



'A River Runs Through It'
**THE RESTORATION OF ENVIRONMENTAL INTEGRITY
& COMMUNITY UPLIFTMENT
THROUGH SUSTAINABLE DAM DEVELOPMENT**

Based on the Berg River Dam

A Landscape Architecture Dissertation
By Kerry Ann Sole

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INTEGRITY & COMMUNITY UPLIFTMENT
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Based on the Berg River Dam

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**A dissertation for Masters in Landscape
Architecture**

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Dedicated to an Engineer, yet to be converted

LIST OF ACRONYMS

BRD- Berg River Dam
CNC- Cape Nature Conservation
DWAF- Department of Water Affairs and Forestry
EIA- Environmental Impact Assessment
EMP- Environmental Management Plan
ha- hectare
IDF- Integrated Development Framework
IDP- Integrated Development Plan
IFR- Instream Flow Requirements
LMET- La Motte Empowerment Trust
MTO- Mountain to Ocean
NEMA- National Environmental Management Act, No. 107 of 1998
NGO- Non-Governmental Organisation
PSDF- Provincial Spatial Development Framework
TCTA- Trans Caledon Tunnel Authority
TMS- Table Mountain Series
SAFCOL- South African Forestry Company Limited
SDF- Spatial Development Framework
SUP- Sustainable Utilisation Plan
WCD- World Commission on Dams
WCSA- Western Cape Systems Analysis
WIDF- Winelands Integrated Development Framework

GLOSSARY

Alluvium- A general term for all material deposited permanently or in transit by streams. It includes gravel, sand, silt and clay, and all variations and mixtures of these. Unless otherwise noted, alluvium is unconsolidated [40]

Aquifer- A geological formation or structure that transmits water in sufficient quantity to supply pumping wells or springs. The terms water-bearing deposit is often used in association to aquifers [40]

Buffer Areas- usually areas of land consisting of remaining natural or endangered habitat, or vulnerable and threatened eco-systems [59]

Core Areas- terrestrial, aquatic and marine areas of high conservation importance that should be protected from change or restored to their former level of functioning [59]

Cross-bedding- A diagonal arrangement of bedding in sedimentary rocks, especially sand-stone of wind or river origin, such that the layers are inclined at various angles to the more general planes of stratification or to the formation contacts [40]

Development- any man-made change to property, including but not limited to construction or upgrading of buildings or other structures, filling, paving, municipal services, etc, or the associated preparation of land [40]

Hamlet- small settlement or village [18]

Large Dam- one 'with a wall equal to or higher than 15 metres from base to crest' [57]

Watershed- The whole area that contributes water to a particular river, lake or basin; also, the divide or height of land from which the natural drainage flows in opposite directions [40]



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**The Project in Context
Problem Diagnosis**



**Hypothesis
Project Brief**



PART 1
Framing the problem on a
Theoretical Basis



PART 2
Application of Theory through
Planning



PART 3
Theory Demonstration through
Design Intervention



PART 4
Forming a Design resolution



PART 5
Project Feasibility



Conclusion

THE PROJECT IN CONTEXT

Dams capture floodwater in reservoirs and release it during dry periods, sustaining life through droughts. They allow communities to be self-sufficient through irrigation, generate power and provide health and prosperity increasingly in the developing world [19].

Historically, people have believed that water which flows into the sea is “wasted” and therefore must be intercepted for human use. This attitude, enforced by an ever-increasing demand for water by a growing population in a dry country, has largely fuelled the need for river impoundment in South Africa [57]. Given the reality of the country’s severe ‘water-crisis’ [57], it is deemed necessary to collect water in large enough amounts to safe-guard a sufficient supply of water both in dry summer months and years of drought.

In line with the country’s constitution, access to clean water for drinking, health and sanitation is one of the major world development issues and central to poverty alleviation [58]. Through time, large dams have emerged as one of the most significant and visible tools for the management of water resources [58]. However, construction of this kind has severe impacts.

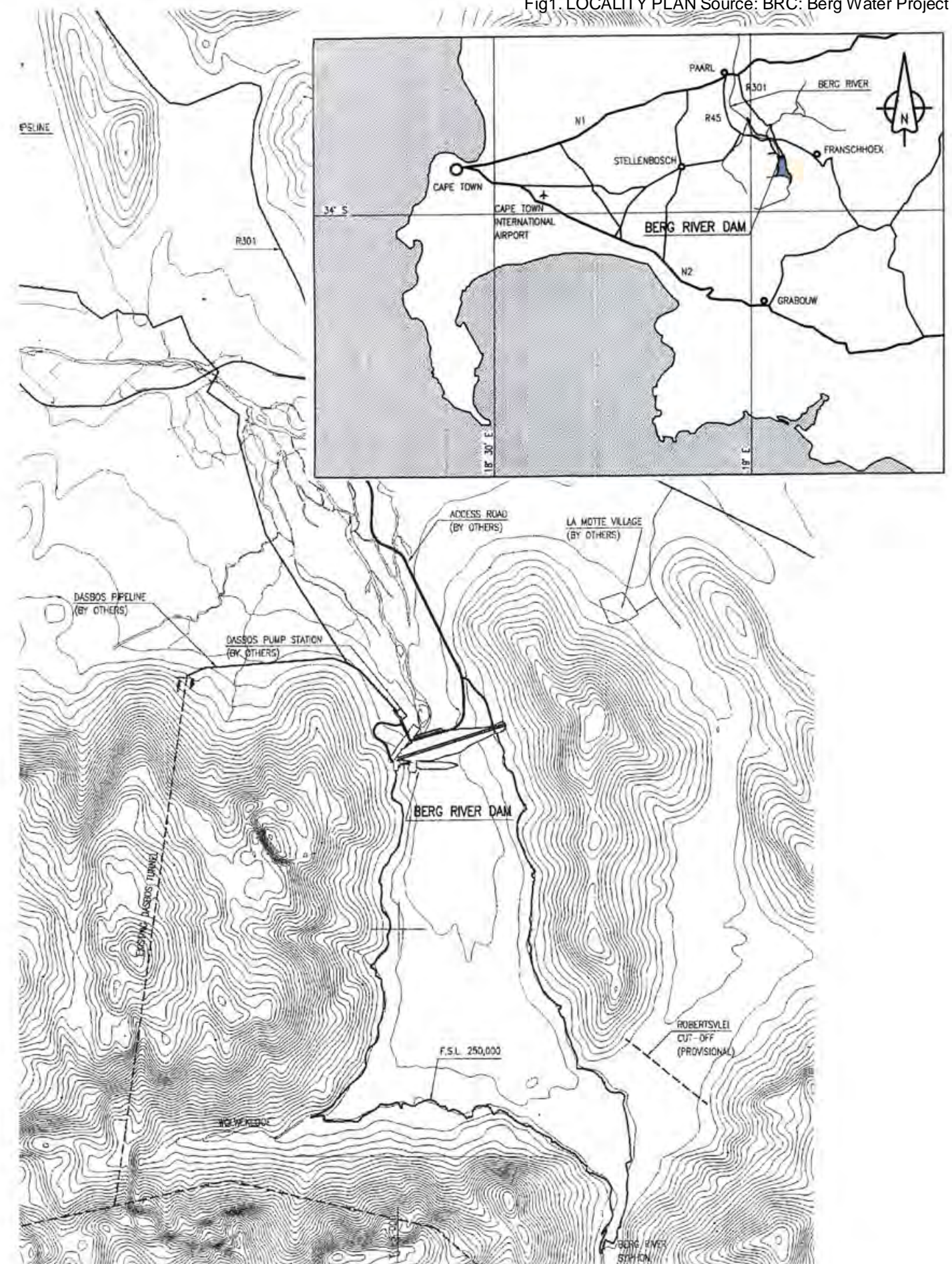
In the persistent goal to achieve a secure water-supply, the conservation of nature and her environs has been neglected in many cases. Furthermore, this conservation is primarily a long-term process, often in direct conflict to the immediate needs of man.

The *Berg River Dam* is currently under construction just outside the town of Franschhoek in the Western Cape. Intended to supply drinking water to thousands, the Berg River Dam represents a promise to plenty. Once completed, this project will constitute one of the largest of its kind in South Africa.

Development associated with the Berg River Dam is due to take place. Given the context of the place, the type of development necessary is debatable. Various stakeholders from all walks of life are involved, all determined to seek what the Dam has to offer in terms of ‘benefits’.

This projects is a journey to discover the true meaning behind dams, their developments and pledged ‘benefits’, and to determine what is appropriate in this locality.

Fig1. LOCALITY PLAN Source: BRC: Berg Water Project





PROBLEM DIAGNOSIS

The clarification of the benefits offered by dams is central to this investigation. As emphasised by Davies & Day (1998), dams are often offered as a means of economic or human upliftment, through the production of electricity, provision of employment, adequate supplies of fresh fish, or irrigation, or in this instance, drinking water. Rivers are seen as instruments, and dams as machines in promoting the economical value of surrounding areas. However, the knock-on affect of related social and environmental implications of dams is usually only apparent in retrospect.

Construction of such scale as that of the Berg River Dam, is likely to cause socio-economic chaos of some kind, whether it is beneficial in terms of creating temporary employment for resident workers, or destructive in terms of attracting more migrant labour into an already saturated small-town-society. Ecological disturbance to an area is unfortunately irreparable, yet the need for such construction is deemed necessary.

Often placed in environments which have a rich background, both in the geological and community perspective [7], dams are found to regularly fall short of paying tribute or optimising the opportunities presented in the immediate community.

Another dimension to this problem, however, is the fact that the Berg River Dam, like many of its kind, is constructed as part of an Inter-basin water transfer scheme (IBT). Stellenbosch municipality is one of the three rural municipalities abutting the metropolitan area of the City of Cape Town [69]. Consequently, it faces threats and demands from its larger neighbour. In this instance, the demand for water extraction has been suggested as having severe environmental impacts on the municipality [69].

A brief look at this scheme will divulge the details, and determine whether the long-term benefits of the immediate communities is secured.

Rivers are 'longitudinal systems', stretching for miles across the landscape, feeding ecosystems and community livelihoods alike [7]. Rarely does one river fall under the ownership of a single man or management body, making rivers frequently at risk of exploitation and mismanagement. This is recognised as a major problem, as river conditions are essentially dependant upon catchment events as a whole.

With the positioning of the Berg River Dam on the Upper Reaches of the Great Berg River, treatment of this system is highly sensitive, and any development within this catchment area should be carried out accordingly. Awareness and ways to overcome ecological damage of impounding rivers is expanding however and environmental control systems related to the Berg River Dam are in place to monitor the future of the Berg River and its eco-system.

Similarly, so must ways of harnessing the socio-economic needs associated with these structures, be addressed.

"... I was looking at a river bed. And the story it told of a river that flowed made me sad to think it was dead."

DEWEY BUNNELL, AMERICA



Fig2. Berg River Dam [63]

PREFACE

The author's goal in mind when researching and writing this dissertation was to bridge her own enjoyable experience of having grown up around small farm-dams in a positive light, with the negative light in which so many people and environments have been affected by the construction of large dams.

This dissertation intends to explore the details surrounding the negative impacts of large dams. Through this process, we shall investigate how repercussions of this type of large-scale construction can be manipulated to actually benefit the communities involved. Undoubtedly, community benefit is a long-term achievement and therefore we can only strive to make a difference in the future.

The Project seeks to take a look at development that is due to take place around the Berg River dam and propose how such development may be carried out with a sensitive approach- that is in order to meet human needs whilst preserving and promoting the possible renewal of our resource base.

Finally, one can only hope that this dissertation has placed a seed of thought into the master-minds that control our living environments, create policy and tailor the fabric of our land into something that will carry human-kind sustainably into the future.

PURPOSE OF THE DOCUMENT

The question posed here is: 'Are dams absolutely necessary, and if so, how can they be utilised so as to cancel out the negative impacts they are so passionately shunned for?'

This dissertation proposes a vision for the future improvement of Dam Development. In the regional context, it intends to have a positive impact on planning in terms of effective and sustainable incorporation of dams into existing communities. Yet, on a local scale, it aims to recognise dams and their catchment areas as key resources for recreation, education and protection of endemic and endangered animal and bird species.

The reality behind the development of dams and their river catchment areas offers the Landscape Architect a unique opportunity to intervene in the planning and design of their surroundings. This project seeks to decide what is 'appropriate' in terms of development in this instance. Furthermore, a development prototype can be realised in reaching a design solution, one that will focus on creating a symbiotic relationship between the local community and the natural environment.



HYPOTHESIS a proposition made as a basis of reasoning

Communities directly impinged upon by dams are unnecessarily deprived of their benefits[57]. However design within catchment areas and around dams can be carried out sustainably, with the view to tending to social needs, promoting local economic growth and advancing environmental sustainability.

PROJECT BRIEF

With Dam construction becoming an increasingly apparent element of the South African landscape, this project intends to indicate how Dam development can simultaneously provide water, benefit the local community and highlight and enhance the natural surrounding environment. Currently in the process of being developed according to the opportunities & constraints presented in a Sustainable Utilisation Planning (SUP) report, the site is located on the upper reaches of the Berg River, just outside of Franschhoek. The dam itself is under construction and is currently surrounded by Nature Conservation areas, which determine the extent of its developable territory.

The site has the ability to appeal to a vast threshold of users, some with an interest in dams and their construction, others with educational interest in the surrounds, and local or perhaps international users with a purely recreational interest in the dam. The environment immediately surrounding the dam falls within TCTA's mandate who have a responsibility to develop the area in keeping with the surrounding Nature conservation areas.

A strong link is encouraged with these surrounding areas and with the river itself, both upstream and downstream of the dam. A secondary link with the town is essential for tourism purposes, with vehicular access via incorporating vineyards on this route, as well as an educational element which links back to the school located in this area. These proposals will be further explored through an in-depth analysis of the area.

Specialists required for consultation include Engineers, hydrologists, ecologists, social-people, and an Environmental Impact Assessment specialist, informed of the rules and regulation surrounding Environmental Law. The development will be financed by TCTA, the Municipality of Stellenbosch, and DWAF with a proposed time-frame of 18 months, which is 6 months after the due completion of the dam itself. Phasing should commence in March 2007.

The Project in Context
Problem Diagnosis



Hypothesis
Project Brief



PART 1
Framing the problem on a
Theoretical Basis



PART 2
Application of Theory through
Planning



PART 3
Theory Demonstration through
Design Intervention



PART 4
Forming a Design Solution



PART 5
Project Feasibility



Conclusion



Background

Affects of Dams

Exploring the Optimal Use



SITE INFORMANTS
•Environmental Analysis
•Infrastructural Analysis
•Socio-Economic Analysis
•Planning Analysis



Identification of **KEY ISSUES,
PROBLEMS & NEEDS**



Comparative Case Study Material



**Opportunities & Constraints for
Development**



Theoretical Summary

Theory Research Methodology

BACKGROUND

HISTORY OF DAMS WORLDWIDE

People have used water to their advantage for thousands of years [83]. Aqueducts and irrigation were first used by the Romans and Egyptians and as early as 200 BC, the first water-wheel was constructed. The generation of electricity began in the USA as early as 1882, whilst additional plants including the one at Niagara Falls began to appear around the world. In 1903, six major damming projects were approved by the Reclamation Act in the USA. Expansion of farmland in the western desert required vast irrigation infrastructure. Additionally, the Roosevelt Dam was constructed in 1911 by the Apache and Mexican peoples. Built of rock from the Grand Canyon's walls, this structure was said to become the tallest rock masonry dam in the world at the time [83]. Dams were seen as shining icons of prosperity and modernity [7].

It is said that the environmental impacts of dams up until about the 1930s were minimal [83]. Rivers were predominantly seasonal and maintained a natural character, however large dams blocking entire basins began to appear, an examples of which is the Hoover Dam, built in 1936 and which is actually visible from space. According to McCully (2001), more than 40 000 large dams, and 80 000 smaller dams have been constructed world-wide, all but 5000 of them since 1950.

Most counties in which many of these large dams have been constructed, are ironically developing countries [57]. With thriving populations and massive social problems, many of these governments have been seduced by the technologies that dams present and placed themselves in massive debt as a result of these immense structures.



Fig3. LA CORTE WATER-MILL, FRANSCHHOEK, 1915 [8]

With severe criticism in more recent years however, the World Bank, as the single largest funder of the international dam industry, has cut the number of dams in its funding to under half its peak level [7]. In the early months of the new millennium, the World Commission on Dams was forged, containing representatives from both the dam industry and the anti-dam people's movements.

The basis of the World Commission on Dams was to attain a means of agreement between dam builders and their critics. The Gland Agreement underlying the Commission's aim stated that these party's would '*work together to review the development effectiveness of large dams and to establish internationally accepted standards that would improve the assessment, planning, building, operating and financing of these projects.*'

DAMS IN THE NATIONAL CONTEXT

Construction of dams initially became synonymous with development and economic progress [58]. This did not disclude South Africa, which was responsible for building the largest number of dams in Africa during the 20th Century[6].

A staggering total of 500 dams have been constructed in South Africa since 1800 [57]- most of these at the apex of apartheid rule in the country [6]. Moreover, major dam building in South Africa is said to be strongly hinged on radical events surrounding the Orange River Development Project (ORDP) and the Lesotho Highlands Water Project (LHWP) spanning between the 1960s and 1990s [6].

Plans to transfer water from the Orange River Basin into the Orange Free State in South Africa, began as early as the 1920s, however due to the lack of political support at the time, the project only went ahead 30 years later when the Nationalist Party came into power. The project included large dams such as *Gariiep* and *Van der Kloof* dams, yet the main agenda behind these schemes, was fuelled by the apartheid idea of promoting white-owned agriculture.

By 1986, construction of the 185-metre *Katse Dam* in Lesotho began with high financial stakes involved as South Africa was effectively 'importing' water for massive royalties paid out to the Lesotho Government. Economic costs were staggering with kilometres of infrastructure to be implemented for the transfer of water, yet social and environmental impacts were equally so. The Department of Water Affairs and Forestry's recognition of water-surplus and water-deficit areas of the country led to the division of the country into 22 'primary drainage regions'. From this division, it was ascertained that the bulk of the South African population lives under that threat of permanent water deficit [57]. Inter-basin transfers of water seemed a logical solution.

The planning and implementation of these vast schemes has generally been carried out with little consideration for the environmental and social impacts [25]. Resultantly, the placement of dams in South Africa are said to generally be in areas of high evaporation and unpredictable run-off [57], resulting in limited optimal water storage.



ENVIRONMENTAL IMPACT ASSESSMENTS

A disturbingly vague approach to EIA's facilitated the implementation of some of the country's first major dams [6]. With the prime aim of the generalised EIA *to establish the impact that a proposed project is likely to have on the environment, and for recommending changes to the project to minimise any predicted negative impacts*, the lack of legislation for compulsory EIAs is seen as placing the process in a sceptical light [25].

Little attention was given to sedimentation and soils studies in early years, nor compensation for displaced people who were not 'of colour'. The EIA process was seen as a bureaucratic requirement to be fulfilled for project approval, isolated from the project planning and implementation. Majority of the time, the EIA process was carried out after the decision on the site of the dam has been chosen, usually determined by economic and engineering criteria, with little or not consideration for environmental or social issues. The entire process was carried out in a shroud of limited information disclosure and public participation [6].

Eventually, and only in 1986, did changes in policy seek to prioritise social and environmental issues yet actual practices were not surprisingly, slow to change. Environmental measures were rapidly marginalised with the onset of the *Katse Dam* construction, however, with increasing world interest on the project, a "Panel of Environmental Experts" was quickly appointed in 1988 [6]. With the arrival of Democracy in South Africa in the 1990s, came a new found freedom and mobility for anti-dam lobbying groups and environmental enthusiasts [6]. This led to increased public participation and community involvement in Dam Construction in general.

An EIA was carried out for the Berg River Dam in 1996. The report summarised that it had *not identified any impacts associated with the construction and operation of the proposed Skuifraam Dam which are so significant so as to suggest that the dam should not be built*. It went on to state that this statement was subject to:

- the accompaniment of a approved Environmental Management Plan
- the implementation of this EMP, and
- the inclusion of the above in the draft White Paper as conditions of approval of the scheme.

Evidently, with legislative reform and the introduction of the 1997 White Paper, the Berg River Dam was approved. Furthermore, emphasis in the White Paper was placed on basic human needs, the needs of ecosystems and water conservation.

In terms of implementing infrastructure associated with Dams, the Department of Water Affairs and Forestry stipulated the inclusion of a Dam Zoning Plan. This was to be drawn up in conjunction with the approved Environmental Management Plan.

'In nature there are neither rewards nor punishments- there are only consequences'

Robert G Ingersoll, *Lectures and Essays, Some Reasons Why* [57]

DAM ZONING

A product of the generation of site specific *structure plans* for compatible and co-operative recreational use of dam basins, the purpose of establishing a Zoning Plan was *to allow fair access to recreational users and uses and sustainable development, while protecting the water resource* [30].

Zoning Plans included some of the following specifications.

- Protect the primary and operational requirements of state dams eg, water quality
- Ensuring dam safety with respect to eventualities which may be brought about due to recreational use
- Preventing environmental degradation, dangerous and unfair usage
- Facilitate DWAF's consideration for requests for access to the waterfront and water surface from surrounding private land in a procedurally fair manner
- Enhance natural and cultural environment of dams as conservation, tourism, sport and recreational amenities
- Enable effective and fair management of recreational use [30]

By Zoning State Dams, the department can thus give clear guidance for recreational water use and safeguard its assets [30]. Although methodically carried out as a necessary process however, Zoning Plans were seen as lacking in terms of only considering spatial & environmental, and leaving out social and economic issues. Additionally, they lacked guidelines regarding institutionalisation, capacitation and empowerment for the implementation of these plans [35].

In an indication to undertake a study to determine the management and 'zoning' of the dam for recreation [10] DWAF have adopted the new approach of *Sustainable Utilisation Planning*. These plans seek to compile sustainable access, utilisation & development plans, with the vision to provide clear guidelines for the effective institutionalisation of management bodies. Such bodies would include water user associations, and by forming a close link to performance criteria they will allow these plans to not only be functional but also workable [35].

The overall idea is that SUPs will focus on implementation and *'build trust by showing that the needs and requirements of the local community are important and form an essential part of the planning process'* [35]. The process trigger for a SUP however is usually one of the following:

- identification of development potential
- possibility for community benefaction
- conflict among users

With the drawing up of a SUP for the Berg River Dam, through the analysis of the existing environment and all its components, we can determine the initiating trigger for this process and seek to arrive at a solution in counteracting the challenges put forward.

THE AFFECTS OF DAMS

INTER-BASIN TRANSFERS

The transfer of water from rivers with a perceived 'surplus' of water to those perceived to be in deficit is an increasingly frequent solution to human demands for water, particularly in arid and semi-arid areas [57]. As the prime reasoning behind the construction of the Berg River Dam is to supply the City of Cape Town with fresh-water, we look at the workings of this scheme and the general effects of Inter-Basin Transfers.

The Riviersonderend-Berg-Eerste River Government Water Scheme forms a large part of the water supply into the CMA. Theewaterskloof Dam receives water from the Riviersonderend River, and this water is then tunnelled through the Franschhoek Mountains into the Upper Reaches of the Berg River. Whilst much of this water is tunnelled to the CMA from this point, the remainder is released down the Berg River to supply summer irrigation demands downstream [12]. With the implementation of the Berg River Dam however, these releases will no longer occur, as the Dam will supply this process.

The following table; Fig 4. [54] indicates the estimated use of water in the various drainage regions of the Western Cape Hydrological Region (WCHR) in the year 2000. (DWA, 1986) With the Berg River being by far the largest consumer in the various drainage regions of the Western Cape Hydrological Region, the CMA in this area is said to be responsible for the low percentage of water allocated to agriculture in the region (49%) [57]. CMA is also receiving a large amount of the Breede/Sonderend region's available water from the Theewaterskloof Dam. Increased use of inter-basin transfers of water, related with the new Berg River Dam, is likely to increase the CMA's capitalisation on external water drastically and further reduce overall available water to the region as a whole [57].

These schemes are said to not only be hugely expensive, but they also have detrimental effects on the river they are designed to tap and feed [57]. For example, the transfer of cold headstream water into warmer middle reach waters will affect the temperature and therefore disturb the equilibrium that exists in that system. With the added affect of the discontinuity imposed by the impoundment of a river, eco-systems are threatened with a very complex problem. This continuity of systems promotes the transfer of invasive species which can effectively alter drinking water-quality. Increased treatment of drinking water is necessary as a result, implicating further costs involved.

Fortunately, with the recent introduction of *instream flow requirements* on the Berg River, experts in fresh water ecology believe that, provided important aspects of these flow patterns are maintained, a certain amount of water can be abstracted from the river without degrading the riverine or estuarine systems.

REGION		Water consumption by region & as % of WCHR consumption	Irrigation consumption by region & as % of regional total	Irrigated area in ha* & as % of WCHR irrigated area	Stock water consumption	Mining water consumption	Power water consumption	Urban – Industrial consumption & as % of WCHR consumption
Olifants	E	420 15%	408 97%	45 000 16%	3	0	0	9 2%
Berg	G	936 33%	460 49%	53 700 19%	7	1	4	464 50%
Breede	H	875 31%	831 95%	69 500 25%	3	0	2	39 5%
Gouritz	J	291 10%	272 93%	74 900 27%	3	0	0	16 6%
S. Cape	K	148 5%	108 73%	13 700 5%	19	0	0	21 14%
Gamtoos	L	166 6%	160 96%	24 700 9%	1	0	0	5 3%
TOTAL	WCHR	2836 100%	2239 79%	281 500 ha	36	1	16	554 19,5%

* Source: DWA (1986): Tables 2.10.1 - 2.10.8.

Fig 4. ESTIMATED WATER CONSUMPTION (IN 10⁶ M³/YR) IN THE WCHR IN 2000

The question of 'benefit' in these types of schemes is particularly unclear. According to McCully (2001) *the hugely expensive , sophisticated and energy-intensive networks of pipes, aqueducts, pumps and treatment facilities that would be needed to provide drinking water to the dispersed rural populations from large reservoirs means that big dams are usually not even an option worth considering for rural water supply in developing countries.* He continues to add that the only way to provide these communities with a low-cost water supply would be through local community-managed schemes, similar to those currently in existence across the extents of the Cape Flat informal-housing settlements.

Furthermore, with subtraction of water from drainage basins, majority of the time, water is reduced from users adjacent to the river, to those connected to the municipal supply systems [7]. In this context, however, the immediate community of Franschhoek is not included as a benefactor of the Berg River Dam, and therefore the immediate and long-term benefits for the community remain questionable.



Fig 5. KATSE DAM, LESOTHO [24]



RESETTLEMENT OF AFFECTED PEOPLES

Globally, the social implications involved around the flooding of vast areas has been detrimental to land owners and local peoples. In the case of Kariba Dam (Zimbabwe) built in the 1950s, thousands of Gwembe Thonga tribes-people were forcibly removed from their homes through inhumane measures (Saidi pers.comm). Having been fishermen throughout their lives, they were then forced to farm and many died from drought and eventual poverty. The Himba goat-herders in Namibia are currently being removed from their ancestral tribal lands on the Cunene River in anticipation of the inundation of the Epupa Falls hydroelectric scheme [57].

In the case of the LHWP an estimated 35 000 people and 7 000 hectares from the first 2 dam projects in the scheme, were negatively affected [6]. Forced removal of communities have accounted for huge social costs with inadequate compensation, for example the Gwembe Thonga people of Kariba. These forced removals of a fishing community that had occupied the land for generations, led to the debilitating community ill-health, and later death. Resettlement initiatives are still to the present, working towards righting the wrongs of the past in this case.

In the national context, 1998, saw a threat to halt works on the third dam of the LHWP by protesters. This action led to the South African troops being sent in to restore order. Dozens were killed in the episode and clearly, progressive approaches to dam-building had a long way to go.

There are countless other examples, yet fortunately, the land to be inundated by the impending Berg River Dam is minimally inhabited and therefore there is very little impact in this regard.

OTHER NEGATIVE IMPACTS OF DAMS

In the beginning, the negative environmental and social consequences behind the construction of large dams was largely unknown [58]. Yet with extensive research over the years, the true impact of dams are both disturbing and devastating. Dams are the main reason that 20% of the world's fresh-water fish are endangered [57]. They are said to disrupt migratory routes, fragment habitats and destroy the nursery areas that floodplains accommodate in the coastal zone. Irrigation schemes seen as a primary benefit of dams, can lead to problems of water-logged soils, changes in the water-table and salinisation of soils if abused.

Dams present lost opportunities to farm prime agricultural land and often, ironically, this loss outweighs the benefits offered by newly implemented irrigation schemes. Dam failure is a major concern to communities, further added to by reservoir-induced seismic activity, and enormous amounts of Greenhouse gases have been said to collect within dam bodies [57] due to the amount of vegetation decaying beneath their surface waters. As seen in the great 'steelhead salmon fisheries' in the Columbia River Basin in America, technologically-generated expansion often results in a loss of small-scale farmers, big fish and sustainable values [58].

A 'DAM' ALTERNATIVE

Environmental Groups have argued that Water Conservation and Demand Management has not been effective and Dam Construction denoted as the 'quick-fix' to secure water supply [57].

In the local context, the argument implies that the City of Cape Town is failing to look beyond the short-term benefits that a Dam can bring, and look to a more long-term sustainable approach to water conservation and demand management.

A look at replacing the conventional supply of water from dams could include the following processes:

- Irrigation systems: utilisation of alternative supplies involving rain-fed, small-scale and local traditional water management measures as well as harvesting systems, including ground-water recharge methods. This method has been used in India, whereby 'check dams' are built across seasonal streams. These trap the runoff during the monsoon months, recharging local wells for the rest of the year. Furthermore, a system called 'dug well recharging' is known to divert runoff from nearby hills and fields and draining it directly into open wells. Although these measures are obviously small and can only be carried out in rural areas, they are seen as a sensible solution where the poorer communities have direct access to 'runoff'.
- Agriculture: in water-stressed areas, the option of growing less water-intensive crops should be considered. For example some local areas in India have collectively decided against growing sugar-cane, a water-thirsty yet profitable crop.
- Re-cycling: Society should increase the efficient use of resources and look at re-cycling of these and more use of renewable resources as a form of energy
- Rain-water-Harvesting: People in the poorer rural areas should have a right to access water through fair and sustainable strategies of management and pricing. As well as encouraging those areas to revitalise existing resources through such schemes as rain-water harvesting.

The City of Cape Town encourages a suite of good house-keeping practices:

- auditing water usage
- Fixing pipes, mains and equipment
- Reusing grey and treated sewerage water
- Tax rebates for responsible water users
- Compulsory installation of water-saving devices in new buildings and retro-fitting in the old ones
- Correct metering and informative billing
- Installing dual-flush, low-flow toilets & low-flow shower heads

Although these practices are effectively up to the individual, small measures have been known to have drastic effects. Furthermore, these practices encompass the concept of 'sustainability'.

'The biggest waste of water in the country by far is when you spend half a pint and flush two gallons.'

Philip, Duke of Edinburgh [57]

SUSTAINABILITY, the 'optimal use'

The Western Cape PSDF outlines Sustainable Development in the following way:

the development needs of present generations should be met without the ability of future generations to meet their own needs, being compromised.

The PSDF continues to talk about reaching a balance and symbiotic relationship between Ecological integrity, Social justice and economic efficiency in order to guarantee sustainability as a whole. The International Union for the Conservation of Nature (IUCN) uses the term 'sustainability' as a suggestion of the idea of the indefinite restraint of human consumption within the compass of available resources. Yet in terms of national progress, the idea of sustainability has often been confused to refer to sustainable economic growth rather than the sustenance of natural ecosystems and communities, as is often the case.

INVESTIGATING AN 'OPTIMAL USE'

Throughout the world, the benefit of dams versus the cost that this type of construction incurs has raised dispute [57]. According to Davies & Day (1998) South African dams *have seldom been designed for more than one purpose*. Some uses have included recreation; angling; storing potable water; power production; storage of irrigation water. Yet ironically, less than ten years ago, no dam in South Africa was used for commercial fish production [57].

Admittedly, Day says, its difficult to manage an artificial water-mass for recreation and for potable water supply simultaneously, but not impossible. Dams can be offered as a means of economic or human upliftment because they will increase production of electricity, or jobs, or fisheries, or irrigation (and hence food), or water supply. Yet a close look at the economic, sociological and environmental effects of dams illustrates time and again that such benefits may be outweighed by the disadvantages, which may be catastrophic [57] in some cases.

Again, we touch on the subject of Zoning and the tendency to designate land with a single use. As McHarg suggests, *we have become accustomed to thinking of single-function land use and the concept of zoning has done much to confirm this* [17]. However, nature soon reveals elements that portray the co-existence of co-operative roles. Every ecosystem has a degree of dominance followed closely by a hierarchy of species. So too can we apply the same concept to the management of resources- where we have dominant land uses, co-existing with subordinate, but compatible as one holistic system.

The optimal use of Dams is therefore necessary and this may be further explored through the multi-use approach to design on the Berg River Dam.

THE ENVISAGED ROLE OF 'DAM DEVELOPMENT'

As long ago as 1970, Dr T.C. Robertston wrote:

In time to come this dilemma will have to be resolved by a holistic water plan in which each city and its river becomes a bio-economic unit, with wealth dependant on water, and all the units functioning as a whole in the service of the country. To apply such a plan a new philosophy is needed: water resources can no longer be exploited primarily for the people and their industries; people have to be regulated for the sake of the efficient use of the water resources. Until this inter-relationship of man, wealth and water- the demographic-economic-ecological pattern- is understood, the Golden Age of Water Conservation, man's ultimate hope of survival, will not have dawned. [57]

Today, as it enters its second decade of democracy, South Africa faces continuous challenges to adopt a better culture of water conservation. However the 'development of water infrastructure, including the building of more dams' is said to still be required [6]. Dam-building in general, however, is said to be dropping [57]. The reasons behind this have been determined as a dramatic decrease in available sites for the construction of dams, although the pressing issue of water-shortages remains.

A comprehensive approach to integrating social, environmental and economic dimensions of development is now considered appropriate given our growing understanding of the full dimension and extent of environmental effects on large dams. And at the heart of the dams debate today are issues of environmental sustainability, equity, governance, justice and power- issues that underlie the many intractable problems faced by humanity in taking development decisions. These issues all enter into, and must be accounted for in the planning of water and energy resource planning approaches in today's context. It is our responsibility as Landscape Architects to carry out our role in this regard and see to it that potential Dam Development ensures that all the above factors are tailored into a design solution. Finally, by adopting a multi-use approach, that is indicative of sustainable design, one can hope to counteract the many negative impacts that dams themselves have inflicted in the past



Fig 6 KATSE DAM, LESOTHO [24]

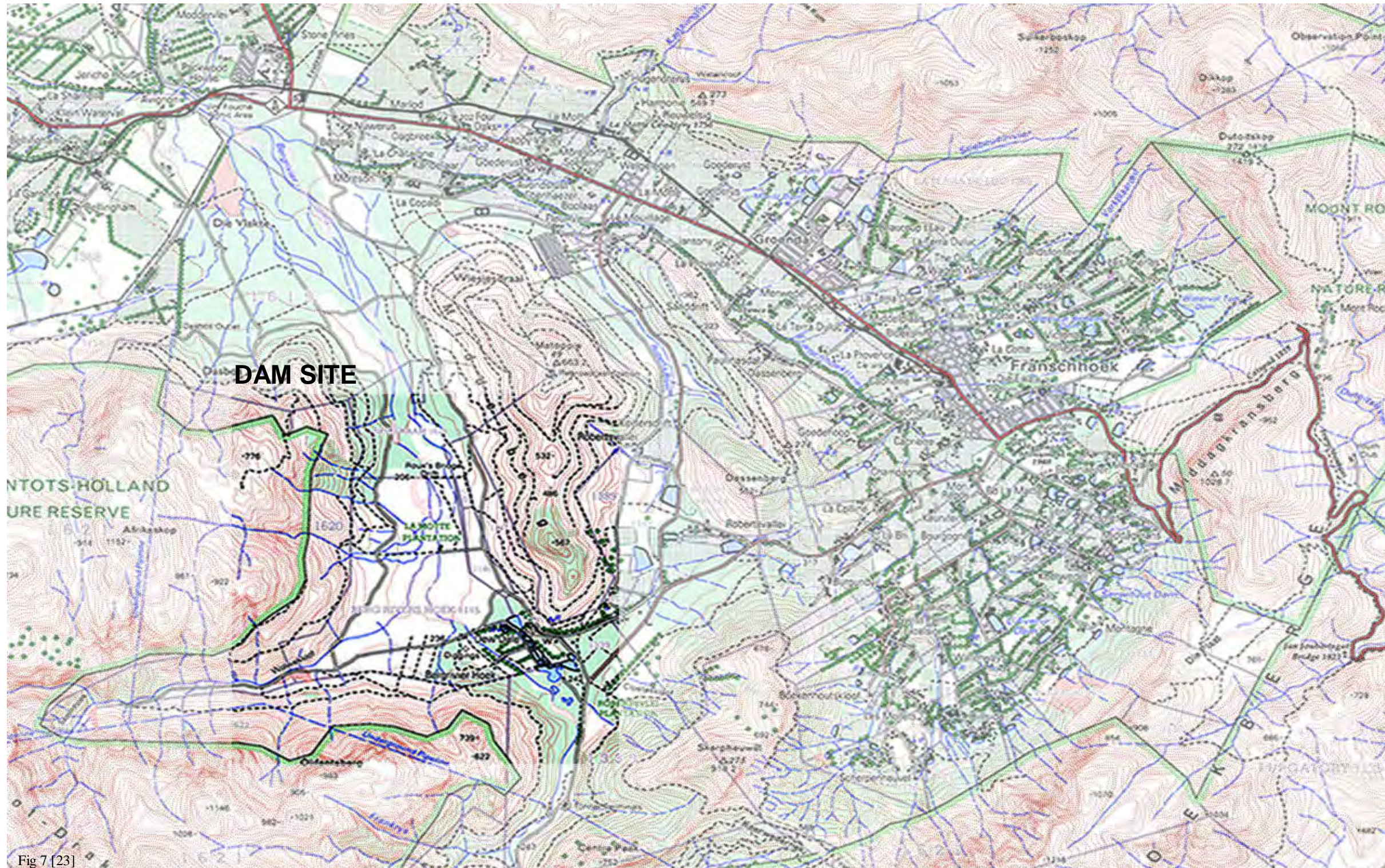


Fig 7 [23]

THE STUDY AREA:
 Situated at 19degrees longitude and 34degrees latitude, the Study Area is approximately 50km from Cape Town within a back corner of the Franschhoek Valley.

It is with this picture in mind that we begin to dissect the study area, one layer at a time from the bottom, up. The intention is to arrive at the end of the analysis with a much deeper understanding of the plan currently illustrated.

INTRODUCTION

Man plans an integral role in his surrounding environment and effectively is part of the global ecosystem that is constantly subject to evolution and change. The process of change relies heavily on the health of our environment and can only be understood through a decomposition of nature and her many layers. Geological time-scales unfold at a tremendously slow rate, unbeknown to man. Erosion reduces relief, exposing various landscapes, whilst conversely deposition of sediments occur to conceal them once again. Soils form as a result of the weathering of these base materials, whilst the effect of climate activates and largely influences the rate of

change of weathered materials. Climate varies over time, and in turn rainfall patterns alter dictating the settlement and migration of humans and animals alike. What can be recognised as a dynamic eco-system, must be treated as such, and in order for man to live sustainably, in tune with these environmental changes, knowledge of his surrounding environment is essential.

With the intention to attain this knowledge, the analysis of the environmental, infrastructural, socio-economic and planning elements of the study area will be explored.

GEOLOGY

REGIONAL CONTEXT

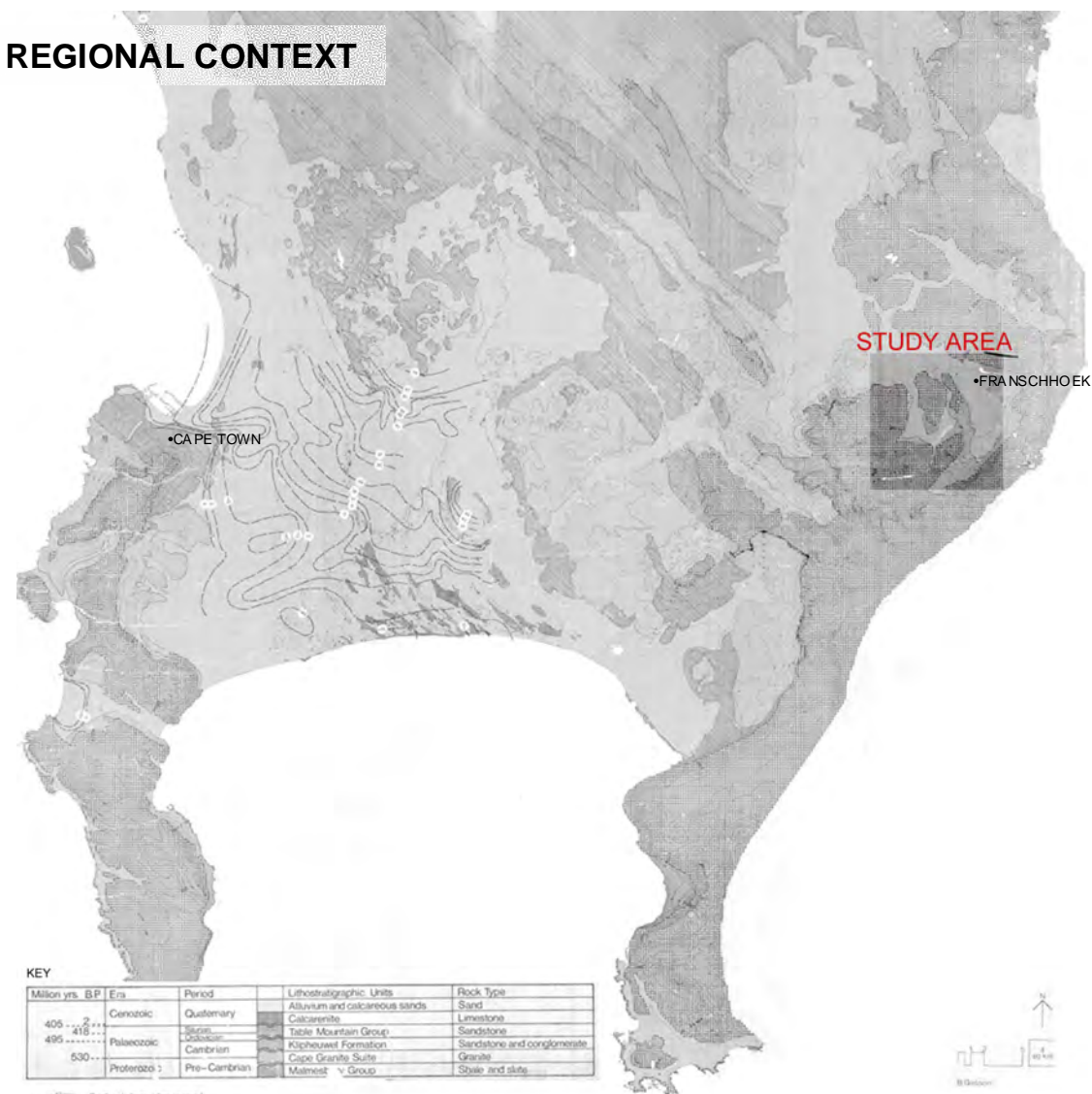


Fig 8.

