Master of Landscape Architecture

Water in constructing ecologies

CLINTON HINDES

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geomatics

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2017 PROGRAMME STRUCTURE

MASTER OF LANDSCAPE ARCHITECTURE 1.

Revision A - 02.03.2017

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Courses:

Landscape Systems – APG4054F
Terrain Analysis – APG4034F

Constructing Landscape Systems – APG4032S

Team:

Landscape Architect, Freshwater Ecologist, Botanical Ecologist, Civil Engineer, Geologist, Soil Scientist

Broad objectives:

- Analyse: Understand the landscape through landscape and urban ecology
- Design: Intervene in the landscape from an ecosystem perspective

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Schools of thought (ecology and the city)

Landscape ecology (landscape suitability)

Landscape sustainability (triple bottom line)

Urban ecology (cities as CAS, hybrid patches)

Ecological Urbanism (design – speculative, imaginary agenda)
('…extension of ecological metaphors within urban design discourse' [Gandy 2009].)

Urban metabolism (input – output, material flow analysis, life cycle assessment)

Urban political ecology (biophysical is entangled in the social and political, value articulation)

Landscape Systems – APG4054F
Terrain Analysis – APG4034F

Objectives:

Frame a conceptual approach to ecosystem analysis

Evaluating ecosystem (landscape) performance

Understand how to frame effective ecosystem intervention (to be strategic)

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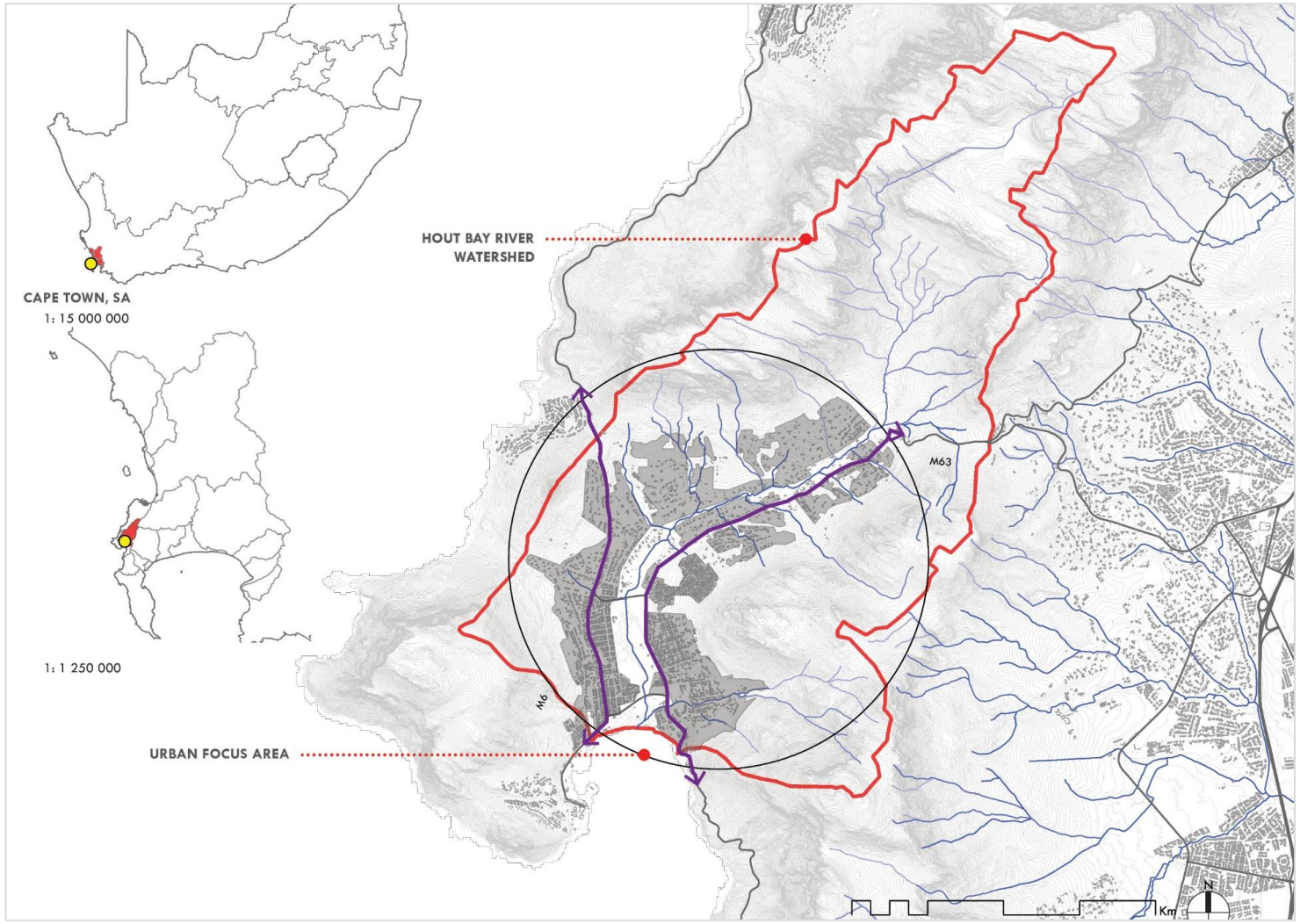


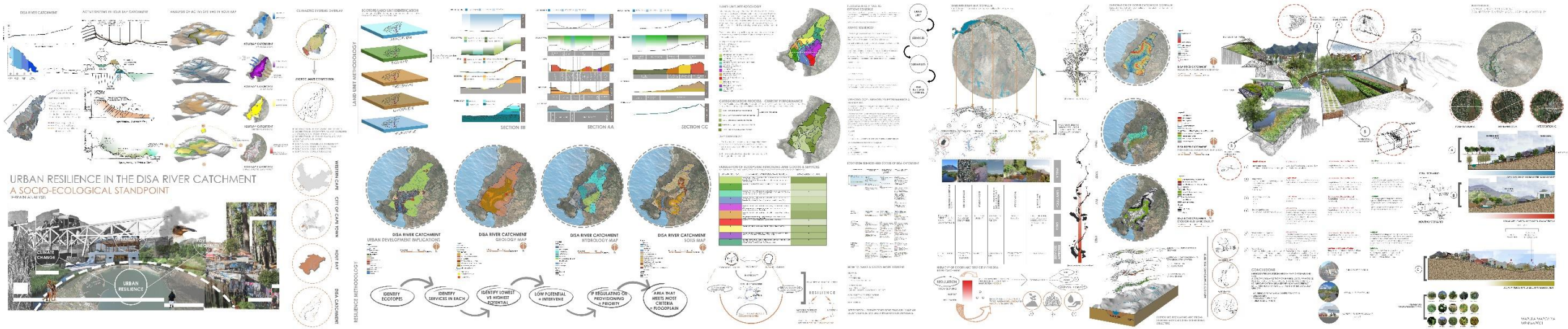
Project aim:

Ecosystem study

Ecosystem evaluation

Conceptualise an intervention

Josh McFarland



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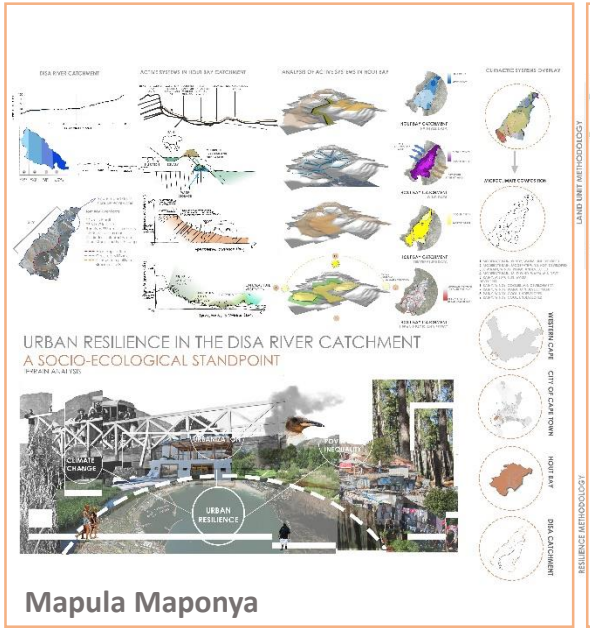
General context study



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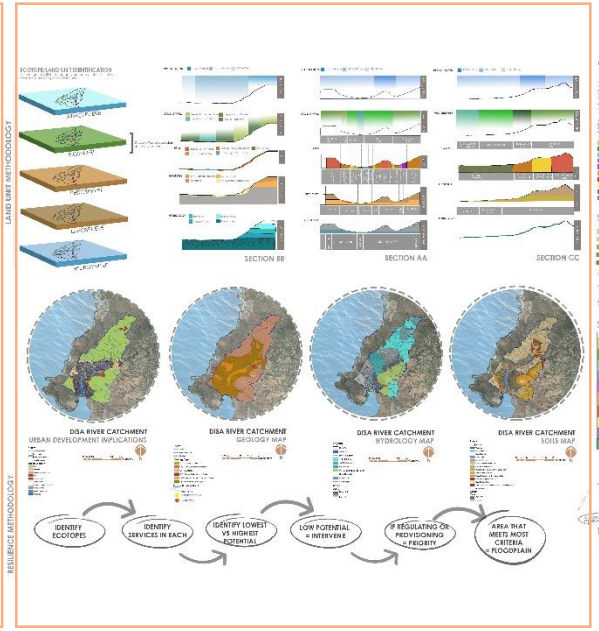
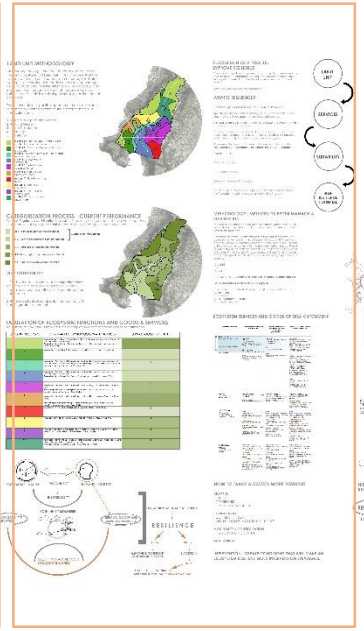
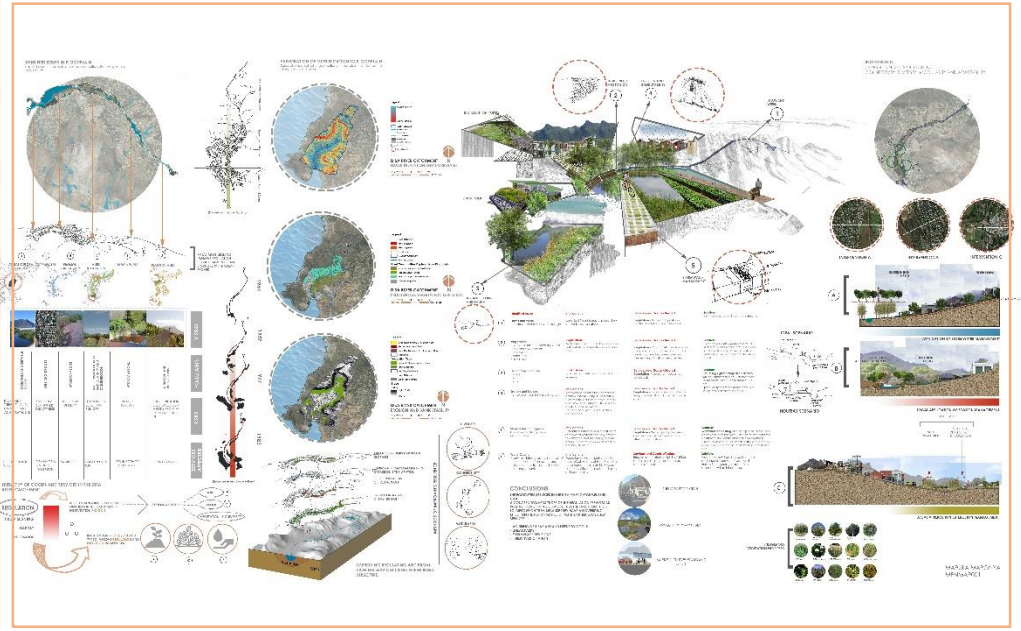
Ecotope identification



