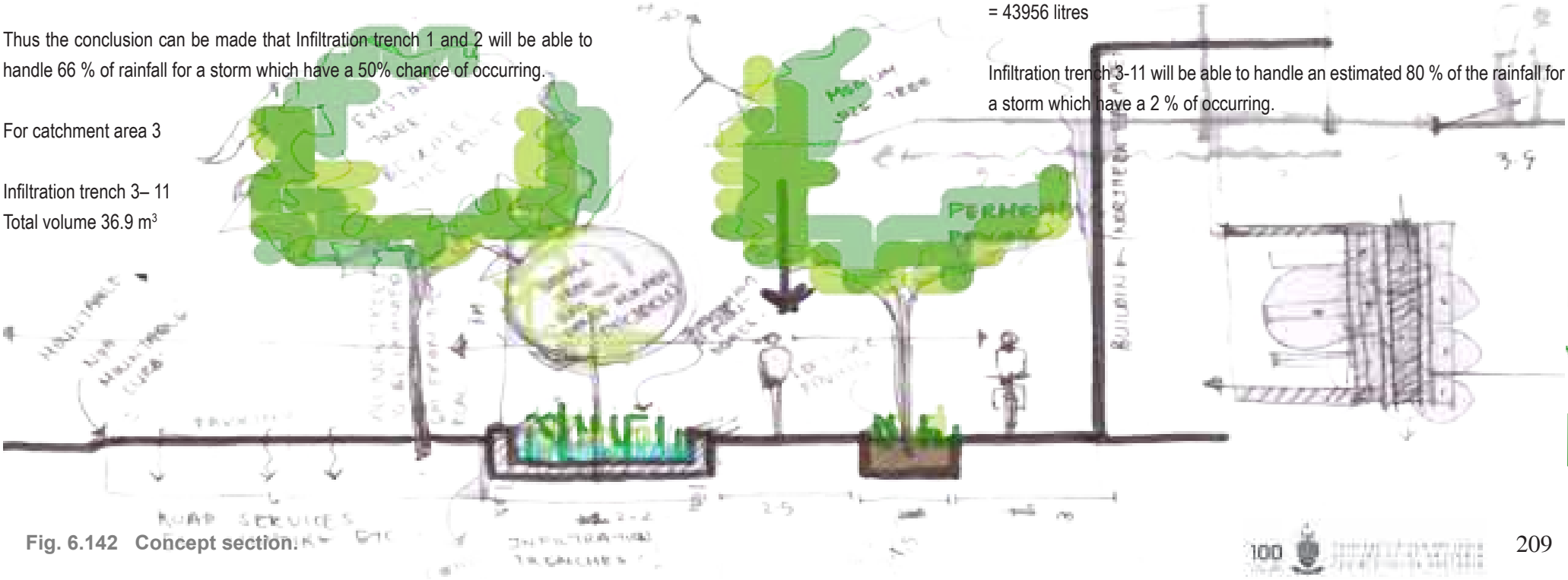


Fig. 6.142 Concept section.

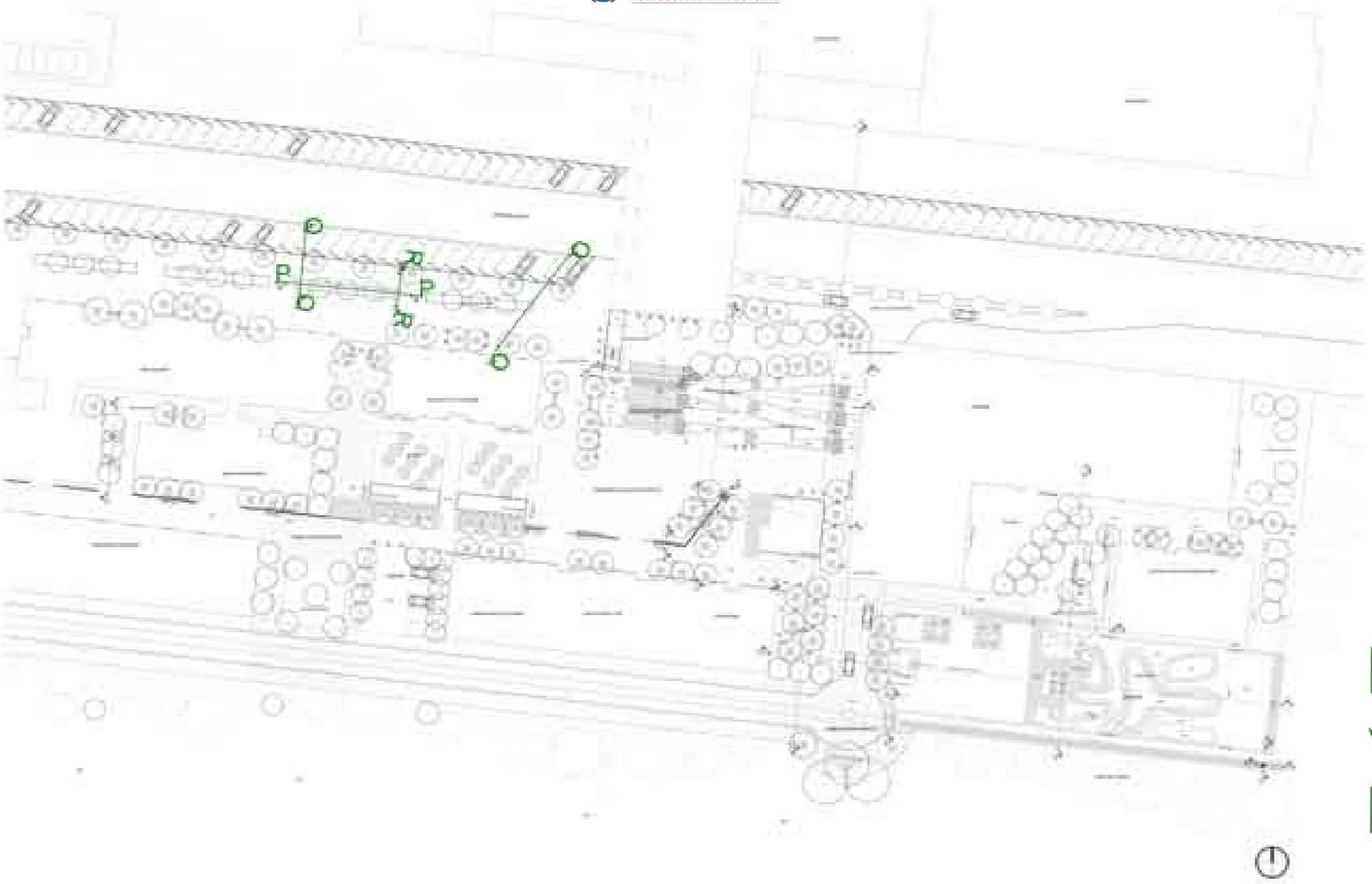


Fig. 6.143 Orientation key.