1:100 000@A0 [59]

Geologically, the complexity of the Western Cape Province can be traced as far back as the Pre-Cambrian period with the breaking up of Gondwanaland. The oldest sequence of rocks in this region were formed from folding sediments of the Malmesbury and Klipheuwel Groups. With a composition of mainly soft, erodible rocks, the folding of these predominant groups gave way to flat plains in low-lying areas [12].

More recently, during the Cambrian period, these sediments were extruded by the Cape Granite Suite, giving rise to massive granite masses and prominent features such as Paarl Rock, in the local context.

Progressive erosion, transportation and deposition resulted in the formation of the sedimentary basis of the Cape Super group, encompassing the formations of the Witteberg, Bokkeveld and Table Mountain Groups.

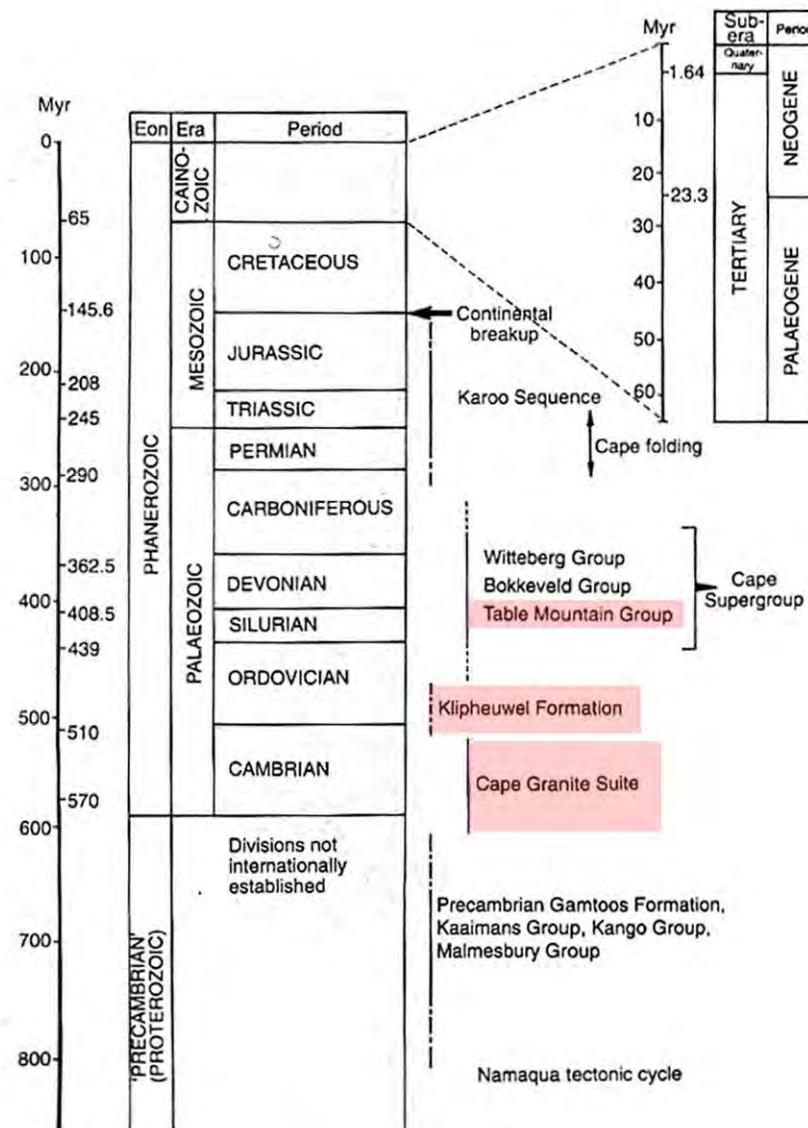


Fig 9. GEOLOGICAL TIME-SCALE & ROCK UNITS IN THE FYNBOS REGION [9]

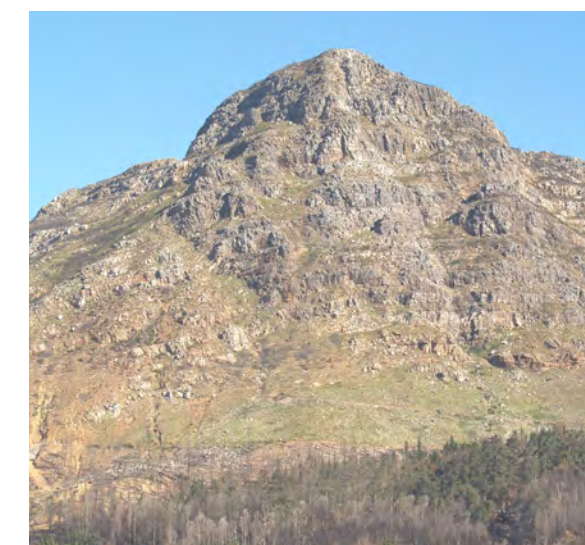
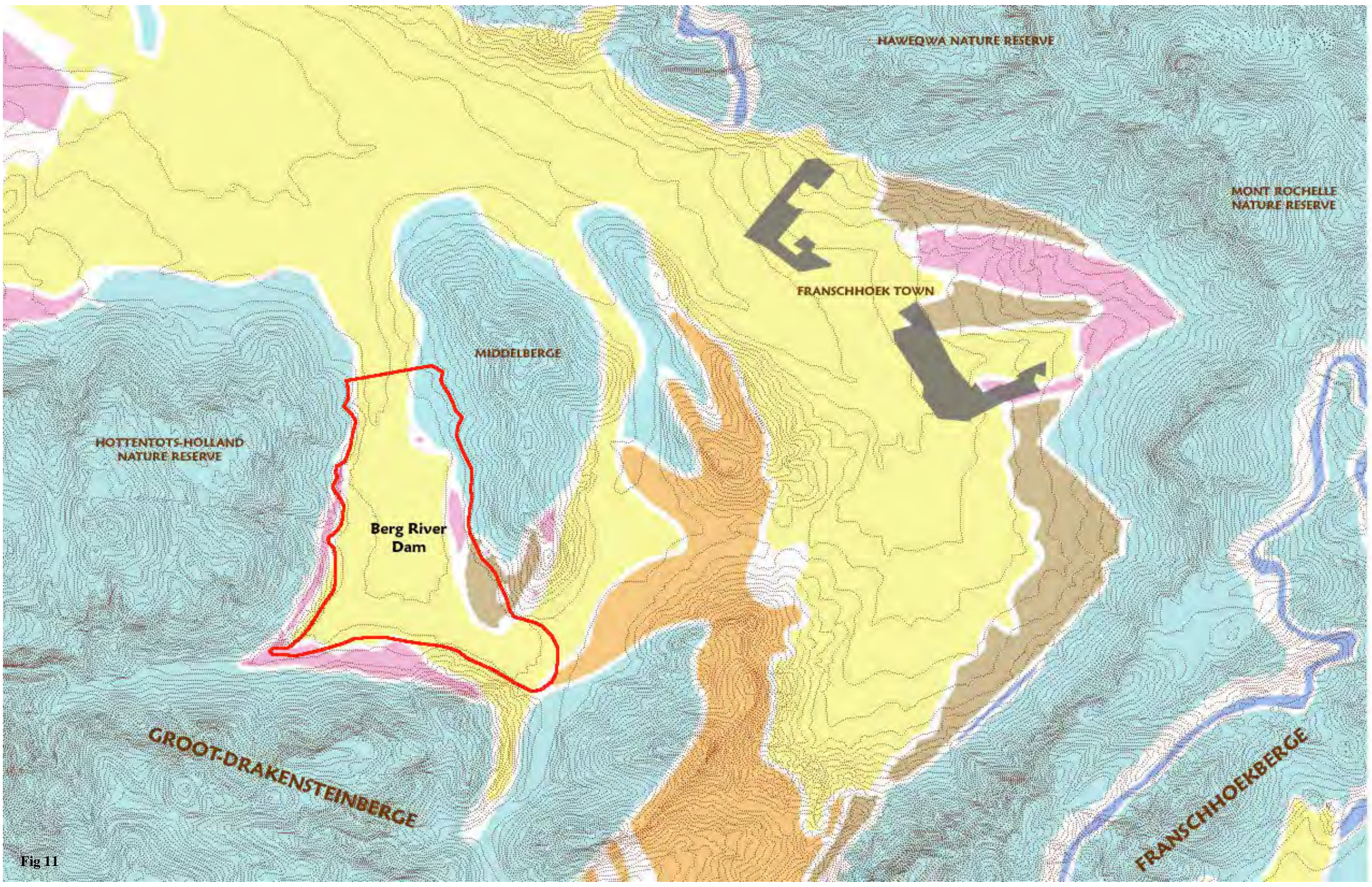


Fig 10. TABLE MOUNTAIN SANDSTONE GROUP [63]

The peaks and much of the steep slopes surrounding the study area consist of Table Mountain Sandstone (TMS). Rock types associated with this geology are highly resistant quartzites which have been continually folded and faulted to result in high water-bearing features [12]. Further movement in the Earth's crust during the Carboniferous Period led to intense folding and deformation. These occurrences are said to have moulded the mountain chain of the Cape Fold Belt that structures the core of the Western Province [54].

Other pockets of conglomerate and sedimentary breccia occur between the steeper slopes and the bedrock within the study area. This is evidence of where the TMS has been eroded away to expose the underlying Post-Klipheuwel layers [10].

Similarly, small granite cavities are revealed, which are younger than the Klipheuwel Formation. Debris slides are notably common in these steep slopes, particularly where the Klipheuwel layers form the substrate [10].

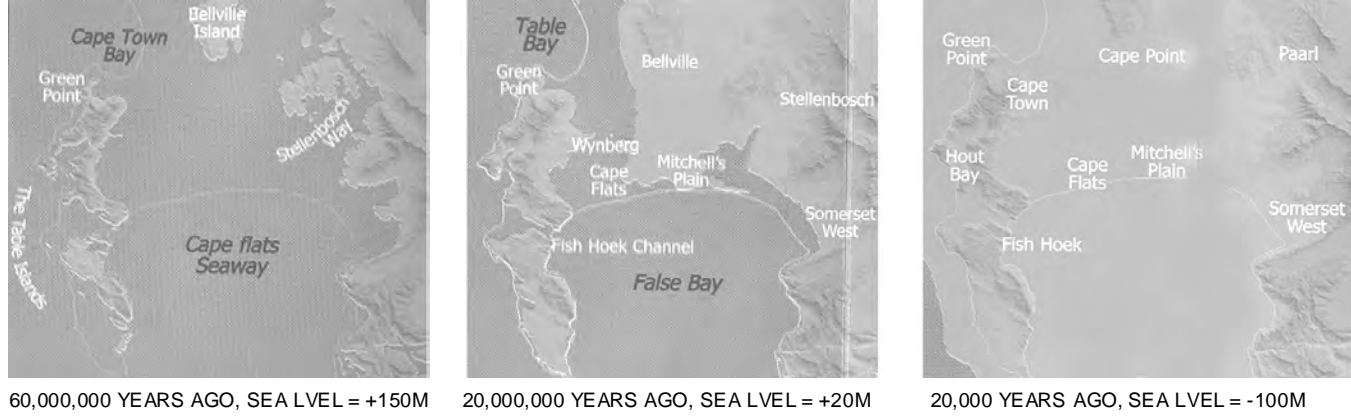


GEOLOGICAL IMPLICATIONS:
 Debris slides associated with Klipheuvel layers in the geology surrounding the study area pose implications for development. Rock-falls may be hazardous to human safety and development and any move to build in these areas should be undertaken with cautionary measures specified in specific design-guidelines



Fig 11

Fig 3. SEA-LEVEL CHANGES



The Quaternary Period of the geological life-cycle presents an interesting scenario of sea-level changes until approximately 20 000 years ago. These fluctuations resulted in the deposition of gravel, sand and clayey deposits, which are evident in the marine sands which cover half of the Cape Peninsula and Cape Flats today [3] (Fig3).

The sandy matrix or 'drift sand' that constitutes the valley floor of the Franschhoek valley can perhaps be accounted for by this exercise.

SEISMIC ACTIVITY

REGIONAL CONTEXT



'...the tectonic conditions responsible for a given earthquake like the one in the Boland region will remain operative in the future. It is only a question of time, geologically speaking, until the next release of energy in the area takes place. Experience has shown that this period should be at least of the order of one of two centuries, since no historical record exists of any other earthquake of this magnitude in the area.'

Fernandez (1974:50)

Fig 12. [59]

THE 'NORTH-WEST ALIGNMENT



Fig 13. MAP INDICATING NORTH-EAST AXIS OF LANDSCAPE IN THE WESTERN PROVINCE

Fig 13.

1:100 000 @ A0 [59]

Plate tectonic movements on the Earth's surface result from a build up of extreme heat and pressure from within the Earth's crust. Geological fault-lines appear as the crust ruptures, allowing periodic and unpredictable release of pressure in the form of seismic activity. These major crustal movements along lines of weakness may give rise to earthquakes and consequently be hazardous to life [61].

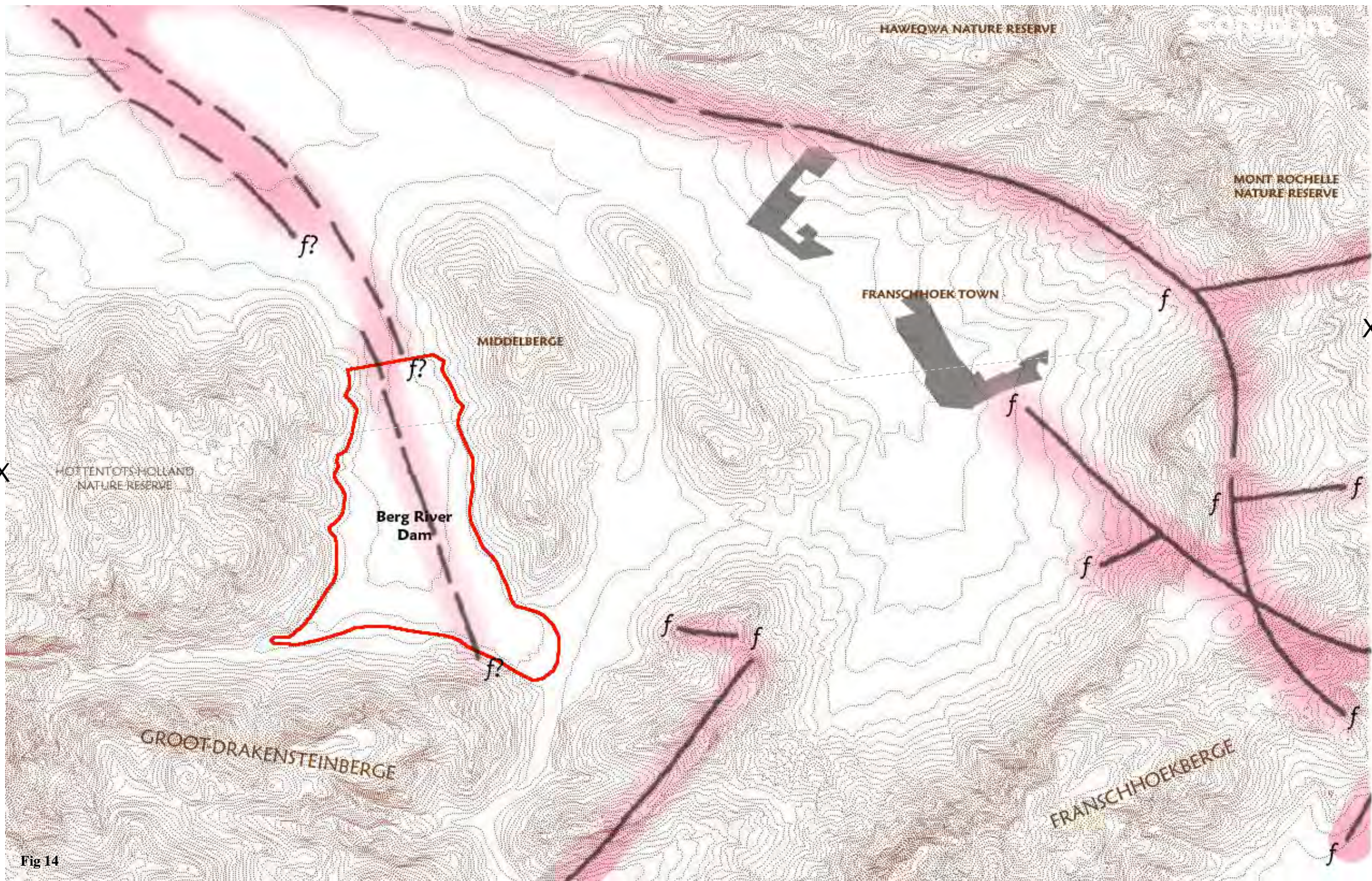
A number of regional lines of weakness are located across the Western Cape Province of South Africa. The Saldania Sub-province has been divided into 3 tectono-stratigraphic domains; the Tygerberg, Swartland and Boland terrain [12]. These domains are segregated by two major north-westerly striking fault systems [12], the Wellington- Piketberg Fault and the Saldanha-Franschhoek fault.

The distinct north-west alignment of these faults across the province is strongly dictated by the underlying geological processes and influences the topographical orientation of the land.

According to the Hazard Assessment Report [59] the area with the greatest seismic intensity in the Western Cape is an area stretching 80km from Bellville to Tousrivier. There is said to be a 10% probability of an earthquake occurring, at an intensity of 7 to 8 on the Modified Mercalli Scale, which is at least once in 50 years [54]. 7 to 8 is classed as a *very strong to destructive quake in which walls crack, chimneys fall, and poorly constructed buildings collapse* (Holmes, 1965).

More importantly however, is one of the least known side-effects of large dams in the landscape, is their propensity for triggering earthquakes [57]. '*Reservoir-induced-seismicity*' is the name given to a phenomenon that involves the huge mass of water bodies, pressing down into the earth, to make it groan and contort [57].

Sufficient seismic activity in the province in recent years suggests that this is an on-going concern for development in the area.



SEISMIC IMPLICATIONS:
 Although the map indicates evidence of seismic activity in this region, the 100 year period suggests there is 90% probability that the magnitude VII (modified Mercalli Scale) quake will not be exceeded (Forbes, Dick and Associates 1995) However, in this event, there are serious implications for any development downstream of the Berg River dam-wall in the event that the wall collapses due to intense seismic disturbance.

Fig 14

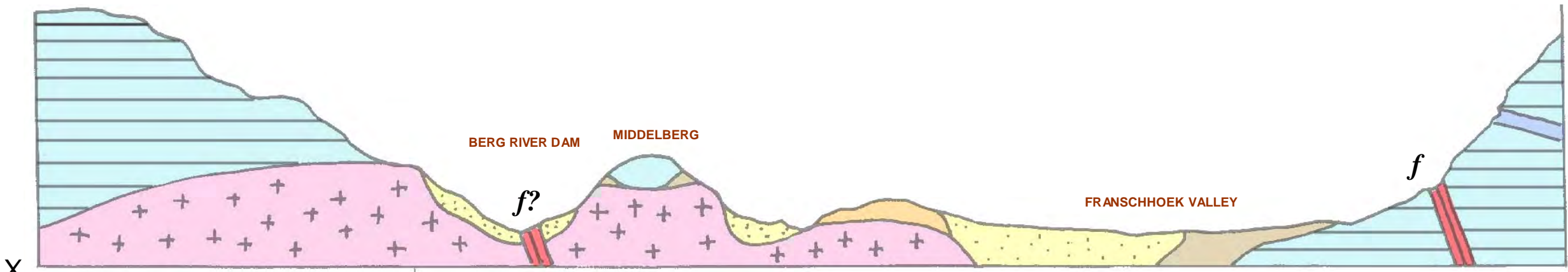


Fig 15. Geological section x-x indicating position of fault lines in the Study Area

PHYSIOGRAPHY • TOPOGRAPHY

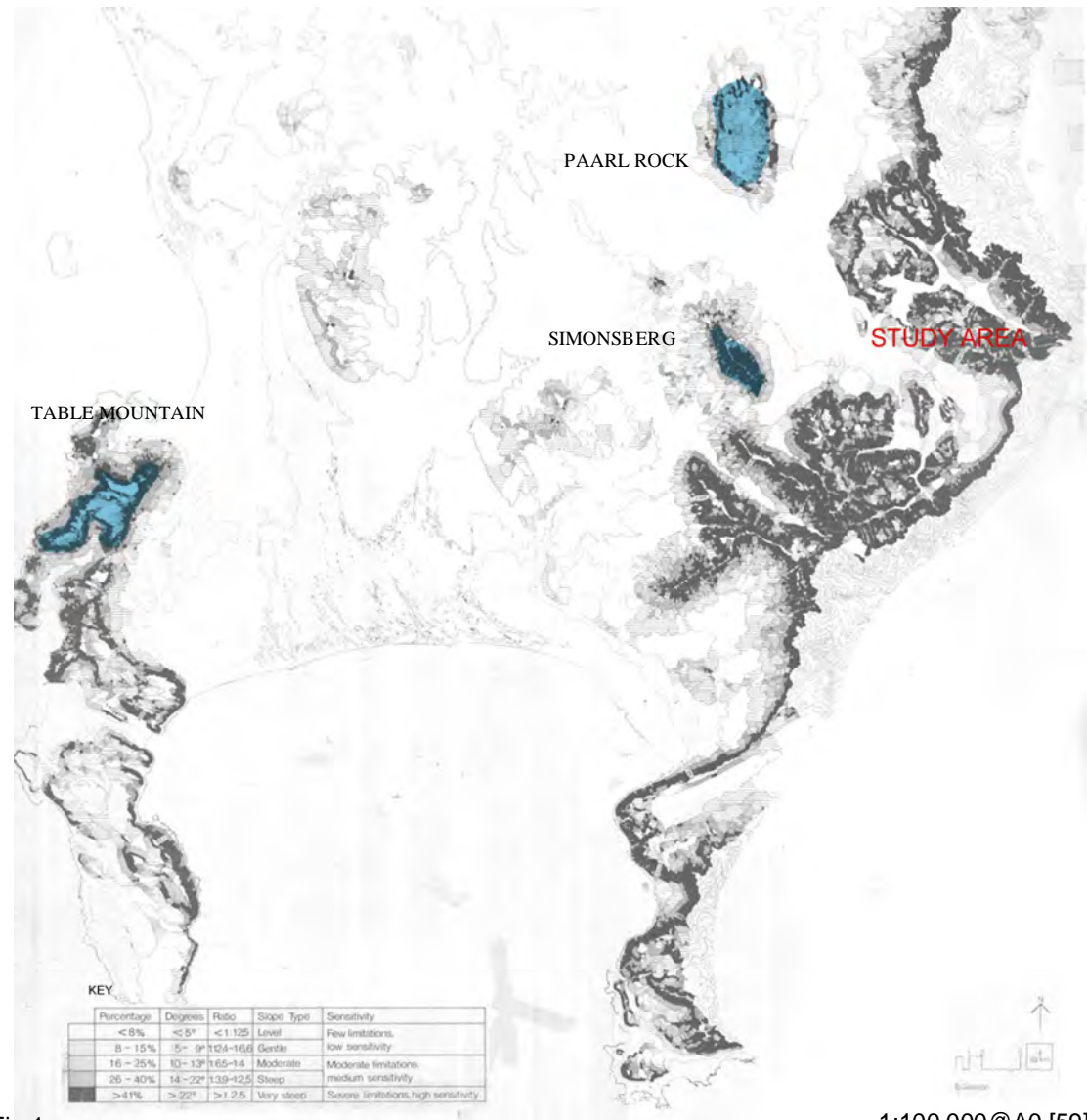


Fig 1.

1:100 000@A0 [59]

Physiographically, this area is typical of the high mountains and valley landscapes of the Cape Fold Belt with alignments that broadly parallel the coastline [54]. Erosion has reduced the high sandstone mountain ranges to give way to undulating shale flats associated with the older Malmesbury rocks. The resistant sandstone lithologies and erodible fault lines, together with the linear structure imposed by folding [9] has resulted in the blocky framework of hills forming a string of island-like land masses across the Province.

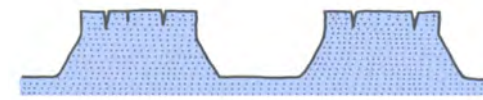
The moderate height and orientation of these mountains is said to have played a dominant role in effecting different climatic periods of the past [9]. In relation to major storm-tracks coming in off the surrounding oceans, the mountains largely affect the patterns of precipitation in the region [9].

REGIONAL CONTEXT

SEDIMENTARY LANDFORMS

Topography
Flat table rocks

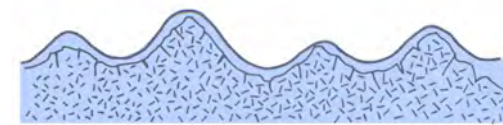
Example
Table Mountain



IGENOUS LANDFORMS

Topography
Rounded, steep sided exfoliation domes

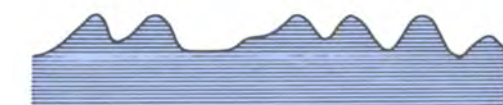
Example
Paarl Rock



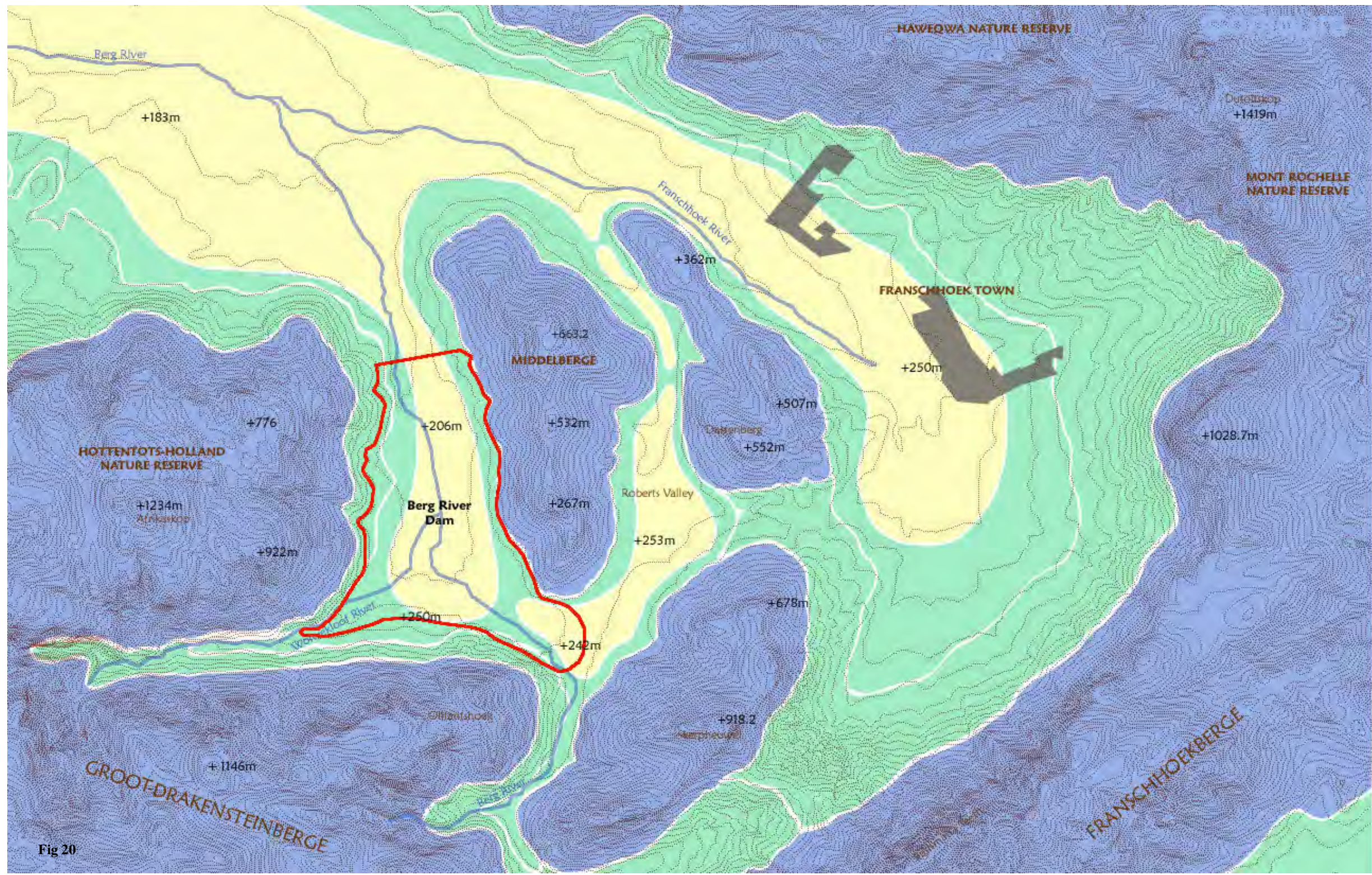
METAMORHPIC LANDFORMS

Topography
Steep, highly dissected ridge lines with rounded tops

Example
Simonsberg



KLIPHEUWEL GROUP



TOPOGRAPHICAL IMPLICATIONS:
 The dominance of high peaks and visually exposed ridges in the study area have implications for development. Development will be exposed to the elements and inaccessible for building purposes.



Fig 20

Topographically, the area is complex, ranging from the dramatic flat-tabled structure of Table Mountain, to the bold, domelike hill of Paarl Rock and the steep-sided Simonsberg. Landforms are the primary elements of natural places and are indicative of the underlying geology's resistance to weathering. Landforms also contribute strongly to an areas 'Sense of Place'.

The dam site itself is surrounded by a ring of quartzose substrates which visually enclose the area. Typically, landforms associated with these structures form residual ridges with vertical cliffs which give rise to a colluvial covering dominating most of the foothills of the Franschhoek valley [9].

Namely, *Groot-Drakensteinberge* in the south west, *Franschhoekberge* on the south eastern boundary and part of the *Wemmershoekberge* on the northern side, form the ridgeline boundary of the valley, falling away through a range of 1500metres in height.

Central to the study area is a landmass ironically known as *Middleberg* which sits under the shadow of its surroundings, at a height of 663.2 metres. The lowlands of the study area are dictated by the fault lines cutting through the valley in a north west to south easterly direction and are generally interspersed with a rich tapestry of rivers that are fed by the surrounding mountains.

PHYSIOGRAPHY • SLOPE • ASPECT



Fig 21.

CRITICAL SLOPE STEEPNESS FOR SPECIFIED ACTIVITIES

Steepness %	Critical for:
1	International Airports
2	Railways; large commercial vehicles; local airports; Ploughing & Cultivation of Crops; Flooding & Drainage problems in site development
4	Major roads
3	Agricultural machinery; soil erosion becomes problematic; land construction becomes difficult
8	Housing; roads; Excessive slope for general development; intensive camp & picnic areas
9	Absolute maximum for railways
10	Heavy agricultural machinery; large-scale industrial site development
15	Site development; tractors
20	Ploughing; combine-harvesting; housing site development
25	crop-rotation, loading trailers; recreational paths & trails

Fig 22. ADAPTED FROM CROFTS 1973: Source- [62]

The pre-dominantly mountainous character of the Franschhoek valley leads to a large portion of its land lying under significant slope-angles.

The dam site is located in a U-shaped valley with Middelberg and the Drakenstein mountains tight up against the long edges of the dam, creating over 26% slopes on both the eastern and western edges of the dam itself (See Fig 24, Section B-B).

North of the dam-site, the land is generally flat with a 0-15% gradient (See Fig 24, Section A-A), as it is throughout the base of the Franschhoek Valley extending around into the back of Roberts Valley.

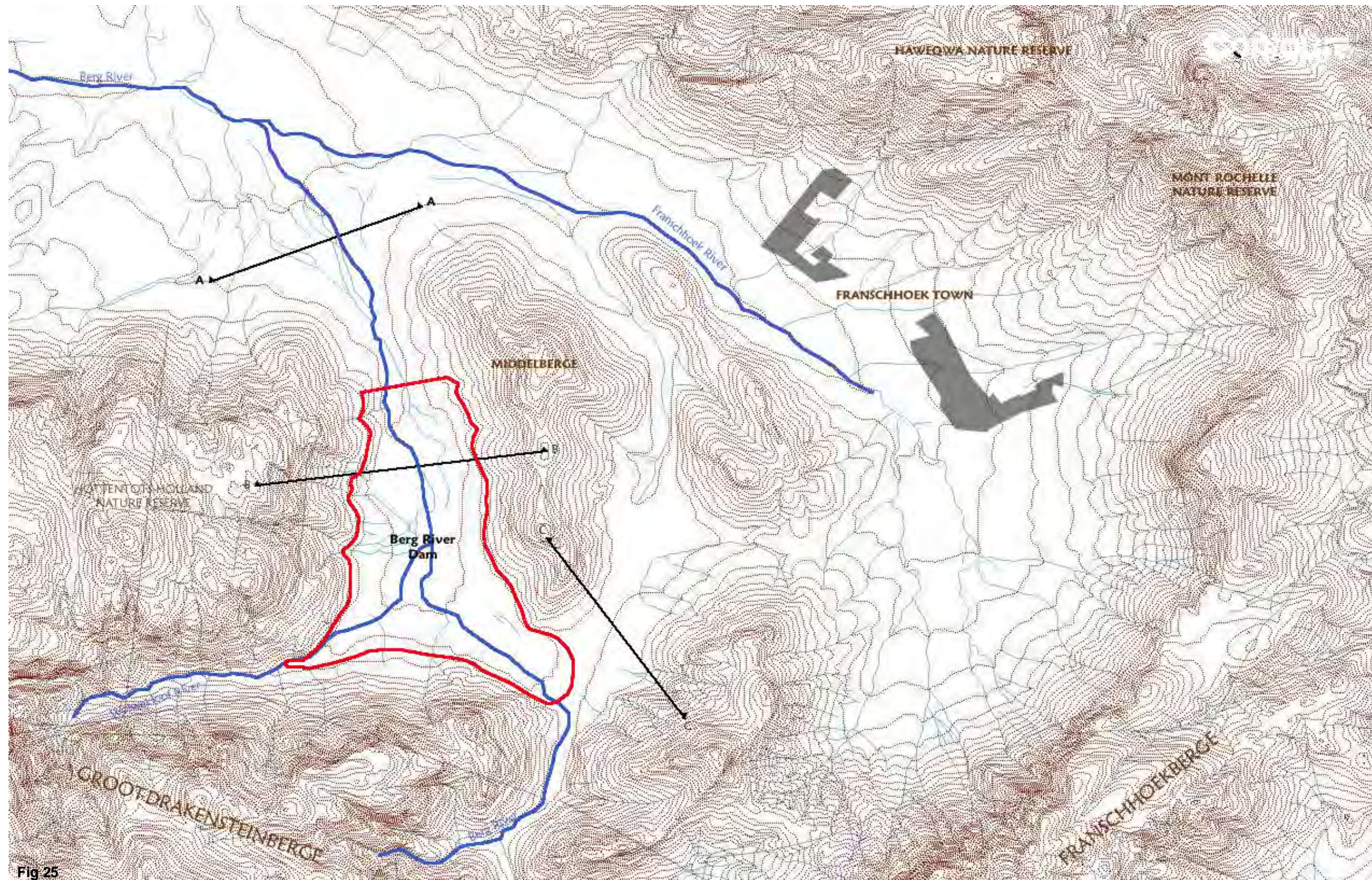
The Wolvekloof valley and the southern section of the dam-site boast limited gentle-slopes (16-25%) adjacent to the dam boundary, however these increase rapidly to almost vertical slopes over 26% that gives the dam its back-drop.

According to Crofts (Fig 22) these degrees of Steepness throughout the study area provide critical conditions for most activities, posing as a severe restraint for development of any kind.

The various aspects found within the site are a result of the complex topographical makeup. Primarily the site is dominated by NW-SE and NE-SW slope plains [1] which later affect localised temperatures. Further exploration of Aspect will take place at a more detailed stage later in the project.

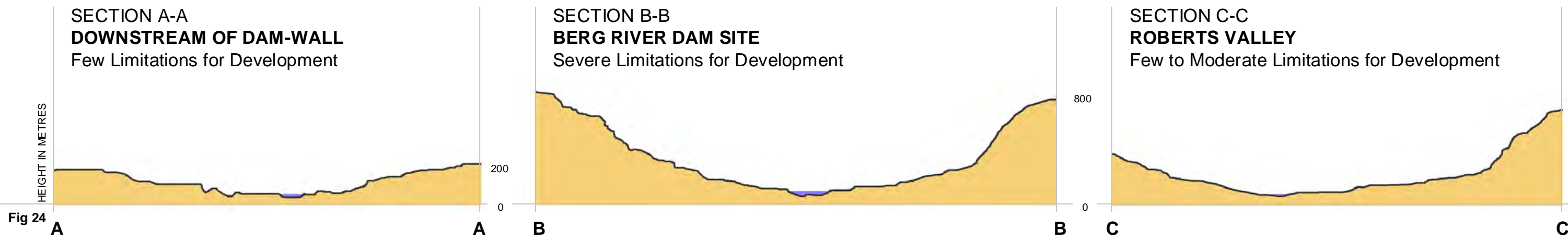
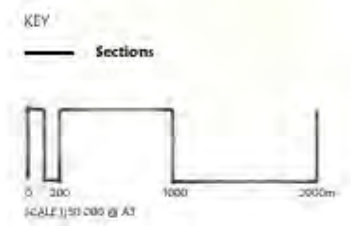


Fig 23. Olifantshoek [63]



SLOPE IMPLICATIONS

- Steep slopes throughout the area that are clear of vegetation are extremely dangerous, especially after heavy rains, as mudflows accelerate downhill and can cause excessive damage to development [28]
- Steep slopes implicates high costs of building and installing services, as access is difficult



SOILS

REGIONAL CONTEXT

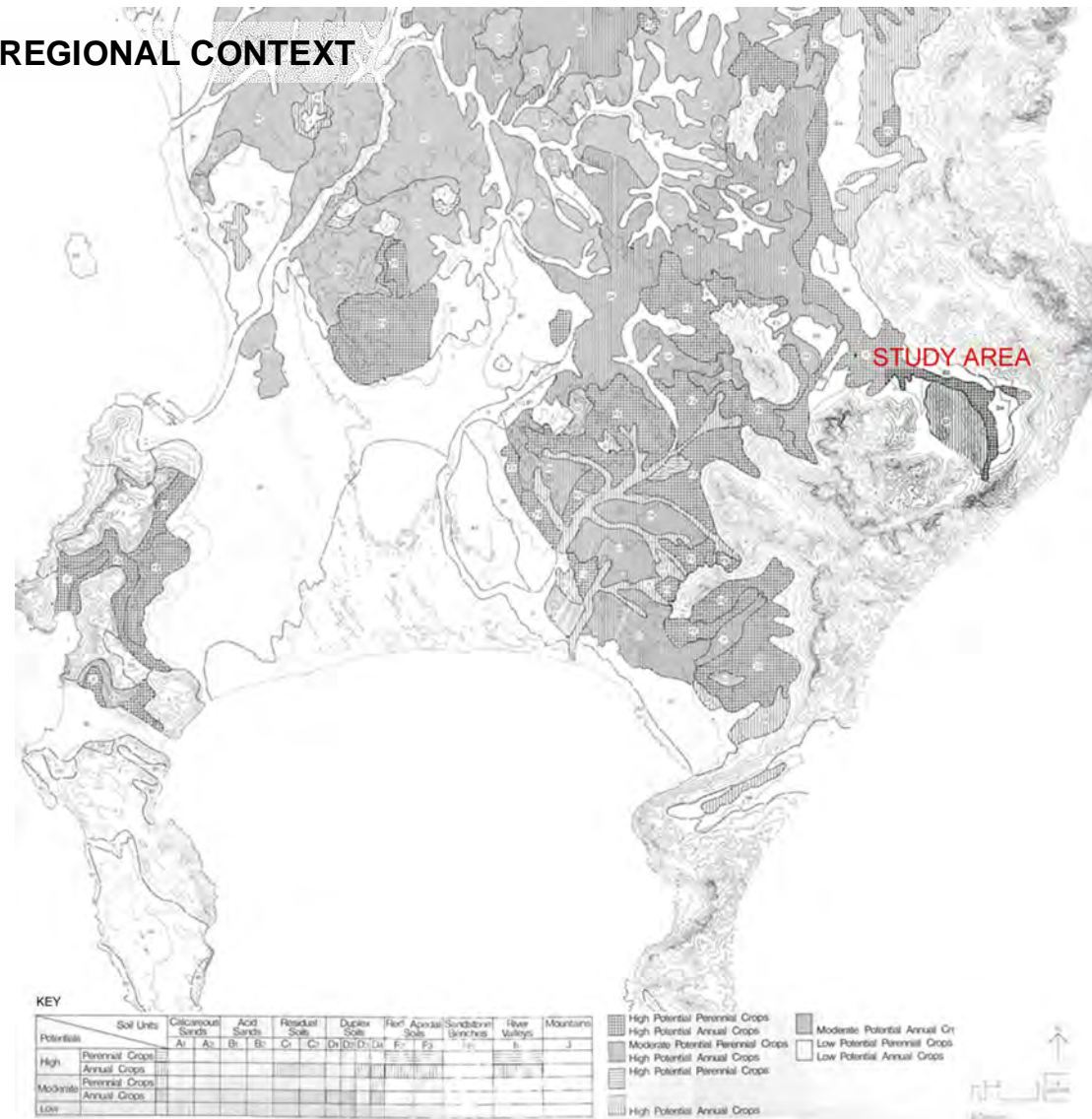


Fig 26.