Ecosystem evaluation



Conceptualise intervention



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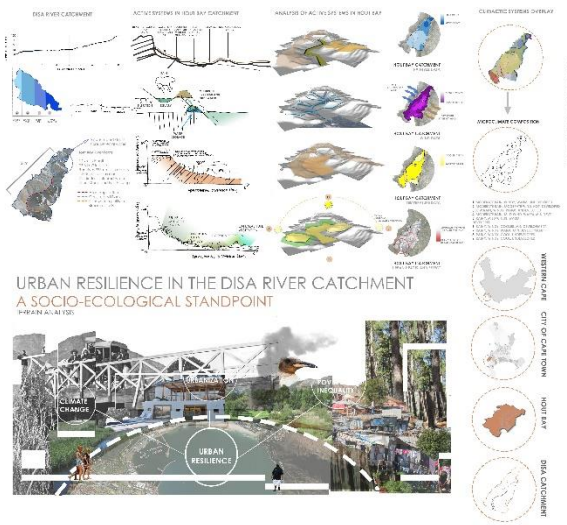

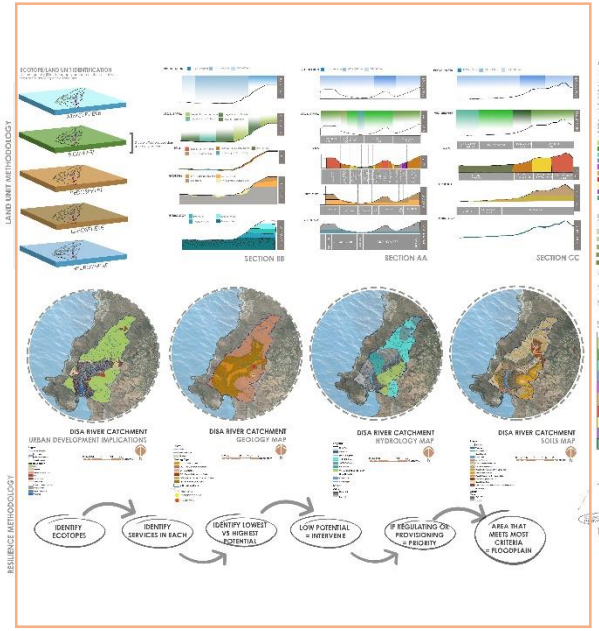

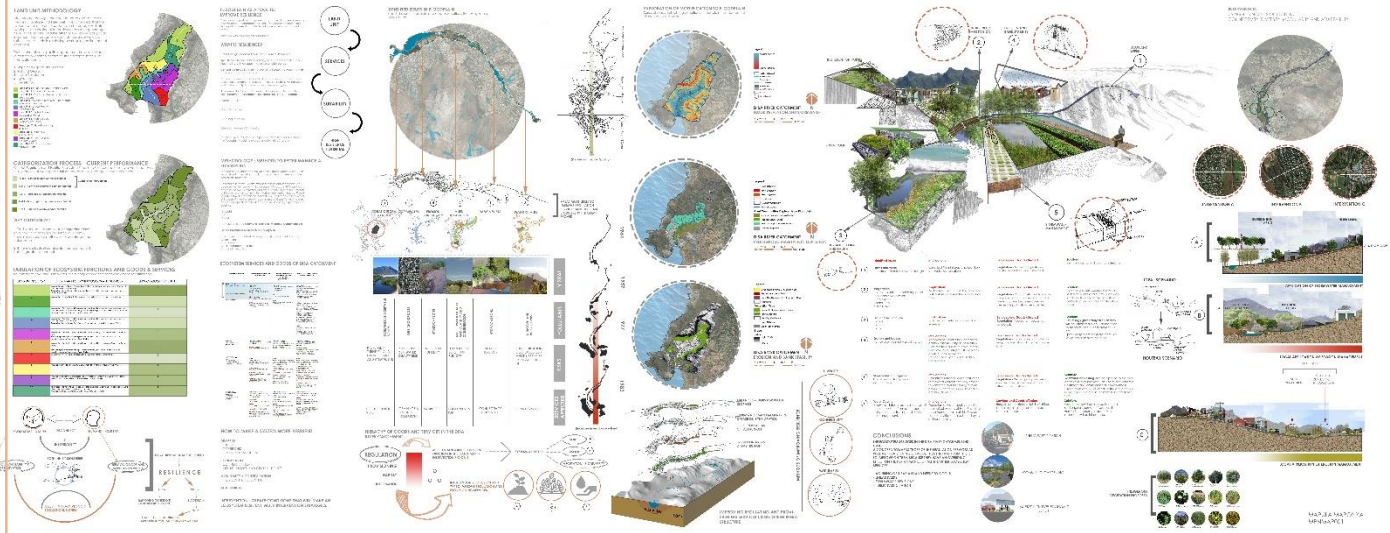

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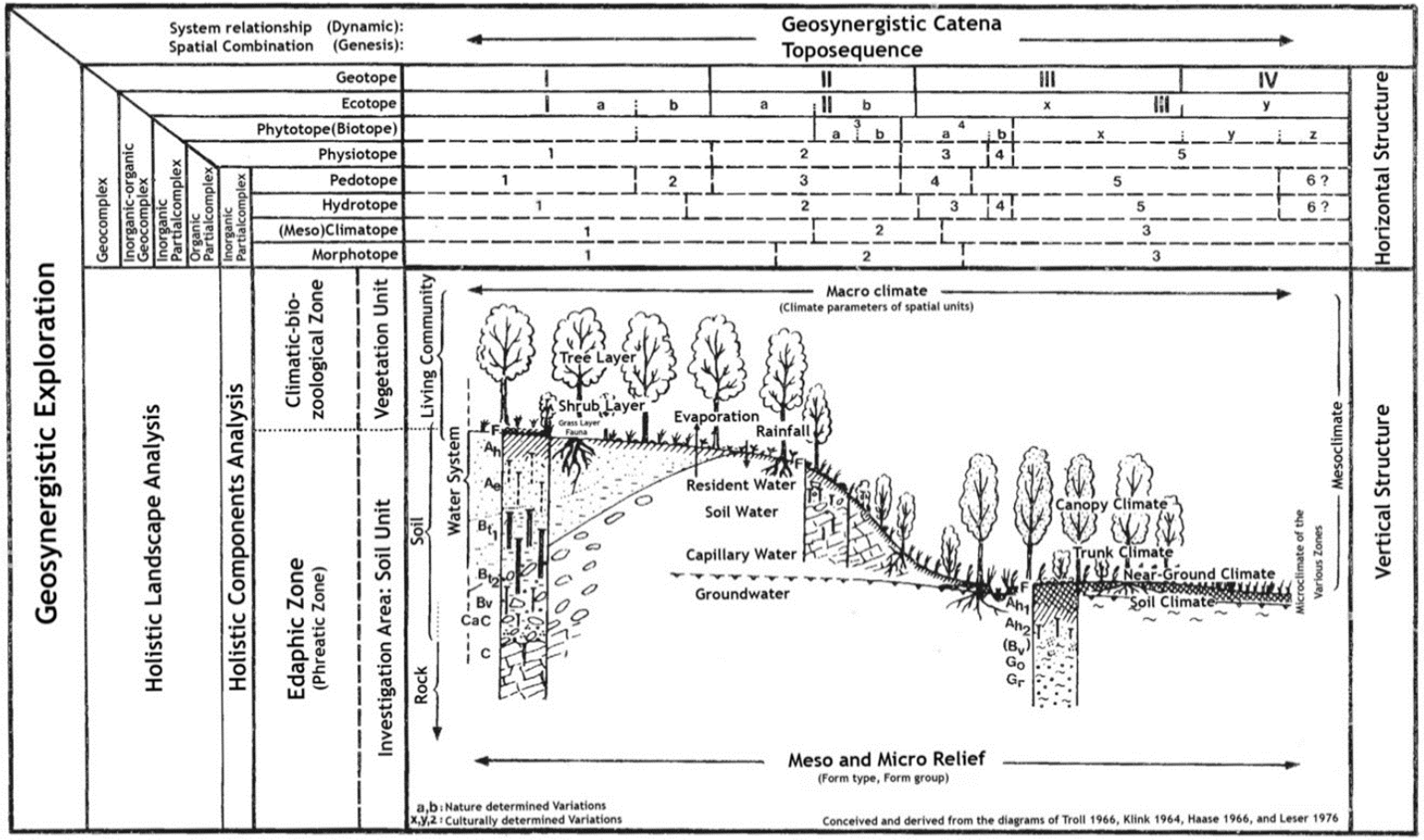
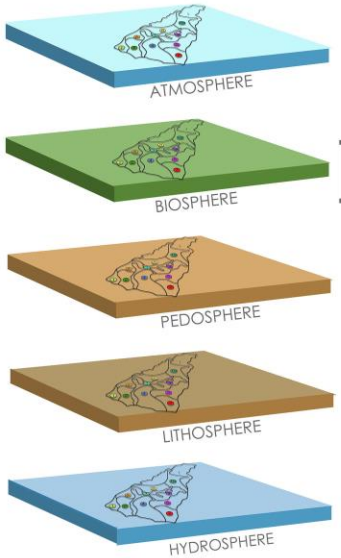


Detailed abiotic and biotic content of the ecotope catena / toposequence (Leser 1997)

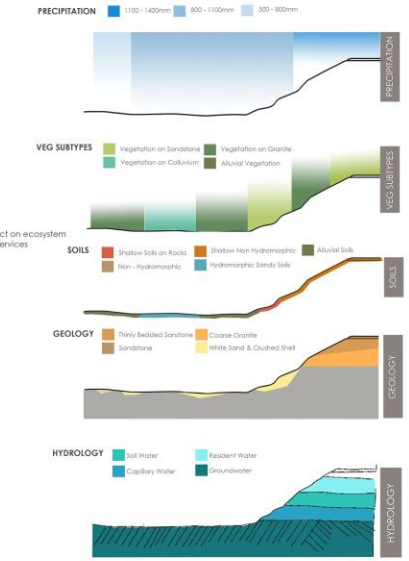
ECOTOPE/LAND UNIT IDENTIFICATION

As homogeneity (i.t.o) topography became depleted, that was the basis in deciding a new Land Unit.

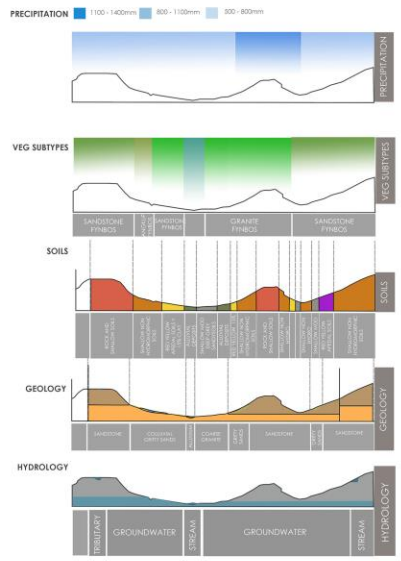
LAND UNIT METHODOLOGY



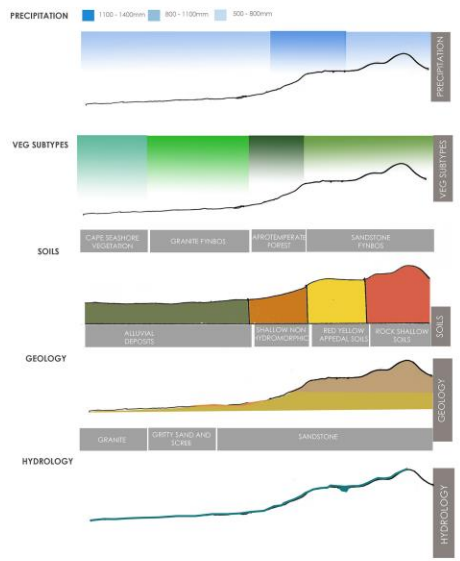
Greater effect on ecosystem goods and services



SECTION BB



SECTION AA



SECTION CC

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Thus, I have taken a specific approach and devised a specific manner in which to determine the ecotopes in the Disa River Catchment.

1. Slope and Aspect are **Priorities**
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3. Urban Development
4. Hydrology
5. Vegetation

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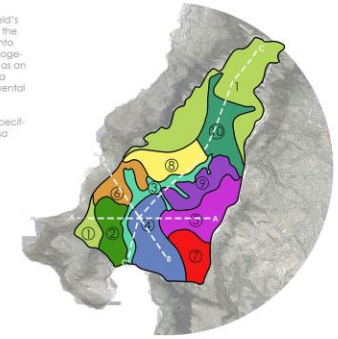

CATEGORIZATION PROCESS - CURRENT PERFORMANCE

Without **Regulation** and **Habitat** Ecosystem Functions/Services, the other two would not exist. Thus, groups that were greatly influenced by these 2 categories were prioritized.