1:100 000@A0 [59]

Surface soils are a direct product of their parent materials and terrain [9]. According to Gasson (1996) pedologically, this part of the Western Province is primarily dominated by shallow rocky soils on the steeper upper elevations and deeper sandy loams on the midslopes and valley bottoms. Adding to this Acocks (1976) considered this area to have limited soils accompanied by soils with sandy texture, leached and with subsurface accumulation of organic matter- iron and aluminium oxides either deep on hard or weathering rock.

Soils associated with the Cape Fold Mountains are specifically known as *lithosols*. These soils are generally shallow and weakly developed and are said to be formed by the process of podolization [9], which is a leaching process that deludes the soil of most plant nutrients, particularly phosphates [9]. This makes the soil particularly suitable for *Fynbos* which will be explored later on.

The following soil types are dominant throughout the study area.

SANDY SOILS

These are usually leached non-calcareous coastal sands or colluvial sands occurring in the inter-montane valleys [61]. In this case, these soils are derived from Table Mountain Sandstone.

GRAVELY SOILS

Often formed *in situ* from the weathering of the parent rock, in this case, quartzitic sandstone. These soils are characteristically shallow, well drained and have a low erodability [9]. They are largely located on the mountains.

DUPLEX SOILS

Characterised by more relatively permeable sandy topsoil materials overlying clayey subsoils. These soils occur in relatively flat landscapes [61] and have a tendency to become wet and expansive due to their clayey nature. The Klipheuwel formation is the underlying bedrock responsible for these soils.

RED & YELLOW APEDAL SOILS

Generally well-drained luvisc soils, derived from the Cape Granites. Apedal soils are leached, weekly structured, deep, well drained soils that support well-developed root growth [9] These soils are however, sensitive to disturbance and the presence of erosion dongas can be seen around the study area. In the flatter areas, these soils provide good drainage and founding conditions.

ALLUVIAL SOILS

Soils that are usually associated with River valleys [61], these soils are usually located on the side of valleys (Dry alluvial soils) or on the flood plain (Wet alluvial soils) and are characterised by a well-draining structure.

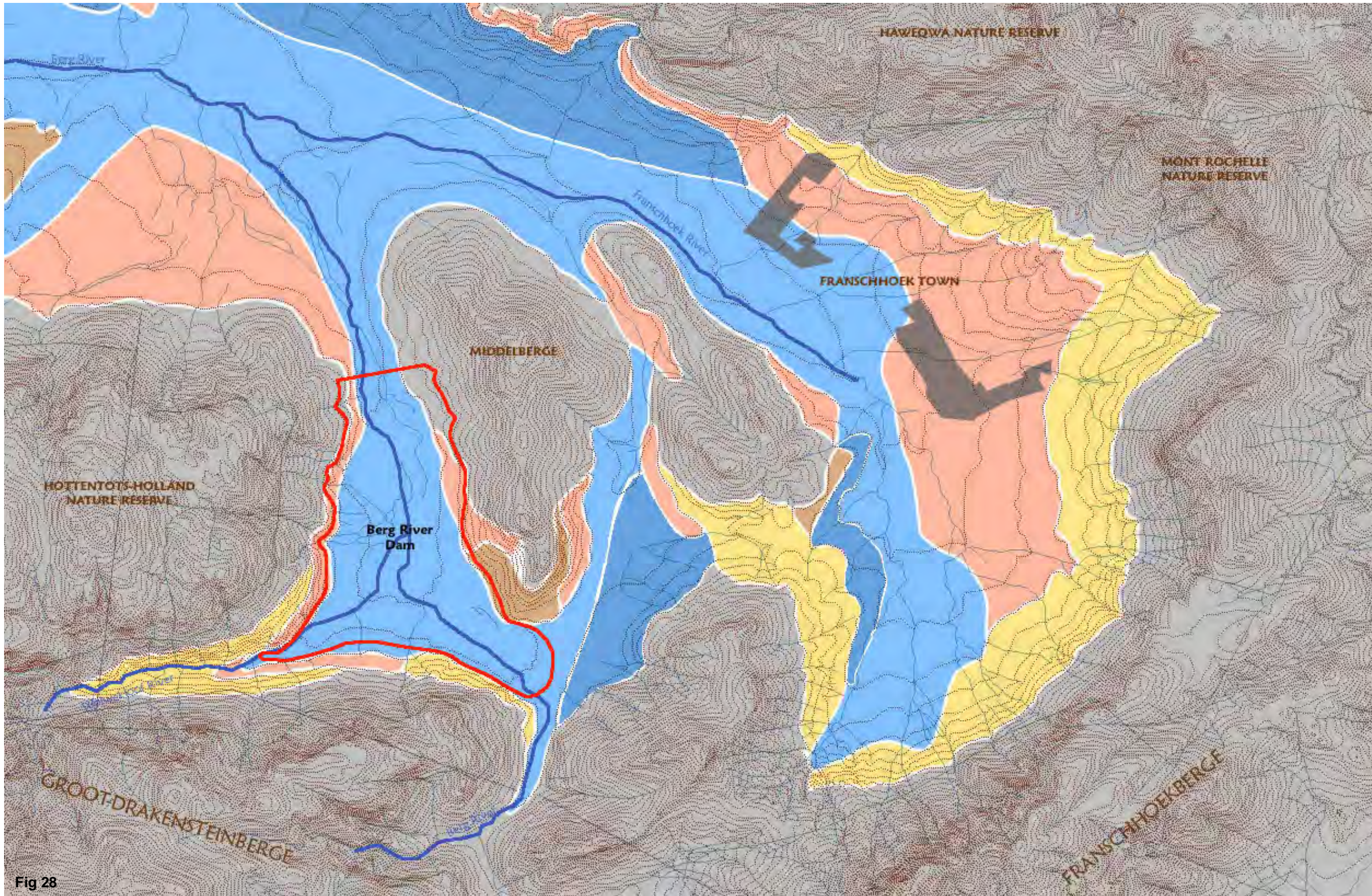
All soils are a mixture of sand, clay and silt [28], yet it is the composition of a soil that determines whether it is suitable to develop on (see Fig27). Soils influence their resource value and potential to support biotic growth and play its role as a base of the “pyramid of life” [61].

Generalised Soil Description	Soil Depth (in mm)	Topsoil Texture	Dominant Soil Forms	Suitability for Development/ Perennial Crops/ Landscaping
Sandy Soils	Deep	Medium Sand Dominant	Fw, Ct	Medium
Gravel Soils	Moderate	Loamy	Gs, Sv, Fw, Vf	Medium to High
Duplex Soils	Moderate Deep	Loamy	Sv, Km, Gs, Tu, Cf	Medium
Red & Yellow A	Moderate Deep	Loamy	Oa, Hu, Cv	High
Alluvial Soils	Deep	Loamy Sand	Du, Oa, Tu	High

SOIL DEPTH	TOPSOIL TEXTURE
Shallow: < 350mm	Sandy: < 10% Clay
Moderate: 350-500mm	Loamy: 10-25% Clay
Moderate Deep: 500-800mm	Sandy Loam: 10-15% Clay
Deep: > 800mm	Loamy Sand: 5-10% Clay

Fig 27. SOILS CLASSIFICATION & SUMMARY

Fig 27. has been drawn up as a summary of the soils found in the study area. The table gauges the suitability of soils for Development, Perennial Agriculture and Landscaping



PEDALOGICAL IMPLICATIONS

- Duplex soils-associated with high water table have implications for development. Foundations will become unstable on water-logged soils causing subsidence and collapse
- Red & Yellow Apedal Soils may give way to Erosion problems, and therefore require careful site preparation if development is to occur.

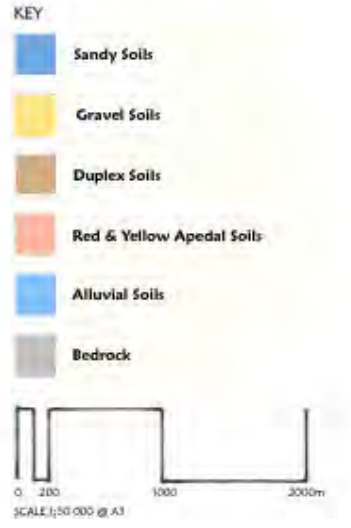


Fig 28



Fig 29. SITE DOMINANT SOILS [14]

HYDROLOGY • SURFACE DRAINAGE

REGIONAL CONTEXT

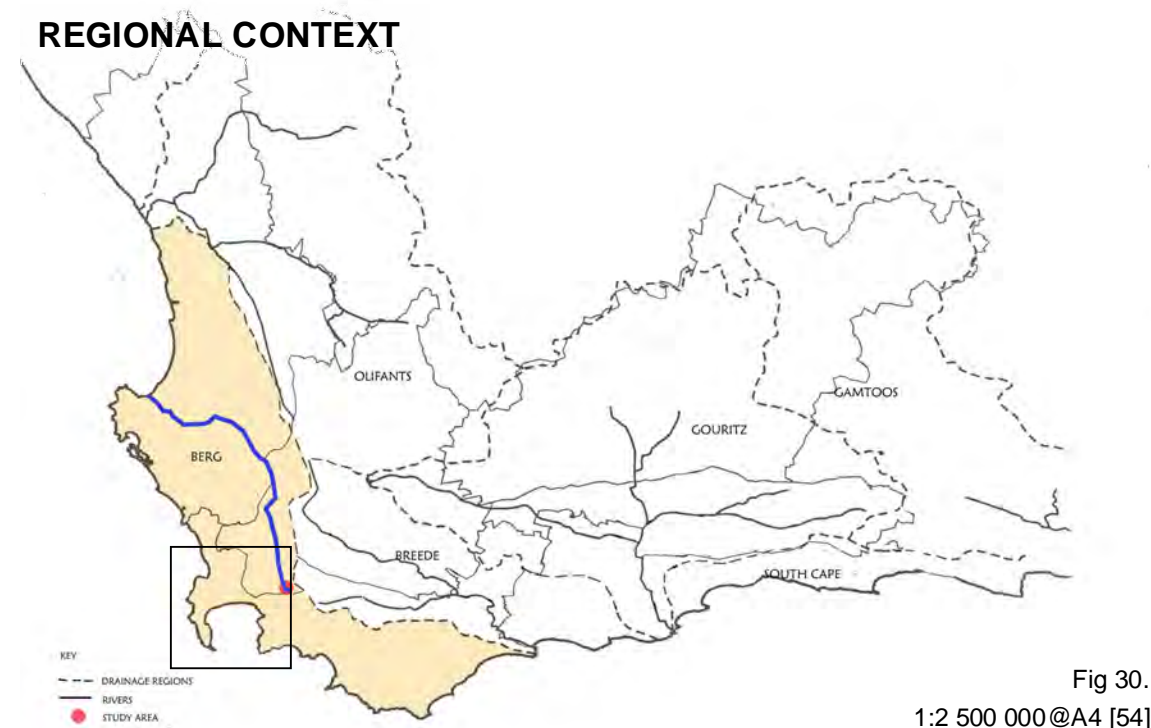


Fig 30.

1:2 500 000@A4 [54]



Fig 31.

1:100 000@A0 [59]

Water resources throughout the Western Cape are limited and it is critically important to manage these effectively for the sustainable development of the country [59].

The Western Cape Hydrological Region IV (Midgley et al, 1994 as seen in [54]) consists of six major drainage regions, of which the 'Berg' is one of them (Fig30). Covering 25 312 square kilometres of land, the Catchment area of the Berg River is the fourth largest in the Western Cape.

Drainage patterns dissecting the Catchment Area are directly resultant of underlying geological patterns (See Fig33), however drainage of a site is strongly determined by topography and soil properties as well as vegetation cover and climate [28]. An untouched landscape develops a natural drainage and runoff pattern over time. However, disturbance or interference with that landscape, in the form of earthworks or the clearing of natural vegetation can disturb the natural balance of the drainage having negative effects on the amount of drainage from the site.

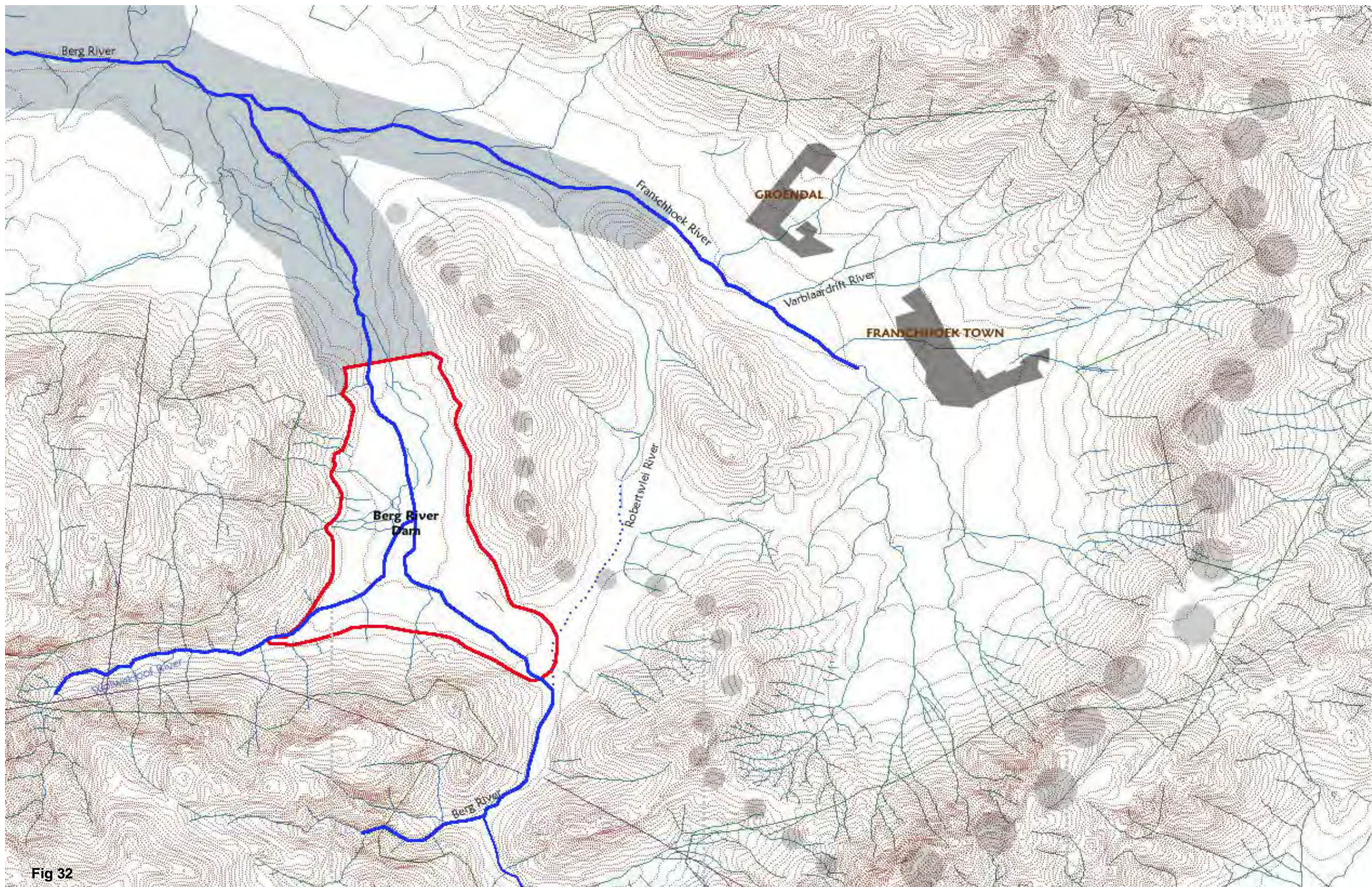
As the Berg River Catchment is being depended on for stocking the Berg River Dam, optimal drainage in the area is a top priority.

The Berg River itself is said to be an old river, having its origins in the orogenic folding in the Western Cape Mountains some 200-300 million years ago during the Carboniferous Age. [10] The source of the river today, is found in the Drakenstein and Franschhoek mountains south of Franschhoek [12]. This has not always been the case however. According to Forbes, Dick and Associates (2002 as seen in [10]) in the geological past, the course of the Berg River flowed from Assegaibos, past what exists of the Robertsvlei camp, northwest down the Robertsvlei River and into the Franschhoek River. It is said that a mountain slide occurred, blocking the upper reaches of the Robertsvlei gap, thereby causing the course to divert into the present Berg River dam site [10]. The Robertsvlei stream still flows however, and although it disappears underground for a short distance, it reappears at the point of La Motte village draining down to the Franschhoek River where it later rejoins the Berg [10].

Presently, the river continues north from this point, past the towns of Paarl and Wellington until it turns west in a rough arc, past Gouda, Piketberg and Hopefield. Finally, the river arrives at the Atlantic ocean at Veldrif, covering a total distance of 300 kilometres. [10] The north-trending ridge of mountains (Piketberg, Swartberg) is responsible for the orientation of the river as it swings west out to sea.

The Berg River Dam and hence the study area, is located on the Upper Reaches of the Berg River, fed by three of the nine main tributaries, three of which are the Franschhoek stream, the Wemmer and the Dwars. Flow in these tributaries is very low in the dry summer months, with the exception of the Wemmer, which has an exceptionally good catchment,[11] and is impounded by the Wemmershoek Dam. Run-off originating in the TMS is said to be of high quality; nutrient poor, low in silt and stained brown by sandy acids [10]. At the Berg's confluence with the Dwars/ Banhoek River, the area has been declared a Special Standards River in terms of effluent standards (Republic of South Africa, 1984) and therefore the dam site appears to have been located strategically in terms of access to the best water quality in the Berg River catchment.

Robertsvlei
A CATCHMENT
HAMLET



HYDROLOGICAL IMPLICATIONS

Altered water drainage patterns and increased surface runoff have the following implications for development;

- soil erosion can lead to damage to property and clogged drains
- increased potential for flooding on site [28]

Fig 32

Fig33



DRAINAGE PATTERN
Angular to Rectangular Dendritic

This drainage pattern is typical in arid climates where the joints in the sandstone have maximum control over the drainage pattern. Many streams are intermittent in sandstone landforms, so large areas have no apparent drainage [40], eg, Robertsvlei.



DRAINAGE PATTERN
Medium to Fine Dendritic

Typical of a less-resistant bed-rock, as the soft materials exert no control over the drainage system. A finely dissected pattern reflects rapid runoff and the impervious nature of the underlying sandy soils in this area [40].

Wolwekloof River

Tributaries of the Franschhoek River

HYDROLOGY • CHANGE FROM RIVER TO DAM

Rivers change along their lengths, across their widths, through their depths and with time [57], yet the fact that they are longitudinal functional units denotes impacts on the river at any point has severe reverberating consequences.

The continuous life of a river from source to mouth can be divided into 3 sections, the Foothill Zone, the Middle Reaches and the Lower River.

The *Foothill Zone* marks the zone of headwater-streams and is usually located in mountainous areas. These streams are characteristically cool, fast flowing, clean systems [57], they carry little sediment, for the land they drain is frequently rocky, with very loose soil [57]. Only three rivers in the Western Cape, namely the Olifants, Molenaars and Berg Rivers contain foothill zone which are in relatively good ecological condition [10].

However, the lower sections of this zone of the Berg River are said to have been damaged by releases of water from the Theewaterskloof Dam for summer irrigation and furthermore by the invasion of exotic vegetation, the planting of pine plantations and regular bulldozing of its banks. In comparison, the foothill zone is said to be still worth conserving [10].

A river in its *Middle Reaches* becomes wider and deeper as it collects more water from its tributaries. Velocity decreases with a gentler slope gradient and the river begins to accumulate sediment. Water is less pure in this zone due to leaching of minerals and the activities of living communities upstream.

The middle reaches of the Berg River begin in the vicinity of Wellington over a bed of stones, pebbles and quartzitic sand derived mainly from the TMS. However, the high resilience of the underlying sand-stone results in a low sediment load. Malmesbury Series rocks also protrude into the bed at this point. This middle stretch of the river is degraded and suffers from high levels of nutrient salts, as well as loss of water due to irrigation. [10]

The *Lower Berg river* approaches its mouth some 20 miles overland from the sea. The level of the river begins to approach that of mean sea-level, after which the river meanders slowly to its mouth depositing the materials it has been carrying across a small flood plain. This particular flood-plain consists mainly of superficial coastal deposits of windblown sand, gravels and surface limestones [11].

The Berg River estuary is being investigated for Ramsar status [54], which is the highest level of international protection that a wetland can receive. Wetlands are often chosen for their unique characteristics, including location and the number of rare and endangered plants, birds and animal life frequenting them. The aim of the convention is to stem wetland loss, promote their wise-use and protect listed wetlands. [54]

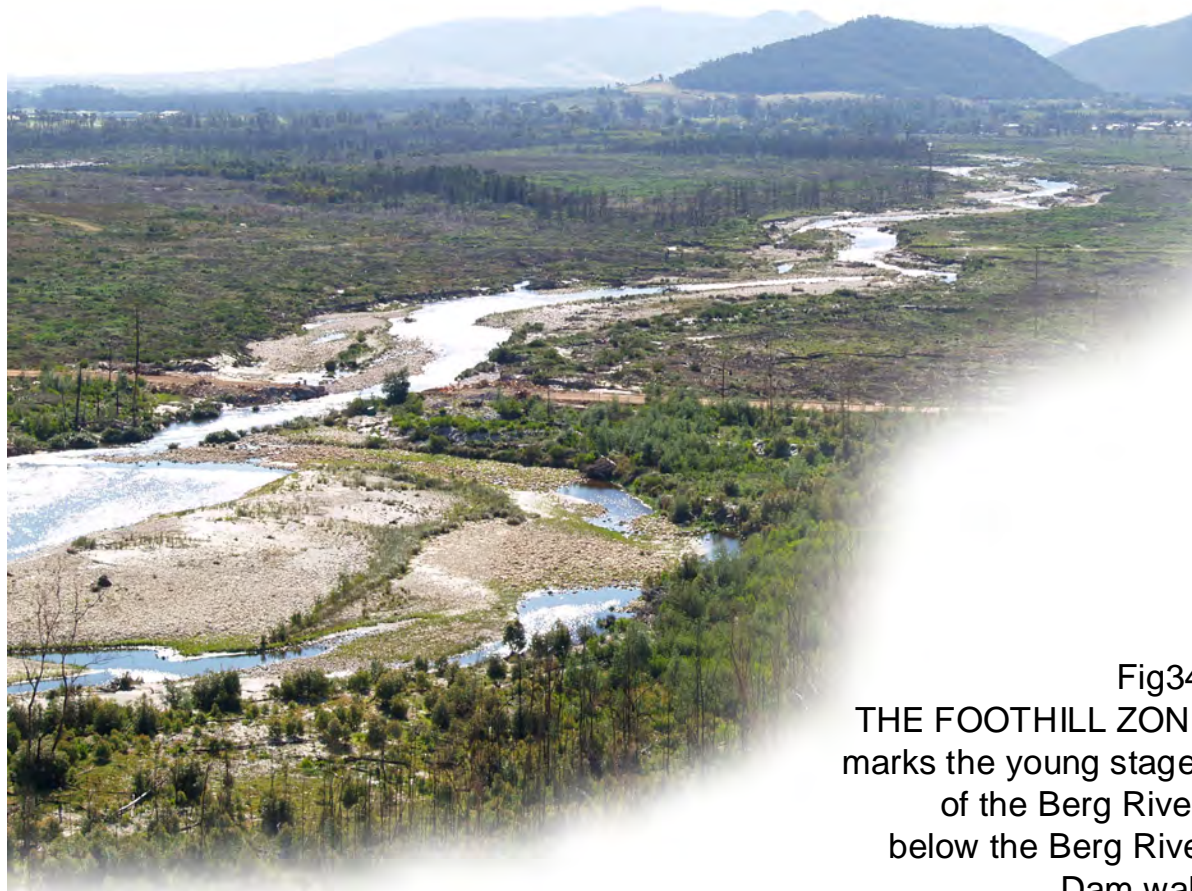


Fig34.
THE FOOTHILL ZONE
marks the young stages
of the Berg River,
below the Berg River
Dam wall.

The Berg River Dam is located in a mountain valley at an altitude of 195m. Inundation will constitute approximately 25% of the foothill zone, 6km of the Berg and Wolwekloof Rivers will be inundated. [10]

Due to the changes in level and transport of sedimentation that the river will experience due to impoundment, the river channel is likely to change as a result. Increased velocity of the water will result in eroding of the river banks and bed for a short distance downstream of the dam.

Subsequently, the dam will reduce the frequency of small floods, and therefore decrease this erosion, yet, allowing for the natural invasion of exotic species in these more stable areas. This is compared to a snow-ball affect, as increased exotics results in stabilisation and reduction in the capacity of the river channel, increasing the frequency of the river and the river's ability to cut a new course across its floodplain [10].

FLUCTUATING WATER LEVELS

Water drawn off the dam throughout the Summer months, leads to a high fluctuation of water levels in the Dam. In the case of the 5% Summer level of water, huge areas of shoreline will become exposed, having significant impacts, both aesthetically and biologically. According to Davies and Day (1998) the establishment of rooted plants around impoundments are rare as the plants do not have chance to establish with changes in water levels creating biological unpredictable irregularity [57]. However, some invertebrates are said to take advantage of the fluctuating system which in effect creates an artificial floodplain [57]. What results are new biotopes ripe for exploitation and a rich biodiversity of species that would otherwise not occur.

Many fish species fall into this group and are dependant on shallow waters for nesting. Sensitive management of water-levels is required to balance the needs of eco-systems with those dependant on the dam for drinking-water purposes.

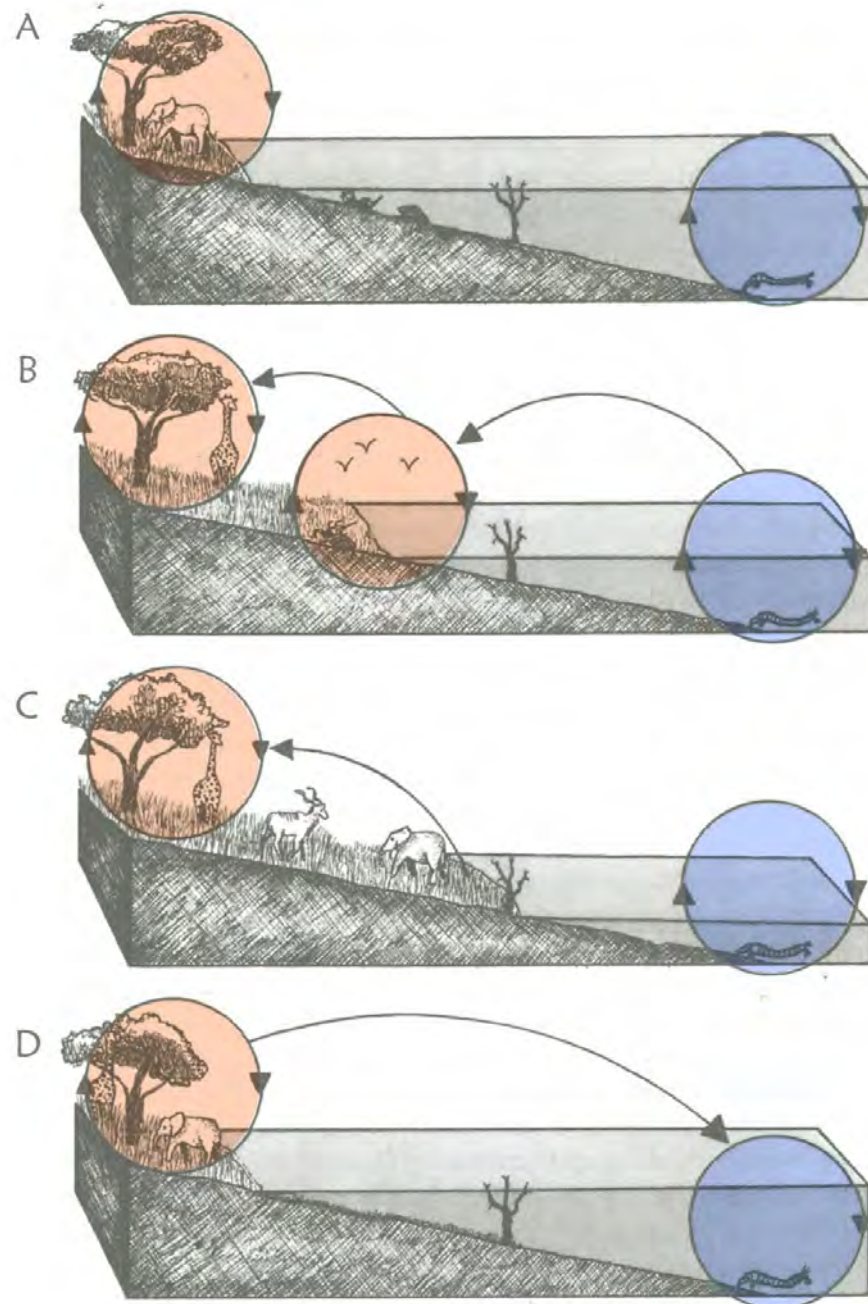
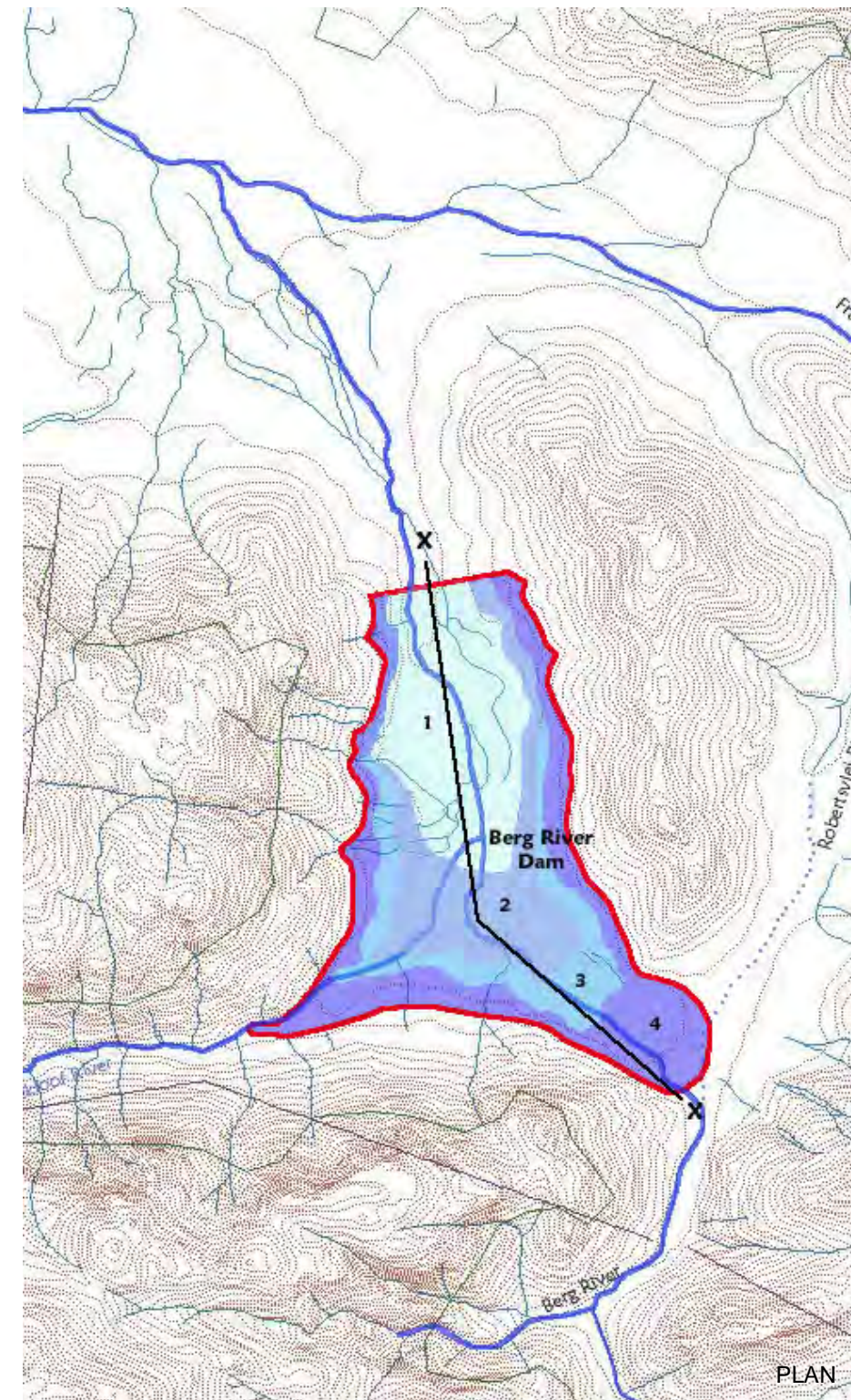
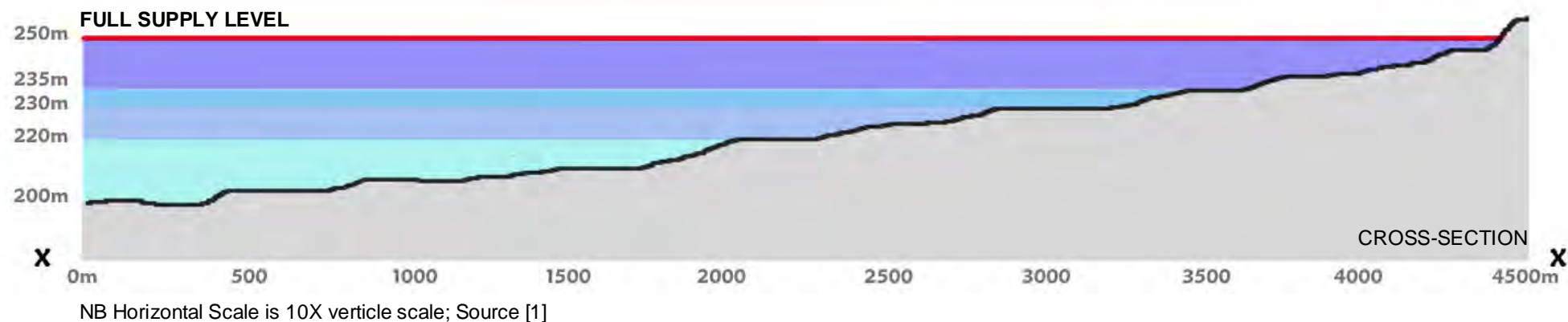


Fig35. Illustrating the 'Artificial Floodplain'
At full supply level (A), terrestrial and aquatic eco-systems are independent of each other. As water levels fall (B,C) terrestrial organisms can make use of the shore line, and as levels rise, the aquatics take over (D). Thus regular changes are effected between the lake and the land (Modified from [57] & McLachlan, 1974)

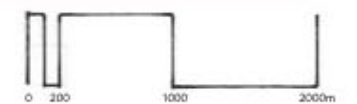
Fig 36. SECTION X-X
Indication of Fluctuating Water Levels



DAM CONSTRUCTION IMPLICATIONS

- Aesthetic and biological impacts resulting from Fluctuating Water Levels should be mitigated and development planned so as not to further antagonise the sensitive eco-systems in this area.
- upstream of the dam should be conserved as best as possible in order to limit the impact of ecosystems lost

KEY
Dam Fluctuation Water Levels
1 5% of Summer (-30m) 220m
2 25% of Summer (-20m) 230m
3 75% of Summer (-15m) 235m
4 Winter Period- Full Supply Level [1]



GROUNDWATER

REGIONAL CONTEXT

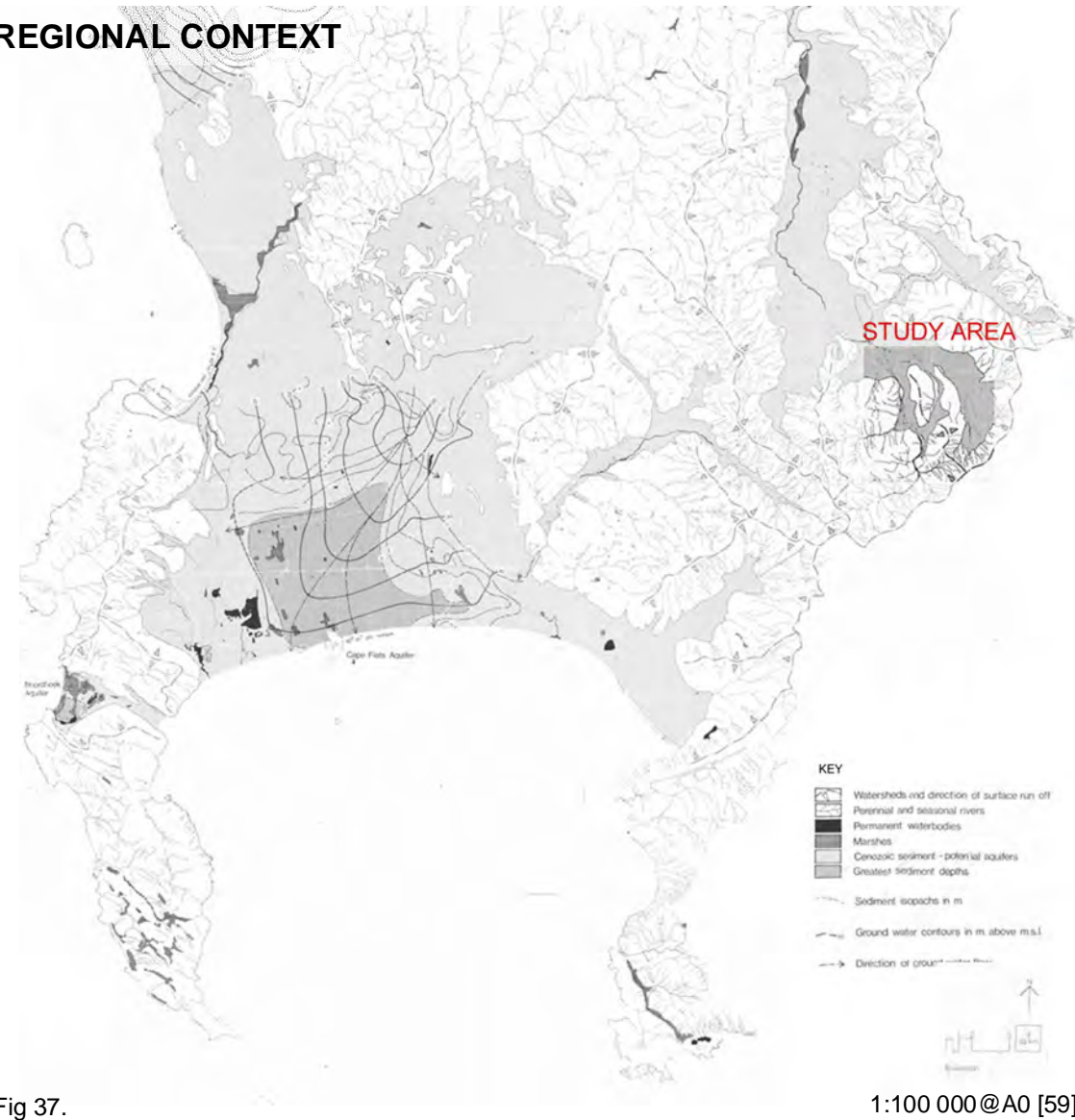


Fig 37.

According to Gasson (1999) significant localised groundwater bodies exist in the interior valley gravels of the Western Province (See Fig37).

S

Secondary aquifers exist to a limited degree in the hard rock formations of the TMS Group which, at high elevations, receive very high rainfalls, and high levels of infiltration are therefore possible- approaching 15% of precipitation. The quality of water is said to be excellent, yet abstraction is apparently expensive [54]. Hence the City of Cape Town's need to import surface water from outside its metropolitan borders.

The main source of groundwater in this context, is the high mountainous areas or wet catchment of the Hottentots Holland range. Aquifers and their associated valleys are vital areas of recharge, fuelled by water percolating into the ground from surface streams.

In the Franschhoek Valley, groundwater is a significant resource for the local economy. Countless streams and seepage lines filter down off the surrounding circle of mountains, feeding the valley with water. Groundwater supply and quality can deteriorate however with exploitation and mismanagement and it is necessary to accomplish a balance between extraction and recharge to maintain a *status quo*.

GROUNDWATER MANAGEMENT

Activities that potentially could alter the suitability of groundwater resources in the Franschhoek Valley include;

- Agricultural and effluent irrigation and saline return flow
- Application of fertilizers and pesticides in agricultural areas
- Wastewater disposal from sewerage treatment plants
- Wastewater disposal by the fruit processing industries by land application
- Livestock-farming
- Poorly sited waste sites and uncontrolled dumping
- Poor waste management practices at industrial sites
- Informal settlements

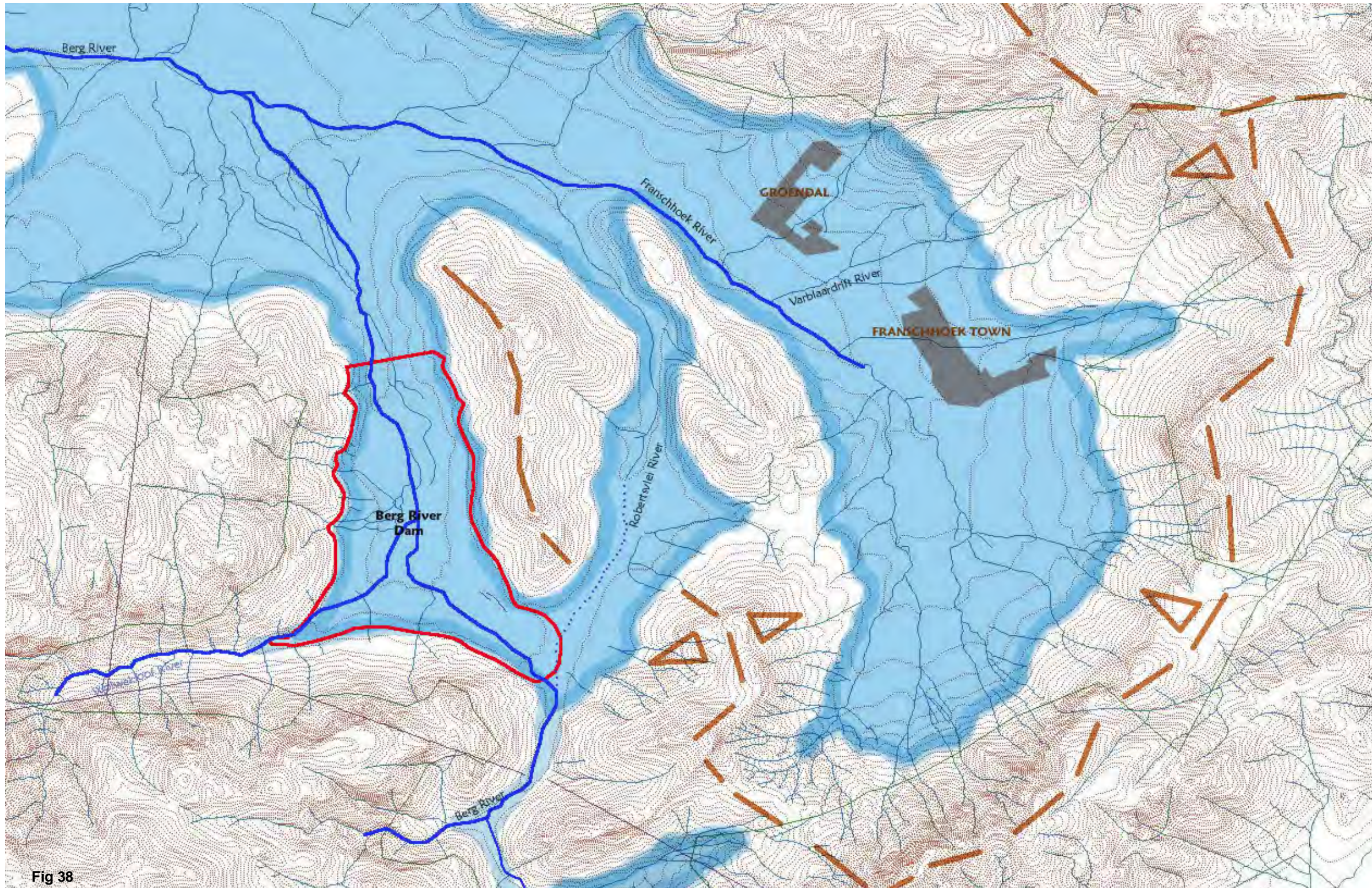
Agricultural activities can be regarded as regional pollution sources whereas the rest of the activities are localised point sources of pollution. (Breede Basin Study, 2003)

To prevent over exploitation and/or pollution of the aquifer resources, sound groundwater management is essential. Regular long term observation and monitoring of the water-levels and water quality needs to be interpreted and related to groundwater abstraction and recharge conditions.

Within the winter rainfall region of the study area the most common groundwater management approach is the conjunctive use of groundwater and surface water. During November to April (summer) groundwater is generally used, while surface water is utilised from May to October (winter) to allow for recharging of the groundwater.

Waste disposal sites and sewage sites should be selected with utmost care by a groundwater pollution specialist to protect vulnerable aquifers (Deep Water Affairs, 1994)

Highest abstraction should be in areas of higher recharge.



IMPLICATIONS FOR GROUNDWATER:

•presence of a potential aquifer throughout the study area has serious implications for development in these areas. Ultimately, the fact that aquifers pose as groundwater recharge areas, building upon them should be avoided. However, this does limit development throughout the entire valley, and therefore if building is to take place in these areas, recharge at a more localised scale shall be encouraged.

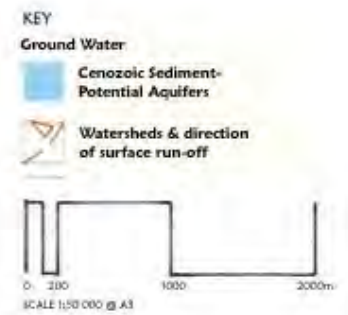


Fig 38

According to Sowman & Urquhard (1998), pollutants that are likely to pollute ground-water include:

- roadways
- live-stock areas
- septic tanks and soakaways and
- gardens or fields where fertiliser is used

Clearly, this is a concern for the study area, as the maintaining of a high quality of water is essential for optimal dam-storage

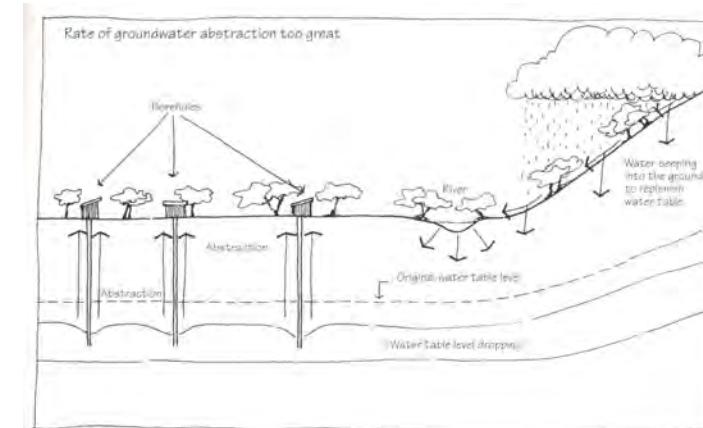


Fig 59
An illustration of over-abstraction of Ground Water [28]

CLIMATE • SEASONAL VARIATION • MICRO-CLIMATES

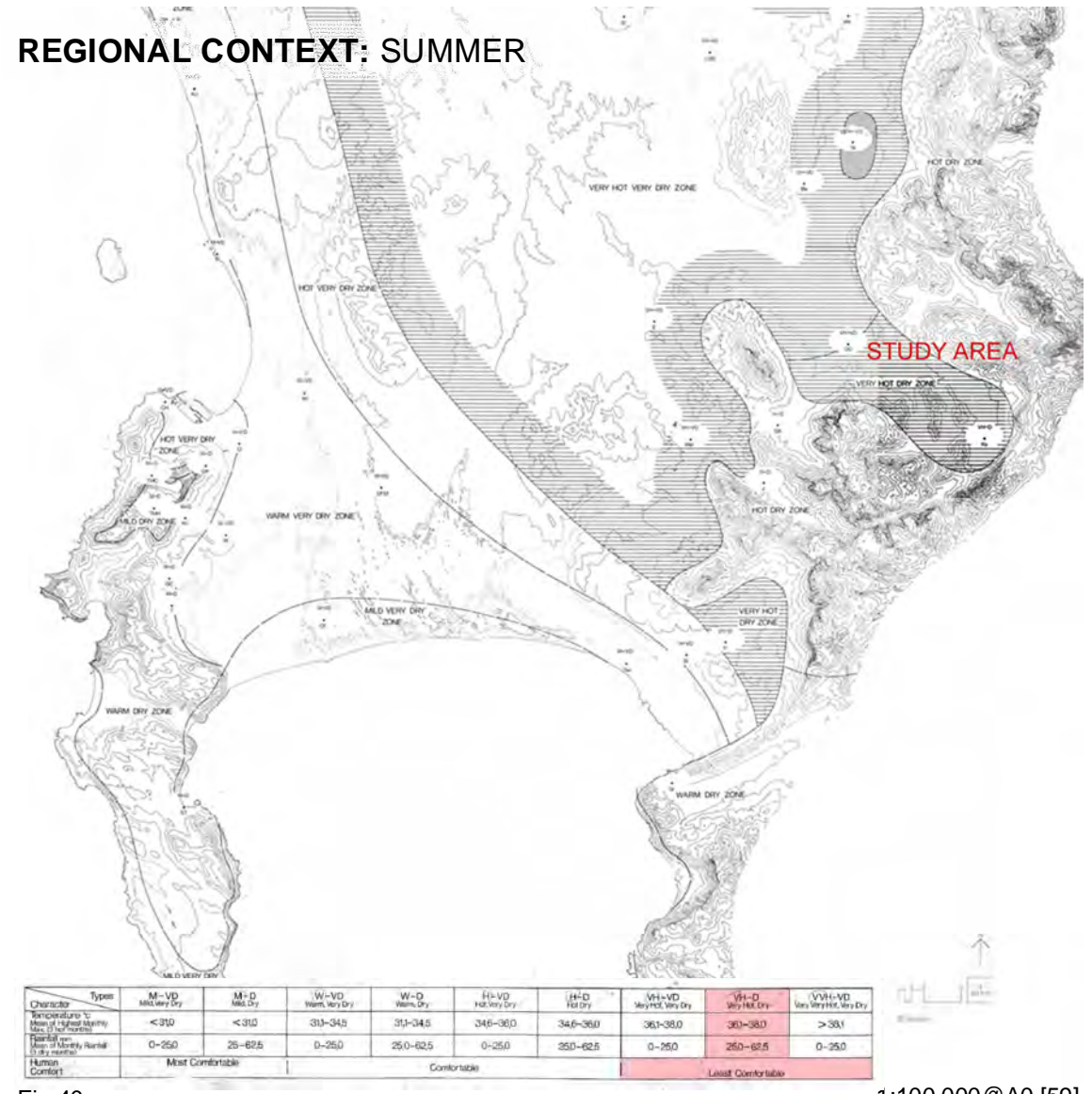


Fig 40. 1:100 000@A0 [59]

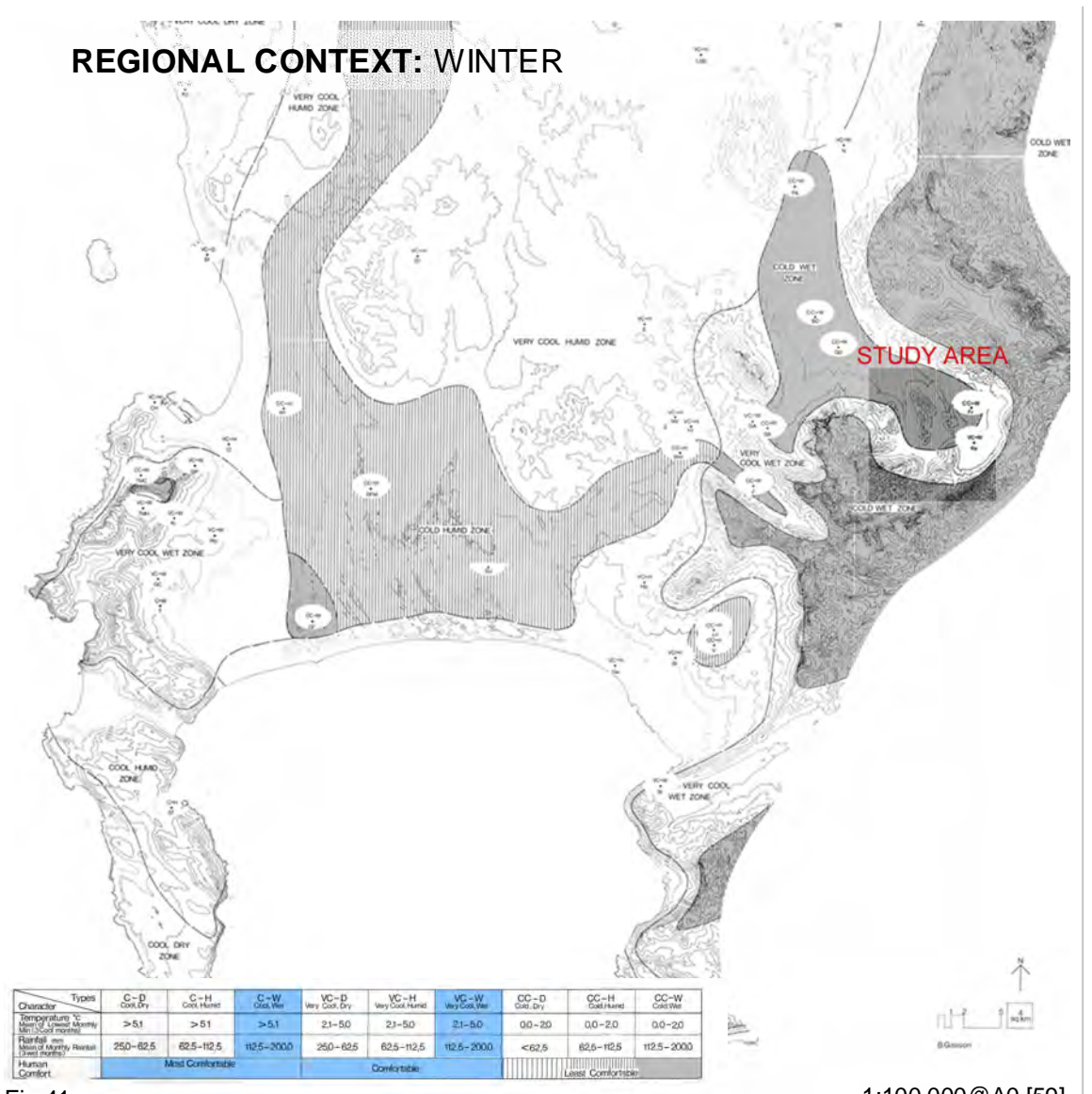
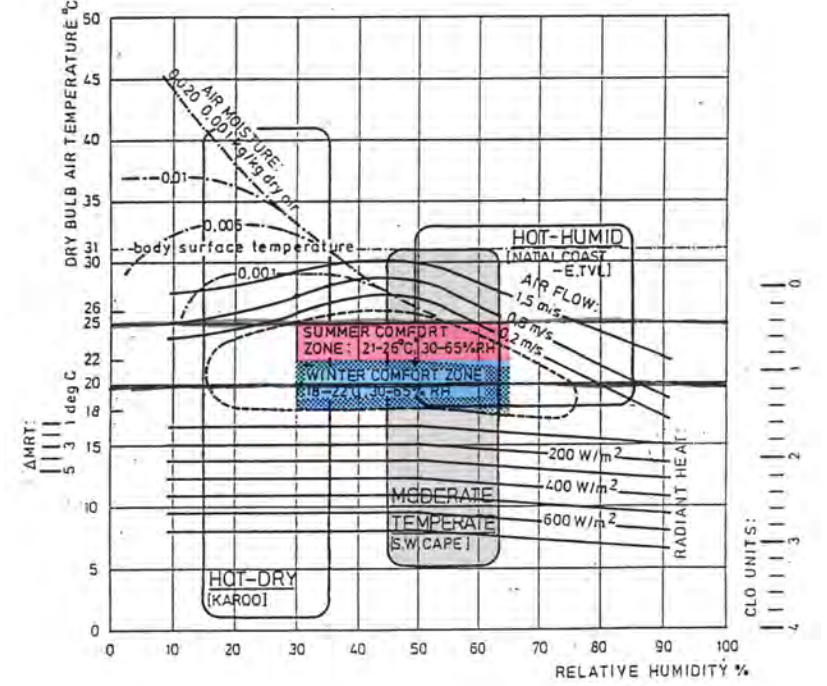


Fig 41. 1:100 000@A0 [59]

A Mediterranean-type climate is said to have dominated the Western Cape for the past few million years [9]. Distinguished generally by warm dry summers and cool wet winters, temperatures of our particular climate are characterised by strong space-time variations in temperature and moisture [54]. These variants include coast to interior; one part of the interior to another; lower to higher elevations and finally seasonally and diurnally [54] and affect day-to-day weather in terms of winds, moisture and temperature [9]. On the other hand, the wide expanses of ocean on three sides of the Cape are said to have a moderating influence on our climate [59] specifically the influence of the warm Agulhas current off the Eastern/ Indian ocean coast [59] in terms of our study area.

The hot-dry summers within the study area occur from November to March with an abundance of solar irradiance [9]. Sunshine records are said to be 13% lower than Cape Town International airport however, and this is due to the orographic affects in the valley [1].

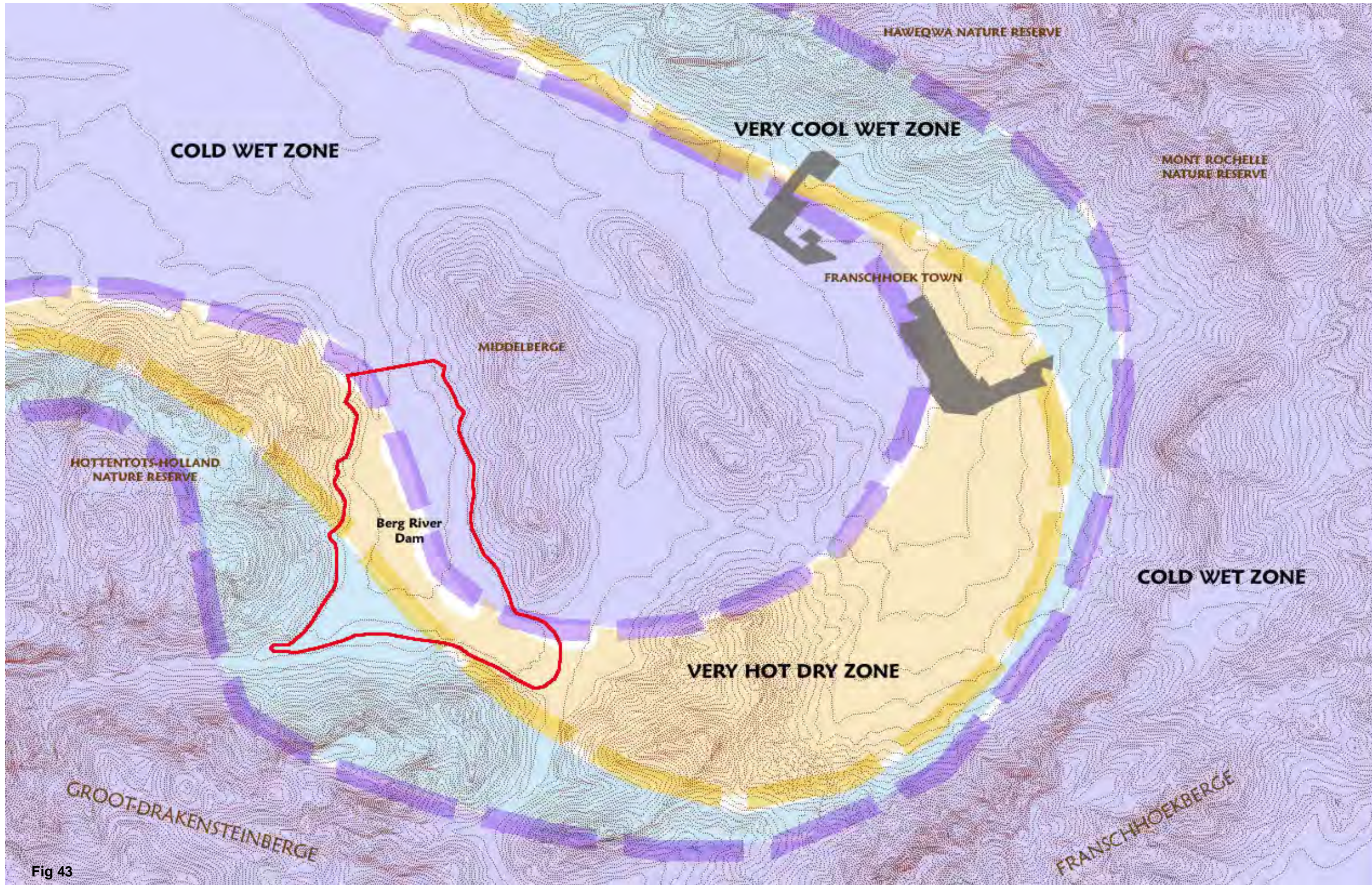
Fig 42. SOUTH AFRICAN CLIMATE & THE COMFORT ZONE [61]



Human comfort is primarily concerned with Humidity levels determined by local moisture and temperature levels.

Fig40. and Fig41. indicate degrees of human comfort, with a level of Least Comfort for the area in Summer and a level of Most Comfortable to Comfortable in the Winter months.

Localised temperatures vary however, as a result of the complex topography and aspect within the study area.



CLIMATIC IMPLICATIONS:

- Levels of discomfort in the Summer months suggest implications for development and will have to be counteracted with careful planning of buildings for increased ventilation and trees for shade in the landscape.
- Further implications in terms of increased fire risks must be adequately dealt with to limit impacts on development

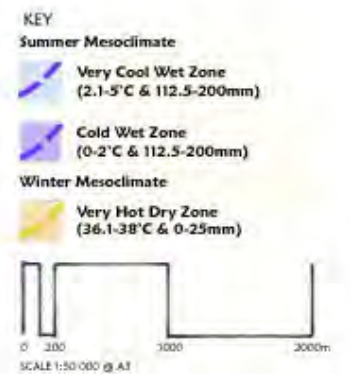


Fig 43

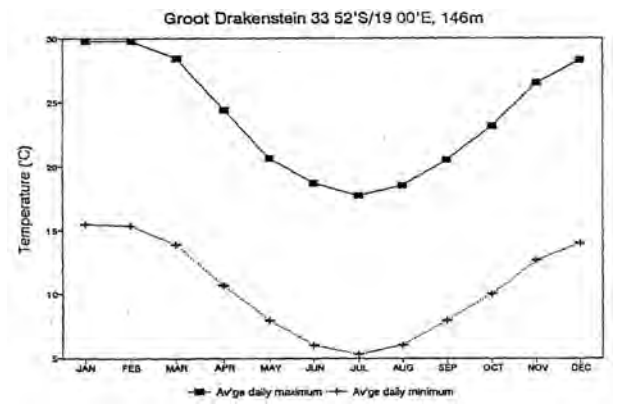


Fig.44 MAXIMUM AND MINIMUM TEMPERATURE [10]

Warmer north and west facing slopes appear are predominant within the Very Hot Dry Zone whilst concurrent cooler south and east-facing slopes appear to be the more comfortable slopes for site suitability.

Closest temperatures to the site were measured at Bien Donne Farm, located in the Berg River Valley, approximately 10km north-west of the Berg River Dam. Average Summer maximum and minimum daily temperatures was found to be in the order of 27°C and 13°C respectively (Dept of Environmental Affairs, 1986).

Corresponding Winter temps are currently 20°C and 8°C whilst average daily maximum temperatures, measured at Groot Drakenstein are 23,9°C with a minimum of 10,5°C (Fig44)[10]

Characteristically, dams have a moderating affect on local micro-climates. Unfortunately, low dam-levels correspond with high Summer temperatures which result in little moderating benefits for the surrounding edges of the water-body. Other issues associated with high temperatures are the level of water-stress imposed on plants. Drought may be an issue in the dry Summer months, whereas plants may be susceptible to the occasional frost in Winter.

WINDS

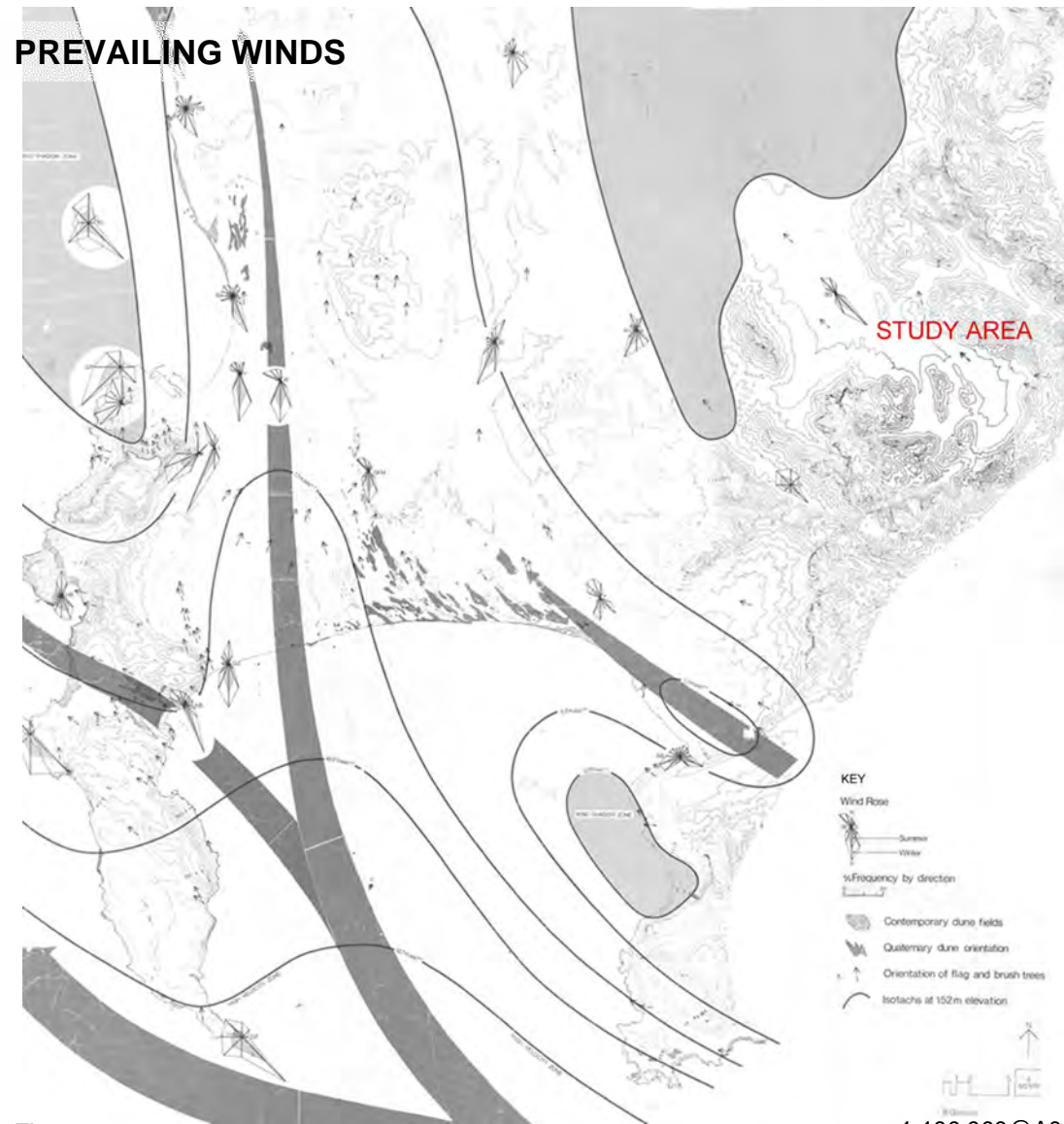


Fig 45.

1:100 000@A0 [59]



Fig 46.

1:100 000@A0 [59]

Wind patterns and associated rainfall in the Western Cape are largely prescribed by the alignment of the Cape Fold Mountains to the coast.

This mountain chain gives rise to windward-leeward patterns such as föhn-like 'berg' winds [9]. A ridge of high-pressure is said to extend from the South Atlantic anticyclone to the the coast of Cape Town [9]. In the Summer, this ridge pushes south to 37°S bringing with it shallow and dry south easterly winds. In Winter months, this ridge rises northwards once again to 32°S, giving rise to strong westerly winds. These Westerlies are associated with unstable weather conditions.

Localised topographical conditions play a large role in wind direction and velocity variations [1]. Wind data has been based on data from Bien Donne Farm, located in the Berg River Valley, approximately 10km north-west of the Berg River Dam. Fig47. indicates strong south-easterly winds during summer months followed by moderate north-westerly and south-easterly winds during the winter period. [10]

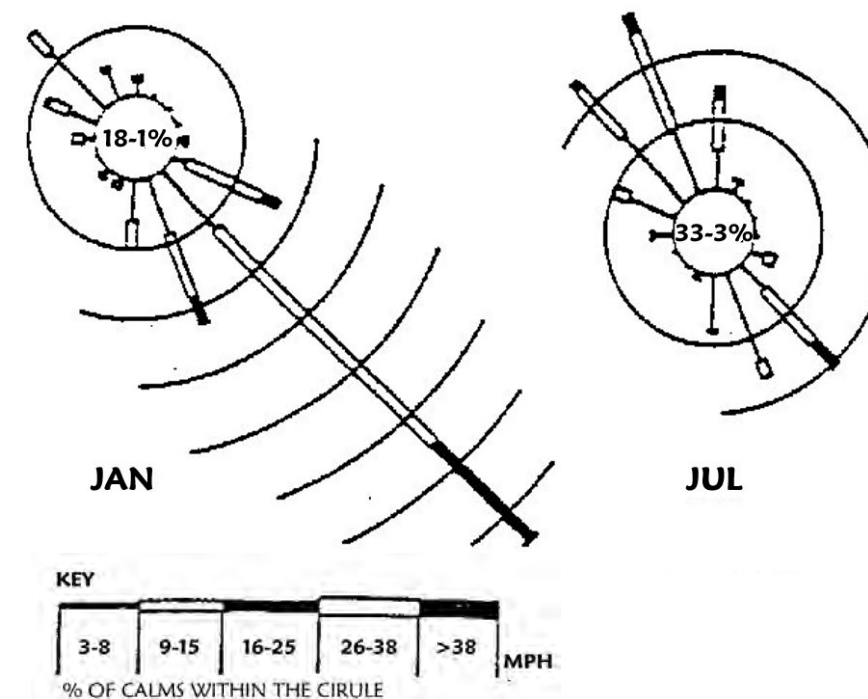
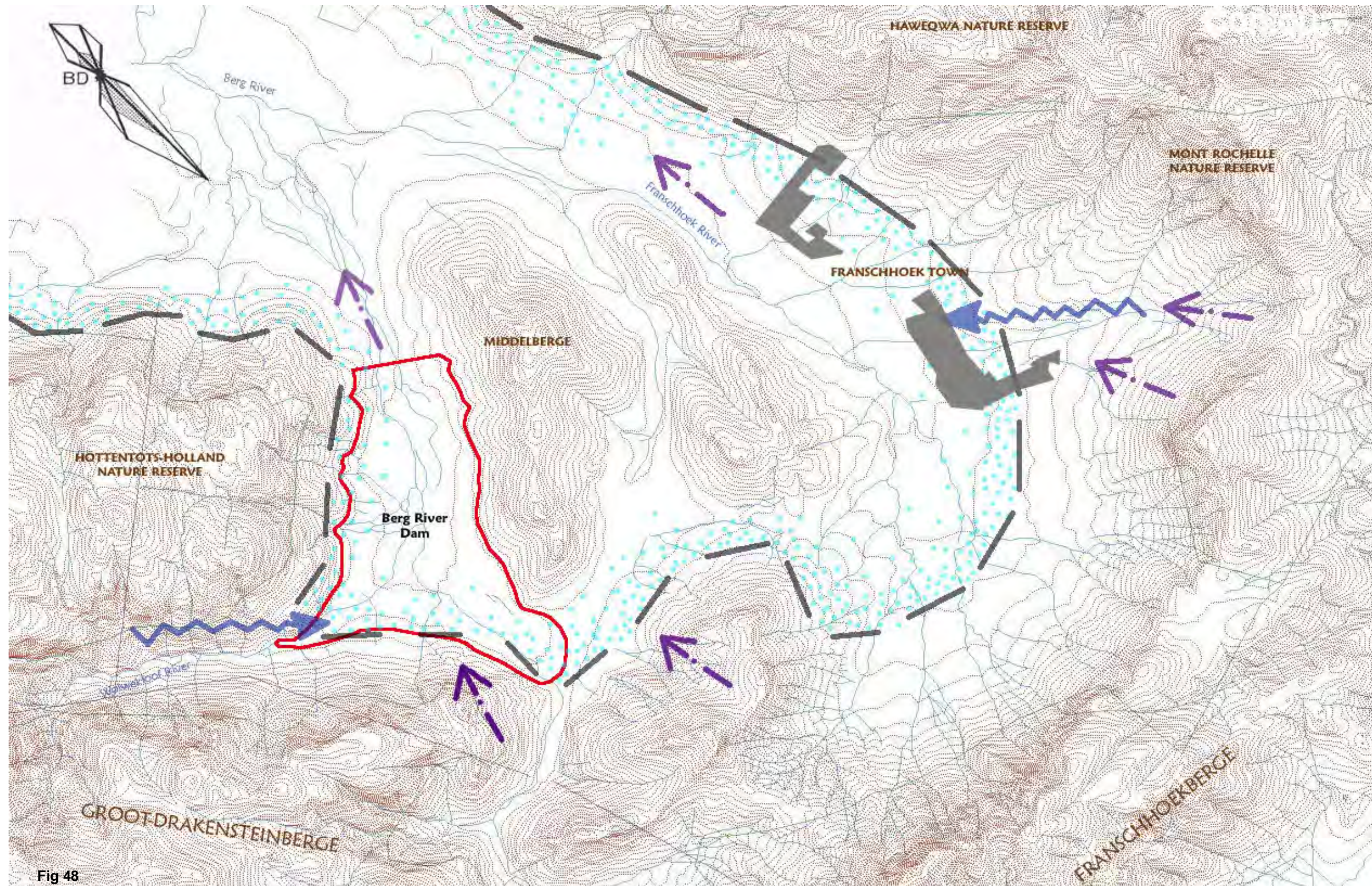
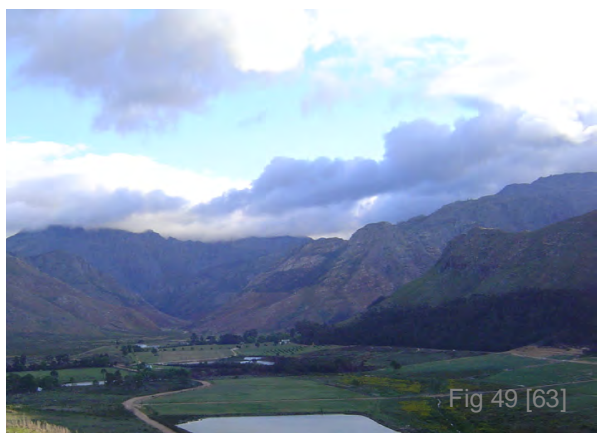


Fig47. WIND SPEED & DIRECTION AT BIEN DONNE [10]



WIND IMPLICATIONS:

- South-easterly Prevailing winds and north-westerly Winter winds pose implications for development. Optimum areas for development will have to be places in strategic positions that are sheltered from these particular winds.
- Katabatic winds largely affect the Wolwekloof valley with similar implications
- Local winds with their 'tunnel-affect' through the study area have direct implications and again, necessitate sheltered sites for development.



KATABATIC WINDS

These winds occur at night with the cooling of the land and the consequent movement of air masses to the low pressure zones off-shore (See Fig46.). The process is reversed during the day, as winds travel inland upward into the valleys.

A blanket of cloud usually accompanies these winds in the Franschoek Valley. (See Fig49)



WIND TUNNEL-EFFECT

The positioning of the dam site within its chosen location in relation to the prevailing winds creates a **wind-funnel situation**. Areas exposed to these winds will be create highly exposed and unsuitable positions for development.

PRECIPITATION

REGIONAL CONTEXT

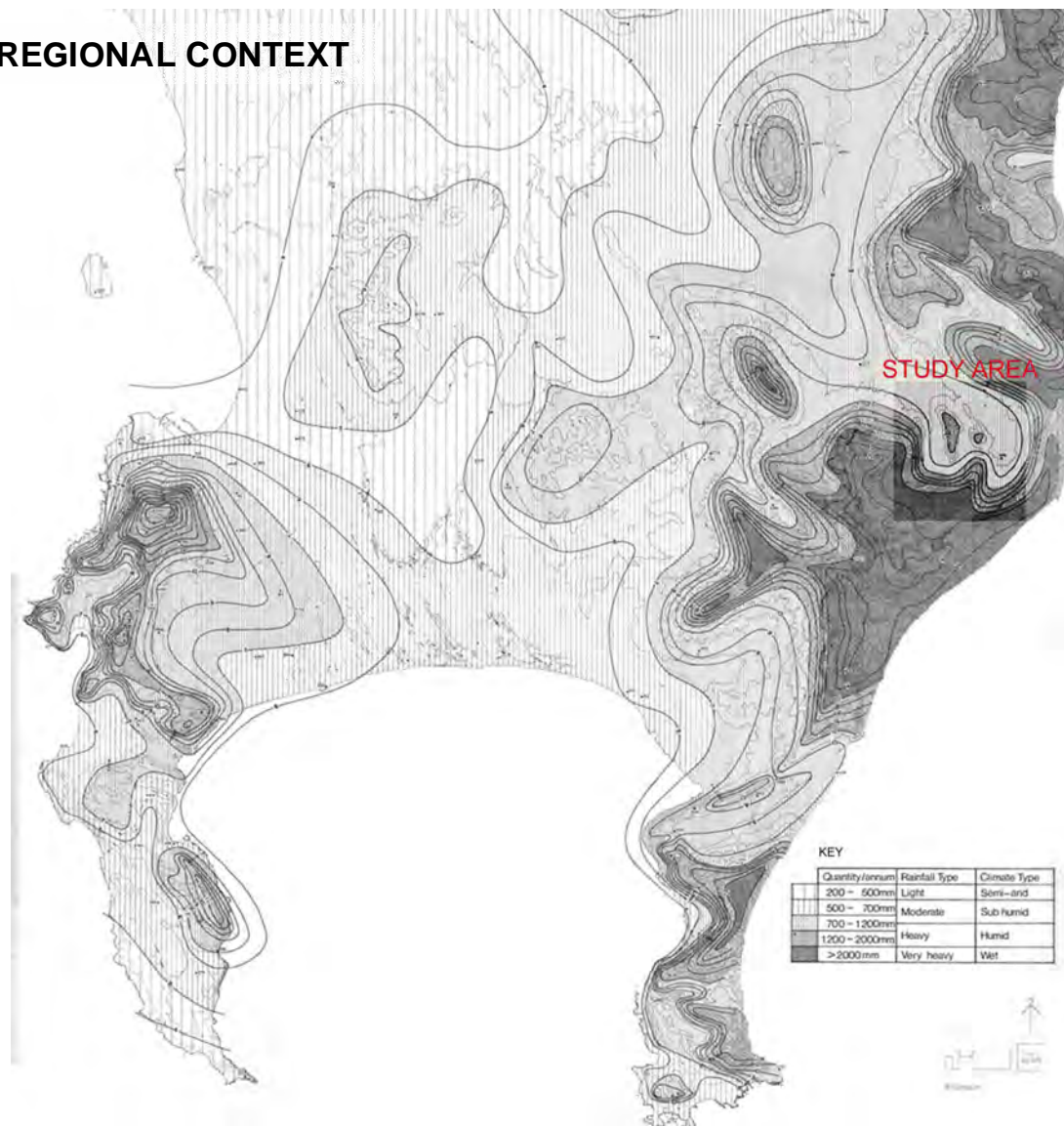


Fig 51.

1:100 000@A0 [59]

Winter rainfall in the Western Cape is directly related to topography yet mainly dependant on the location of the warm Agulhas Current off the south-east coast. Westerly winds occurring in Winter, captivate a constant moisture supply off these warm seas initially bringing about Frontal Rainfall. On approaching the Cape Fold Belt, this rainfall is forced to rise rapidly, resulting in Orographic rainfall.

The Upper Reaches of the Berg River are dependant on this rainfall, which arrives in the form of heavy down-pours during the months of May and August. Rain is cyclonic in nature [12] lasting for a few days followed by clear weather. Large spatial variability of mean annual precipitation occurs throughout the catchment area, with an average rainfall of 2600mm a year in the Upper reaches of the Berg [47] making our study area the recipient of the highest rainfall in South Africa.

Amounts decrease northwards with the decreased altitudes until only a mere 400mm is received at the mouth of the Berg River on Keldrif [10].

EVAPORATION

Another variant in terms of space and time is evaporation. Mean Annual Potential Evaporation (MAPE) in the study area is 1500mm/a, which is in fact lower than the general amount of MAPE in the Berg River Catchment as a whole. This exceeds 2000mm/a but again, marks a considerable seasonal variation. Typically in summer the monthly evaporation is in the order of 230-250mm, while in winter the value varies between 40 and 50mm.

MAPE at Bien Donne (137m ASL) has been measured as 777mm yet increases by more than 3000mm toward the higher peaks of the Groot Drankenstein mountain range. Precipitation and evaporation records over a short period are available for Assegaaibos (305m ASL), located close the Dam site (Dept of Environmental Affairs, 1986). MAPE is approximately 2108mm, with approximately 75% of the rainfall occurring during winter months of April to September inclusive (See Fig52).