- Cat 1 - Low Ecosystem Service Potential
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] Suitable For Intervention

- Cat 3 - Med Ecosystem Service Potential
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- Cat 5 - High Ecosystem Service Potential

WHY CATEGORIZE?

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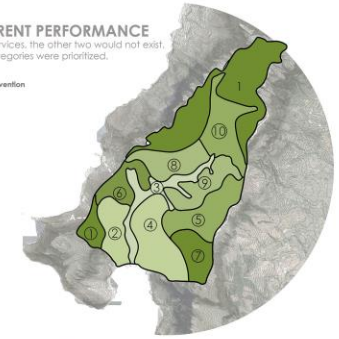
2. If there are **budget constraints** - method that will benefit greater catchment



TABULATION OF ECOSYSTEM FUNCTIONS AND GOODS & SERVICES

A summary of how land units were used in conjuction with service and goood identification.

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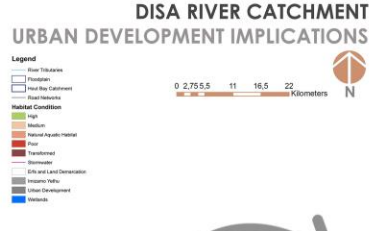
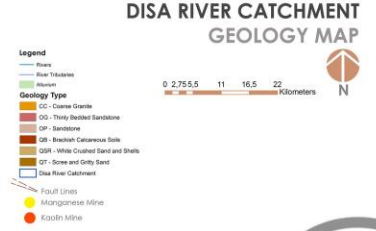
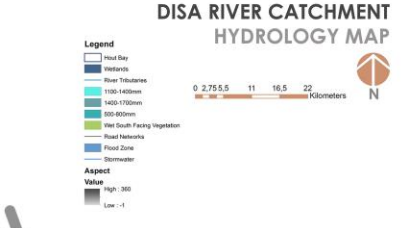
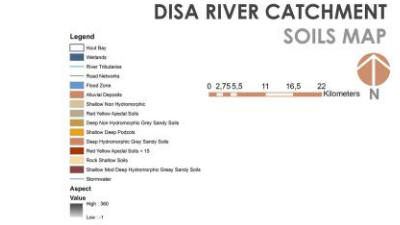
7	**Information** : Aesthetic and Recreational - Used for hiking, scenic views,..	1
8	**Provisioning** : Wetlands, Streams and Conservation Parks are found in this unit.	3
9	**Provisioning** : Kaolinite Mine present as raw material source. Water Supply in the form of streams and a small wetland. There are also conservation parks.	3
10	**Regulation** : Plantations have been uprooted and alien invasive have been planted. Lots of agriculture along R45. Soil Erosion prevalent **Provisioning** : Upper Catchment with Turbulent Cleaner water.	3









METHODOLOGY

IDENTIFY

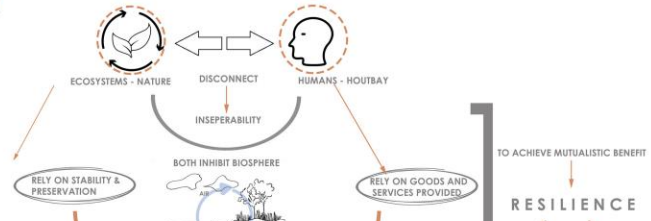
IDENTIFY

IDENTIFY LOWEST

LOW POTENTIAL

IF REGULATING OR

AREA THAT



FLOODPLAIN AS IMPROVE RESILIE

They are an important cor and resilience. To approac lence point of view, it can to Wu.

Intention : Make Floodplai

WHAT IS RESILIEN

Either through **Specified R**

Specified resilience looks stabilizing it's resilince agai

General resilience looks a stand unforseen disturban

Because systems are multi ecological components | fied resilience only. Other

A system in **Houtbay** that i triple bottom line approac

-Water retention

-Food Production

-CO2 sequestration

-General Increased Biodiv

Thus if we were to interver the floodplain would have

METHODOLOGY FLOODPLAIN

The age of the Anthropoc responsible for almost all n natural environments.

Floodplains in particular a because they're located i direct link between terrest of biodiverse plant comm ly reduced water retentio ching benefits for the grec address unexpected crisis cluding:

-Drought
-Fires
-Floods

They accumulate : **Sedime**

Issues Identified in Hou

1. Water Quality and Risk
2. Sanitation
3. Biodiversity
4. Risk Management (Fires
5. Lack of integration

ECOSYSTEM SER

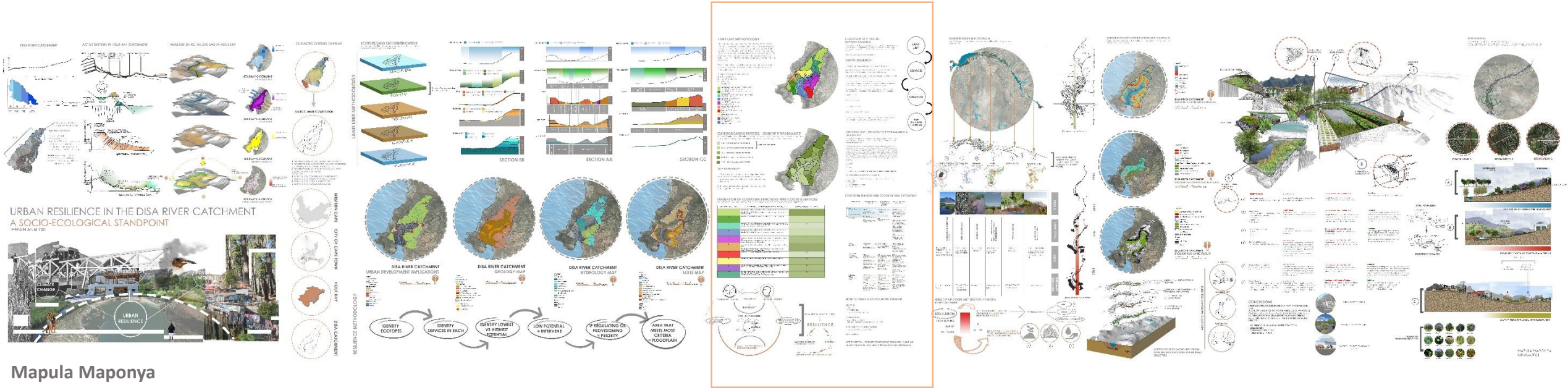
HOW TO MAKE

DIVERSITY
: BUFFERS
: CORRIDORS
: GREEN INFRASTRUC

CONNECTIVITY
: CONNECT SYSTEMS
: IDENTIFY NODES AN

MODULARITY + CONI

Ecosystem evaluation



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Ecosystem evaluation (landscape performance):

Landscape suitability analysis for settlement / development

McHargian –Landscape Suitability Method (Ndubisi: 2002)

Landscape sustainability & Ecosystem services

Classifying and Valuing Ecosystem Services for Urban Planning
(Gómez-Baggethun & Barton: 2013)

A Typology for the Classification, Description and Valuation of Ecosystem Functions, Goods and Services
(de Groot: 2002)

The social production of ecosystem services: A framework for studying environmental justice and ecological complexity in urbanized landscapes
(Ernstson: 2013)

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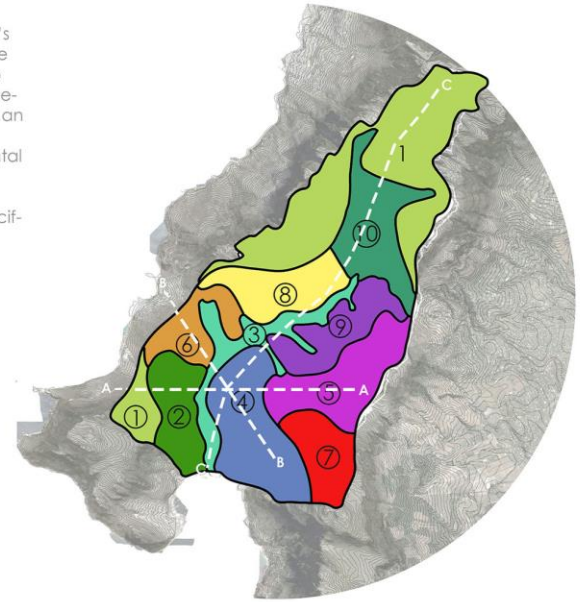

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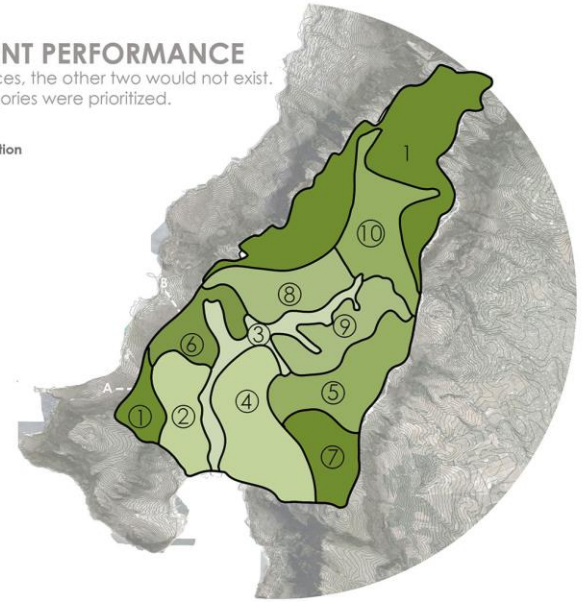

FLOODPLAIN AS A TOOL TO IMPROVE RESILIENCE

They are an important component of global environmental security and resilience. To approach the Disa River catchment from a resilience point of view, it can be done in one of two ways according to Wu.

Intention : Make Floodplain Adaptable.

WHAT IS RESILIENCE?

Either through **Specified Resilience** or **General Resilience.**

Specified resilience looks at isolating an element in a system and inquiring it's resilince agaisnt a particular disturbance.

General resilience looks at the overall resilience of a system to withstand unforseen disturbances.

Because systems are multifaceted (include social, economic and ecological components) it doesn't make sense to delve into specified resilience only. Other surrounding issues are ignored.

A system in **Houtbay** that I think is multifacedted in terms of the triple bottom line approach is the **floodplain**. It has the capacity for

-Water retention

-Food Production

-CO2 sequestration

-General Increased Biodiversity

Thus if we were to intervene to prepare the system for disturbance, the floodplain would have greater potential to improve it.

METHODOLOGY : METHODS TO BETTER MANA FLOODPLAIN

The age of the Anthropocene which is currently where soiciety is, is responsible for almost all modifications of the biosphere and other natural environments.