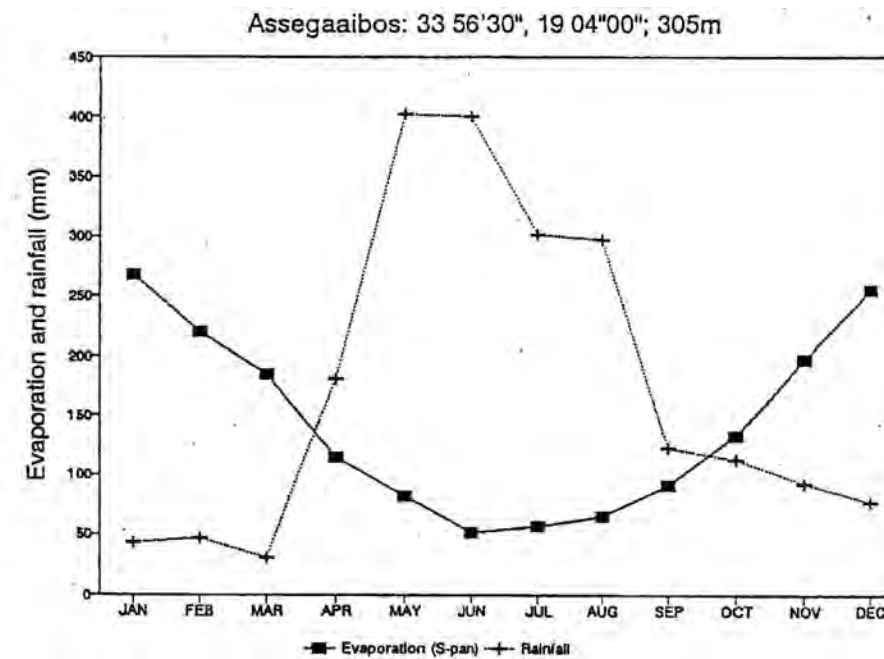


Fig 52. EVAPORATION AND RAINFALL MEASURED AT ASSEGAAIBOS

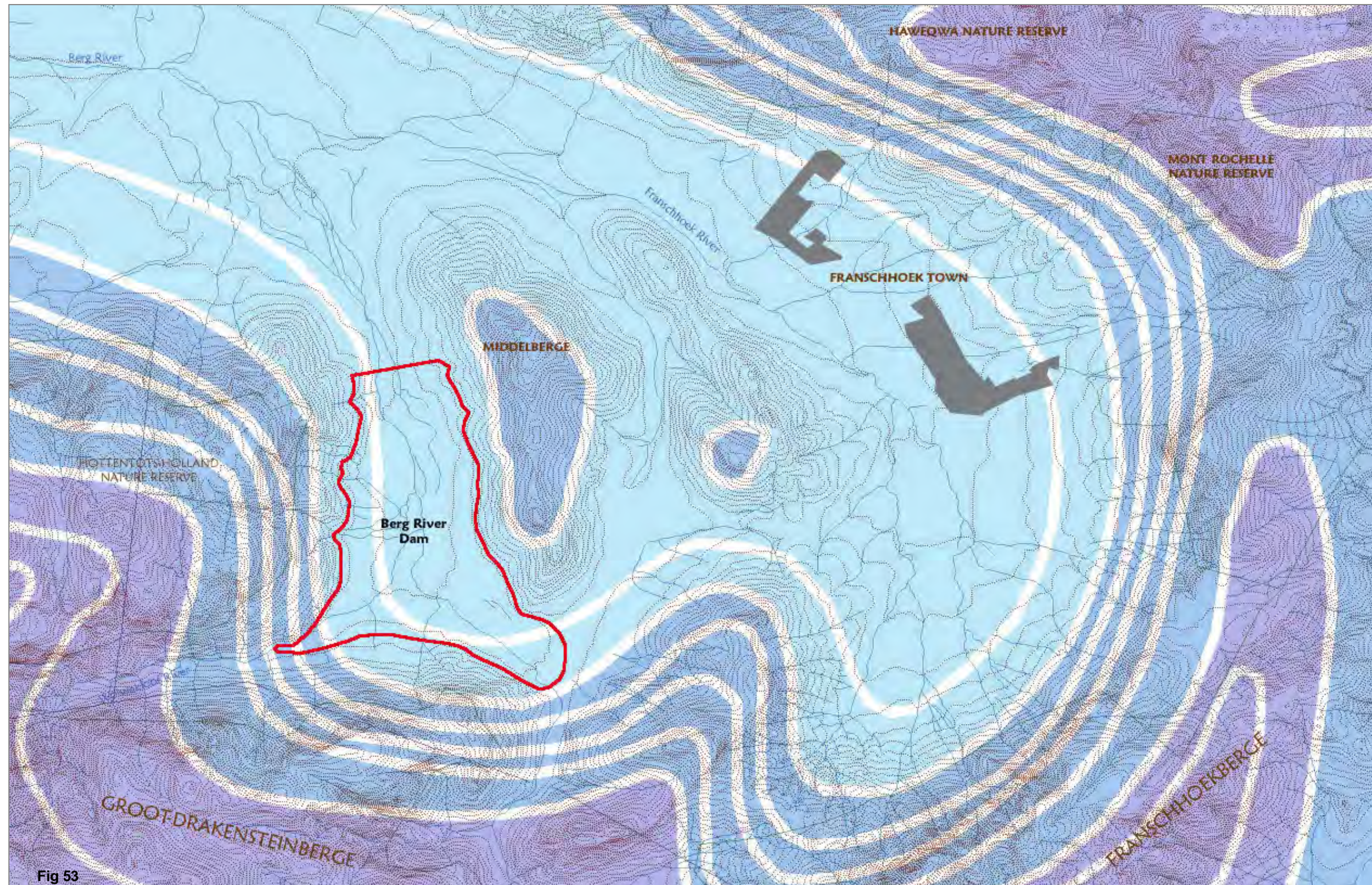
SNOW & FROST

Snow is known to fall on the upper slopes and the mountain peaks around the Franschoek valley during cold winters

Severe frosts are practically unknown [11] in the study area although Summer mists are said to buffer the climate and minimise certain aspects of the day-to-day variability [12].

HUMIDITY

Air humidities are seldom very low due to the influence of the prevailing southerly winds blowing off the sea in the summer months. Mist often occurs on the mountain peaks as a result of this moisture in the air.



RAINFALL IMPLICATIONS
Increased runoff of surface water from sudden rainfall in steep areas results in flooding of drainage channels and low-lying areas, causing potential discomfort for people in the area and the increased incidence of disease [28]

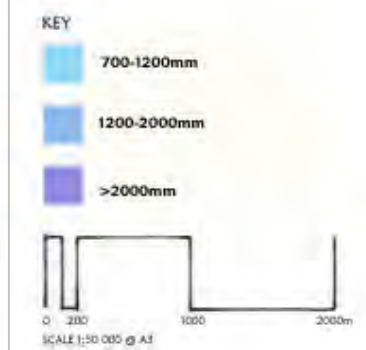


Fig 53

FLOOD HAZARDS

Sudden heavy periods of winter rain in the Berg River catchment leads to periodic flooding of the river systems in the area, with a rapid falling back to normal[11]. During summer, the flow drops back down to a very low level.

Localised flooding in the vicinity of the study area is insignificant compared to other areas around the Western Province such as in the Breede River catchment where major destruction was caused at Laingsburg and at Montagu respectively. (Kovacs, 1983)

VEGETATION

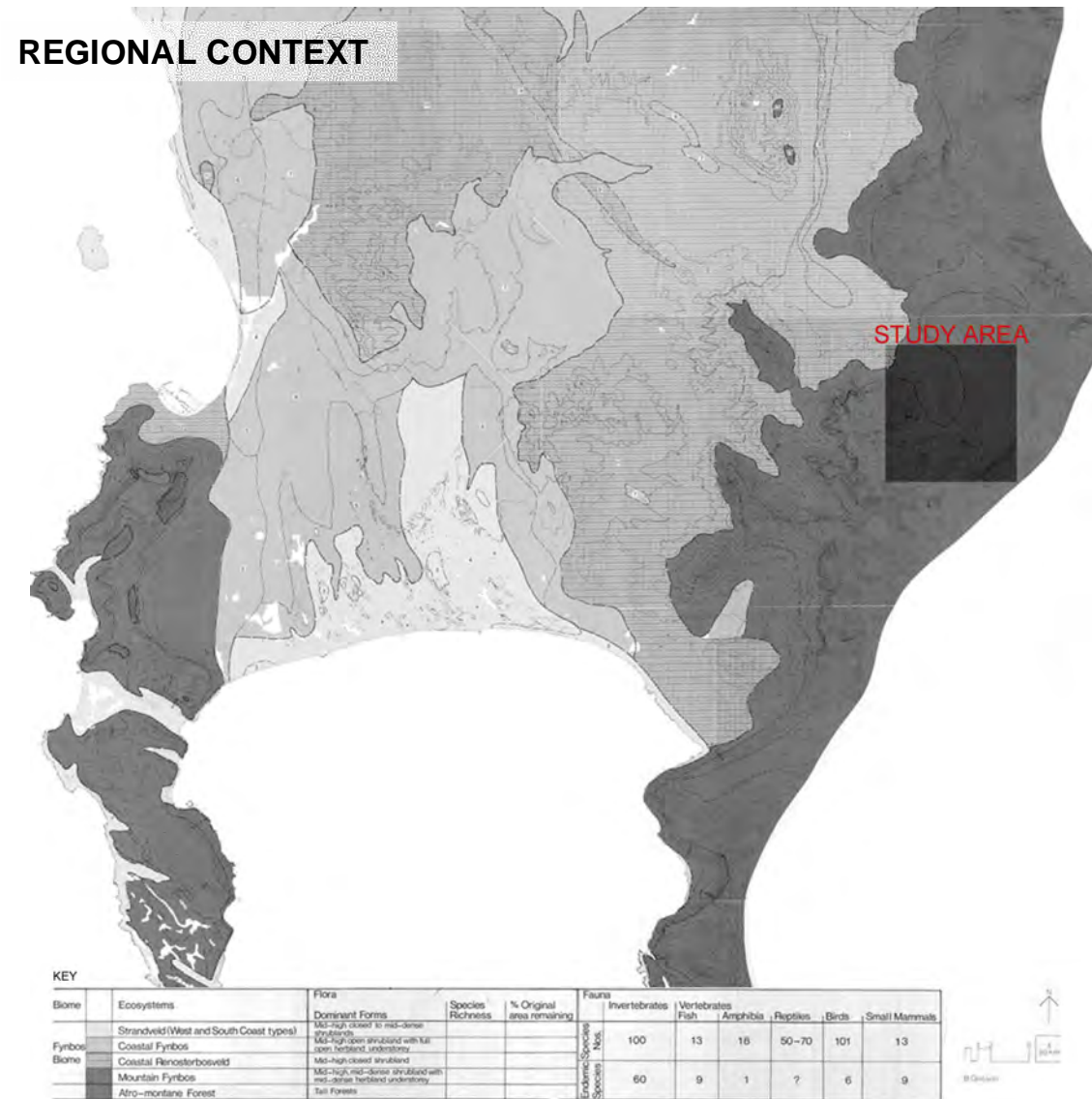


Fig 54. 1:100 000@A0 [59]

Dominant terrestrial ecosystems in this area of the country are a result of the combination of moisture, temperature, nutrient conditions and variations. The Fynbos Biome makes up one of these unique ecosystems and represents an area of relatively homogeneous physical and biological conditions [54].

Typically, *fynbos* consists of low growing (under 3metres high) grasses, shrubs and woody shrubland and is adapted to the summer droughts and nutrient-poor soils associated with the Cape Fold Belt mountain-valleylands. The biome itself, consists of over 8700 species, 68% of which are endemic, whilst it contributes to 65% of rare and threatened species in the southern African region. [54] These phenomenal statistics make it no surprise that this biome is known as one the world's six floristic kingdoms, and consequently 16,7% of it is conserved [54].

The areas around the Cape Fold Belt are said to have the greatest concentration of species diversity within the Fynbos biome.

In particular, Sir Lowry's Pass and the Hottentots Mountains house 26% of all species, due to the areas great physiographic, geological and climatic variations [54]. *Mountain fynbos* dominates the higher areas and is generally well conserved and pristine due to the fact that the land is not generally suitable for agriculture, forestry and other forms of development. Lower elevations are highly disturbed however, and have been largely utilised for cultivation by State Forestry.

The EIA survey carried out in April 1996 (Fig55b) reported highly modified remnant vegetation around the site of the proposed dam. The findings were classified into three very diverse, but major plant communities which are said to strongly correlate with underlying geology, and to a lesser extent rainfall and other climatic variables [12]. These communities are Non-riverine Dryland vegetation, Riverine Vegetation and Exotic vegetation.

For the purpose of this analysis, we will be focusing primarily on vegetation communities above the specified level of inundation of the Dam, which is 250m ASL. Existing natural communities however, must be considered in terms of fitting the pieces of the 'flora puzzle' together once the dam fills and level-fluctuations come into play.

NON-RIVERINE DRYLAND vegetation dominates the western slopes and foothills of Middenberg and eastern slopes of Afrikakop and is differentiated into 3 groups;

•Sandstone slope vegetation

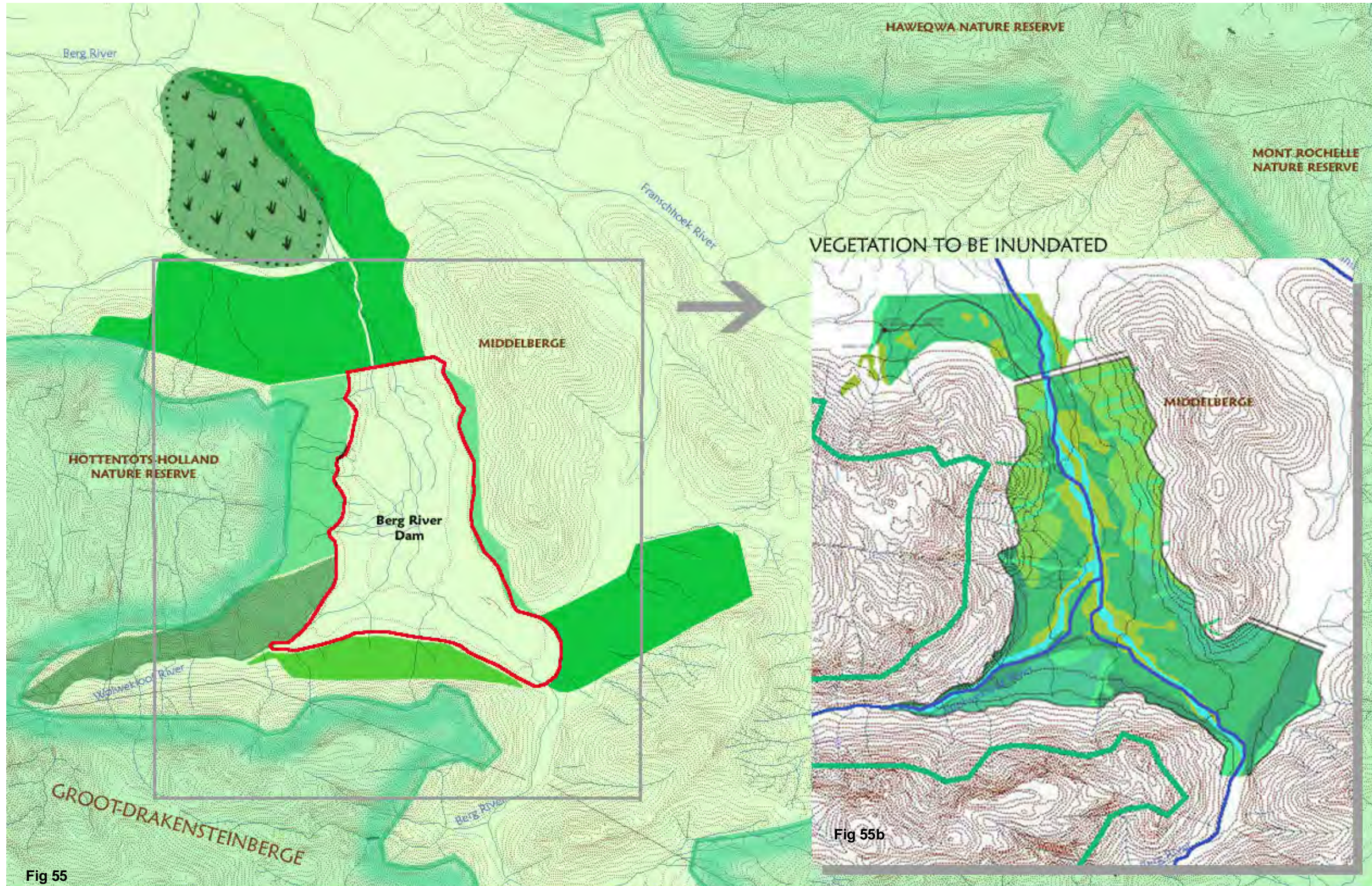
Primarily based on TMS, typical vegetation is fynbos. Previously forested and after the occurrence of a fire in 1994 [10] this vegetation is still found to be in recovery, yet is found to be very similar to that of the lower slopes around the Franschhoek Valley [10].

•Kilpheuwel and Post-Klipheuwel Formation vegetation

Although no direct accounts on these substrates has been found in the literature [10] a similarity can be drawn between vegetation observed in this instance to that of a community found on the lower granite slopes of the Swartboschkloof in the Jonkershoek Valley (McDonald, 1988) [10] Furthermore, seeps along the base of the Klipheuwel layers, where conglomerates, sedimentary breccia and subgreywackes form the substrate, are dominated by *Pteridium aquilinum*

•Heeria-Maytenus rocky outcrop community

Rocky outcrops in this area are said to support remnants of the *Heeria argentea-Maytenus oleoides* community, which is endemic to the Western Cape [10]. It is conspicuous among fynbos however as it dominated by a tree-like habit compared with the typical shrub-habit of most fynbos species. Deeper sand deposits in the valley bottom, however, accommodate distinct indigenous species [10] with exotics inhibiting their growth.



VEGETATION IMPLICATIONS

•Although the clearing of exotic invasive vegetation is essential for effective catchment management, rapid clearing can result in faster surface runoff, leading to increased soil erosion which in turn may cause water pollution [28]

RIVERINE habitat is primary associated with the Berg River and its minor tributaries and it is this section that is therefore due to be inundated. First documented record of the Berg River vegetation is by Barrow (1806) who records that, in 1797, the uncultivated parts of its banks are covered in “thick shrubbery, aquatic moss and sedge”. Today’s scene however, is very different.

•Mountain stream zone

Extending upstream from the Dam, from Berg River syphon to river source, this section retains a large portion of indigenous species. Many exotics are present however. See illustration, Fig 56.



MORE IMPLICATIONS

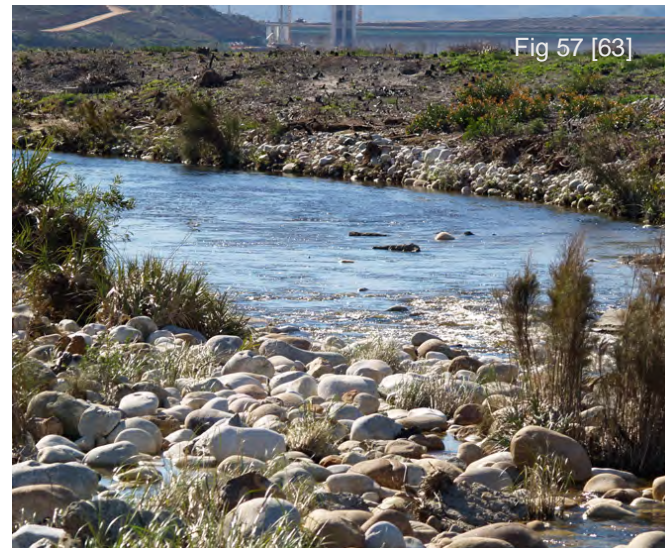
•Sensitive wetland areas down-stream of the dam-wall should be conserved for low-land fynbos and as wetland

VEGETATION continued...

RIVERINE HABITAT continued...

•Foothill, stony run zone

From upstream of the Dam to below Wellington the zone characterised by quartzitic stones and boulders forming channel bed. Large patches of *Isolepis digitata* was reported to be seen on the stony bottoms of this section of the river (Harrison and Elsworth, 1959 and Harrison, 1964), however this species is now rarely seen due to the recent changes in flow strength in the main channel.



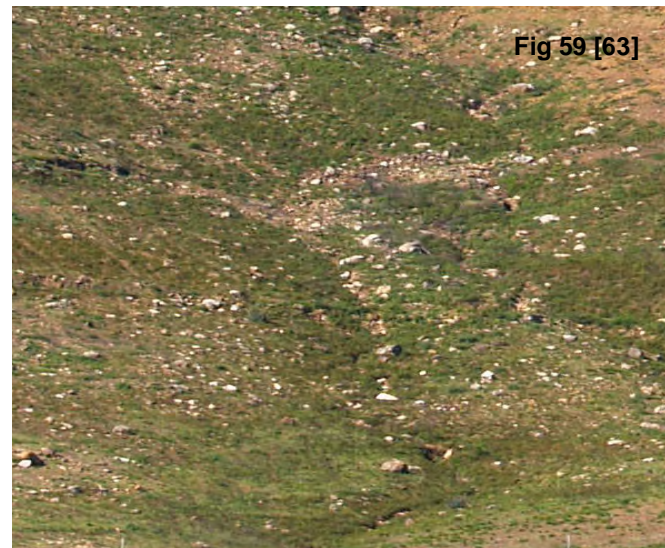
•Wet river bank vegetation

The moist sand on the exposed river banks bordering the channel with cobbles should support patches of *Prionium serratum* as it functions as a bank stabiliser. The lack of this however [12] may account for the many eroding banks observed- particularly near pines and eucalyptus.



•Dry sandy valley bottom vegetation

Boucher (1987) found that the *Polygono-Stoebetum vulgare* community typically occurred in the upper dry riparian zones of the Western Cape rivers in association with loamy or silt-laden alluvial sand on banks covering boulders or cobbles. Remnants of this community are found in the lower flat valley areas to be inundated by the dam. This riparian vegetation is not unique to the Berg River however [10]



Exotic species were assessed by Boucher in 1996, as the most dominant river bank plants in this zone of the river. Boucher noted that virtually the entire Berg River between the Franschhoek Road Bridge to below Paarl had been high disturbed and manipulated for human purposes. The consequence has been an invasion by the more resistant exotic species; with their competitive advantage over the indigenous species as they lack their natural biological control mechanisms that were not introduced along with the original stock and they have therefore flourished [10].

The fynbos biome, and the riverine zone in particular, is vulnerable to invasion by woody exotic vegetation. [10] Since 2001, Working for Water have been active in the area however, clearing the thirsty invasive species from the dam basin in preparation for optimal water-storage.

Previously, approximately, 17km² (22%) of the catchment of the Berg River Dam supports plantations of *Pinus* species. Other exotic species include *Eucalyptus sp* (gums), *Acacia mearnsii* (black wattle) and *Acacia saligna* (port jackson) [10] Pines appear to be the dominant exotic plant, except in the riverine areas, where the Acacias' gain superiority.

FYNBOS & FIRE

As well as binding the soil and preventing erosion, the relatively low biomass of Fynbos ensures conservative water use and low-intensity fires. This in turn ensures high water yields and low impacts on the soil from periodic fires. Invasion of the fynbos vegetation by exotic woody shrubs and trees, however, increases biomass and reduces runoff [41].

Fires in fynbos areas is said to contribute to increased sediment yields over short periods (DWA, 1992d) [10] which is a concern, as Fynbos requires fire for natural re-growth. Fires are therefore a concern throughout the study area and measures should be taken so as to limit fires directly around the dam, to avoid the sedimentation of high quality water.





NON-RIVERINE DRYLAND SPECIES		
TYPE/ AREA	INDIGENOUS	EXOTICS
1 Sandstone Slope Vegetation		
Upper Stratum	<i>Othonna cf. quinqueidentata</i>	
Lower Stratum	<i>Muraltia macropetala</i>	
	<i>Ficinia bulbosa</i>	
	<i>Oftia africana</i>	
	<i>Flagodiola uniolae</i>	
	<i>Setago serrata</i>	
	<i>Sarruria sp.</i>	
Drainage Lines	<i>Juncus capensis</i>	
2 Klipheuwel and Post Klipheuwel Formation Vegetation		
Yellow Flinthites	<i>Tetraria bromoides</i>	
Seeps	<i>Peridium aquilinum</i>	
3 Heeria-Maytenus rocky outcrop community		
Valley Bottom	<i>Passerina vulgaris</i>	<i>Acacia longifolia</i>
	<i>Rhus angustifolia</i>	<i>A. mearnsii</i>
	<i>Stoebe vulgaris</i>	<i>Eucalyptus sp.</i>
	<i>Peridium Aquilinum</i>	<i>Pinus pinea</i>
	<i>Brabejum stellatifolium</i>	
Drainage Lines	<i>Ischyrolepis subverticillata</i>	
RIVERINE SPECIES		
4 Mountain Stream Zone		
Trees	<i>Brabejum stellatifolium</i>	<i>Acacia longifolia</i>
	<i>Quornia capensis</i>	<i>A. mearnsii</i>
Shrubs	<i>Brachylaena neriifolia</i>	<i>Briza maxima</i>
	<i>Cryptocarya angustifolia</i>	<i>Ipomoea purpurea</i>
	<i>Erica caffra</i>	<i>Pinus pinaster</i>
	<i>Metrosideros angustifolia</i>	<i>Plantago lanceolata</i>
	<i>Passerina vulgaris</i>	<i>Sesbania punicea</i>
Restionaceae	<i>Ischyrolepis subverticillata</i>	
Ferns	<i>Gleichenia polypodioides</i>	
	<i>Lyopodium gnidioides</i>	
	<i>Todea barbara</i>	
5 Foothill, Sony run zone		
Sedges	<i>Juncus punctarius</i>	<i>Acacia longifolia</i>
	<i>Juncus lomatophyllus</i>	<i>A. mearnsii</i>
	<i>Mariscus sp.</i>	<i>Hypochoeris radicata</i>
Grasses	<i>Ehrharta villosa</i>	<i>Paspalum dilatatum</i>
	<i>Eragrostis samentosa</i>	<i>Pinus sp.</i>
Restios	<i>Ischyrolepis subverticillata</i>	<i>Sesbania punicea</i>
Other	<i>Persicaria attenuata</i>	
	<i>Metrosideros angustifolia</i>	
6 Wet river bank vegetation (seeps & drainage lines)		
River-bank	<i>Prionium serratum</i>	<i>Acacia longifolia</i>
	<i>Salix mucronata</i>	<i>A. mearnsii</i>
	<i>Juncus lomatophyllus</i>	<i>Eucalyptus sp.</i>
	<i>Persicaria lapathifolium</i>	<i>Pinus pinaster</i>
	<i>Isoplepis prolifer</i>	<i>Brabejum stellatifolium</i>
Bank Stabiliser	<i>Prionium serratum</i>	
Trees	<i>Brabejum stellatifolium</i>	
	<i>Maytenus oleodes</i>	
	<i>Metrosideros angustifolius</i>	
	<i>Kiggelaria africana</i>	
	<i>Podocarpus elongatus</i>	
7 Dry sandy valley bottom vegetation		
Water-lovers	<i>Cynodon dactylon</i>	
	<i>Ficinia brevifolia</i>	
	<i>Oftia africana</i>	
	<i>Stoebe vulgaris</i>	

EXISTING PLANT SPECIES & ILLUSTRATIONS [52]



Juncus capensis- Sandstone Slope Vegetation typical of drainage lines



Erica caffra- Mountain Stream Shrub



Brabejum stellatifolium- Heeria-Maytenus Valley-Bottom species



Stoebe sp.- Heeria-Maytenus Valley-Bottom species



Ischyrolepis subverticillata- Foothill Restio



Kiggelaria africana- Wet-river bank tree



Salix mucronata- wet-river bank tree



Podocarpus elongatus- Wet-river bank tree

MORE IMPLICATIONS
 • Development should promote the re-establishment of existing communities, rescuing plants from the dam basin would be useful in initiating this re-establishment.

Fig 61. Plant list of those located in inundated area

ANIMAL HABITATS • MIGRATION ROUTES

REGIONAL CONTEXT

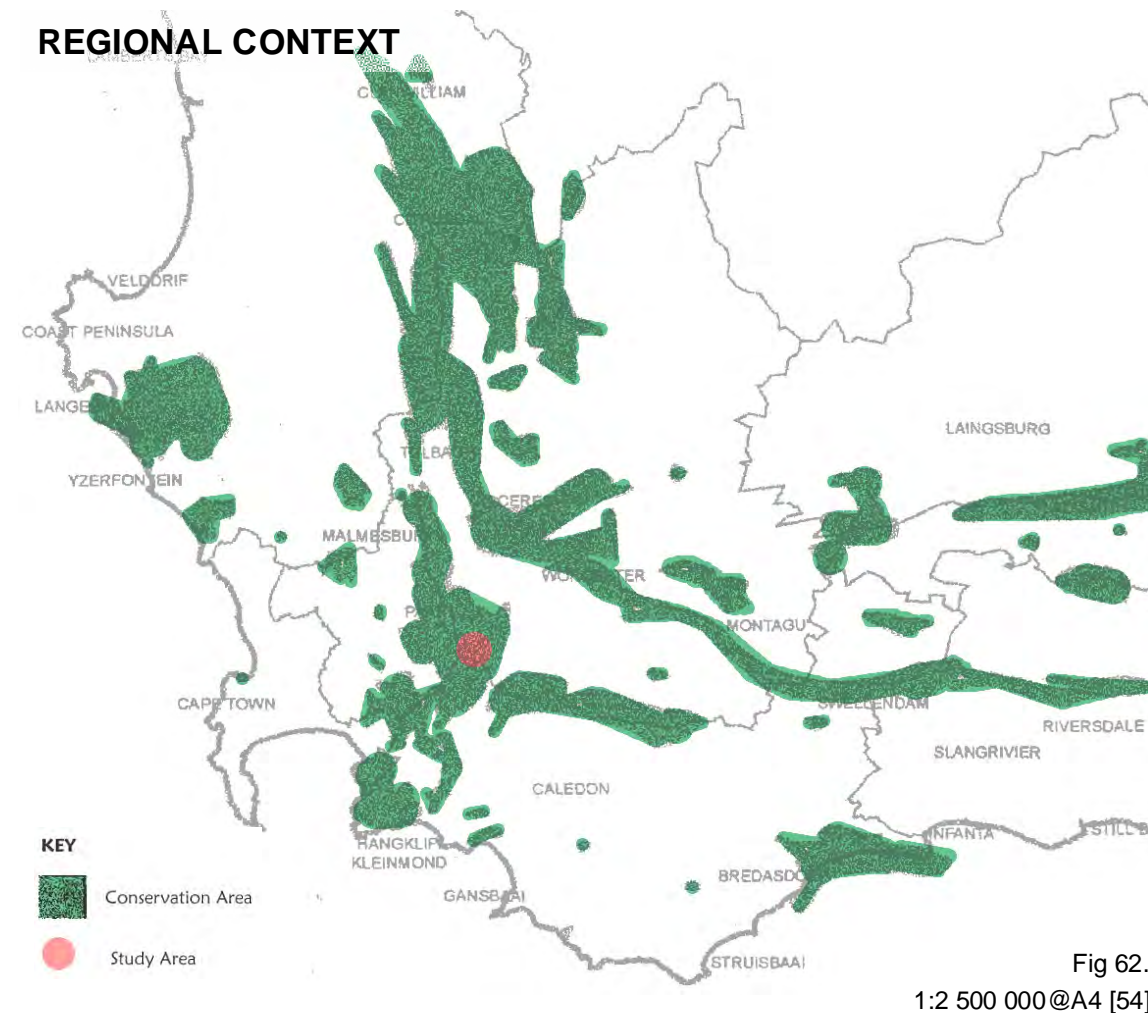


Fig 62.

1:2 500 000 @ A4 [54]

Creatures are very specific to their environments and therefore fauna inhabiting this area are directly related to their vegetative food resource. The Fynbos Biome is in fact, not a productive food producer for mammals, as most plant species are unpalatable and are therefore not suitable for grazing [54]. The greatest number of endemic animals found in this biome are resultantly, invertebrates. This group is further broken down into the two different environments that occur here, the terrestrial and aquatic. Fig62 Indicates the distribution of conservation areas throughout the Province, indicating a large portion occupying the inaccessible and uncultivated areas of the mountain regions [54]. The movement of animals throughout this network would be optimal, but for now, we can seek to maintain these corridors at the local scale.

As rivers are linear-ecosystems, activities occurring at a point can have resultant implications for considerable distances downstream. The “river-type” in this context is considered by river ecologists as ‘threatened’ [10]. The Upper Berg River, however, is said to still contain a number of rare and endangered species [12]. In November 1991, Dallas and Day undertook a comparative survey of the invertebrate fauna and water quality of the Berg River. They concluded that this fauna between Dew Dale farm and the Berg River siphon had changed little since 1951 (DWAf, 1992c).

However, obvious changes within the area of the proposed dam, have occurred due to a faunal community by chironomids (non-biting midges) indicating mild organic pollution. [10] It has been said that further changes to the faunal communities in the Upper Berg River have been a result of effluent from Dew Dale trout farm and the release of water from Theeswaterskloof [10] which have changed the chemical balance within the river waters.

A number of small **mammal** species such as klipspringer, grysbok, mongoose, mice and baboons are likely to occur within the site of the dam, as well as the rare leopard (*Panthera pardus*) [47] No animals are expected to need resettling as no islands are predicted to be created which can trap them as the water rises once impoundment starts.

A lack of **avi-fauna** diversity in the Fynbos has been accredited to the uniform structure of the fynbos and therefore its inability to provide niches and shelter-belts [9]. This results in no more than 6 endemic bird-species, including *Chaetops frenatus* (Cape Rockjumper) and *Nectarinia violacea* (Orangebreasted Sunbird). Further downstream however, at the Berg River flood-plain or estuary, the area is regarded as an internationally important bird-life area [10] and the most important wetland on the west coast. This area would obviously be vulnerable with the damming of the Berg River.

According to the EIA, the study area does not appear to support any endemic or threatened herpetofauna [10]. However, further studies have suggested a large **reptile** component, consisting of 30 snake species, 6 tortoise species, 30 frog and toad species as well as 50 lizard species [9].

The Berg River catchment streams are highly unique eco-systems with their summer low flows and winter flooding, creating a high diversity of habitats and specialised array of aquatic fauna [9]. Of the 300 species of aquatic fauna in the Cape Floristic Region, 65% are endemic [9] and many of these families are abundant in the study area, particularly upstream of the

Theewaterskloof siphon [9]. The impact of dams on these eco-systems, according to Davies and Day (1998) is fatal. The damming of rivers disrupts the continuity of the riverine habitat, and therefore disrupting migration routes of animals. These movement corridors exist in both the riverine environment, as well as across it. Fig63 Illustrates a ‘seep’ line which accommodates the movement of species from the upland, down into the rivers.

However, as suggested previously, the artificial ‘flood plain’ that will be created with the fluctuating water levels of the dam, will have some positive effects on existing biotopes. Some species possess the ability to adapt to new aquatic environments and may live through the changes from river to lake, even proliferating in the new system [57]. Some species of fish such as the Cichlidae family (‘tilapias’ or bream) fall into this group [57].

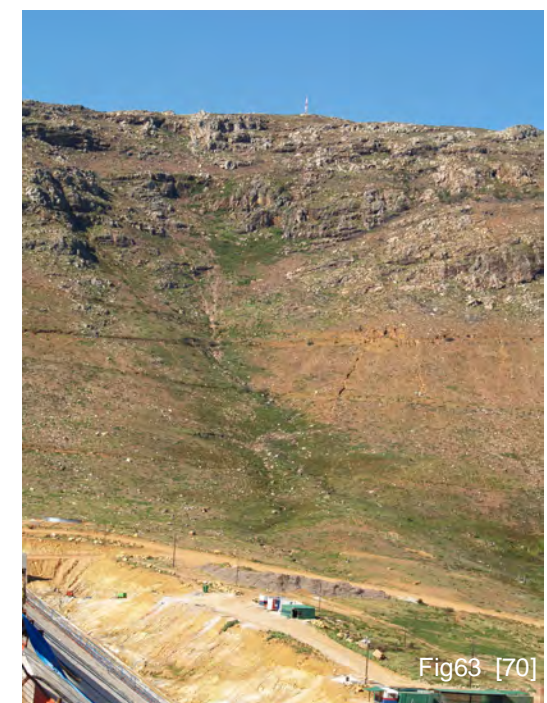
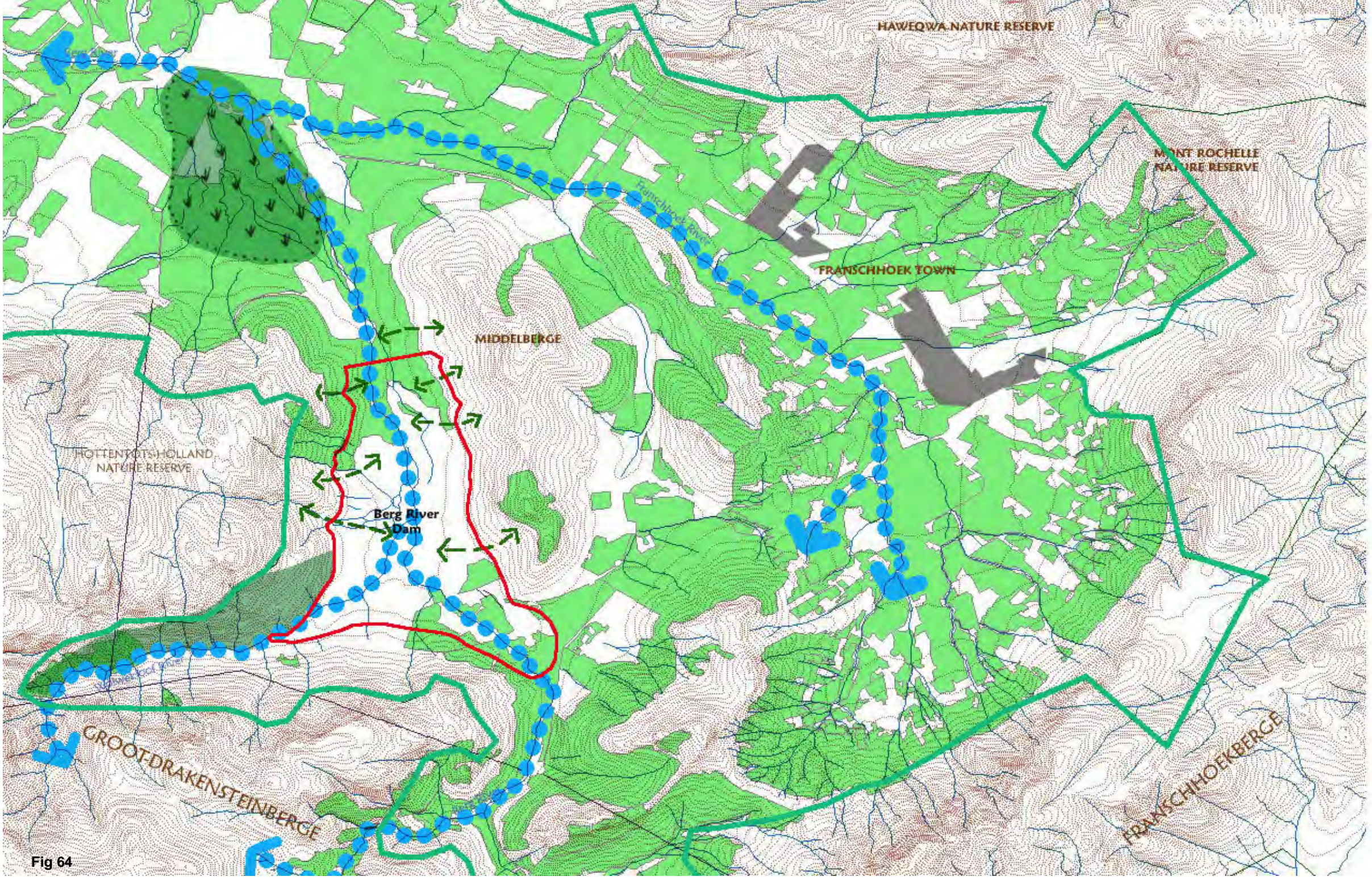


Fig63 [70]



VEGETATION IMPLICATIONS
 Clearly the creation of a transition or buffer zone that will act as a bridge between the two different environments in this area is essential. This holds implications for developments, as set-back distances must be stipulated in order to accommodate this 'linking' or eco-systems.



Fig 64

Although they have no angling value, indigenous fish are a very important component of the food web and ecosystem of Cape Town's rivers. This is because with so few indigenous fish species occurring, the value of each species within the food web increases. These species are referred to as keystone species. The future survival of indigenous fish in Cape Town rivers is dependent on adequate flow, good habitat diversity and quality and minimising the impact on invasive alien fish and plans [20].

It has been discovered that the foothill zone of the Berg River contains some rare and endangered kinds of fish [10] including *Barbus andrewi* (witvis) and *Pseudobarbus burgi* (Berg River redfin) and *Galaxius zebratus* (Cape galaxias)[12].

The Exotic trout species has become well established in the main river (Fourie and Steer, 1971) and distribution extends upstream of the dam wall (Gale et al. 1996) *Tilapia sparrmanii* (banded tilapia) endemic to the warmer waters of Natal, may also occur upstream from the dam wall.

Fishways allow migratory species of fish to pass up and down the river to their feeding and spawning ground[57]. Any wall across a river acts as a barrier to the free movement of aquatic organisms.

There was once a fishway on the Berg River, but has disappeared under tonnes of silt deposited over the years [57]. Unfortunately, the Berg River Dam is too large a construction to incorporate this feature, even so it would not be effective.

HISTORICAL & CULTURAL ARTEFACTS

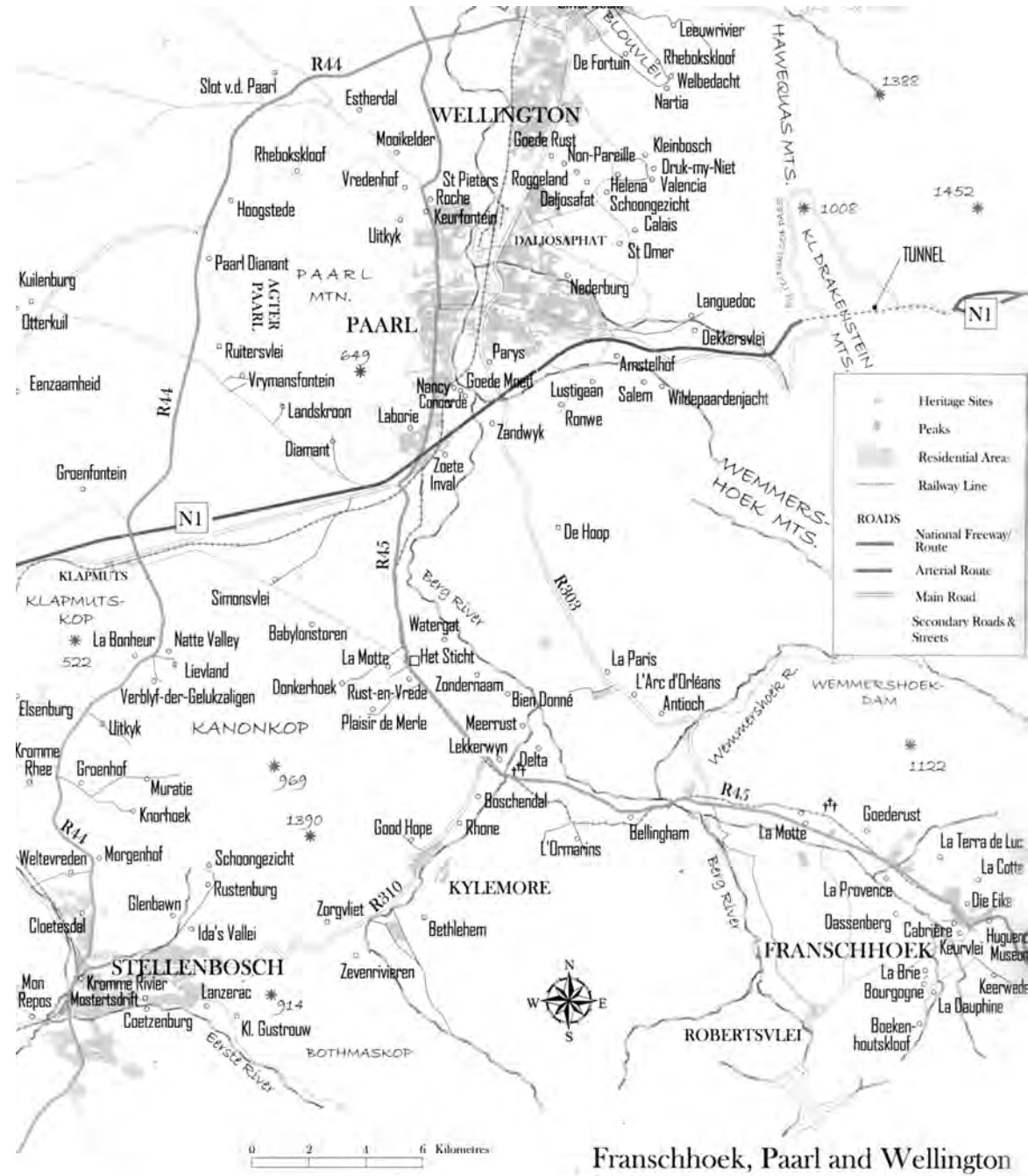


Fig 65. Franschhoek, Paarl and Wellington [8]

The civilisation of man has been on the southern tip of Africa for thousands of years and can be traced back to the Stone Age, 30 to 40 000 years ago. Evidence of these peoples in the Franschhoek Valley has been found in the form of rock paintings in the Wemmershoek Valley [15].

The first seafarers and explorers arrived in the Cape in the 15th century, recognising 2 basic groups of people inhabiting the Cape; the herders or Khoikhoi, whom the Europeans referred to as the "Hottentots" and the hunter-gatherers or San, whom they called "Bushmen". The Khoi herders were said to use the Drakenstein Valley as their grazing land in the 17th century [15].

The valley itself however, has a unique historical background relating to the French and Dutch settlers, yet before colonial civilisation arrived, the valley was known as the 'Oliphantshoek'. This relatively remote valley, protected by mountains on three sides was home to Elephants, seeking isolation for the raising of their calves. It is said that these herds were encountered by the first European settlers,[56] and in 1692 a chap by the name of Heinrich Muller from Basel, was allocated the first farm in the area, and named it 'Keerweder', meaning 'turn back'. This perhaps indicates the enclosing nature of the valley and the mountains as a then impassable barrier.

French Huguenot refugees and free blacks from India, Batavia and Macassar settled in the area in the early 18th century, in order to supply ships passing the Cape with grain. Farms in Drakenstein were allotted to Dutch and German free burghers in 1688, on the Cape Town side of the Berg River, yet permission was obtained to obtain better farms, when the poor quality of the soils was realised. Permission was approved and in October 1694, nine farms were allocated to settlers in the 'Oliphantshoek', including La Motte, Cabriere, La Cotte, La Terra de Luc and La Provence. [56]

The name Franschhoek originated in 1713 when it was referred to as 'de france hoek' meaning 'the French corner'. The name was due to the fact that most of the inhabitants of the valley were then French-speakers. The name eventually evolved into Franschhoek in 1805. This was the same name given to the Municipality which was created in 1881. [56]

Livestock farming in the 18th century was significant in the area particularly on the farms Driefontein c 1795, Berg Rivers Hoek c 1839 and Skuifraam c 1813, which are located within the dam-construction area [15]. The historical remains of buildings associated with these farms have been located (See Fig68)

By the mid 19th century, Franschhoek had become a self-sufficient town, based primarily on viticulture introduced by the French Huguenots [15]. Large scale forestry and fruit production began in the later part of the century, when these three farms were purchased by the state and developed as the La Motte Plantation. Labour were housed in forestry hamlets, one of them being Robertsvlei c 1917 [15].

The town of Franschhoek began as a small town nucleus, developing around the spot where the Dr church was erected in 1833 and still is today. Significant historical buildings include the Huguenot Monument, many old streets and several homesteads including Klein Cabriere c 1858 and La Dauphine c 1804 [8].

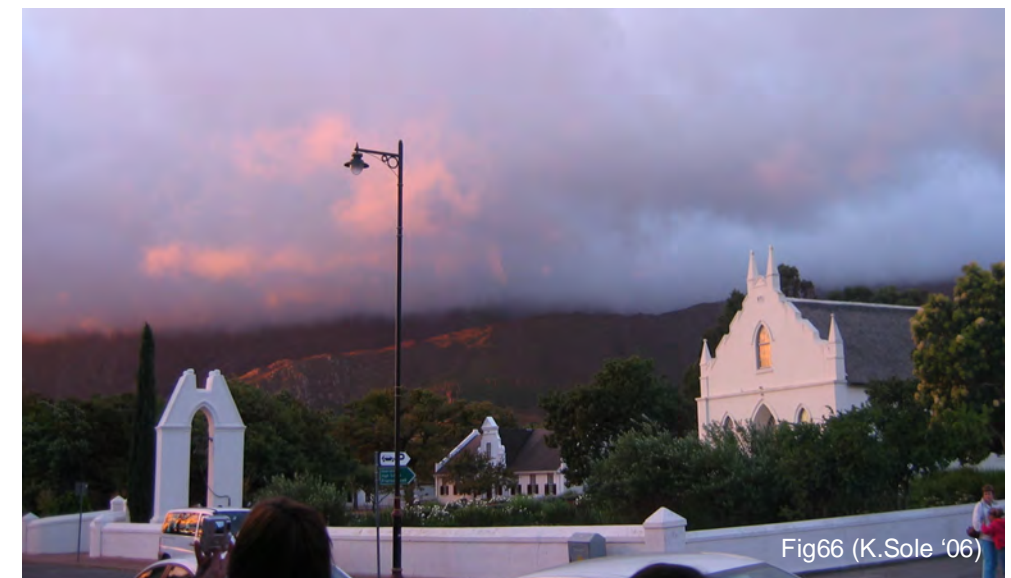


Fig66 (K.Sole '06)

Robertsvlei
A CATCHMENT
HAMLET



HISTORICAL IMPLICATIONS
The Franschhoek Valley is typical of a 'Boland landscape' which has been nominated for World Heritage Site Status and therefore any development should pay heed to specific guidelines informing built environments in the valley. Record should be made of the remaining ruins and graves prior to inundation and appropriate means of memorialising the heritage significance of the valley formulated [15].



Fig68 [49]

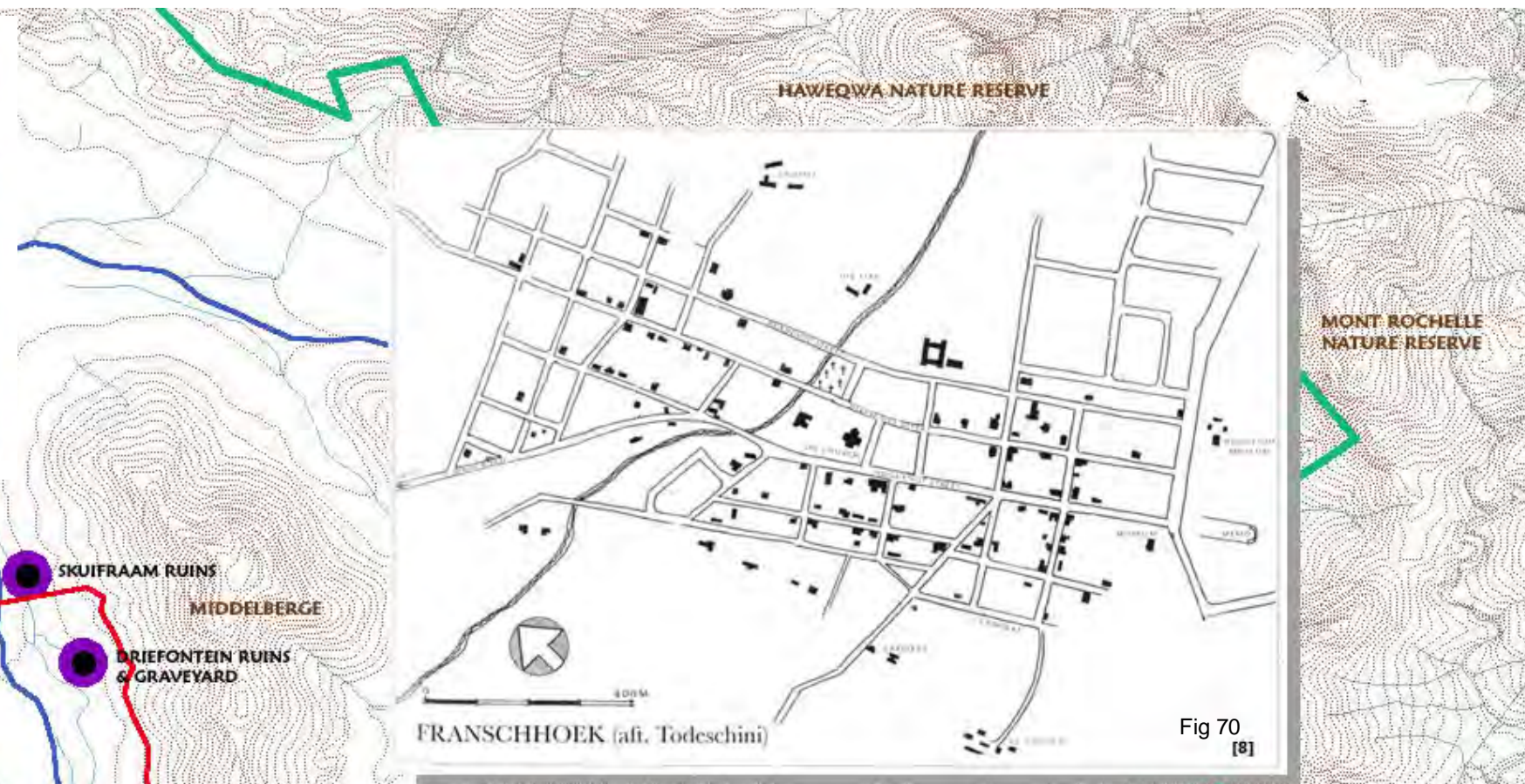


Fig 70 [8]

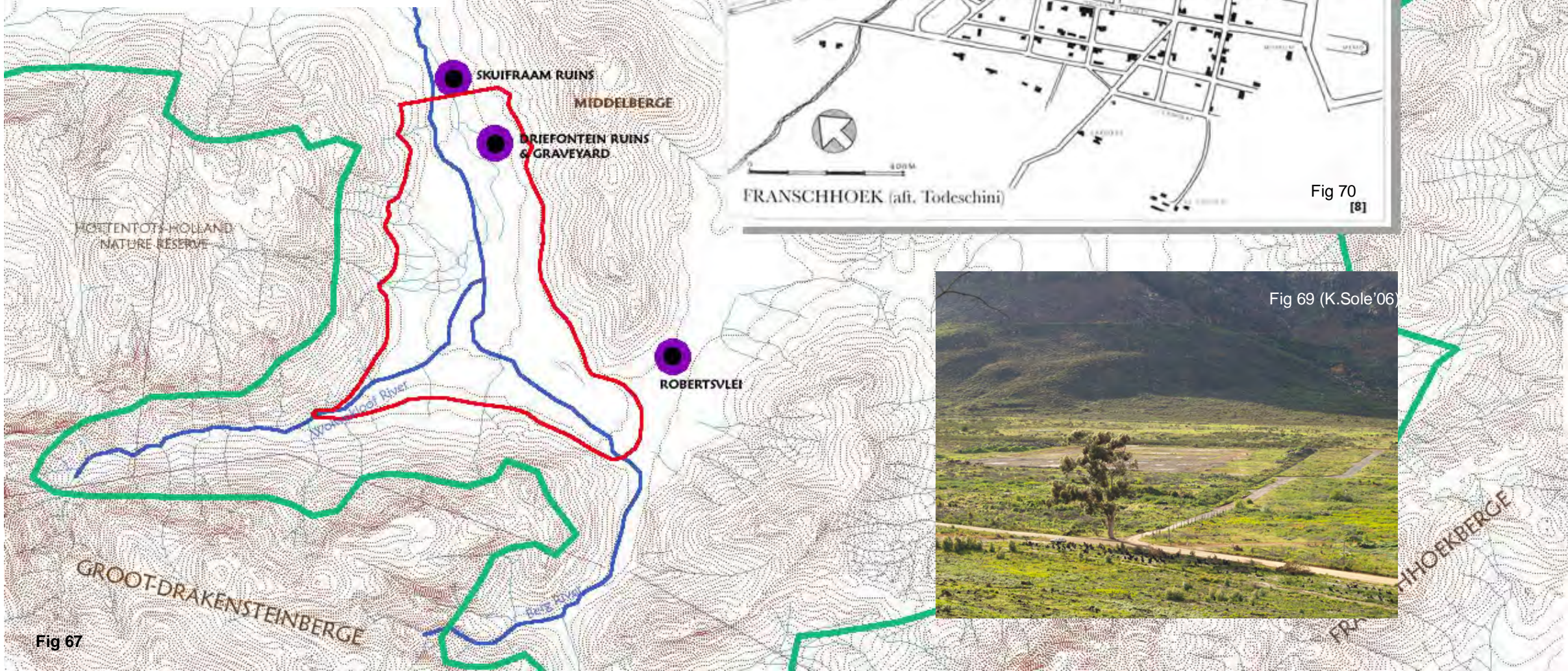


Fig 67



Fig 69 (K.Sole'06)

SKUIIFRAAM
 The remains of a substantial building which could have been a place of residence or a utility building (See Fig68). A study in the archives resulted in no additional information on the building, as the property is listed as state land. Unfortunately, the Driefontein ruins and graveyard will be inundated by dam. However intervention has been made with the Archaeological Planning Committee of the National Monuments Council to save what evidence they can prior to the dam filling.

DRIEFONTEIN RUINS & GRAVESITE
 These contain a graveyard of about 29 graves [16] and are said to be evidence of the site being used as a forestry settlement during the 1940s [15]. The graves are protected by three different acts: The National Monuments Act (No 28 of 1969), the Exhumations Ordinance (No 12 1980) and Human Tissues Act (No. 65 of 1983). These acts state that 'If exhumation is necessary, correct procedure must be carried out'. [10] The graves have been reallocated to a church in Wemmershoek.

ROBERSTVLEI
 This village was constructed in 1917 and demolished in 1948, after the construction workers for the Riviersonderend were housed there. The structural remains of 14 houses are still evident (See Fig69) as well as significant landscaping features, including mature Cypress trees and Oaks [15]. There is said to be some scientific-historical significance in terms of the remnants of a mining shaft associated with the extraction of manganese ore from the area [15].

SCENIC RESOURCES & AESTHETICS



Fig 71.

The structure of an area's topography impacts on the spatial qualities of that landscape [59] and consequently relates to the sensory relations of man with nature. According to Norbert-Schulz (1984) and his need to recognise scenery as a resource, the Western Cape has been distinguished into 4 different types of landscapes [59]:

- Cosmic Landscapes: comprising of large flat plains where cadastral boundaries tend to be geometric or based on subdivisions of original farm boundaries
- Romantic Landscapes: rolling undulating hulls often forming an interface zone between the mountains and the plains
- Classic landscapes: formed by dramatic cliffs and escarpments of mountain ranges and the steeply enclosed mountain ranges in between
- Complex landscapes: where an overlap of these three broad areas of landscapes exists, resulting in areas of opportunity for settlement. [59/63]

The study area itself consists of the Classic type landscapes which refers to the mountainous areas as well as the Romantic type landscape which involves the characteristic hills of the 'Boland'. The Berg River Dam is located in a scenic valley surrounded by the magnificent backdrop of the Groot Drakenstein and Wemmershoek Mountains.

Robertsvlei
A CATCHMENT
HAMLET

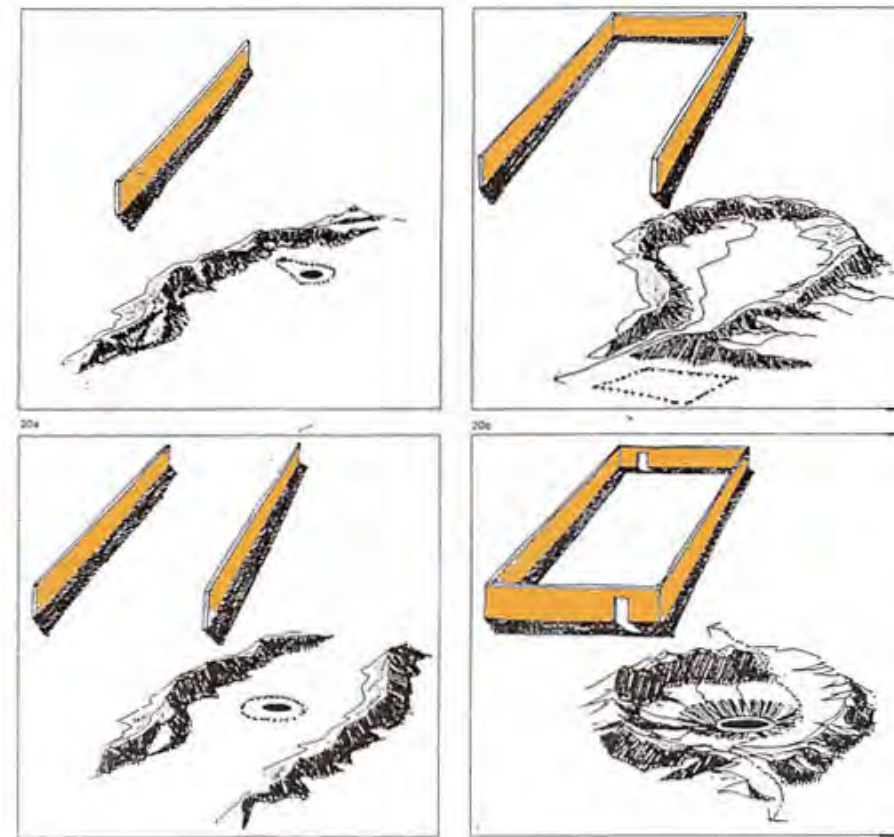


Fig72
Different enclosures of places illustrated
(Ardalan, 1973)

Franschhoek can be described as an 'enclosed place' with the Franschhoekberge as its backdrop and Wemmershoekberge & Groot-Drakensteinberge holding the valley to the north and south. Fed by the streams off these mountains, the colours of the valley change with the seasons and the turning of the vines. The mountains retain their hues of blues and greens throughout the year and never fail to amaze one with their magnificence. The town still has a very historical presence, held by the Huguenot Monument at its zenith (See Fig 71).

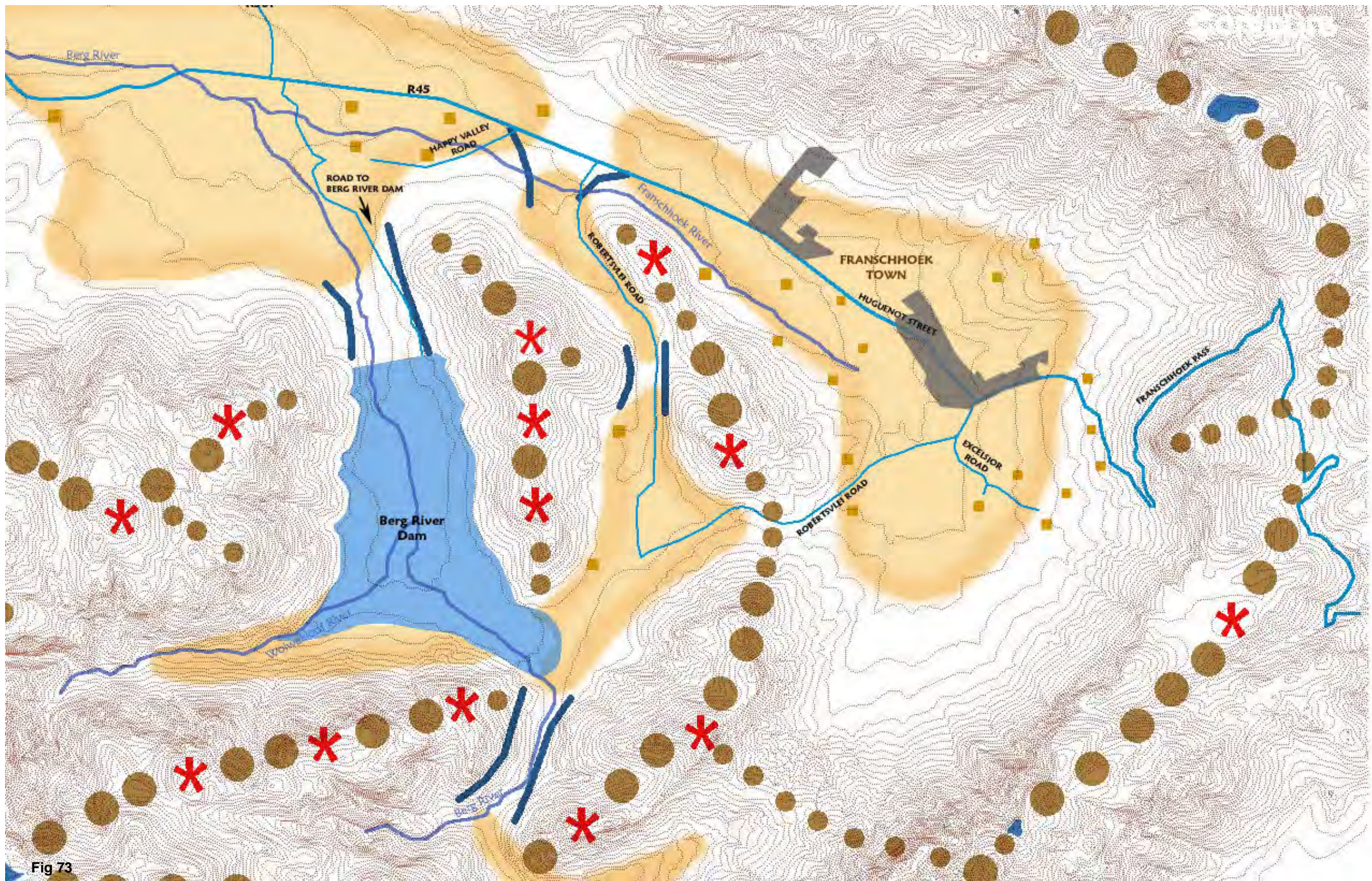
There is a strong relationship between landscape types and visual carrying capacity [59]. The more undulating a landscape, the more opportunity there is to shelter buildings within the lie of the land and therefore make them less obtrusive.

The enclosed nature of the valley and the steepening slopes means that noise can travel and reverberate across the sides of the valley [1]. Furthermore, the placing of buildings or activities within the catchment area will effectively have a high visual impact on the surroundings as a result of the topography.

According to the PROVINCIAL SPATIAL DEVELOPMENT FRAMEWORK *'The visual impact of urban settlements structures and activities within different environments should enhance and respond to the natural environment and built heritage in which they are located'* [59] The study area is said to be within its very own 'landscape room' [69]. It is important that the settlement patterns in these different landscape rooms maintain rather than detract from their identity [69]

Landscape rooms can be treated uniquely in terms of:

- development control and building design guidelines
- agricultural activity
- visual impact assessments
- environmental impact assessments and river corridor planning [69]



SCENIC IMPLICATIONS
Increased runoff of surface water from sudden rainfall in steep areas results in flooding of drainage channels and low-lying areas, causing potential discomfort for people in the area and the increased incidence of disease [28]

SCENIC ROUTES

Due to the nature of the valley as a tourist destination, the main arterial roads through the area are being investigated as 'scenic drives' [69] and therefore strongly contribute to the local sense of place. The Franschhoek town itself has a high aesthetic quality and the Franschhoek Pass, linking the town to Villiersdorp is a well-known scenic-drive.

The Berg River Dam wall is openly viewed from the R45. Appropriate vegetation of the earth section of the dam wall is underway and will reduce visual dominance of the structure. A small portion of the dam may also be visible from the Franschhoek Pass, but is likely to be regarded as appropriate to the rural landscape. [10]



Fig 74

Fig 72. Franschhoek Valley [63]

VISUAL CATCHMENTS

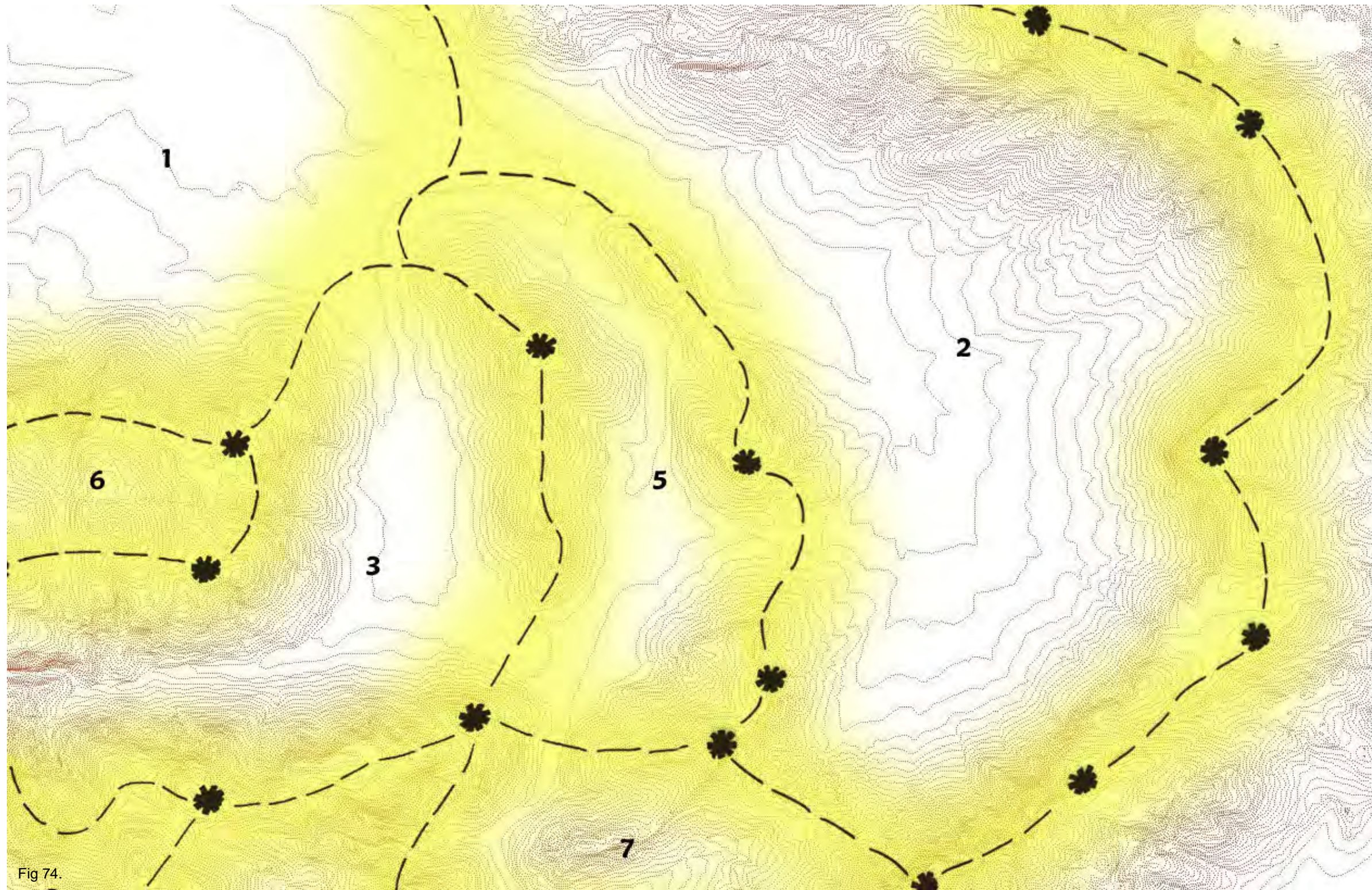


Fig 74.

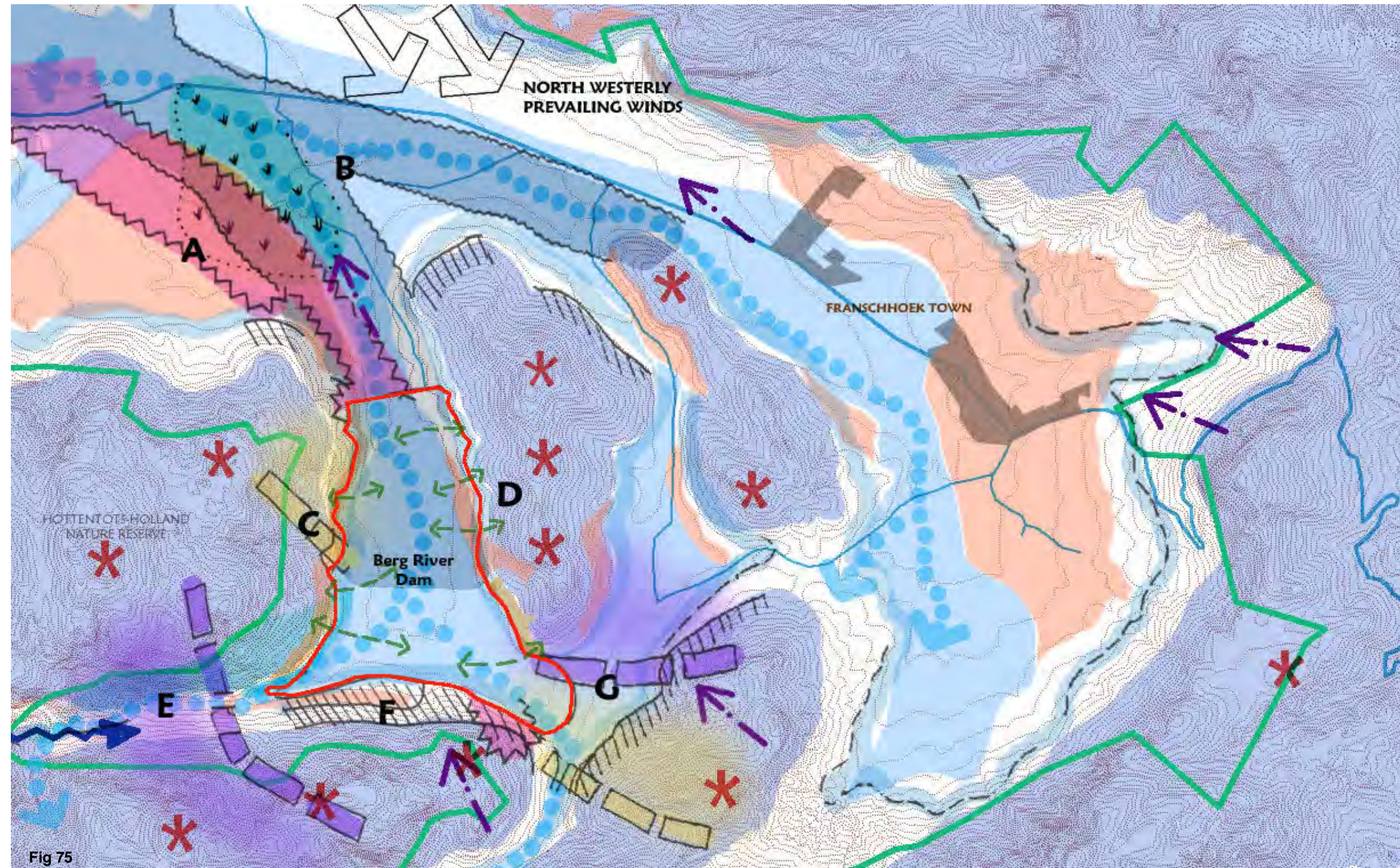


Fig 72 & 73 Franschoekberge [63]

The local area has been divided into 'Catchment Domains' in order to identify a 'Sense of Place' for each. Each domain may be treated individually in terms of architecture and design, bringing about local meaning and uniqueness.

The Study Area has been consolidated into one visual catchment, called the Wolwekloof Corner in this regard, which curves West toward the Grout Drakenstein Mountains. Links between these areas could be an interesting planning technique.

NATURAL IMPLICATIONS: A summary



KEY

GEOLOGY
 Unstable slopes associated with Klipheuwel Formation

SEISMICITY
 Slight earth tremours may discourage development

TOPOGRAPHY
 Steep slopes associated with mountains restrict development

SOILS
 Apedal & Alluvial Soils are best suited for agriculture, development & landscaping

HYDROLOGY
 Potential aquifer poses constraints for development
 Floodlines requires setbacks from river-corridors

CLIMATE
 Warmer north-facing slopes more favourable for development

WINDS
 Areas sheltered from prevailing winds & valley in-flows more favourable
 Areas sheltered from valley in-flows of Katabatic winds more favourable

RAINFALL
 Southern & higher areas receive significantly more rainfall

VEGETATION
 Undisturbed areas should be remain pristine
 Sensitive Areas should be protected

FAUNA
 Riverine habitat should be conserved
 Green corridors should not be obstructed by development

HISTORICAL
 Areas of historical interest should be avoided

SCENIC RESOURCES
 Ridgelines & hillcrests should remain free of development to avoid visual disturbance
 Scenic drives & wine-routes should remain in keeping with surrounding areas

0 200 1000 2000m
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A natural analysis synthesis of the study area at the 'local' scale is deemed necessary for the full understanding of nature and its interacting processes that represent a certain value-system.

In summarising the area immediately around the dam, the area has been designated into the following zones: A-D. A brief overview at this point highlights Zone G at this stage as most favourable in terms of proposed development, with Zone F following as a close second, although somewhat exposed. Zones C and D have severe topographical implications for development, whilst Zone E, is susceptible to cold spells. Zone A is directly down-stream of the Dam and therefore risky for development in terms of seismic activity.

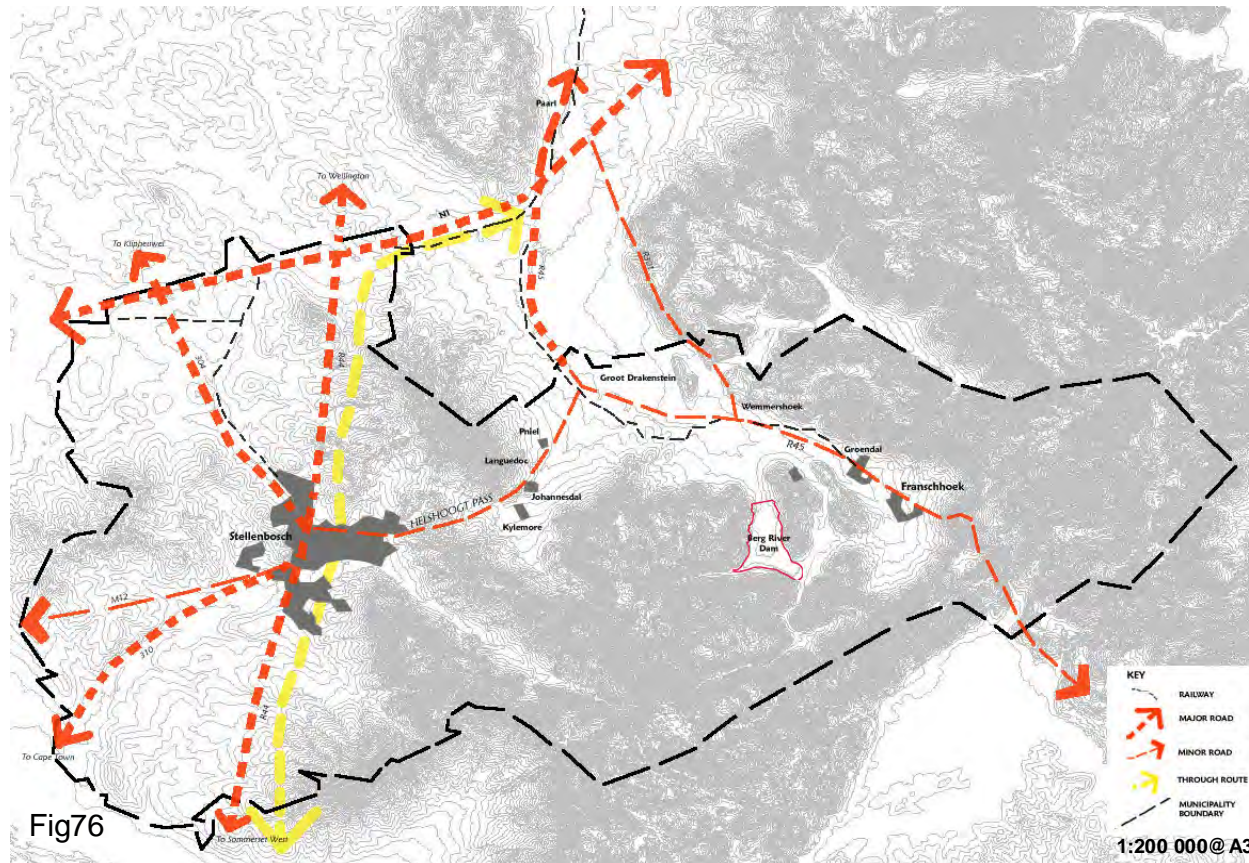
A reliable interpretation of the implications at this early stage can help determine the opportunities and constraints for *development* presented in the following chapters. Resultantly, an overall accurate synthesis can then be accomplished for the entire area.

What follows is a look at the Infrastructural component of the study area, which is found to strongly relate to the natural processes.

'In nature there are neither rewards not punishments- there are only consequences'

Robert G Ingersoll [57]

ROADS & ACCESS



According to the literature, Franschhoek valley developed primarily due to its close proximity to one of the two main transport routes leading from Cape Town to the interior [2]. These two main routes, the N1 and N2, are forced through their various regions by the configuration of mountain chains across the Province [54]. Not only do these routes provide fast internal links within each region, but they allow access to passing trade and provide fast external links to the provincial capital city of Cape Town [54].

Holistically, the municipality is dominated by two major infrastructural components, the road system and the rail system. Presently, the City of Cape Town is the prime economic hub of the Western Cape Province and therefore, functional efficiency of the routes into the city has been extremely important in terms of access to employment.

In the local context, the study area is located off one of the two main road sub-systems dissecting the area, that of the linear corridor connecting the valley to the N1 and Paarl in the North (See Fig76). Helschoogte Road is the main connecting route to Stellenbosch itself over the Jonkershoekberg and Simonsberg, whilst the R45 route is seen as a important route for local transport into the Franschhoek Valley.

In line with a scenario of the Stellenbosch Muni-SDF, the greatest level of activity is planned to be along the major transport routes in the area [69].

The Franschhoek corridor is seen as one of these major routes in the area, with the concentration of growth at Groot Drakenstein, Wemmeshoek and La Motte. This linear circulation typology however, can lead to heavy congestion, which occurs occasionally in Franschhoek. In terms of the study area, the growth point at Wemmeshoek holds great significance in creating a possible sense of entrance into the site.

'Transport, both public and private, is a primary spatial structuring element providing access and mobility to both urban and rural communities' [59] A balance of transport types allows choice and diversity and optimal access for all users. Unfortunately, like many rural situations in South Africa, private transport is dominant in Franschhoek. Poor public transport is limited to an informal taxi-service which is restricted to operate in specific areas only. There is no formal bus-service.

RAIL

Provincially, the state of rail transport is of grave concern [59] and with the focus of transport on roads, little is being done to capitalise on the existing rail framework across the province.

The promotion of rail as a commuter service is seen to:

- minimise the use of private vehicles
- reduce traffic congestion on existing roads
- reduce the need to widen existing roads and therefore damaging the visual value of the area as well as other environmental impacts [69]

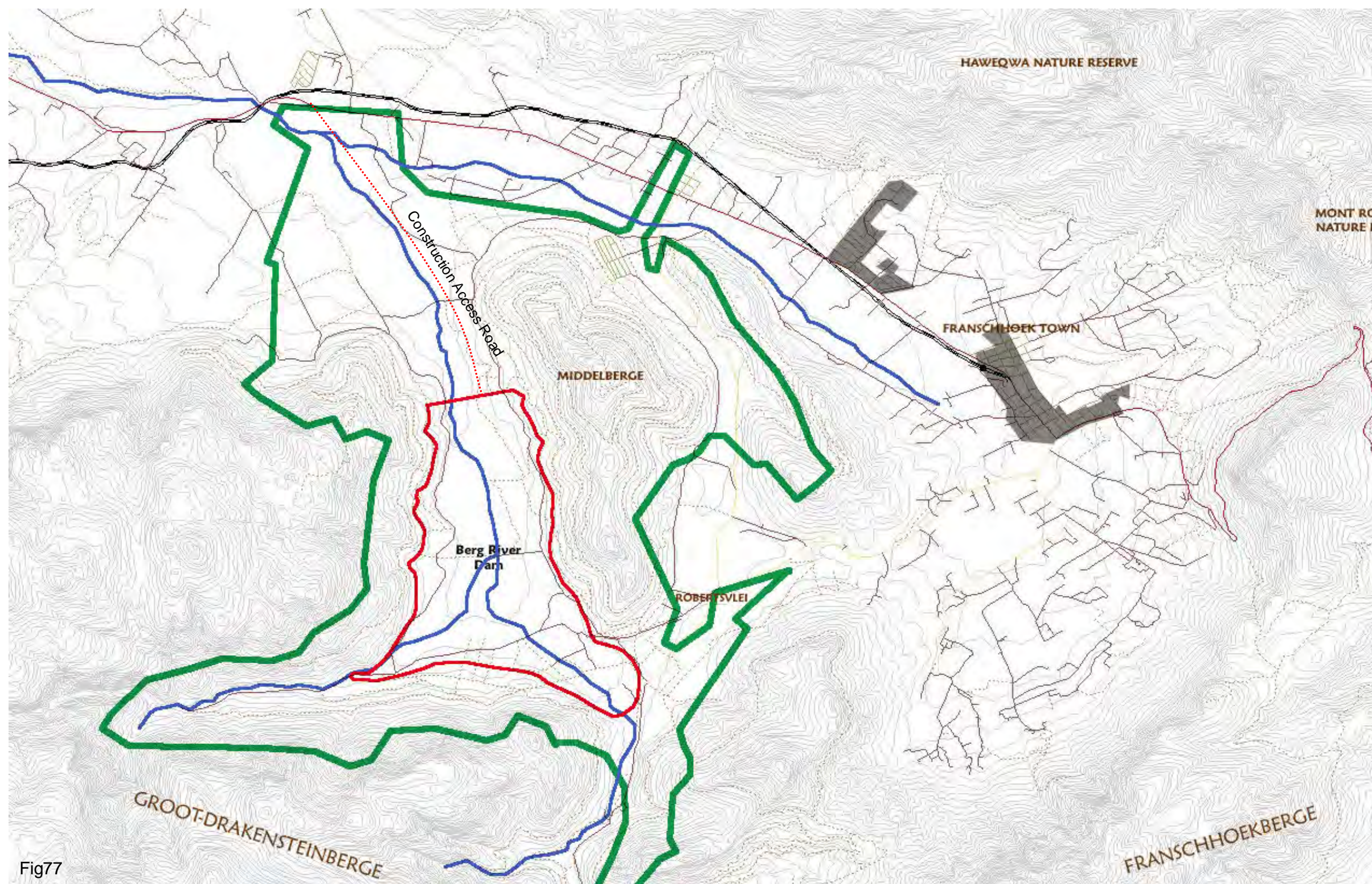
This concern extends into the Franschhoek valley where the railway line is, according to the EIA, not commercially viable at present [10]. The closest railway station connecting to the national route, for passenger use is 30km away, located in Paarl. The Franschhoek line was largely a freight line, operated by Spoornet extending to Franschhoek spur, with stops at Groot-Drakenstein, Lategan, Wemmeshoek, La Motte and Franschhoek north and south. Again, the Wemmeshoek rail-link could create possibilities in terms of access into the study area.