Floodplains in particular are exposed to high anthropogenic stress because they're located in Landscape depressions. They provide a direct link between terrestrial and aquatic flora and fauna = mosaic of biodiverse plant communities. Human intervention has significantly reduced water retention in ecosystems. The floodplain has overarching benefits for the greater ecosystems of Cape Town. And can address unexpected crisis which are currently being experienced including:

-Drought
-Fires
-Floods

They accumulate : **Sediments, Nutrients, Microbial Contaminations.**

Issues Identified in Hout Bay Floodplain

1. Water Quality and Risk Management (Flooding and Drought)
2. Sanitation
3. Biodiversity
4. Risk Management (Fires)
5. Lack of intergration

ECOSYSTEM SERVICES AND GOODS OF DISA

Cat 4 - Med/High Ecosystem Service Potential

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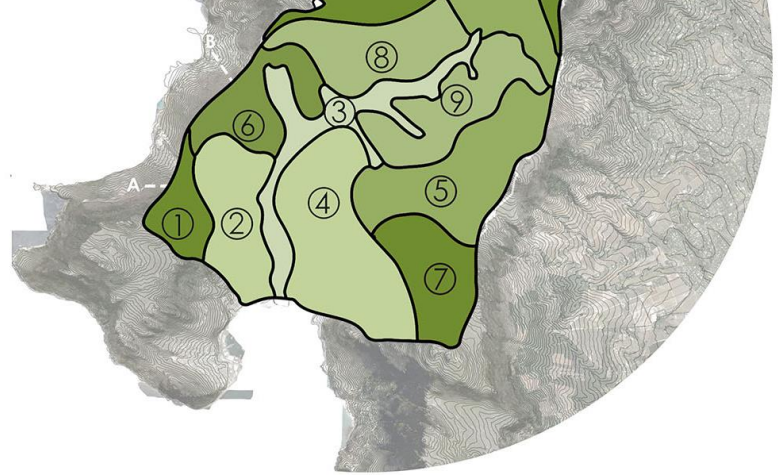

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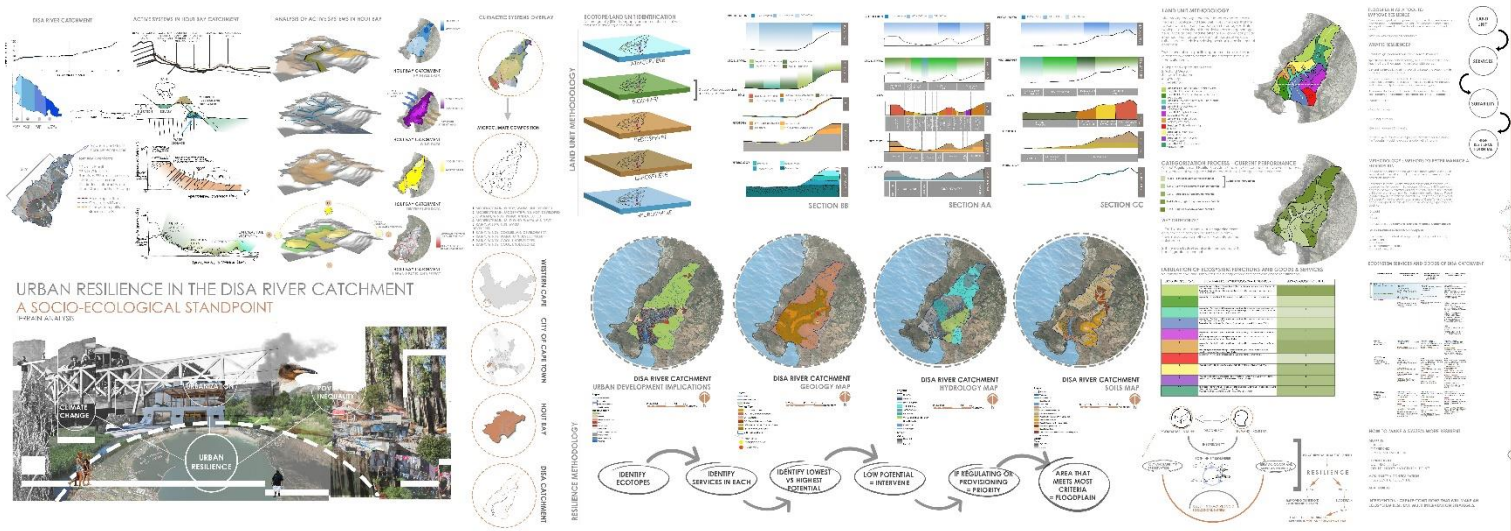
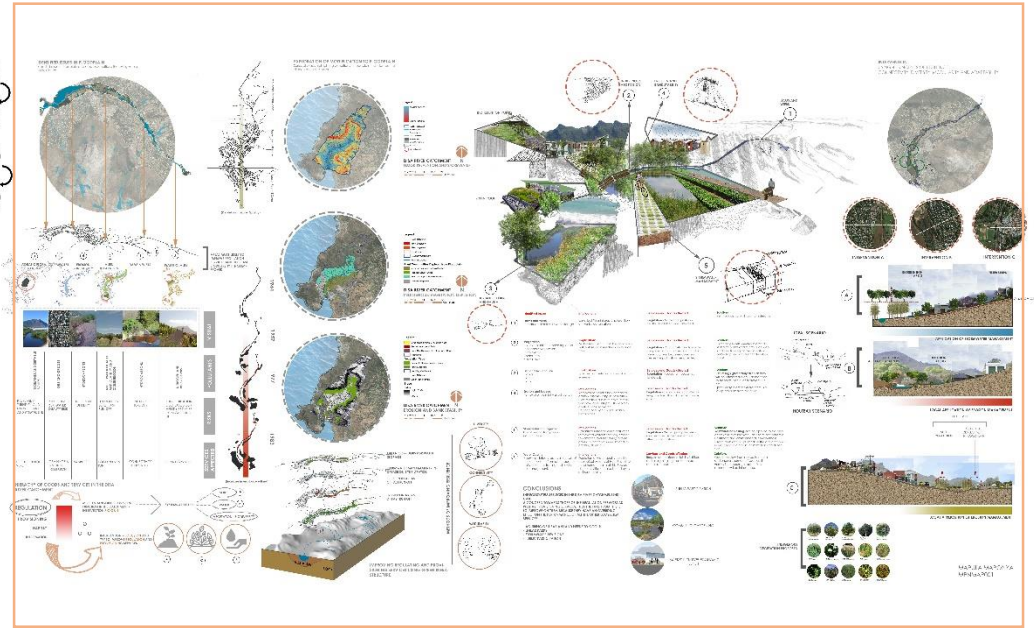
ECOSYSTEM SERVICES AND GOODS OF DISA CATCHMENT

ECOSYSTEM FUNCTION	ECOSYSTEM PROCESSES AND COMPONENTS	GOODS, SERVICES AND DISSERVICES POTENTIAL IN HOUTBAY (IF UNDISTURBED)	THREATS THAT HAVE AFFECTED GOODS AND SERVICES
REGULATION WATER SUPPLY AND REGULATION SOIL RETENTION AND FORMATION WASTE TREATMENT	**RIVER SYSTEM** - FILTERING - RUN OFF ASSISTANT -FRESHWATER SOURCE -TRANSPORTATION OF SOLIDS TO OCEAN **SOILS** -ROCK WEATHERING -SOIL ABSORBTION AND PERMEABILITY **WASTE** -MANAGEMENT OF SEWER WASTE -CHEMICALS AND THEIR ROLE ON ECOSYSTEM	**RIVER SYSTEM** - WATER FOR DRINKING, IRRIGATING, OTHER EVERYDAY USES -FOR TRANSPORT **SOILS** -FERTILE LAND FOR FARMING **WASTE** -ORGANIC WASTE CAN BE USED TO ENRICH SOILS	**RIVER SYSTEM** -CHANNELIZED RIVER SYSTEM = MORE RUN OFF = LESS GROUNDWATER RECHARGE -POLLUTION UPSTREAM AND URBAN DEVELOPMENT HAS AFFECTED QUALITY AND QUANTITY OF WATER. -MECHANISED STORMWATER MANAGEMENT SYSTEM **SOILS** -NH3 FROM FERTILIZERS CHEMICALLY IMBALANCING SOIL -OTHER CHEMICALS MAKING SOIL HYDROPHOBIC AND THUS BEING UNABLE TO ABSORB WATER, THUS INC RUN OFF. -MINING OF MANGANESE HAS AFFECTED SOIL QUALITY -SOIL MINING AND BUILDING INDUSTRY NOT CONSIDERING RARITY OF SOIL FORMATION PROCESS. -SLOPE STABILITY – CHEMICAL COMPOSITION OF SOIL CHANGES **WASTE** -SEWER BEING DEPOSITED STRAIGHT INTO OCEAN
			-MISMANAGEMENT OF WASTE – DUMPSITES ARE FULL OF NON-BIODEGRADABLE MATERIALS.
HABITAT REFUGIUM FUNCTION NURSERY FUNCTION	**REFUGIUM FUNCTION** - SUITABLE LIVING SPACE FOR PLANTS AND ANIMALS **NURSERY FUNCTION** -SUITABLE REPRODUCTION HABITAT	**REFUGIUM FUNCTION** -MAINTAINING DIVERSITY BY REPLANTING INDIGENOUS SPECIES TO ENCOURAGE HEALTHY HABITATS **NURSERY FUNCTION** -RESULTS IN FISHING, HUNTING	**REFUGIUM FUNCTION** -NATURAL HABITATS ARE UNDER THREAT WITH URBAN DEVELOPMENT TAKING PLACE. **NURSERY FUNCTION** -REPRODUCTION BECOMES DIFFICULT IF CERTAIN SPECIES ARE BEING OVERHARVESTED – CREATES AN IMBALANCE IN THE ECOSYSTEM.
PROVISIONING FOOD RAW MATERIALS MEDICINAL RESOURCES ORNAMENTAL RESOURCES	**FOOD** - PHOTOSYNTHESIS -FRESHWATER SOURCE -TRANSPORTATION OF SOLIDS TO OCEAN **RAW MATERIALS** -SOLAR ENERGY INTO BIOMASS **MEDICINAL RESOURCES** -ENSURING REGENERATION OF THESE RESOURCES **ORNAMENTAL RESOURCES** -ITEMS NEEDED FOR INDUSTRY, JEWELERY, SHELLS	**FOOD** -RESULTS IN BUILDING MATERIAL AND VEGETABLE AND FRUIT AT BENEFIT FOR HUMANS AND ANIMALS. -FODDER AND FERTILIZER -FISHING INDUSTRY **RAW MATERIALS** -MANGANESE FROM MANGANESE MINE -SHELL COLLECTION POTENTIAL **MEDICINAL RESOURCES** -PIGS EAR PLANT AND BUCHU AVAILABLE ON SITE **ORNAMENTAL RESOURCES** -SHELLS USED FOR JEWELERY,	**FOOD** -RESULTS IN BUILDING MATERIAL AND VEGETABLE AND FRUIT AT BENEFIT FOR HUMANS AND ANIMALS. -FODDER AND FERTILIZER -OVERHARVESTING OF FISH AVAILABLE IN OCEAN **RAW MATERIALS** -MINING CREATES LAYER OF TOXIC METALS ON SURFACE OF WATER **MEDICINAL RESOURCES** -DEVELOPMENT THREATENING FYNBOS BIOME WHICH IS WHERE THESE PLANTS ARE FOUND **ORNAMENTAL RESOURCES** -OVERHATVESTING OF THESE ITEMS HAS LED TO THEIR ULTIMATE DEPLETION
INFORMATION AESTHETIC RECREATION	**HIKING AND CYCLING** GEOLOGICAL AND VEGETATIVE PROCESSES THAT NEED TO OCCUR	**HIKING AND CYCLING** -MORPHOLOGY OF LANDSCAPE USED AS A SERVICE	**HIKING AND CYCLING** -URBAN DEVELOPMENT CHANGING EXPERIENTIAL QUALITIES OF ACTIVITIES

Conceptualise intervention





Mapula Maponya

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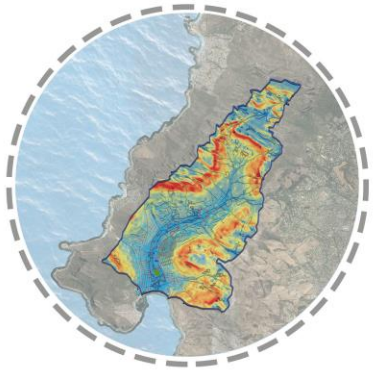
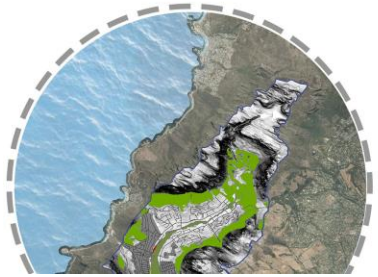
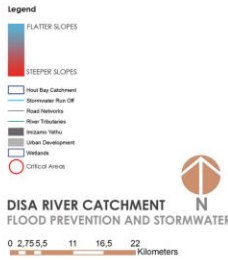
EXPLORATION OF MODIFIICATION TO FLOODPLAIN

Series of Maps highlighting conditions in floodplain that dampen resilience of holistic system.

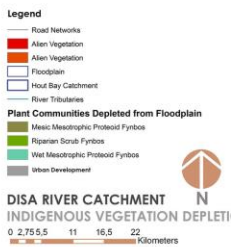






DISA RIVER CATCHMENT N
FLOOD PREVENTION AND STORMWATER

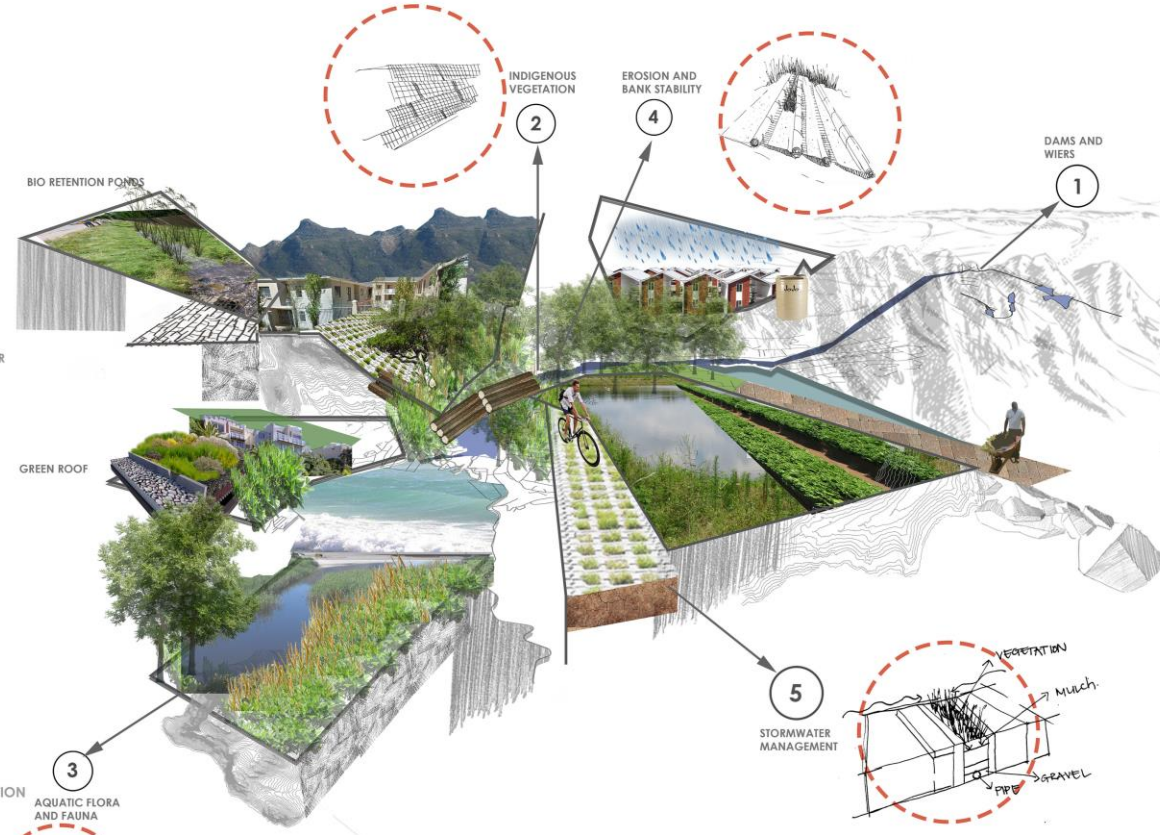
0 2,755,5 11 16,5 22 Kilometers



DISA RIVER CATCHMENT N
INDIGENOUS VEGETATION DEPLETION

0 2,755,5 11 16,5 22 Kilometers

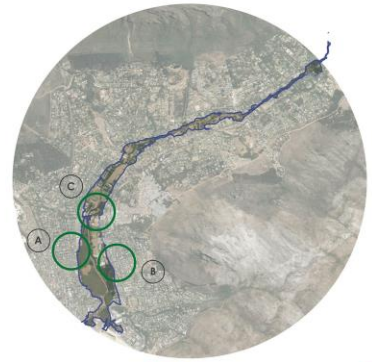
DISA RIVER CATCHMENT N
EROSION AND BANK STABILITY



	Identified Issues	Implications	Services and Goods affected	Solutions
1	**Dams and Weirs** Constructed artificial water storage	Longkloof Weir interupts natural flow of river by canalisation	**Regulation** - Nutrient regulation - health of soils becomes affected.	Reintroduce natural flow from streams
2	**Vegetation** Invasive plants that have replaced indigenous vegetation Black wattle Poplar Tree Kikuyu lawn	**Implications** Makes river banks unstable, too many nutrients result in reeds which reduce flow.	**Services and Goods affected** **Regulation** - Productivity functions are tampered with which results in unstable ecosystem because core processes like pollination are affected.	**Solutions** Plant **indigenous species** in order to stabalize banks and reintroduce wetland functionality of river, create a buffer to push back further development.
3	**Fish and Aquatic Life** Tilapia Catfish Carp	**Implications** Species competition for food starts to emerge.	**Services and Goods affected** **Regulation** - Foodchain becomes interefered.	**Solutions** Use of **logs (preferably alien as they will be harvested in-situ)** as methods to stabalize banks and prevent run off. Specifically in areas where there is a steep gradient from the road.
4	**Erosion and Levees** Removal of palmiet via cultivation	**Implications** Removal of palmiet has increased erosion, also resulting in deposition. Construction of levees have intensified flows and disrupted floodplains ability to absord water. Exasperated by runn of from hilly	**Services and Goods affected** **Regulation** - Soil capping and Weir interupts natural flow of river by canalisation	

INTERVENTION

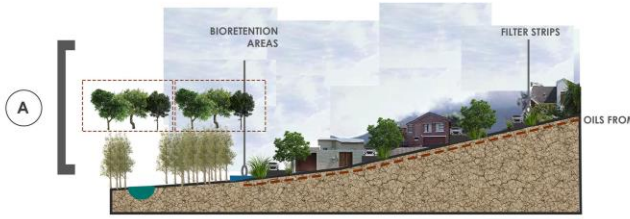
USING 4 PRINCIPLES OF RESILIENCE :
CONNECTIVITY, DIVERSITY, MODULARITY AND ADAPTABILITY



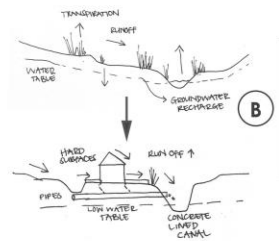
INTERVENTION A

INTERVENTION B

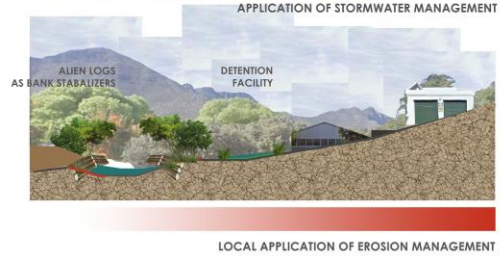
INTERVENTION C



IDEAL SCENARIO



HOUTBAY SCENARIO



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STORMWATER MANAGEMENT

ues

eirs
artificial water storage

Implications
Longkloof Weir interupts natural flow of river by canalisation

Services and Goods affected
Regulation - Nutrient regulation - health of soils becomes affected.

Solutions
Reintroduce natural flow from streams

nts that have replaced egetation

Implications
Makes river banks unstable, too many nutrients result in reeds whcih reduce flow.

Services and Goods affected
Regulation - Productivity functions are tampered with which results in unstable ecosystem because core processes like pollination are affected.

Solutions
Plant **indigenous species** in order to stabalize banks and reintroduce wetland functionality of river, create a buffer to push back further development.

atic Life

Implications
Species competition for food starts to emerge.

Services and Goods affected
Regulation - Foodchain becomes interefered.

Solutions
Use of **logs (preferably alien as they will be harvested in-situ)** as methods to stabalize banks and prevent run off.
Specifically in areas where there is a steep gradient from the road.

evees
almiet via cultivation

Implications
Removal of palmiet has increased erosion, also resulting in deposition. Construction of levees have intensified flows and disrupted floodplains ability to absord water.
Exasperated by runn of from hilly landscapes

Services and Goods affected
Regulation - Soil capping and Weir interupts natural flow of river by canalisation

nanagement
ds of green

Implications
Urbanized surfaces mean that after rain events water is speedily drained towards the river not giving way to groundwater replenishment and increasing flood risks.

Services and Goods affected
Regulation - Water quality and erosion become problems which will affect soil formation.

Solutions
Rainwater harvesting can be applied to the rural context of Imizamo yethu as a form of economic upliftment and environmental conciousness. Green roofs can be planted on the affluent homes in Hout bay as a means of infiltration and detention.

ted streams as a result of up from anthropogenic as faming and sewer nent.

Implications
Depletion of water quality puts the ecological systems of Hout Bay at risk - and human health at risk. Recreational activities are also limited by its reduced quality.

Services and Goods affected
Regulation - Water availability is risked and everything ing the system becomes affected.

Solutions
Good river flow from source to mouth and encouragement of species diversity. To encourage better flow, coir matts will be introduced.

USIONS

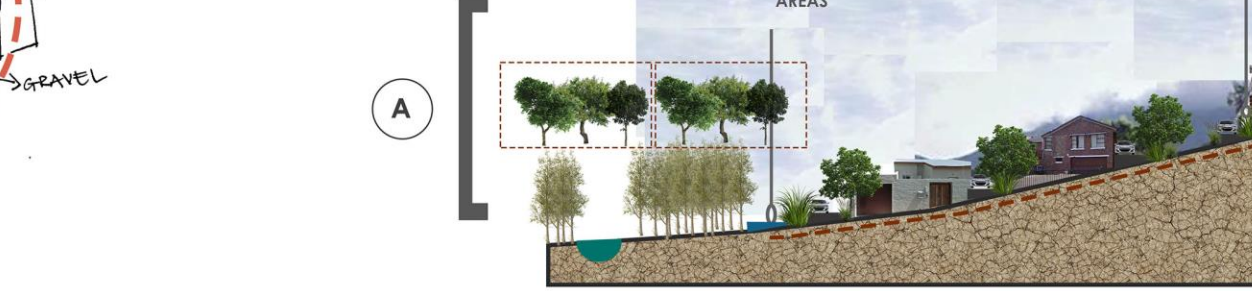
TEM SERVICES IN THE DISA RIVER CATCHMENT INDI-

N TOWARDS THOSE OF THE REGULATION SERVICES AS OVISIONING SERVICES. THUS THE TAKE FROM THIS IS E ON THEM BECAUSE THEY HAVE AN OVERIDING HE PERFORMANCE OF ALL THE OTHER ECOSYSTEM

OF RIPARIAN LAND NEEDS TO OCCUR RKS

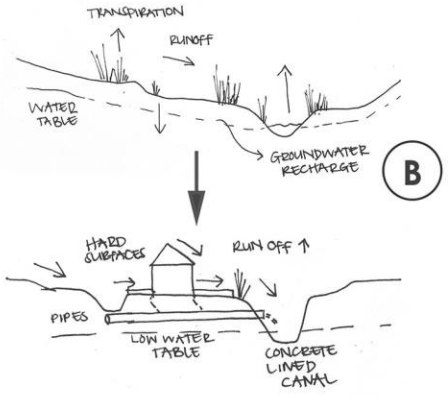
PUBLIC PARTICIPATION

COMMUNITY GARDENING



A

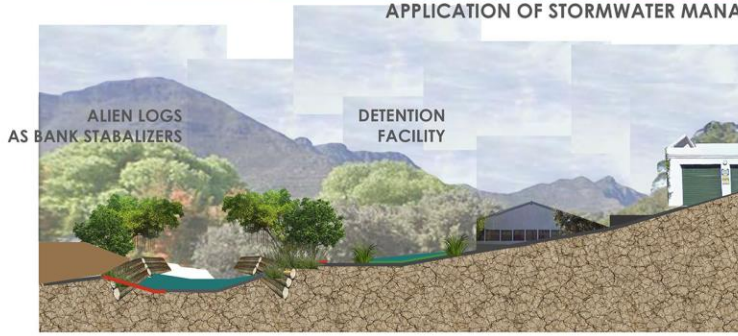
IDEAL SCENARIO



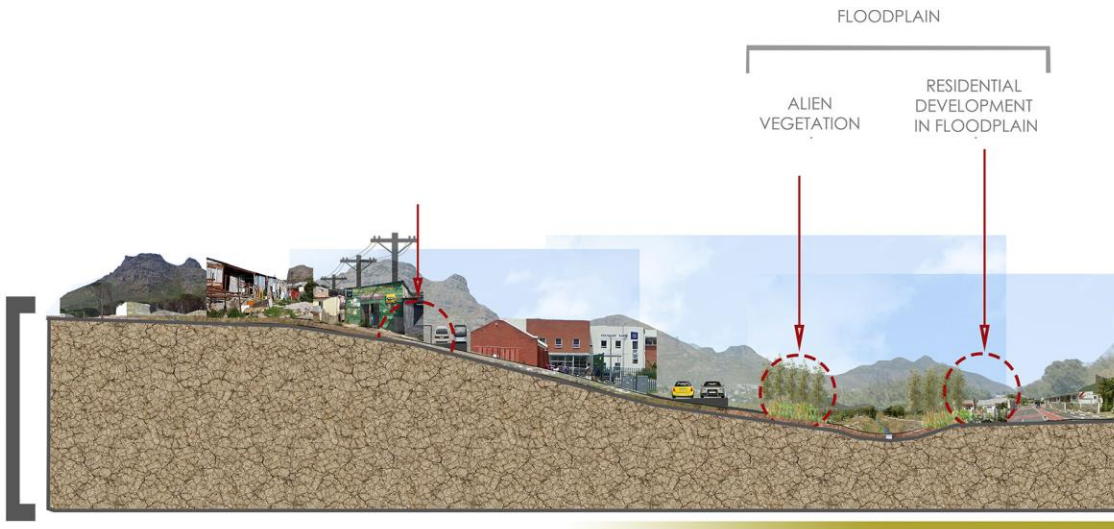
B

HOUTBAY SCENARIO

APPLICATION OF STORMWATER MANA



LOCAL APPLICATION OF EROSION MANA



C

LOCAL APPLICATION OF EROSION MANA

Constructing Landscape Systems – APG4032S

Objectives:

Frame a conceptual approaches to ecosystem analysis
Evaluating ecosystem (landscape) performance
Understand how to frame effective ecosystem intervention

Constructing landscape ecologies
Emphasis on:

- **Topography**
- **Hydrology**
- **Biodiversity**

Some departure points…

Design? Mediating between qualitative and quantitative worlds

Water is a fundamental driver for landscape productivity and sustainability

How can we use water as the primary structuring element for the urban landscape?