AIR

Cape Town International Airport is approximately 50km from the study area and has been described as the most important national and international gateway into the Western Cape [59]. This access point is largely beneficial for the location of the study area and plays an important role in terms allowing foreigners access into the 'Boland'.

RIVER

The inadequacy of the Berg River as a viable transport route has led to it being overlooked as a possible pedestrian-route. The linear route provides a natural access into the sub-region and development of a continuous river parkland with a hiking/cycling/ horse-riding/ cross-country running trail extending from Franschhoek to Wellington has been suggested. Additionally, as suggested in the EIA, a scenic drive would give access to recreational facilities or resorts on the river, established where favourable natural circumstances permit. [10]



ACCESS IMPLICATIONS:

The lack of public transport throughout the area limits the mobility of the low-income residents of Franschhoek. Focus of movement along the R45, could have implications for development occurring too far off the 'beaten track'. However a large enough threshold will provide a demand for transport and the informal transport sector is likely to respond. Evidently, the valley's transport situation needs to be rectified in the future for the benefit of all.

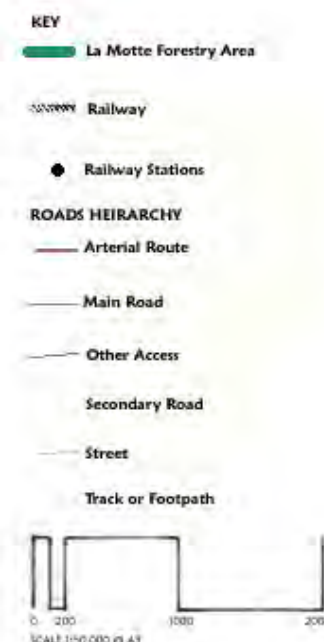


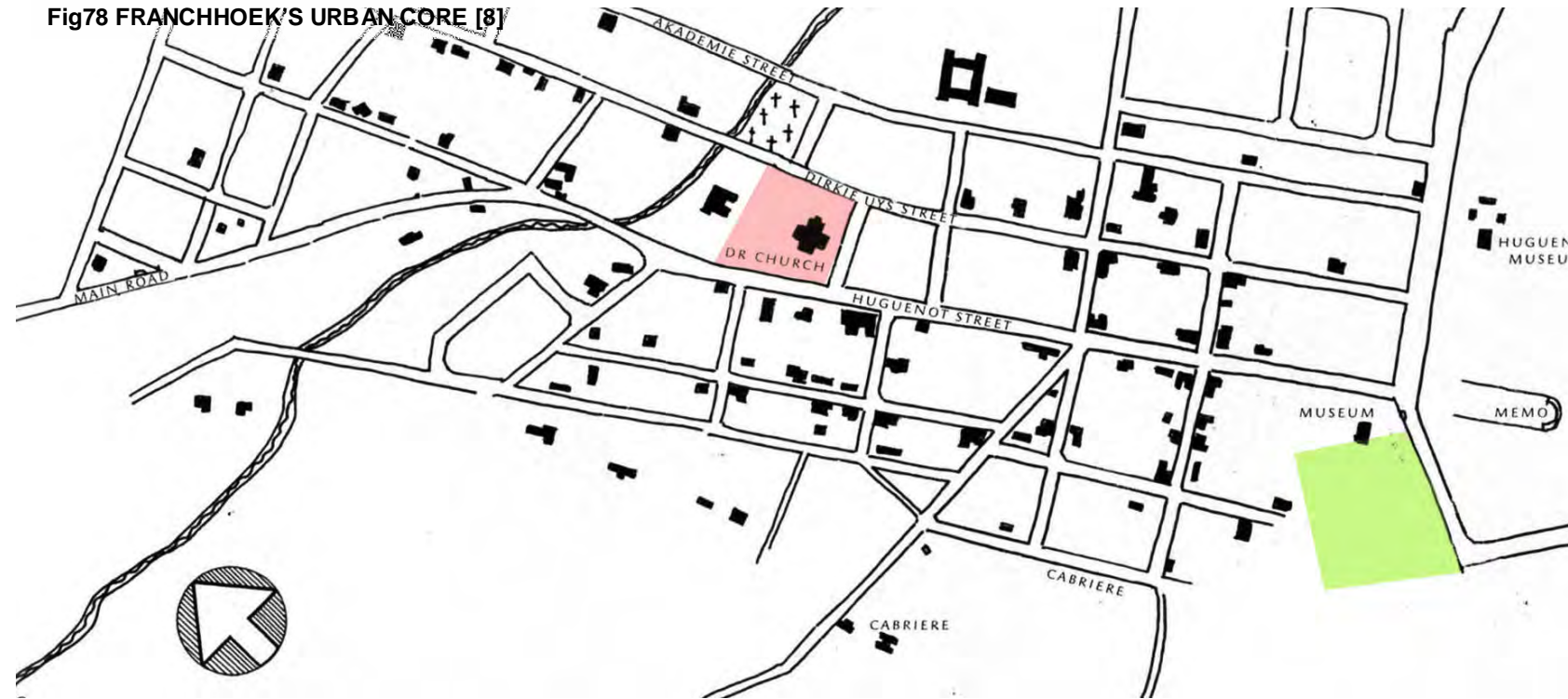
Fig77

Currently, the site itself is predominantly accessible by private vehicle only. An extensive road network has sprung up temporarily due to construction purposes with the main access to the site of the dam wall from the R45 being tarred (See Fig 76). Small-scale construction roads will fall away on completion of the project with a limited few remaining for the management of the dam-operations-area.

The eastern edge of the site is accessed via the Robertsvallei Road, a back ring road connecting Franschhoek and La Motte. The existing road infrastructure around Robertsvallei village itself was implemented during the 1970s when the village was occupied, however, the roads still remain but have fallen into neglect.

As with most plantations, La Motte has a road density that is higher than necessary and some roads are unsuitably placed, causing continuous erosion problems [16]. The deforestation of La Motte is accompanied by a management scheme to close unnecessary roads and rehabilitate them with indigenous vegetation. Roads needed for future management of the area will be redesigned according to the degree of erosion involved, road damage due to poor drainage and the adequacy of river and stream crossings [16].

URBAN FORM & LAND USE



Franschhoek's urban core developed in a linear fashion as a result of the very first sub-divisions of land, with a north-east axis. Two sections of the town developed as a result of a river valley dividing the two, at the point of the present church, described as a 'knuckle' [2] for which the town is hinged [2]. However, these geographically separated "towns" were exploited in the form of the model "apartheid" village [75] in which the different ethnic residents lived in their separate areas.

Known for its beautiful natural setting and its rich cultural heritage, Franschhoek is held within a valley of great wealth. The 'Golden Mile' as its now called, due to the high price of land and exclusive small businesses that border the main road, holds prime location in the town. Additionally, head-offices of several prominent national businesses are located in the vicinity, namely KWV, Boland Bank, Berg River Textiles, Bakke Packaging and Anglo American Farms [10].

Across the river from the village core lies Groendal, located about 2km from the town centre. A suburb designed for the lower-income residents of the Valley, understandably informal settlements began to appear with time along its fringes. Presently, Groendal supports 2 informal settlements, Vietnam and Langrug, with another informal settlement seen further up the mountainside on its northern border. The urban fabric around the valley has been well contained within the 260 to 300 metre contours in Franschhoek [69] however these informal settlements are extending beyond these elevations, resulting in a visual problem for the valley's scenic surroundings.

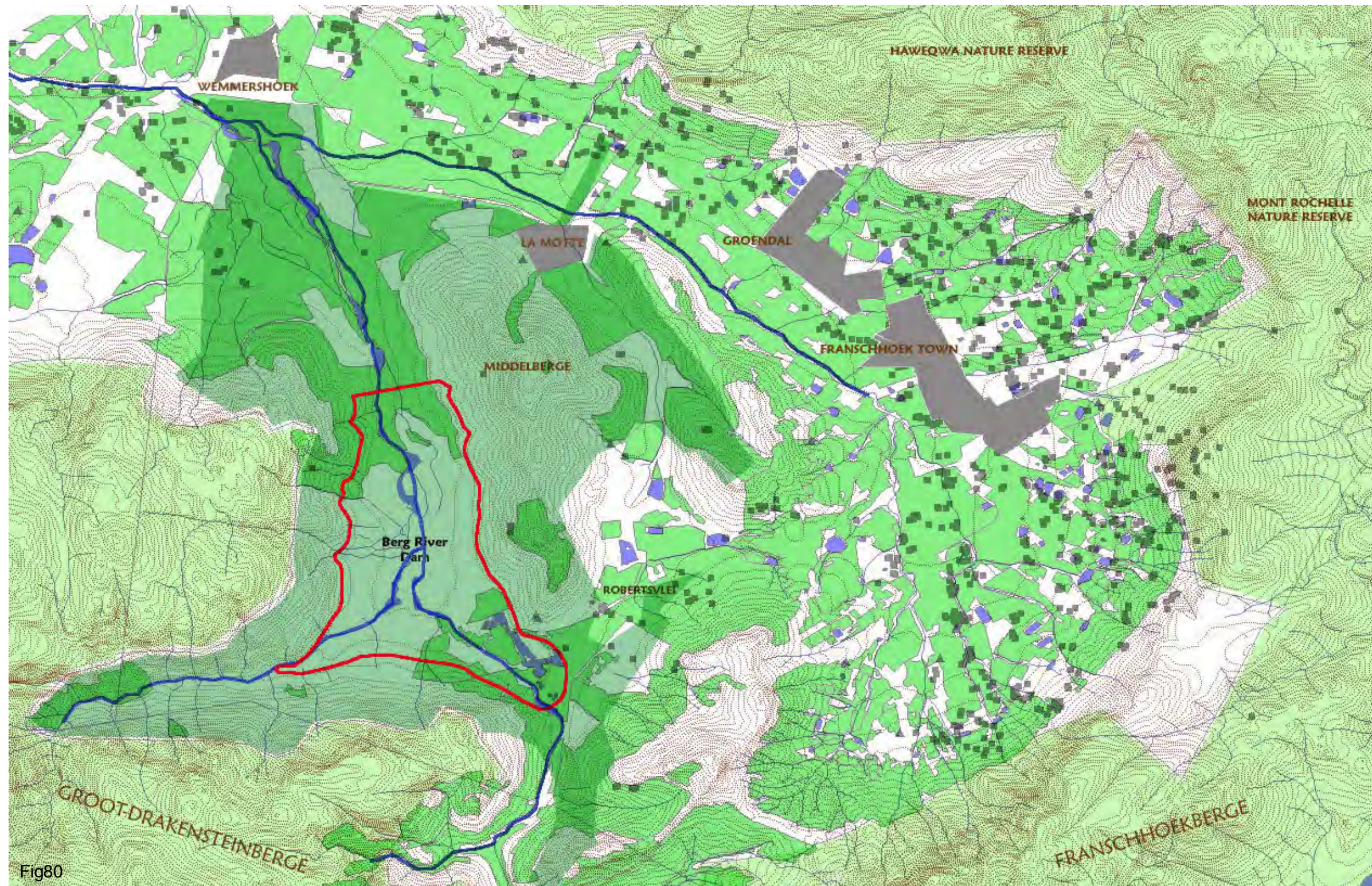
RURAL HAMLETS

Outside of the town are the small satellite State Forestry villages of La Motte and Maasdorp which service the La Motte State Forest in the Robertsvlei and Berg River Dam areas [72]. These villages have grown in importance for housing the low-income residents in the town, however their remote locations have become an issue with the closing of the Forestry Stations in the area.

Bordering the town on the eastern side are the well-established wine-farms, land that has been passed down through family's with heritage linking them back to the original settlers in the valley. Vineyards make up a large portion of the surrounding cultivated landscape, whilst citrus and fruit orchards are found surprisingly close to the urban core of the town, representing its historical significance.

The Mediterranean-type climate in this region lends itself well to the large-scale cultivation of deciduous fruit & vines with small-scale lucerne and vegetable farming, among other crops. These areas are found to dominate the banks of the Great Berg River and its tributaries [10]. Well-developed irrigation systems are said to align with the wet catchment areas of the Berg River, which supplement dry winter deficiencies of the river. This results in a stable and high value production potential, typical of the Franschhoek Valley [10].

La Motte State Forest covers a total area of 4 100ha hectares bordering on the Hottentots-Holland Nature Reserve in the Grout-Drakenstein and Franschhoek mountains. The proposed Berg River Dam will inundate approximately 4km² of this land [72]. Forestry in the Western Cape only contributes a minor percentage to the national output [54]. This is due to two major drawbacks associated directly with the dry summer and wet winter rainfall of the region. A summer growing season, results in trees being vulnerable to water-stress, therefore



URBAN & LAND USE IMPLICATIONS:

- The expansion of fruit and wine farming in this region has been extended laterally up mountain-sides resulting in accelerated soil loss in these areas. Future development must avoid this and maintain any incorporation of agriculture low in the valley.
- The lack of recreation and Open Space in the area hold implications for development, in that it should work towards over-coming this short-fall in the area.

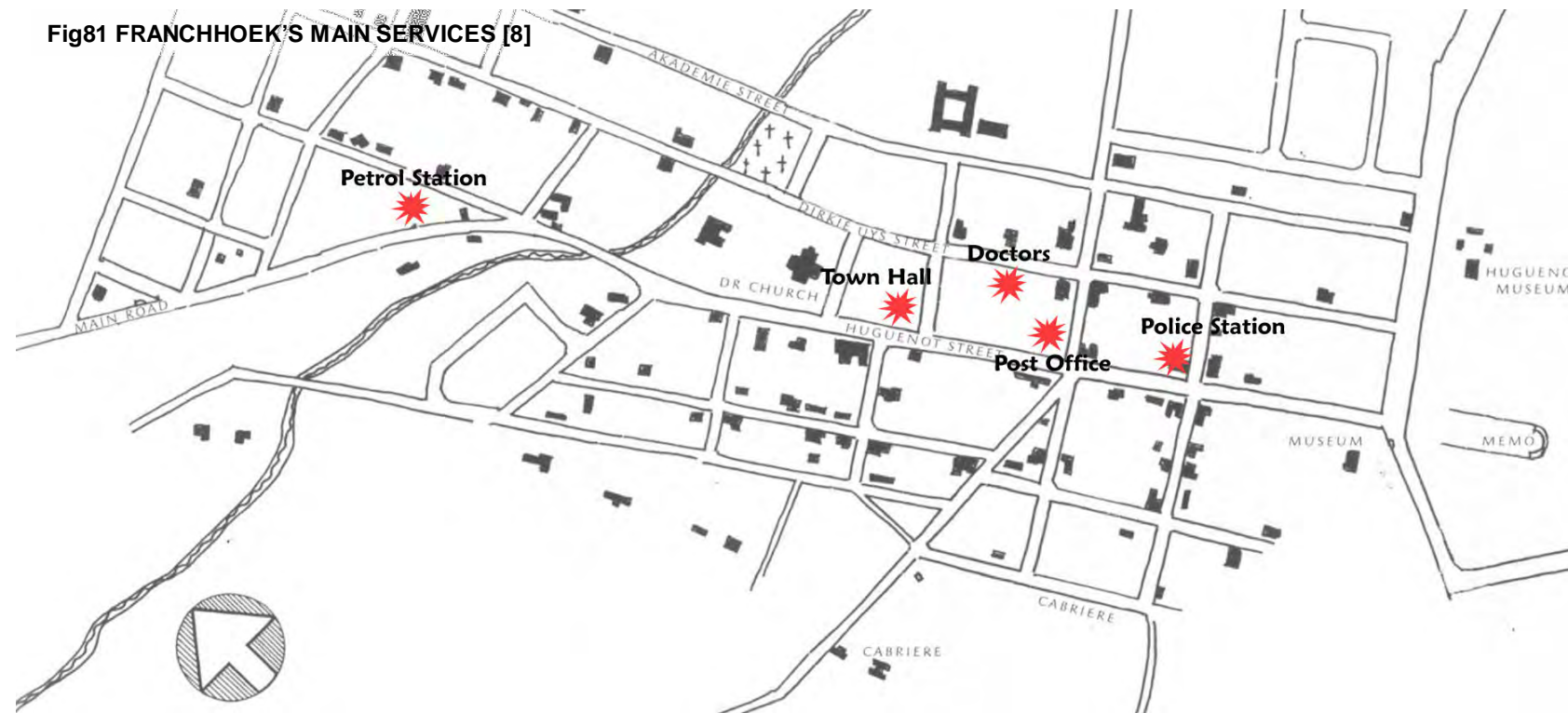
Fig80

stinting their growth and delaying their maturity by an extra 10 years compared to those in other forested areas of the country. On the other hand, trees prefer a minimum rainfall of 700mm combined with deep soils [54]. The high rainfall is available, however, often in mountainous areas, where soils tend to be shallow. Areas comprising these deeper soils are often, as they are in Franschhoek, dominated by the need for more profitable agriculture.

Industry throughout the area is limited. A large fruit-canning and jam factory at Groot Drakenstein is said to contribute to pollution of the river in its upper reaches [10]. Within Franschhoek itself however, the local planning policies supports the initiative of no industrial development, provided provision is made for home industries within the town (Van der Merwe Duxbury and Kirkwood, 1994) [10]

Recreation and Public Open Space is somewhat limited in the valley. Franschhoek Commonage Area is located adjacent to the Huguonot Monument (See Fig79) and has been formalised into a picnic site. The location of this space to the western suburbs of the town, however is detrimental to its optimal usage. Recreational use of La Motte forest is limited due to fire hazard and hence is closed in summer. Other activities such as canoeing and mountain-biking, are allowed by acquiring a permit, during the winter months. The Berg River Canoe Marathon takes place annually as well as other prestigious events.

SERVICES & COMMUNITY FACILITIES



According to the Muni-SDF, the region is relatively well off in terms of infrastructure and services [69]. However, this statement is made in a very broad sense given the state of the housing-shortages in the Franschhoek Valley.

The pressing need and a growing back-log of dwelling units in Franschhoek [10] has only been provoked by the fact that local farmers will no longer accommodate their farm labourers on their private land. Two reasons for this is firstly, the farmers do not want to have to be forced to give away residential rights to any occupier of land after (so many years) under the recent Land Acts and secondly, the farmers prefer to make their labourer's cottages more profitable by turning them into guest-houses for tourists.

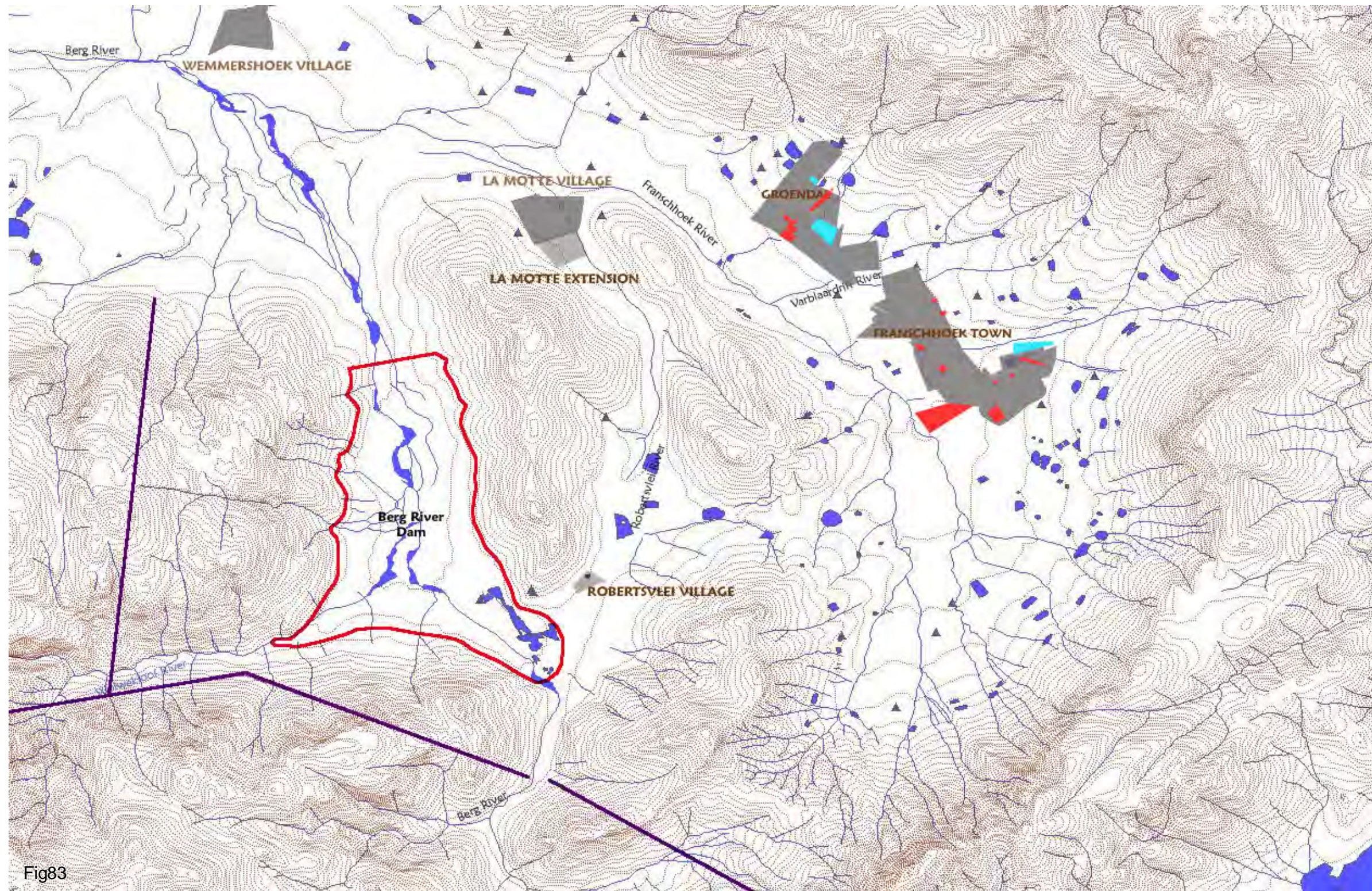
With the Municipality's Mission to 'ensure the provision of reliable and affordable services to all our communities in a sustainable manner', work is underway to conquer the needs of Franschhoek's residents.

There are according to the EIA [10] three pieces of land available for low-cost housing which may accommodate a total of 342 family units, within Franschhoek itself. Two of these are said to be land owned by the Regional Services council and the third by the Franschhoek municipality. There is no other land immediately available, unless commange/ agricultural land surrounding the town be re-zoned for housing.

Furthermore, the rural hamlets surrounding the town are undergoing changes to accommodate more people. La Motte village, is currently undergoing an upgrading of bulk services, providing a reservoir, a new water supply link pipeline, and the upgrade of the sewerage works. These and intended densification are all being managed by the Boland District Municipality [72].

Maasdorp village presently consists of 15 units [72] and although slightly more up-market than La Motte, it is said that it can also be densified to accommodate more people [72]. Robertsvlei Village, on the other hand, lies dormant. Once accommodating a bustling construction community, what remains is a large hall which lies empty whilst the remaining 6 houses are occupied by DWAF staff.

The accommodation of permanent workers on the Dam has taken place within the Franschhoek municipal area in the form of the new extension of La Motte village (See Fig 82) Controversy has surrounded the planning of this development, as it goes against the concept of densification. Despite this, this housing and its infrastructure is suggested as being a positive contribution to the stock of low income housing in the area, once the dam construction period has concluded [10].



IMPLICATIONS OF SERVICES & COMMUNITY FACILITIES:

- access to these facilities would mean development has to be closer to town unless self-sufficient.
- Development dependant of the community water & sanitation supply would not be sustainable given the present situation

Fig83

Other services in the area include an educational presence in the form of 2 high schools and 4 primary schools. These schools though, are suggested as being insufficient for the Xhosa speaking children [10].

The necessary services of clinics, banks, libraries and a community hall are all present within the town, but again, located away from the majority of residents in the western suburbs.

SANITATION & WATER SUPPLY

In the 'Services Summary' section of the Upper Berg River Sub-regional Plan (VDK, 1994) it is stated that Franschhoek has very limited, if any, capacity to accommodate growth within its present services infrastructure. On 25 March 1996, a decision was taken by the Franschhoek Municipality to stop further re-zoning of land until services have been upgraded.

Water for the area is supplied primarily by the collection and storage of water in mountain reservoirs on the eastern slopes

of the town. Elsewhere, most farms access water through bore-holes, drilled into the aquarius soils that lie throughout the valley. Recharge of these sources, as mentioned in previous sections, is vital for the sustainability of the Valley's water supply.

Rapid development throughout the valley in recent years has placed additional pressure on these services. Strategic planning and resolutions to these problems are obviously necessary in the long run, yet an additional water-supply of the Berg River Dam would be an advantage for the community as a whole.

COMMUNITY STRUCTURE • DESIRES FOR THE DAM

Demographically, the National census of 2001 indicated rapid population growth in Stellenbosch town, Franschhoek and the agricultural areas within the municipality [59]. This growth is said to be concentrated within the informal settlements and formal settlements in Franschhoek which is home to 15 000 people in total.[75] This figure is 5 times the total population calculated in the 1991 census, which indicates terrific growth in the past decade or so.

The 1991 census data also indicated the percentage breakdown of ethnic groups in the valley to be:

65% were 'Coloured' People
23% were 'White' people
12% were 'Black' people

Cultural and economic differences tend to still reflect these group distinctions defined by South Africa's historic racist legacy [10]. Furthermore, the geographic split of the community has aggravated segregation of these groups with the predominantly white upper-class income residents living in and around the town centre, whilst the black and coloured middle-income residents living further out.

Social tensions and negative attitudes prevail in the community, especially between the 'Coloured' and 'Black' residents. This is primarily over the issue of low job and housing availability. The 'Coloured' people see themselves as the traditional inhabitants of the area, as in fact the census indicates with the highest percentage of residents born in the Franschhoek valley found to live in Groendal (see Fig 84), whilst this is also found to have the highest number of residents to own the property they live in.

According to the coloureds' generalised perception the 'Black' inhabitants moved to the area during the construction of the Theewaterskloof water tunnel [10] remaining after the completion of it. Their presence in the valley places more pressure on the limited jobs on offer, with the associated implications of raised crime and social problems. Immigrant workers associated with the Berg River project have seen to create similar unrest in the valley, with the level of crime having risen again since commencement of the works [10].

Furthermore with the farm labourers being forced to live in town in more recent years, there is general discontent [10] among these communities.

RESIDENTIAL AREAS WITHIN FRANSCHHOEK

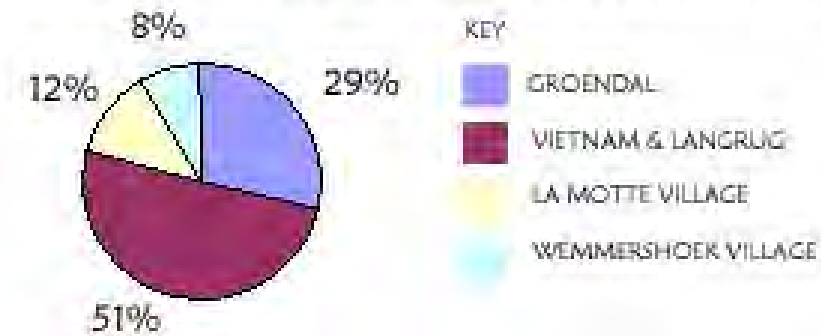


Fig 84.

DESIRES FOR THE DAM

Extensive Public Participation was carried out in order to encourage community involvement in the construction of the Berg River Dam. These were some of the suggestions made by the community for possible options.

- *Freshwater Crayfish Business- Private Businessman*
- *Upgrading of existing trails on Middelberg for hiking, biking and riding with the incorporation of an eco-educational element. All accessed by a single access point in the form of a 'trail centre' with the suggestion of Dewdale as a site. Middelberg also suggested as site for paragliding, rock-climbing, bird watching- Director of Franschhoek Wine Valley Tourist Association (FWVTA) and Chairman of Franschhoek Outdoor Group (FOG)*
- *BEE Plant Nursery & Business, essential oils & medicinal plants- previously disadvantaged members of the community*
- *Sports-ground adjacent to the Wemmershoek School for school and community usage- Franschhoek Trust*
- *Blue Berry Farm Proposal- growing of food-crops, rearing of chickens and fynbos nursery with a Wine Cellar- local BEE potential businessman.*
- *Tilapia Fish Farming- Local Businessman*
- *Development of Flats & Self-catering units with adjacent picnic and braai area next to the river at the R45, R301 junction- local BEE business-owners*
- *Agriculture, associated farm stall & a service-station next to Wemmershoek School- local BEE company*
- *Environmental Educational opportunities alongside traditional sports such as hiking, camping, kloofing, canoeing, sailing, mountain biking, abseiling, rock-climbing, fishing- Bridge House School*



EMPLOYMENT & SKILLS

Stellenboch Municipality has been one of the fastest growing economies in South Africa. A consistent growth is said to be linked with exports of the agricultural economy yet a challenge for the area consisting of the Franschhoek Valley is said to be one of diversification [69]. According to the MUNI-SDF, growth and opportunity lies in the fostering of the local community development along the rural and regional tourist routes [69]. Economic growth forecasts are estimated to increase the number of jobs from the current 2500 approximately, available in Franschhoek. The concern is whether the town can absorb new residents with the ever- increasing housing shortage [69].

AGRICULTURE

Although employment in the agricultural sector in Franschhoek is seasonal in nature, the domination of labour-intensive and land- intensive horticulture-based industries has resulted in the 'Winelands' having a relatively high rural population density. Viticulture is obviously the predominant employer of these industries with other industries supporting the region being olives, market gardening, citrus, fruit, hydro-ponics and to a lesser extent floriculture.

FORESTRY

SAFCOL have been active in the Franschhoek Valley since the 19th century. Although it has been deemed as a less important generator of income in the Franschhoek Valley [10], SAFCOL has provided approximately 200 jobs in its years of mass production [16]. The withdrawal from the Boland of SAFCOL, under the Cape Deforestation Project, converting Forestry to Conservation [16] will see the loss of these jobs unfortunately. MTO (as it is now called) are consequently in the process of negotiating a joint venture with the La Motte Empowerment Trust (LMET) for the systemic take-over of part of the forest as a community forestry project [72]. This initiative will ensure the future employment of SAFCOL's present labour force once the company withdraws completely. In the interim, *Working for Water* is an initiative set up by SAFCOL and DWAF [72] based on the clearing of Alien Plant Species. In line with the national Water Conservation Act, this aims to restore ground-water in our soils. Additionally, this initiative will provide employment for peoples in this area, having a positive impact on the social as well as the natural environment in affected areas.

INDUSTRY & TOURISM

Industry itself in Franschhoek is currently limited, however it is suggested this sector has the opportunity to be developed [69]. Present Local small-scale home-industries include Arts & Crafts and Carpet weaving. Tourism on the other hand is a substantial employment generator in the Valley, given the tourism-figures, however no accurate numbers of employment are available.

UNEMPLOYMENT

Unemployment in the Franschhoek Valley is 19% [10] yet, compared to the rest of the Western Cape, it is said to be slightly less severe than other towns in the Province. A social survey of Franschhoek, carried out as part of the EIA process, indicated that the unemployment in Franschhoek was found primarily in the middle and lower socio-economic classes. 33% of the associated residential areas were found to be unemployed, which resulted in a total of 1526 people. The survey indicated that at least 278 of these people were capable of construction work.

BERG RIVER DAM

Construction of the Berg River Dam is said to create 450 jobs for 5 years [69]. Some of the skills likely to be transferred to the local people employed include; concrete placing; carpentry; machinery operation; steel fixing; general construction skills and horticultural/ landscaping. Skills transfers associated with dam construction is implied to lead to the development of general construction capacity in the area [10]. Although this is likely to benefit the community, Franschhoek appears to be nearing its present development carrying capacity.

According to the surveys done for the EIA, the most important economic-activities of the Franschhoek Valley area appear to be agriculture and tourism, with forestry, services and small-scale construction being less important generators of income. Clearly, intensifying the recreational and tourism opportunities would maximise the number of jobs created in the valley.

IMPLICATIONS of COMMUNITY STRUCTURE:

Our history of promoting social-segregation must be overcome in the future, and this can be carried out through proposed development in the area.

•*Proposed development should consider the 'desires' of the local community for the Berg River Dam.*

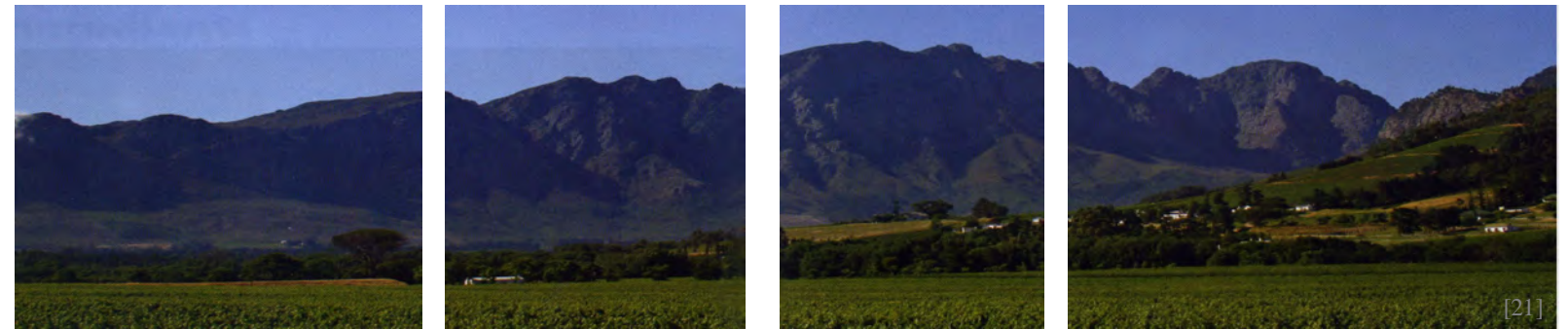
IMPLICATIONS of EMPLOYMENT & SKILLS:

Changes in employment opportunities in the valley could have implications for development. A newly-skilled labour force, will be in search of work once again, on completion of the dam. The implications for development are in the form of providing an economic base for which these unemployed peoples can survive off.



NATURAL & ECONOMIC RESOURCES

*One village of relentless charm
eight of South Africa's leading restaurants
thirty nine extraordinary wine cellars
ninety nine eclectic places to stay
a plethora of galleries and shops
a lifetime of discoveries [21]*



Franschhoek's marketing image certainly sells, given the fact that the valley received up to 200 000 tourist in 1996 [10]. With tourism figures in the Western Cape predicted to rise from its 500 000 foreign and 1,6 million domestic tourists annually, Franschhoek is bound to benefit.

Having gained the reputation as the 'food and wine capital of the Cape' with its countless wineries and restaurants, it is not surprising that Franschhoek has become a haven for the rich and wealthy.

Accommodation provision presently in the valley covers a range of guest houses, hotels, self-catering and bed and breakfast units, yet there appears to be a lack of accommodation that appeals to the lower-end, less exclusive region of the tourism bracket. Adding to this, accommodation geared towards more outdoor recreation such as caravan and camping facilities are particularly limited. The sole caravan park is located in 'De Hollandsche Molen', 10km outside of Franschhoek on the Wemmershoek River.

With this in mind, there is also the consideration of the changing trends in global tourism. According to the literature, the following changes are occurring:

- *people are moving away from MASS tourism and looking more for an experience of the unique, untouched, rural, cultural and traditional lifestyles*
- *a global concern for the environment has led to a demand for alternative destinations, where people can access a rich heritage and interact with local cultures*
- *tourism is growing more towards the incorporation of outdoor pursuits, such as walking and cycling*
- *an increase in special-interest tourism*
- *greater demand for flexibility in accommodation resulting in increased demand for the choice of low-budget self-catering options [59]*

With local tourism predominantly supported by the local South African market, 87% is very seasonal, with a high during the months of November to April. Furthermore the majority of these visitors tend to be day-visitors during the weekends of these summer months [10].

Undoubtedly, AGRICULTURE plays a major role in terms of harnessing the natural resources of water, fertile soils and an optimal climate for the cultivation of vines and fruit in particular. Yet, as mentioned previously, these natural resources must be managed sensitively, in order to be sustainable. In the economic sense, the strong interdependence that appears between the tourism and the local wine-industry allows the utilisation of both resources to their full extents.

On the other hand, due to the seasonal nature of agriculture and the limited jobs on offer, residents have been forced to look toward their hinterland for an income.

HARVESTING OF FYNBOS has become a viable business option for small-scale street vendors and the like. The 'veld' holds great value in wild-flowers, *rooibos* harvested for tea and *buchus*, an expensive, highly volatile, oil used in pharmaceuticals [54]. However, the sustainable harvesting of this resource lies in the responsibility of the harvesters, yet existing concessions in the area continue to prove their economic viability [72].

PISCICULTURE is said to be a growing industry throughout the country and particularly here in the Western Cape [62]. The removal and relocation of Dew Dale Trout Farm downstream of the Berg River Dam, will allow the exploitation of the resource to continue. Although trout are not indigenous to South Africa, they do well as an economic resource, and will continue to dominate the market until the indigenous fish-species become more viable to farm . Pisciculture can provide a good source of protein to the poor as well as provide an opportunity for Emergent Farmers [62].

Although forested areas in the Western Cape are declining, the demand for wood exceeds supply and plantations are being cut at rates that exceed their rate of regrowth [54]. The Wemmeshoek Sawmill has recently been upgraded to allow an increased input of 45 000m³ from 30 000m³ of timber, yet even with the subsidisation of suggested Community forestry schemes [72] forestry is on the decline in Franschhoek, and will no longer provide the resource-base to Franschhoek that it once did.



Existing water resources in the Franschhoek Valley are undoubtedly valuable to the livelihood of the valley. With the building of the Berg River Dam in Franschhoek, it would be seen as likely that the area would have access to the dam, as both a natural and economic resource. This is not the case however, as with the use of inter-basin transfers, the CMA will be receiving 100% of the water supplied from the Berg River Dam [a].

Local water supplies are adequate however, although the quality of water has come under some controversy in recent years [10]. According to the EIA, activities that typically have a negative affect on water quality are:

- Afforestation
- Cultivation
- Stock farming
- Urban development
- Industrial concerns
- Abstraction, addition (ie. Inter-basin transfer) and storage of water also impacts the downstream quality of water

Unfortunately, all of the above occur at some point or another along the banks of the Foothill Zone of the Berg. Changes in water-quality upstream of Paarl have been determined as a result of the presence of Dew Dale trout farm (started in 1985) and the discharge of water from Theewaterskloof Dam, to the Upper Berg River in summer (started in 1982).

Water from trout farms has generally been denounced as detrimental for existing eco-systems [10/57]. Farms are found to generate elevated levels of nutrients in the waters, which stimulate algae and plant growth, as well as various chemicals that reduce oxygen concentrations [57]. Water from Theewaterskloof Dam, also has increased levels of nutrients due to irrigation water accelerating the chemical breakdown of soils. As a result there is more phyto-and zooplankton in these waters than that of the upper Berg River.

Salinisation occurring further downstream, is said to be resultant of the surrounding soils, high in salt content, leaching into the nearby Berg River [10]. Fortunately, this problem does not affect our study area.

Runoff and leaching from possible recreational/tourist and other facilities which may be developed around the periphery of the dam may result in elevated nutrient levels [10]. This may give rise to growth of indigenous plants such as *Typha capensis* (bulrush) and the algae *Cladophora* which may block the channel and impede bird feeding respectively in the lower reaches [10].

INSTREAM FLOW REQUIREMENTS have been ignored until recently [57]. Experts in fresh water ecology believe that, provided important aspects of these flow patterns are maintained, a certain amount of water can be abstracted without degrading the natural systems of a river. Workshops held in 1996 arrived at a Desired Future State for each reach of the river. In this context, the following were determined;

- below the Berg River Dam to the confluence of the Franschhoek Stream; this area should be maintained as an area of natural conservation importance
- the confluence of the Franschhoek Stream to immediately upstream of Paarl; the area to be maintained in a state compatible with the recreational use of the river

The projected future demand growth of Cape Town is predicted to outstrip supply by 2010 [45]. It is said that new schemes are constantly being investigated, and hence the City of Cape Town must recover capital costs of the Berg River Dam quickly. (Yeld 2005)

IMPLICATIONS of NATURAL & ECONOMIC RESOURCES:

- Possibilities surrounding the Berg River Dam in terms of tourism, could effectively harness the deficiencies related to accommodation and outdoor recreation opportunities in Franschhoek
- If the situation were to change regarding the water supply of the Berg River Dam being available for local as well as CMA usage, this would be of substantial advantage to development in the valley.
- The City of Cape Town's need to recover costs quickly poses concerning implications for development in the area.