How does water structure settlement, how is it a fundamental organising component?

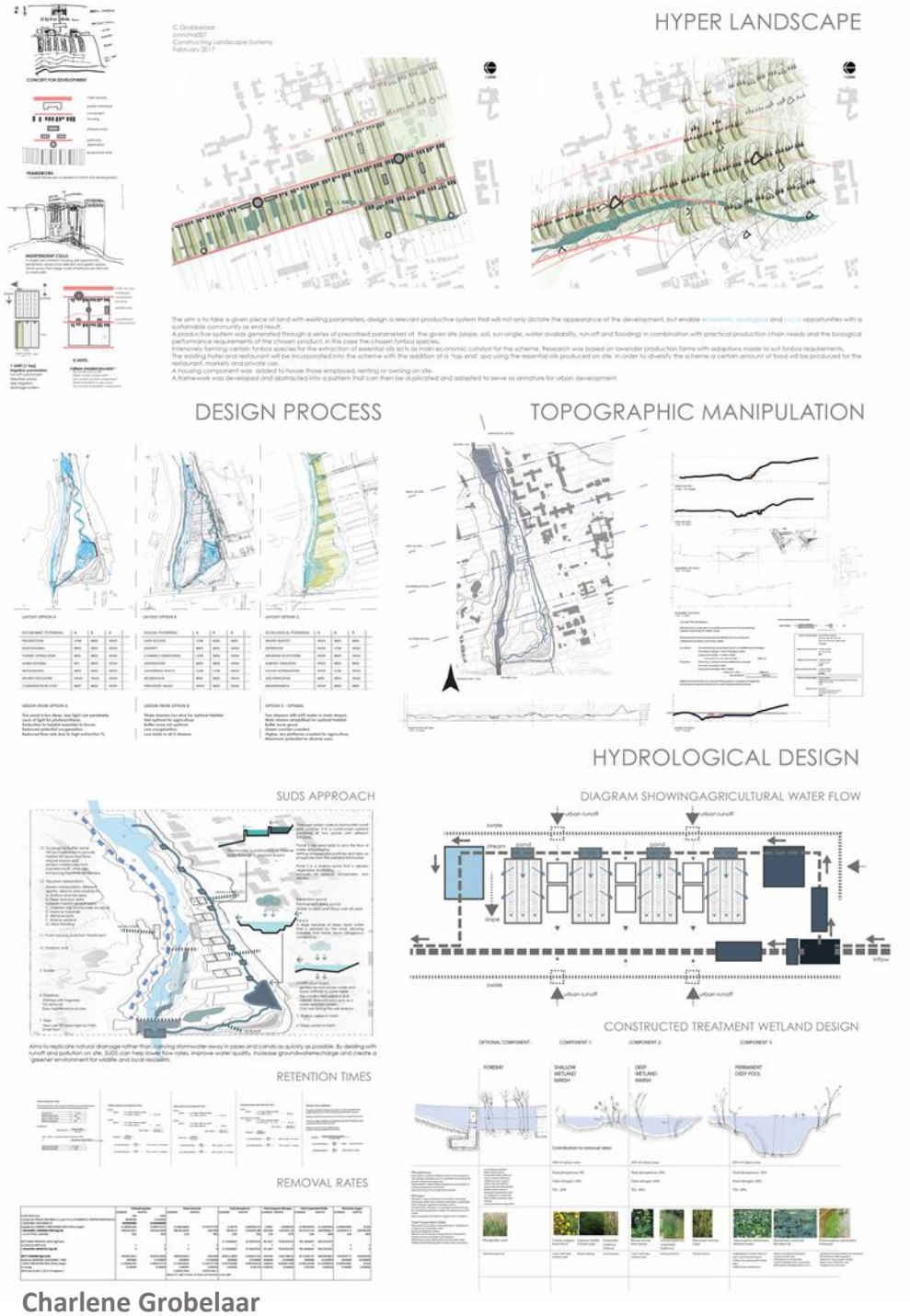

Liesbeek Pkwy
Liesbeek Ave
Low St
Duke St
Willow Rd
Alfred St
M57
Protea Hotel by Marriott
Cape Town Mowbray
The Wild Fig Restaurant
M5
9A
9B
Molenvliet Rd
Dixton Rd
2

Conceptual ways in…

The armature for a productive landscape

The wetland model

Strategy for managing the flow



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Charlene Grobelaar

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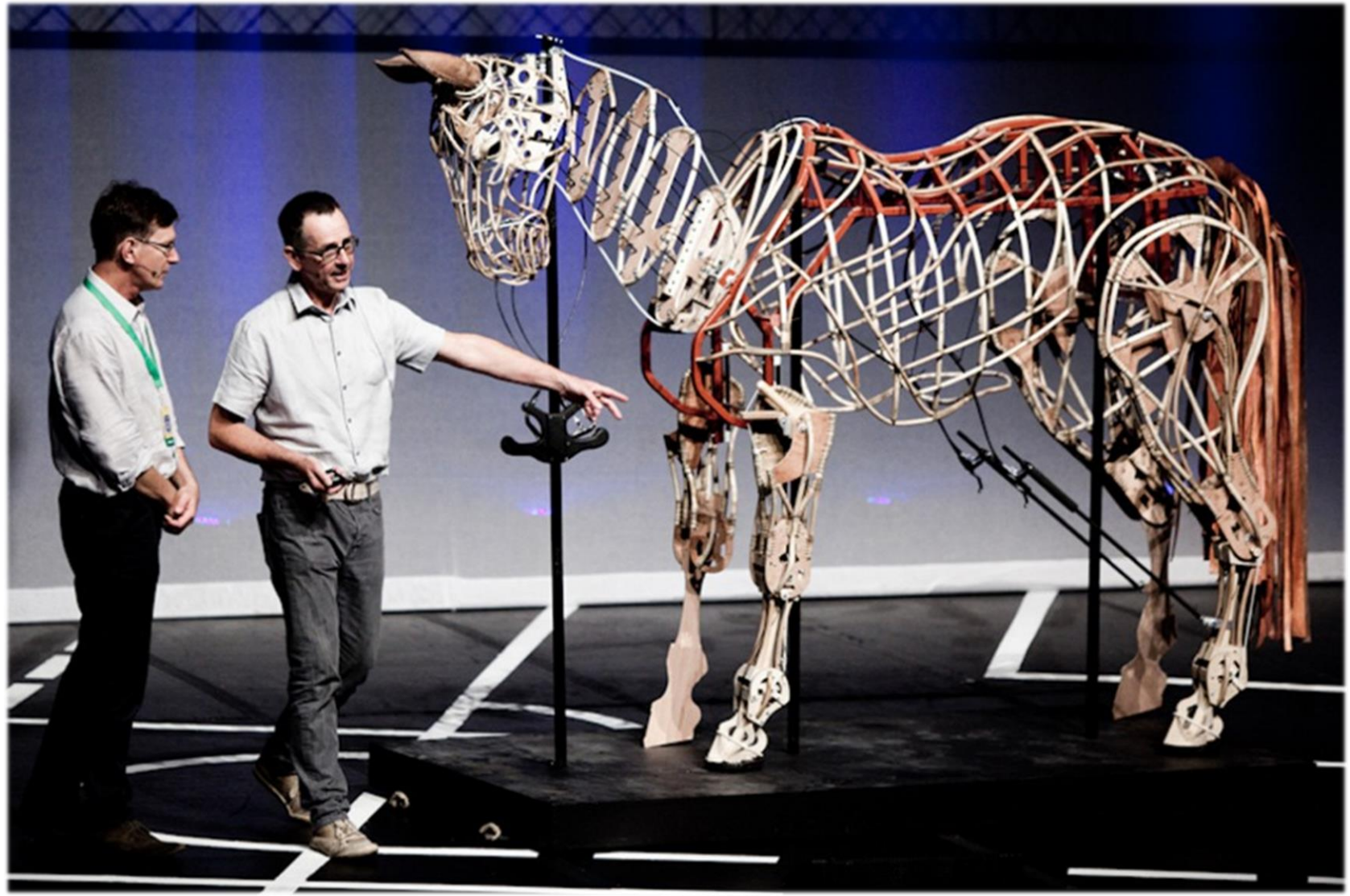

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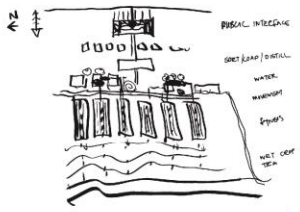
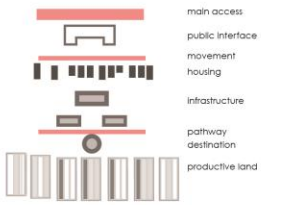
HYPER LANDSCAPE

C Grobbelaar
cnncha007
Constructing Landscape Systems
February 2017

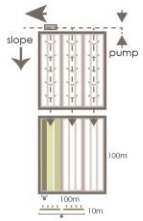


CONCEPT FOR DEVELOPMENT

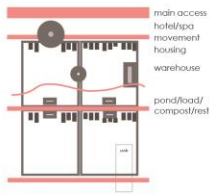


FRAMEWORK:
1 Overall framework is created to inform the development.

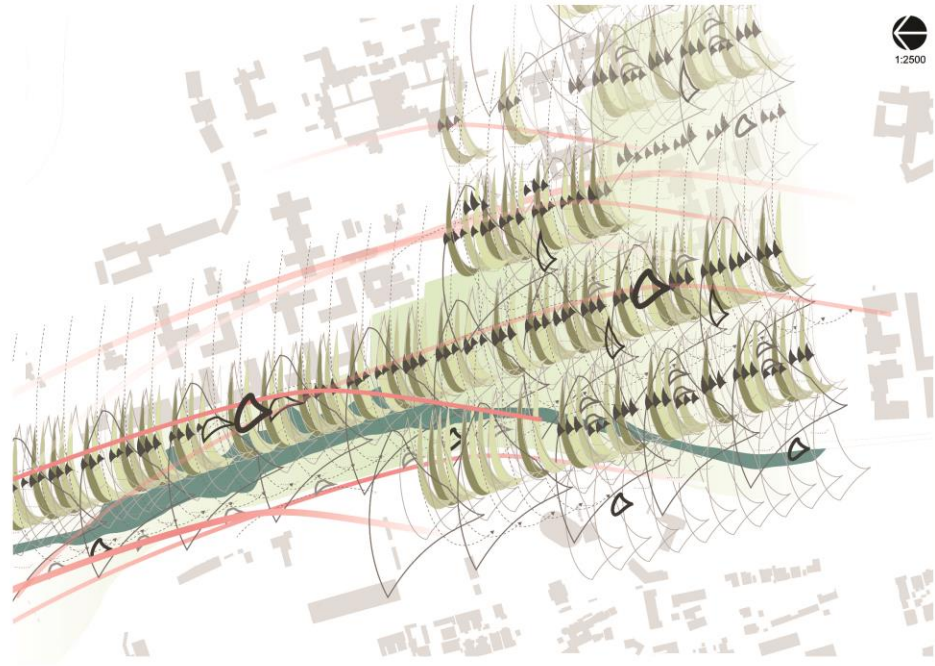
INDEPENDENT CELLS:
A single cell contains housing, job opportunity, recreation, productive element and green space. Move away from large scale infrastructural network to small cells.



1 UNIT (1 ha):
Irrigation parameters:
run-off catchment
retention pond
drip irrigation
drainage system



4 UNITS:
Pattern creation process:
Recreational routes
Main social component
Secondary social component
Main industrial component
Secondary industrial component



The aim is to take a given piece of land with existing parameters, design a relevant productive system that will not only dictate the appearance of the development, but enable economic, ecological and social opportunities with a sustainable community as end result.
A productive system was generated through a series of prescribed parameters of the given site (slope, soil, sun angle, water availability, run-off and flooding) in combination with practical production chain needs and the biological performance requirements of the chosen product, in this case the chosen fynbos species.
Intensively farming certain fynbos species for the extraction of essential oils acts as main economic catalyst for the scheme. Research was based on lavender production farms with adaptions made to suit fynbos requirements.
The existing hotel and restaurant will be incorporated into the scheme with the addition of a 'top end' spa using the essential oils produced on site. In order to diversify the scheme a certain amount of food will be produced for the restaurant, markets and private use.
A housing component was added to house those employed, renting or owning on site.
A framework was developed and abstracted into a pattern that can then be duplicated and adapted to serve as armature for urban development.

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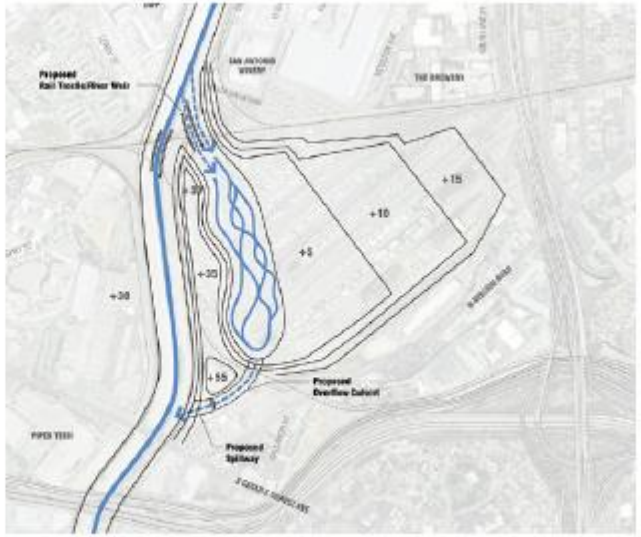
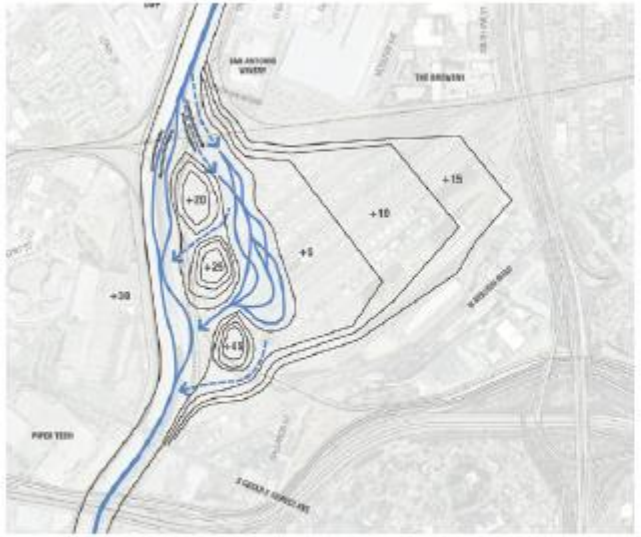
Three River Concepts

Note: Concepts A + C were based upon the 2010 Piggyback Yard Conceptual Master Plan.

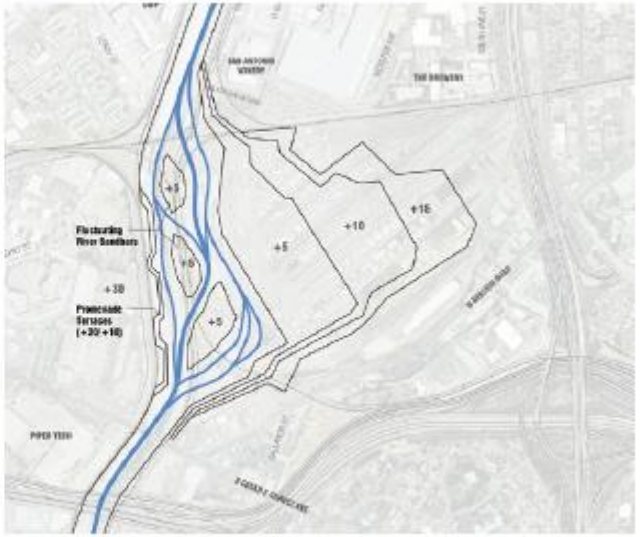
Diagrams, Source:PYFST



A) River Strand



B) Island Overflow



C) Broadened River

(Piggyback Yard Feasibility Study: 2013)

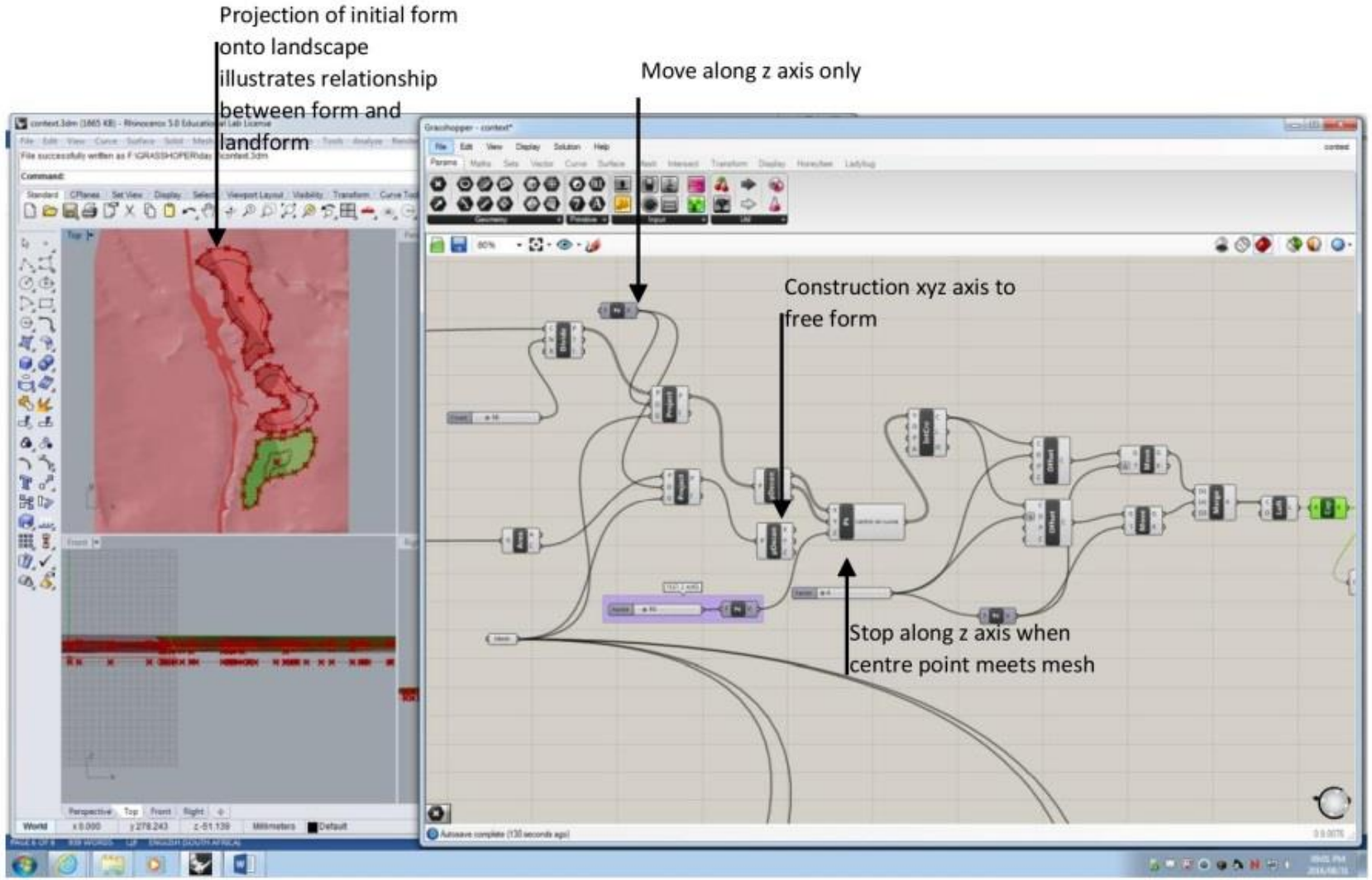
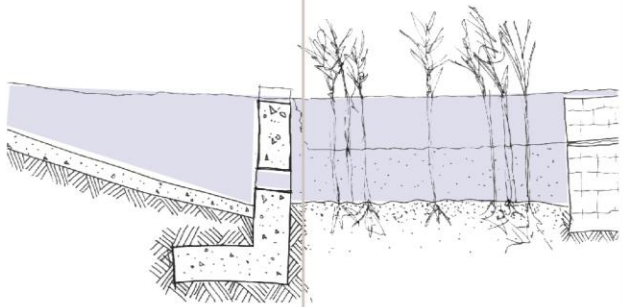
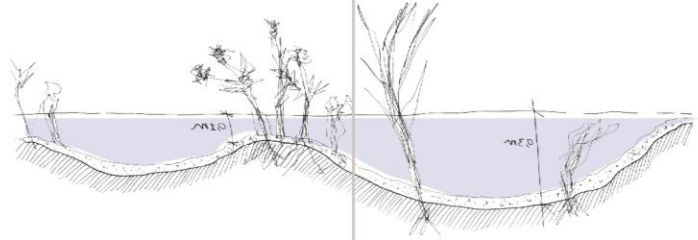
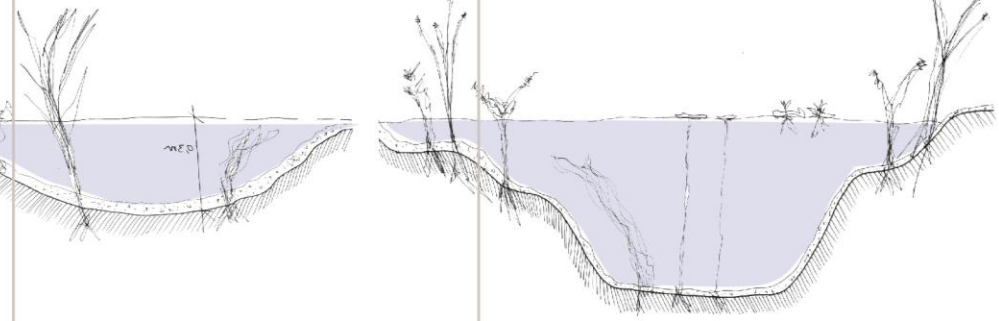


Figure 6 shows the equation which projects the form onto the landform in order to illustrate the relationship between the two.

CONSTRUCTED TREATMENT WETLAND DESIGN

OPTIONAL COMPONENT :	COMPONENT 1:	COMPONENT 2:	COMPONENT 3:
FOREBAY	SHALLOW WETLAND MARSH	DEEP WETLAND MARSH	PERMANENT DEEP POOL
			
	Contribution to removal rates:		
	30% of suface area	25% of suface area	45% of suface area
	Low hydraulic gradient. Water velocity slows. Suspended solids settle out. Forms a bed of sediments. Sediments rich in organic matter and soil nutrients. Good media for plant growth. Wetland plants remove dissolved contaminants such as nitrogenous compounds. Plants further decrease water velocity. Increased sediment deposition.	Total phosphorus: 0% Total nitrogen: 10% TSS: 20%	Total phosphorus: 20% Total nitrogen: 60% TSS: 40%	Total phosphorus: 70% Total nitrogen: 30% TSS: 40%
	 Phragmites reed	 Cotula vulgaris Button flower Cyperus textilis Umbrella sedge Scirpoides nodosus Vleibiesie	 Berula erecta Water parsnip  Schoenoplectus scirpoides Steekbessie  Eleocharis limosa Sedge	 Aponogeton distachyos Waterblommetjie  Nymphaea nouchali Blue Water Lily  Potamogeton pectinatus Fonteingras
	Sediment removal.	Copes with high nutrient load. Basket making. Good habitat.	Copes with high nutrient load. Nesting of birds. Threatened list.	Originating in South Africa. It has a summer dormancy. Perfect for pairing with water lilies. Edible buds and flowers. Edible and medicinal properties. Grown as a food crop. Cultivated as an ornamental. Several medically active compounds. Mild sedative and spasmolytic action. Feeding and rearing habitats for waterfowl, fish and many other organisms. Habitat for many aquatic animals. Major source of food for coot. Dangerous for swimmers.

Phosphorous
Excess place a nutrient imbalance stress on the ecosystem.
Like nitrogen, phosphorous is an essential macronutrient for growth of plants and organisms.
Sedimentation of particulate phosphorous and sorption of soluble phosphorous are the two physical processes for phosphorous removal.

Nitrogen
Nitrogen, a major component of municipal wastewater, stormwater runoff, and industrial wastewater, is potentially toxic to aquatic organisms and plays a role in eutrophication. Nitrogen is an essential nutrient that may be removed through plant uptake. The ammonium and/or nitrate
taken up by plants are stored in organic form in wetland

Total Suspended Solids
Physical processes play an important role in reduction of inorganic and suspended solids.
Mostly gravitational settling.
Efficiency of TSS removal is proportional to the particle settling velocity and length of the wetland.
Wetlands promote sedimentation by decreased water velocity and the filtering effect of plant stems and leaves.

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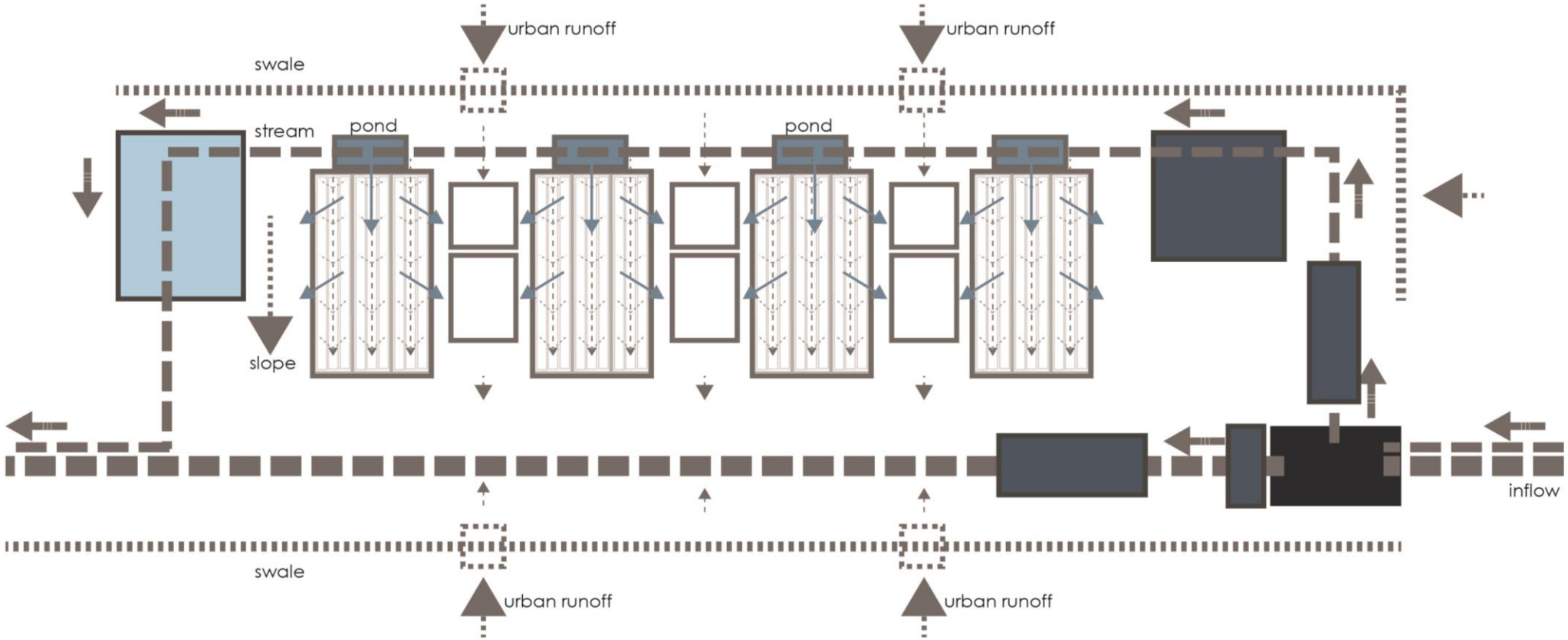
HYDROLOGICAL DESIGN

DIAGRAM SHOWINGAGRICULTURAL WATER FLOW



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DESIGN PROCESS

LAYOUT OPTION A

LAYOUT OPTION B

LAYOUT OPTION C

ECONOMIC POTENTIAL	A	B	B
PRODUCTION	LOW	MED	HIGH
EDUCATIONAL	MED	MED	HIGH
TOURIST ATTRACTION	MED	MED	HIGH
AGRICULTURAL	NO	MED	HIGH
RESTAURANTS	MED	MED	HIGH
SPORTS FASCILITIES	HIGH	HIGH	HIGH
CONSTRUCTION COST	MED	MED	HIGH

SOCIAL POTENTIAL	A	B	B
SAFE ACCESS	LOW	MED	MED
IDENTITY	MED	MED	HIGH
CONNECT SURROUNDS	LOW	MED	HIGH
DESTINATION	MED	MED	HIGH
GATHERING SPACE	LOW	LOW	HIGH
RECREATION	MED	MED	HIGH
PERCIEVED VALUE	HIGH	MED	HIGH

ECOLOGICAL POTENTIAL	A	B	B
WATER QUALITY	HIGH	MED	MED
DETENTION	HIGH	LOW	HIGH
RIPARIAN ECOSYSTEM	HIGH	MED	HIGH
HABITAT CREATION	HIGH	MED	MED
FLOOD ATTENUATION	HIGH	LOW	HIGH
SUD PRINCIPLES	MED	MED	HIGH
MAINTENANCE	HIGH	MED	MED

LESSON FROM OPTION A

The pond is too deep, less light can penetrate.
Lack of light for photosynthesis.
Reduction to habitat essential to fauna.
Reduced potential oxygenation.
Reduced flow rate due to high extraction %.

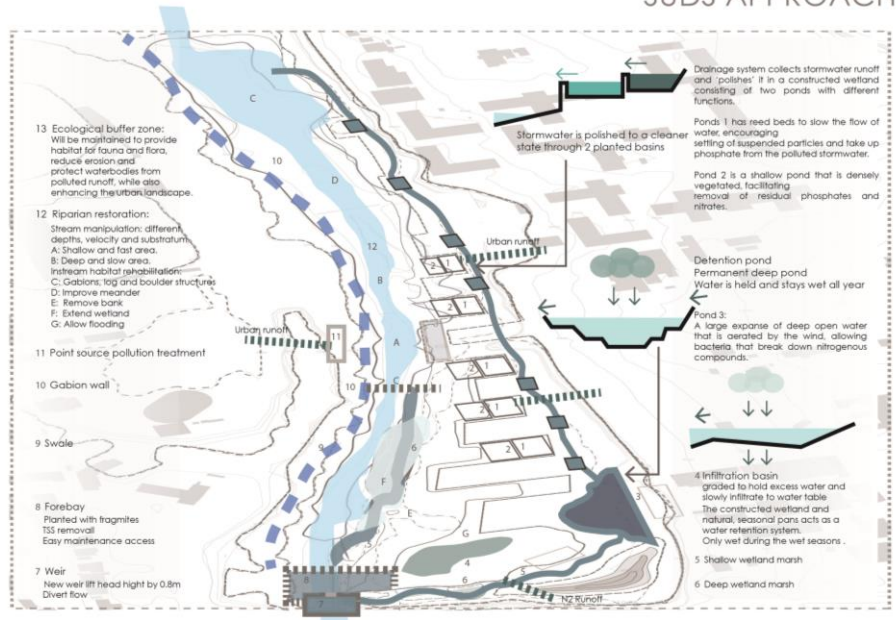
LESSON FROM OPTION B

Three streams too slow for optimal habitat.
Not optimal for agriculture.
Buffer zone not optimal.
Low oxygenation.
Low biota in all 3 streams.

OPTION C - OPTIMAL

Two streams with 65% water in main stream.
Main stream rehabilitad for optimal habitat.
Buffer zone good.
Green corridor created.
Higher, dry platforms created for agriculture.
Maximum potential for diverse uses.

SUDS APPROACH



Aims to replicate natural drainage rather than carrying stormwater away in pipes and canals as quickly as possible. By dealing with runoff and pollution on site, SUDS can help lower flow rates, improve water quality, increase groundwaterrecharge and create a 'greener'environment for wildlife and local residents.

RETENTION TIMES

REMOVAL RATES

	Orthophosphate		Total ammonia		Total phosphorus		Total Inorganic Nitrogen		Total Suspended Solids		Dissolved oxygen	
	SUMMER	WINTER	SUMMER	WINTER	SUMMER	WINTER	SUMMER	WINTER	SUMMER	WINTER	SUMMER	WINTER
FLOW RATE (l/s)	100	1000										
multiply by PERIOD (SECONDS in a year X no of SUMMER or WINTER MONTHS/12)	18396000	13140000										
= SEASONAL DISCHARGE (l)	**1839600000**	**13140000000**										
multiply by CURRENT CONCENTRACTION LEVELS (mg/l)	0.184962264	0.049727273	0.318163636	0.154777778	0.26775	0.087035714	0.8651	0.8395625	22.89259259	12.52592593	6.209433962	8.016
= SEASONAL LOADING/1000 (kg) (A)	340256.5811	653416.3636	585293.8255	2033780	492552.9	1143649.286	1591444	11031851.25	42113213.33	164590666.7	11422874.72	105330240
= % of TOTAL LOADING	34%	66%	22%	78%	30%	70%	13%	87%	20%	80%	10%	90%
WETLANDS REMOVAL RATE (kg/ha/y)					27.41666667	19.58333333	99.1667	70.83333333	781.6666667	558.3333333		
multiply by AREA (ha)	1	1	1	1	1	1	1	1	1	1	1	1
= SEASONAL REMOVAL (kg) (B)	0	0	0	0	27.41666667	19.58333333	99.1667	70.83333333	781.6666667	558.3333333	0	0
NETT LOADING (kg) (A-B)	340256.5811	653416.3636	585293.8255	2033780	492525.4833	1143629.702	1591345	11031780.42	42112431.67	164590108.3	11422874.72	105330240
divide by SEASONAL DISCHARGE / 1000	1839600	13140000	1839600	13140000	1839600	13140000	1839600	13140000	1839600	13140000	1839600	13140000
= NEW CONCENTRATION LEVELS (mg/l)	0.184962264	0.049727273	0.318163636	0.154777778	0.267735096	0.087034224	0.86505	0.839557109	22.89216768	12.52588343	6.209433962	8.016
% change	0.0000%	0.0000%	0.0000%	0.0000%	-0.0056%	-0.0017%	-0.0062%	-0.0006%	-0.0019%	-0.0003%	0.0000%	0.0000%
NH3 level at ph7.5 20 or 15 degrees C			0.003817964	0.001315611								
			above 0.1 mg/l is toxic, so these concentrations are safe									

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Section through Stitch Impression Five

Julia McLachlan

'Until recently the missing link between the reclamation era and authentically green cities has been social motivation (...**landscapes need to arouse the desire in the public to participate**, **to cultivate and to advocate**).' (Amidon, 2008)

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Learning…

Address water as a conceptual / strategic departure point

Address the social and economic opportunities in water infrastructure

Use water infrastructure as a place-making tool

Seek ways to mediate between disciplinary domains regarding water

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Thank you!

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