STRUCTURE PLANS

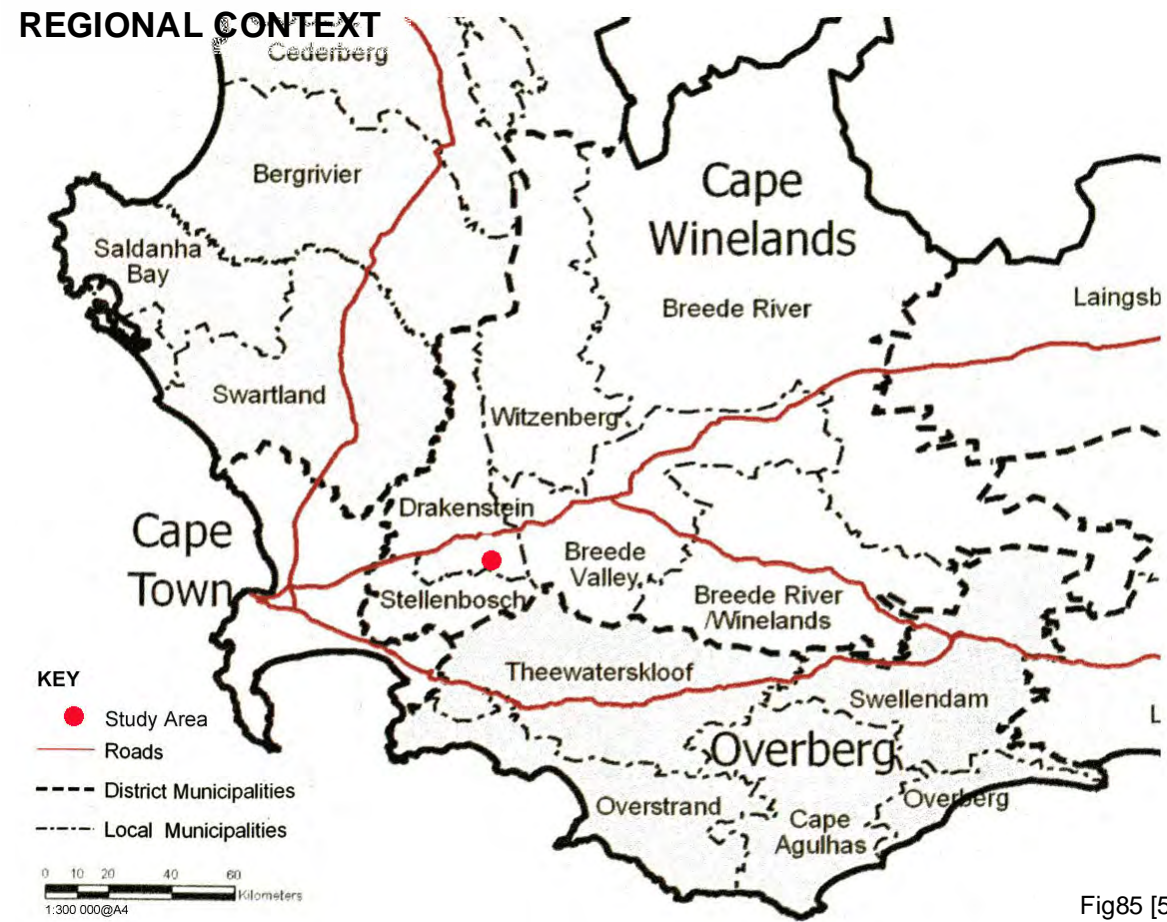


Fig85 [59]

Stellenbosch municipality is one of the three rural municipalities abutting the metropolitan area of the City of Cape Town [69](See Fig 85). Local Planning Documents forming the context of the study area are:

- Boland District Council Spatial Development Framework (draft 2002)
- Winelands Integrated Development Framework Spatial Plan (2000)
- Stellenbosch Municipal Integrated Development Plan (2002)
- Stellenbosch Municipal Spatial Development Framework (2003)

Additionally, a number of development frameworks have been created as a result of planning and economic studies completed in this area:

- Franschhoek Valley Conservation Study (1992)
- Franschhoek Spatial Development Plan (2000)

STELLENBOSCH MUNI-SDF (Fig 86)

The preparation of an IDP for the greater Stellenbosch municipal area (WC23) is currently underway. In accordance with both the Municipal Structure and the Municipal Systems Acts the draft IDP's for the former Winelands District Council and that of Franschhoek town have been incorporated into the new IDP process as policy documents [72]. As part of the Integrated Development Plan, Stellenbosch Municipality has prepared a Spatial Development Framework (See Fig 87). This framework feeds into the Boland District SDF and coordinates with surrounding SDFs, such as the City of Cape Town, Breede River, Drakenstein and Overberg [69].



Fig86 THE STELLENBOSCH MUNICIPALITY IN THE SUB-REGIONAL CONTEXT [69]

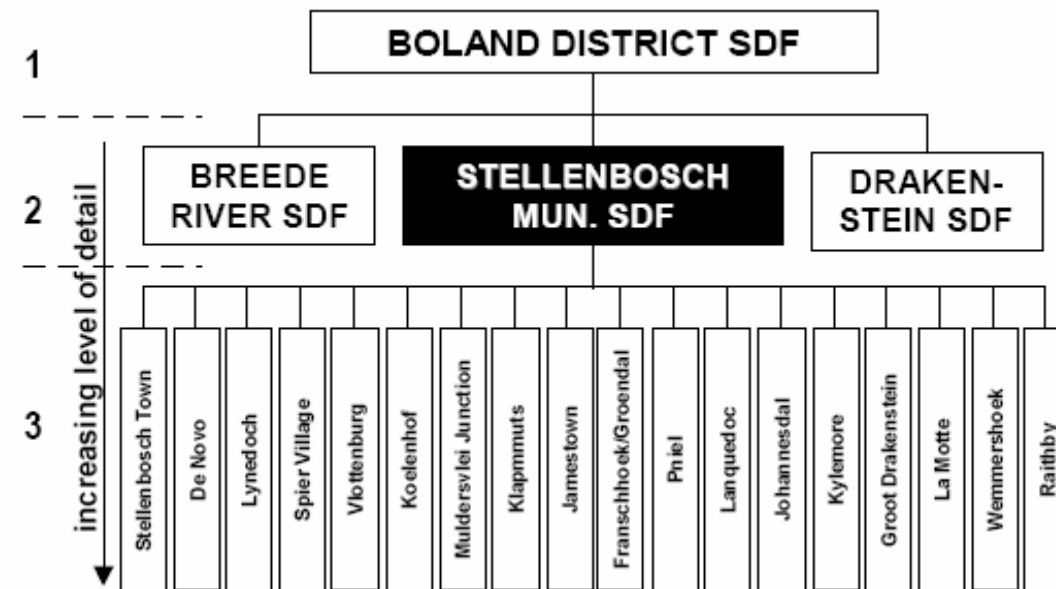


Fig87 HEIRARCHY OF RELEVANT PLANS [69]

Municipal SDF Mission Statement

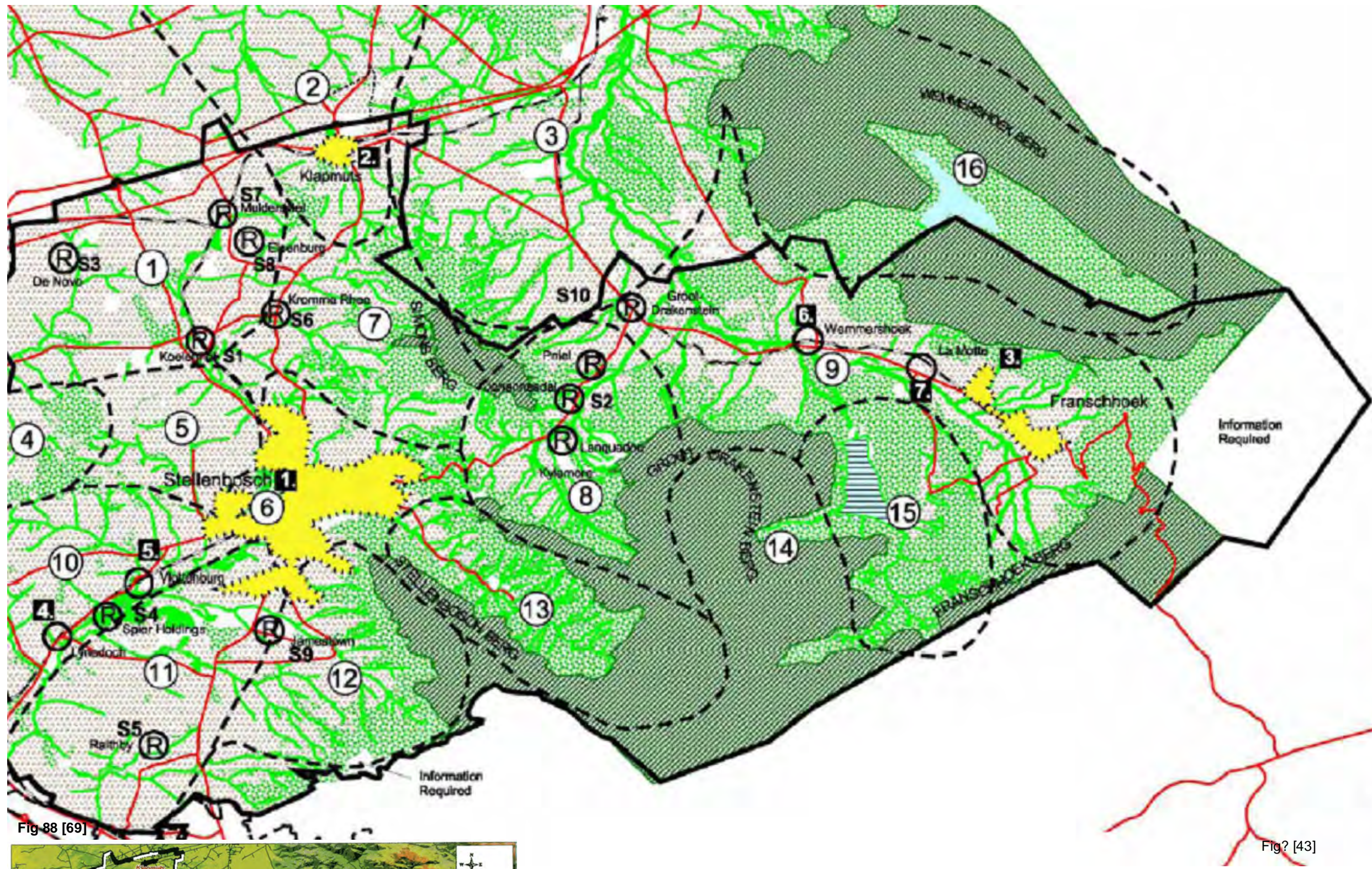
"The spatial development framework of the Stellenbosch Municipality should be measured by the "triple bottom line" of economic efficiency, environmental sustainability and social justice with an emphasis on the issues facing the rural and urban poor"

With this in mind, central to **Franschhoek's spatial planning** is the fact that the urban "footprint" (as defined in the Franschhoek 2000 Spatial Plan) should not be allowed to expand. Whilst the Urban Edge of Franschhoek is undergoing definition at present [69] the plan allows for future demographic pressure to be accommodated through inward densification and integration, and the development of rural hamlets at appropriate places elsewhere in the valley [72]. This appears to be in line with the **Winelands IDP** which provides for the establishment of neighbourhood/development areas and mechanisms to empower local communities to be effectively and efficiently involved in the planning and development of the areas [72].

The study area falls under Development Area No 9 (See Fig89)



STRUCTURE PLAN IMPLICATIONS:
 Planning and Development proposals should be consistent with the IDP's of both the former Franschhoek Municipality and Winelands District Council IDP Spatial Plans and the Stellenbosch IDP development principles



- KEY**
- Bio-regional Planning Zones
 - CORE
 - BUFFER
 - AGRICULTURE
 - SUB-AREAS
 - 15 Berg River Valleys
 - 9 Franschhoek Valley
 - EXISTING SETTLEMENTS
 - 3 Franschhoek
 - 7 La Motte

Fig 88 [69]

Fig? [43]



Fig89 DEVELOPMENT AREA 9 [75]

BIOSPHERE RESERVE PLANNING
 The establishment of the Boland Biosphere Reserve is underway and aims to co-ordinate local, provincial and national government bodies to promote the long term sustainable development of the area by active involvement of local communities [72].

UNESCO's MaB Programme and its Biosphere Reserve concept is said to provide for an internationally accepted spatial model for the implementation of bio-regional planning principles and the promotion of sustainable development [72].

POLICY SURROUNDING THE DAM

According to the Muni-SDF, and the Biosphere Reserve Plan, the study area is located adjacent to a *Core Conservation Area*, and therefore will act as a Buffer Zone in this respect.

Core Conservation Areas in the municipality have been described as 'high mountains' and will consist of:

- Stellenboschberg
- Jonkershoekberg
- Simonsberg and
- Wemmeshoek

Buffer Zones are designated to the lower slopes of the mountains where more human interaction can be accommodated. These areas include:

- Public conservation areas
- private conservation areas
- ecological (river) corridors- which can extend through transition areas
- rehabilitation areas (former alien tree plantations requiring restoration)

Activities permitted in these areas include;

- applied research
- environmental education, and
- eco-tourism.

Any development proposals that are made must result in considerable increased environmental improvements, such as acquiring land for conservation purposes, clearing of alien vegetation, or other similar improvements. No agriculture is permitted in these areas. The only exception would be the sustainable harvesting of natural resources such as Protea farming [69].

The *Transition zone* between the two is the designated agricultural area. Two types of agricultural practice are allowed on low-lying slopes of the region;

- extensive (grazing and pastures) and
- intensive agriculture (fruit and wine farming)

This zone is said to experience considerable pressure from development [69] and require development control and design guidelines as urban development in this area can have a major visual impact.



Fig90 AN ILLUSTRATION FROM TODESCHINI & JAPHA, GUIDELINES FOR CONSERVATION & DEVELOPMENT [2]

The Berg River Dam is on the border of 2 different Local Municipality Boundaries: Stellenbosch and Drakenstein, making it a contentious area in terms of planning. The Regional Authority has indicated that they would undertake a structure plan for land surrounding the dam [10] to guide the development of recreation and tourism development associated with it.

'The Upper Berg River **Sub-Regional Plan** was initiated by the Regional Planning Branch of the Winelands Regional Services Council with the purpose of revisiting the Guide Plan for the Cape Metropolitan Area: Paarl/ Wellington volume and to extend the planning boundaries to include the surrounding rural areas (Van der Merwe Duxbury and Kirkwood, 1994)

The Sub-regional Plan recommends that Todeschini and Japha's reports (1992a;1992b) on the conservation of the Franschoek Valley guide all development in the area (Van der Merwe Duxbury and Kirkwood, 1994).

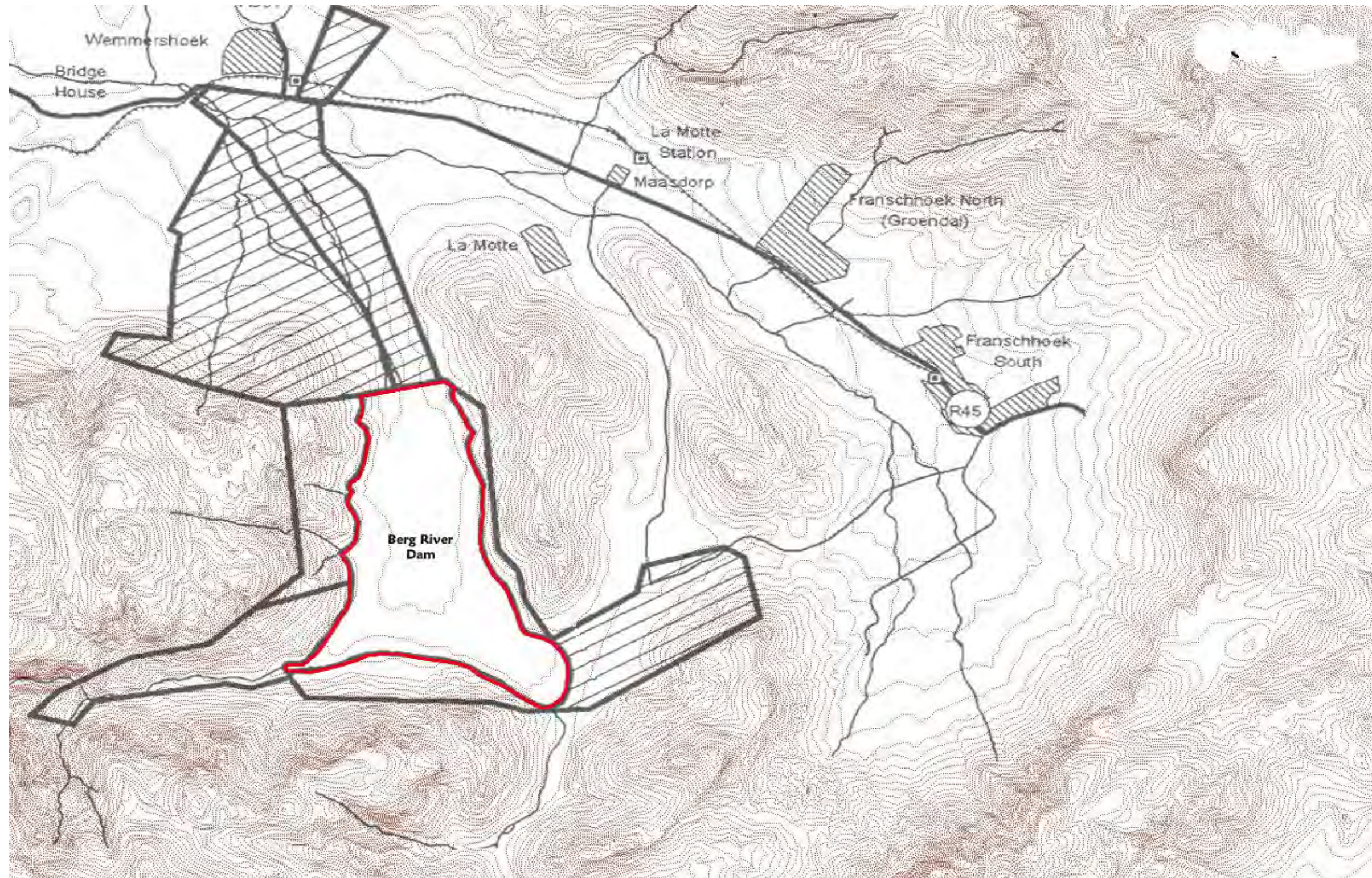
Franschoek **Guidelines for Conservation and Development** were compiled for the Franschoek Trust, drawn up with the aim to conserve the historical aspect of the town and its surrounds. The document encourages both private and public developers to follow general principles, rules and regulations in their work, yet it has subsequently been decided that the draft sub-regional plan will not be finalised into a formal plan, but that it will rather be used to inform planning decisions [10].

With regards to the Berg River Dam, the Sub-regional Plan recommends that large dams should be open to the public so that they can be utilised for recreational use rather than solely for water storage (Van der Merwe Duxbury and Kirkwood, 1994) It continues to say that "... every effort should be made to open up these natural assets (being the Berg river and surrounding mountains) so that they can be enjoyed by as many as possible" (VDK & ZS, 1995)

Considering these stipulations, DWAF was committed to carry out certain actions outlined by an integrated Environmental Management Procedure.

This included the initiation, management and compilation of a zoning plan granting access to optimise the recreational development and conservation potential of all land within the expropriation line (including the water surface) for use by the public.

This zoning plan was to be finalised during the design phase of the dam, allowing opportunity for public participation and later incorporated into a regional structure plan if the structure plan was initiated by the regional authority [10].



LOCAL POLICY IMPLICATIONS:

- Development must be consistent with the Bio-Regional planning 'Buffer Zone', its designated areas and preferred activities as well as the Franschoek Guidelines for Conservation and Development
- Initial stages of the SUP process define uses for the dam and suggest suitable areas for these activities. Although this process is on-going, it does suggest implications for development.

Fig91 [69]

KEY

- original SUP Area
- CLCC land added

SCALE 1:50,000 @ A3



The SUSTAINABLE UTILISATION PLANNING PROCESS has integrated the above plans and frameworks as well as other local development initiatives and guidelines such as:

- La Motte Land Reform Initiative
- Franschoek empowerment and development initiative
- DWAf Policy on Using Water for Recreation Purposes (march 2002)
- DWAf Summary Planning Procedure for Sustainable Utilisation, Access and Development for Recreation, Tourism and Socio-Cultural Purposes (July 2001)

An Opportunities and Constraints Analysis has introduced the SUP process for the Berg River Dam (above). According to the SUP, *only economic economic uses related to conservation, environmental education, research, tourism, recreation and agriculture are in alignment with the policy, legal and administrative framework.*

Additionally, it has made it clear that this land is state owned and will not be made available for private purchase.

LAND OWNERSHIP & LAND REFORM

Of the 560ha of land required for the dam, the majority is under state-ownership as Forestry Land. Two privately-owned farms were purchased by the State for the extents of the reservoir, one of these being Dew Dale Trout Farm.

The farm, on the southern portion of the proposed inundation area, is about 38hectares in size with good infrastructure and an extensive area of ponds supporting the fish-farming. Buildings associated with the fish-farm have been demolished for the purpose of relocation, yet one large building, which is currently used by DWAF, will remain above the 250metre mark of the full-dam-level. Additionally, the ponds will remain within the section of fluctuating water levels, but their purpose of course would fall away. According to the EIA, the owners have been generously compensated for their loss of land.

The western and southern edges of the inundated area accommodates a 'conservation link' to the False Bay Coast, which is protected by the urban edge of the municipality [69]. The Cape Nature Conservation Area has full jurisdiction over the vast mountainous area of the Hottentots-Holland Nature Conservation Area, managed for conservation and a source of high quality water [10].

Forced removals were carried out under the Group Areas Act, which further antagonised the issue of the "haves" versus the "have-nots" in the days of Apartheid. The lack of democracy during these times has resulted in no public housing being provided for the past 17 years prior to 1996 [75/10].

Realising at last that transformation was essential, and guided by progressive leaders in the village, the Franschhoek community decided in 1998 to take hands and signed an Historical Social Accord [72]. This agreement, with its aim to commercialise municipal-owned assets to the best advantage, aims to cross-subsidise development projects which will house, employ and uplift the previously disadvantaged members of the community.

La Motte Empowerment Trust is involved in land reform initiatives, with the aim of benefiting all stakeholders across the spectrum. The trust has recently put forward a proposal to have some the La Motte State Forestry awarded to the community as a land reform project. This proposal seeks to address the land issue in a meaningful manner [72].

OWNERSHIP IMPLICATIONS:

- *State-owned land holds little opportunity for private developers yet encourages community-orientated schemes to operate successfully.*
- *Although there are no land claims in this area, land reform initiatives are seen as sensible, providing they are sensitively implemented and do not jeopardise the priority of the area for optimal water-quality storage.*



Fig 93. Dew Dale Trout Farm [24]



KEY ISSUES & PROBLEMS

In depth analysis of the study area has highlighted a number of key issues, problems and needs. As in the analysis, issues and problems have been considered in terms of:

- the existing environment
- infrastructure
- the socio-economic situation &
- planning policy regarding the area

The needs for the study area will be informed by short-comings outlined by the above, and will be looked at separately in terms of:

- The regional & local community
- Tourism & Recreation &
- The Local Authority

This section will dictate the Opportunities and Constraints for the site.

ENVIRONMENTAL ISSUES

- The position of a regional fault line cutting through the site poses the threat of seismic activity in the area
- The topography of the site leaves limited flat ground and space for development, with the added issue of visual impact.
- Red & Yellow Apedal soils, found throughout the study area, are easily erodible and therefore have implications for development
- Hydrologically, a major issue with developing around the dam will be the fluctuating water-levels
- The free-flow of water from around the catchment into the dam is essential and therefore any development will have to pay heed to natural drainage lines
- Development below the 100year flood-lines could cause considerable damage by naturally-occurring floods
- Areas around the dam with an ideal degree of human comfort in terms of climate are limited to the steep eastern slopes of the dam
- Indigenous vegetation is largely recovering around the dam, and therefore should remain intact and undisturbed as far as possible
- Ecologically sensitive riverine corridors and animal migration-paths must be retained as far as possible in order to make up for the loss of habitat due to inundation of the dam-area
- The presence of a sensitive wetland downstream of the dam wall should prohibit any development in this area
- Preservation of sites and vegetation of historical interest should be carefully considered

ENVIRONMENTAL PROBLEMS

- The danger of Debris slides on the south-eastern side of the study area due to the Kilpheuwel substrate is a problem, and these areas should be avoided in terms of development
- Eroding banks increase sedimentation into the river which is huge problem in terms of optimal water quality
- Physiographically, the area is dominated by ridges which presents the problem of noise travelling across the dam and reverberating against the steep valley sides
- The slope analysis of the site indicates that the area is dominated by critical slopes which is a severe constraint for development
- The rise and fall of water-levels will restrict permanent features below the height of 250m contour line. These areas are also unlikely to support fringing vegetation.
- A 'potential' aquifer in the Robertsvlei valley should be explored further and be considered as a constraint for development, if proved viable
- High winds created by the tunnel-affect by the valley leave most areas around the dam exposed
- Katabatic winds result in a blanket of cloud collapsing over the entire dam-site in the early hours of each day- this could have implications for the early morning views across the dam
- Hot Summer temperatures and strong winds make the study area susceptible to the risk of fire
- High winds have the potential to pick up loose sand around the dam. Wind-blown sand could be a bigger problem in summer months, when the water levels are low.
- Restoration of indigenous fish species will be impossible until the exotic species are eradicated
- A sense of place is lacking in terms of 'arrival' into the site- there is poor utilisation of the 'natural gateways' presented by the topography of the site
- Scenically, the site has a low visual carrying capacity, and any form of activities and development will have to be placed with visual sensitivity.

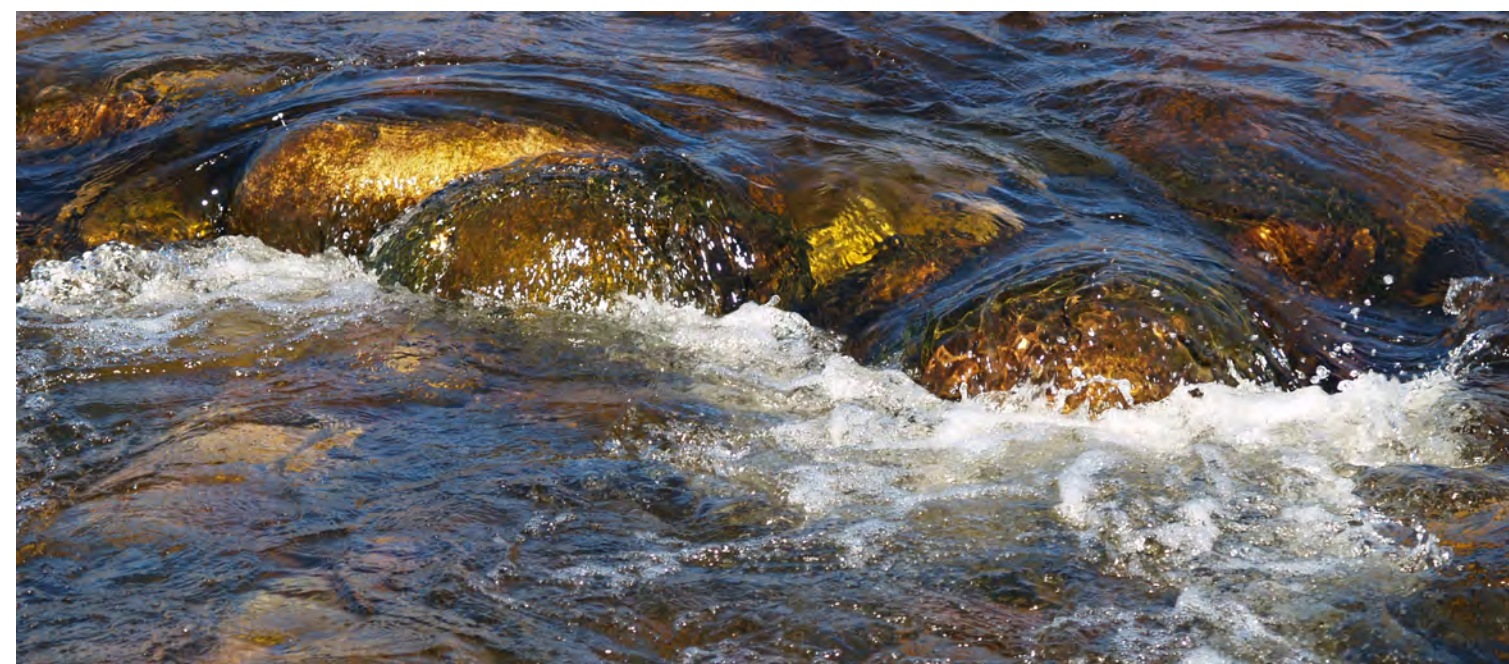


Fig1 HIGH-QUALITY WATER [63]

INFRASTRUCTURAL ISSUES

- Road infrastructure implemented for construction purposes is extensive throughout the site and strategic planning should enable many to be eradicated if not suit for the purpose of future development
- Rail transport into the area should be considered for the purpose of encouraging daily commuters out of Franschhoek and therefore helping the level of unemployment during the 'off-season' months
- Rail transport could also be promoted for tourist-use
- Limited access filters though to the linear form of the river downstream
- The remote nature of the site from Franschhoek itself limits the possibility of extending Sewage-services to the site.
- The lack of outdoor recreation and alternative accommodation choice in the valley limits opportunities for a particular bracket of tourists

INFRASTRUCTURAL PROBLEMS

- In terms of sub-regional access, the Franschhoek Valley is located on a Bypass route (R45) which can inhibit local trade and the character of a place to some extent
- Disused Forestry Roads promotes unnecessary access into the site
- Limited public transport throughout the valley, with the exception of informal taxis, is a problem, particularly for the study area, are these taxis are restricted from operating these areas.
- Discharge of waste water from any form of development must be management effectively so as not to affect the high quality of the water

PLANNING ISSUES

- Land throughout the study-area is state-owned, therefore limiting opportunities for private developers. Whilst recognising this is positive in promoting community-public-partnerships for use of the land, lack of ownership could be detrimental to creating a 'sense of belonging' in the study area.
- International canoe-events will be curtailed by the impoundment of the Berg River, although the most favourable stretch is that upstream of the dam-site.

PLANNING PROBLEMS

- The City of Cape Town's need to recover the costs of the Berg River Dam quickly may be detrimental to the lower-income communities of Franschhoek in terms of benefit and access to the Berg River Dam.

SOCIO-ECONOMIC ISSUES

- Tensions between socio-economic groups have developed due to the increased shortage of housing in the area
- The loss of jobs on completion of the dam construction works will leave skilled-workers with limited future work opportunities in the valley
- Social conflicts have been foreseen [10] as a result of permanent DWAF staff receiving housing in an area which has a great shortage
- The lack of functional, accessible recreational spaces for the lower-income communities poses an issue
- Education facilities in the valley have room for improval
- Further pressures on jobs and infrastructure within the valley have been estimated [10] as a result of migrant workers arriving in the valley looking for work, during construction of the dam
- The Franschhoek tourism market currently caters solely for the upper-class and exclusive clientele only

SOCIO-ECONOMIC PROBLEMS

- The loss of jobs associated with the inundation of both LaMotte and DewDale Trout Farm will further add to the unemployment problem in the Valley
- The unlikelihood of the dramatic increase of employment in the valley poses a large problem for the future inhabitants in the valley, particularly those currently unemployed
- The fact that the bulk-water supply of the Berg River Dam is going to the City of Cape Town highlights the problems of Dams in general. They are not usually positioned for the direct benefit of the local community.



Fig2 DAM OPERATIONS AREA [63]



KEY ISSUES • PROBLEMS • NEEDS

REGIONAL COMMUNITY

- The CMA's need for water is obviously a priority in this context, and development around the dam should in no way impede this need.
- Recreational needs of the time should complement those activities that are limited on a regional scale, for examples on surrounding dams such as Theewaterskloof
- The needs for small-scale timber production has been suggested in the 1996 White Paper on Sustainable Forest Development. Perhaps the study area could incorporate such activities.
- DWAF's strategy for the Zoning of State Dam Basins pronounces that *Affordable, equitable public access shall be ensured at all State dams.* This is of course relevant in this context.
- The fact that this area susceptible to fire, the need to incorporate Integrating Fire Management is essential, this would be in line with meeting the needs of a new provincial initiative "Working for Fire"

LOCAL COMMUNITY

- The location of the historical site of Skuifraam Ruins adjacent to the dam wall presents a need for historical preservation
- Housing is seen as a vital need within the Franschhoek valley as a whole and the building of La Motte village to accommodate the permanent workers on the Dam has seen to reduce the shortage of housing slightly
- A shortage of educational facilities for Xhosa speaking children has been pin-pointed



- Creating employment within the local community should be addressed as a priority
- Subsistence farming and the harvesting of indigenous flowers and reeds along the Berg River could to some extent, resolve the problems of unemployment in the area. Although this would have to carefully monitored.
- Links to the existing community with the study area are seen as a need in providing equitable access to the dam

TOURISM PROMOTION

- CNC is currently promoting the stocking of dams with *Barbus andrewi* in order to promote it as a recreational angling fish. Exotics upstream will have to be eradicated or contained prior to stocking of indigenous fish for it to be successful.
- The position of the dam wall in relation to the R45, a local 'scenic route' is a concern. Measures should be put in place to limit the visual impact of the dam wall and further development in this area planned accordingly.
- Additionally, development around the dam should be in keeping with the surrounding Conservation areas
- The study area should look towards accommodating the needs of the changing tourism industry, that is, with the view towards Eco-tourism and recreation

RECREATION

- Upgrading of the existing road infrastructure within the site should be carried out in order to guide access throughout the study area
- Lack of access to the riverine corridor highlights the need to establish some sort of pedestrian footpath network along the river system
- According to the EIA:- Provision of *access to the surrounding mountains* would be important to the full realisation of the amenity value of the dam
- The need for more standard youth and family-orientated accommodation and camping facilities within the Franschhoek valley has been highlighted
- The dam operating-area should be carefully considered so as to ensure safety of the user of the amenity

LOCAL AUTHORITY

- The study area should strive to meet the needs put forward in the Sub-regional Plan, that is to conserve the Franschhoek valley according the Guidelines for Conservation [2]
- Furthermore, it should attempt to deliver the recommendation of the Plan to enable large dams to be accessible to the public and dually used for recreation as well as water-storage
- A workable Development Plan is needed based on the SUP, to further dictate site-selection and development around the Dam
- Access to the study-area is required through Private Land income cases. Permission for access will be required from relevant owners and planning permission approved.

MISSION SETTLEMENTS

With careful consideration of the key issues, problems and needs of the study area, precedent aims to help harness these elements allowing for the initiative of the conceptual process.

Mission Settlements are unique to this day. Their physical forms are dominated by a simple structure that hosts environments which are both distinctive and varied [72], allowing a complex social-makeup. The word 'mission' in South Africa has unfortunately led to racial distinction. but for the purpose of this document we are looking at the positive elements of missions and why they carry such value in terms of the planning and structure of small-scale settlements.

MISSION SETTLEMENTS IN THE WESTERN CAPE

Their Raison d'Etre

Missionary activity began in South Africa began in the 19th Century as it did in most parts of the world. The first mission settlement was established as a school for young slaves by Jan van Riebeeck in 1658 [72] and later efforts were made to evangelise Khoi people in and around these settlements.

Defined as 'small rural settlements...on defined pieces of land which were developed by or controlled by a church as centres for an existing or potential Christian community, and which cater for or are inhabited by the rural poor' [72]. Supported by the colonial government, many of these mission settlements were quickly populated with the help the vacuum left by the breakdown of the indigenous culture- the "Hottentot Laws" of 1809 laid down that the Khoi-khoi had to have a fixed place of abode, which meant a white-owned farm or a mission.

In the Western Cape and amongst the Khoi, it was the Moravians which had the largest influence over mission establishments whereas elsewhere in the country, other external and localised institutions had more influence. This ultimately influenced the church domination operating throughout the country.

Historically, Mission Settlements also played an important role in providing community education and services, yet in more recent years, central and local authorities have extended their control over areas of South Africa, leading to the more secular functions of missions falling away [72].

Their Structure

2 Predominant concepts evolved from the onset of urbanisation in the 1900s:

- **Mission settlements** in rural areas where population dominated These were economically productive institutions- self-sustaining and self-containing, dependant on agricultural practices and social services.

- **Mission stations** which invited a range of social services to rural areas and were not specifically centres of population

Most settlements were based on farming and used land to attract potential converts. Additionally, they offered education & training, small-scale industrial or craft production. Many mission stations were based on the same model: a strong mission involvement in all aspects of the community, strict adherence to moral and work ethics, and the promotion, first by incentives and then by regulation, or 'western' as opposed to indigenous building forms [72]. Changes to the housing type and traditional dress in the settlement was seen as visible sign of success that people had been converted.

ELEMENTS THAT CREATED A WORKING MISSIONARY SETTLEMENT:

- Most missions were found to be carefully planned, large scale, and relatively dense .
- A high degree of geometric organisation was centred around a well-planned nucleus and permanent domestic buildings. This form developed in response to a strict religious order and were arranged to form a farm-like 'werf'.
- Evidence of those unwilling to conform was evident in the haphazard arrangement of traditional dwellings of all kinds with colonial buildings. This loose form was also said to be seen in village that had existed before the arrival of missionaries, and therefor had maintained their traditional form.
- Arrangement of rectangular buildings (See Fig 3) in parallel rows was also indicative of a definite sense of purpose. Based on the Herrnhut model first used by the Moravian Church in Europe. Each house had a garden as well as the shared access to communal lands for agriculture and grazing This was a particular influence of the German Missionary Societies, (Berlin, Moravian, Hermansberg or Rhenish) which tended to implement a more organised approach to total planning than other societies. Often towns were orientated with the existing topography and had a strong interaction with the local climate. The Mission villagers worked with the land, as subsistence agriculture was seen as a means of survival.
- The associated architecture had common white lime-washed walls, pitched thatched roofs or flat-roofs and parapets, gable-end walls, scultural chimneys and usually raised stoep platforms often covered with a pergola.

Two examples of Missionary Settlements that are still living communities today are Genadendal and Elim...



Fig3 A TYPICAL ROW OF RECTANGULAR BUILDINGS, WUPPERTAL 1830 [72]

GENADENDAL

Established by the **Moravian Missionary Society** in 1730s, whereby the missionaries settled amongst an existing group living in a remote valley. These “Hottentots Laws” encouraged the establishment of Genadendal

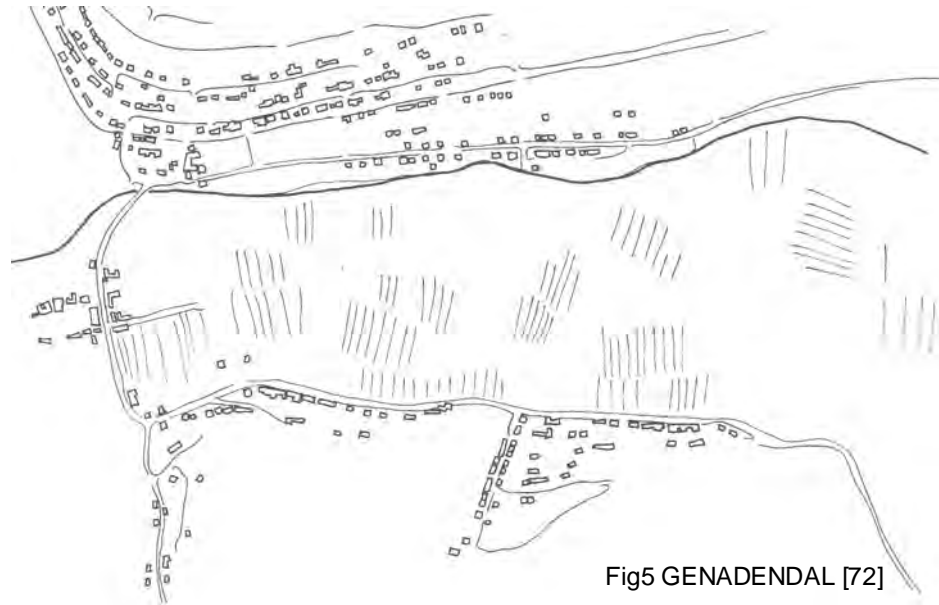


Fig5 GENADENDAL [72]



Fig4 VALLEY LANDSCAPE OF GENADENDAL

LAYOUT

- Contains 2 historic mission cores. The mission core in the main village is characterised by a *werf* which was conceived as the spiritual centre of the mission station as far back as 1850

- houses of 4 coherent village-scapes which result in a highly unique cultural landscape
- houses flank the river valley and are orientated towards the agricultural land at the valley-bottom situated along the contours (See Fig4)
- many vantage points offer views toward the *werf* buildings and across the settlement and its surrounds
- most houses bound the street edges, serviced by water furrows, emphasising the linear form of the settlement
- Furthermore Genadendal is the centre of 3 other outstations, Bosmanskloof, Voorsetekraal and Bereaville
- other elements which determine the quality of the streetscape are: stoeps, pergolas, boundary walls, fences, gates, hedges and trees

HOUSING

- 200 cottages, built of wattle and daub with thatched roofs.
- Houses were rectangular in shape, usually with a span of 5m determined by the length of the timber-beams offered by the mission societies at the time.
- The basic external form usually consisted of a single-storey with thatched pitched roof and gable ends with the occasional *wolwegevel* over the front door [73]. These materials were obtained locally.
- They usually occurred in short runs of 4 to 5, but in some cases up to 15. Specific standards were apparent of the control exerted by the mission societies

5000 residents remain today. The old town is valued for its vernacular landscape and deeply imbedded cultural meaning.

SOCIAL ASPECTS

- Strong mission involvement in all aspects of the community
- Strict adherence to moral and work ethics
- Promotion first by incentives and then by regulation, of “western” as opposed to indigenous building forms
- Magnolia Nursery at Genadendal is a small-scale nursery developed to supply local planing and landscape projects
- Some communities invited the missionaries in order to maintain associated possession of the land yet still maintained their nomadic-characteristics

ELIM

Established in 1824 by **German Missionaries**, Elim, meaning ‘Place of God’ is located near the southern-most tip of Africa. Originally the *Vogelstryskraal Farm*, it was taken over by the missionaries and presently, is a lively community with a large tourist attraction for wine, good food and hospitality.



Fig6 STREET LANDSCAPE OF ELIM

LAYOUT

This small hamlet community is centred around the beautiful thatched Moravian Mission Church. In comparison to Genadendal, Elim is the inverse in the flatter coastal landscape (See Fig 6). The village is held by the built historical core that is the street whilst the agriculture bordering the outside.

Ironically, although the missionaries subscribed strongly to the principles of sobriety and Christian living, the need for sacramental wine for the church services gave reason to found the first vine-yard over 100years ago. Today, Elim is a world-famous wine-producing hamlet [74].

Elim is surrounded by fynbos which is largely endemic and due to its close location to Geelkop Nature Reserve, it benefits from this attractive from a tourist perspective.

The people of Elim are famous for their ‘thatching skills’; a skill that has been traditionally passed down from generation to generation [74]

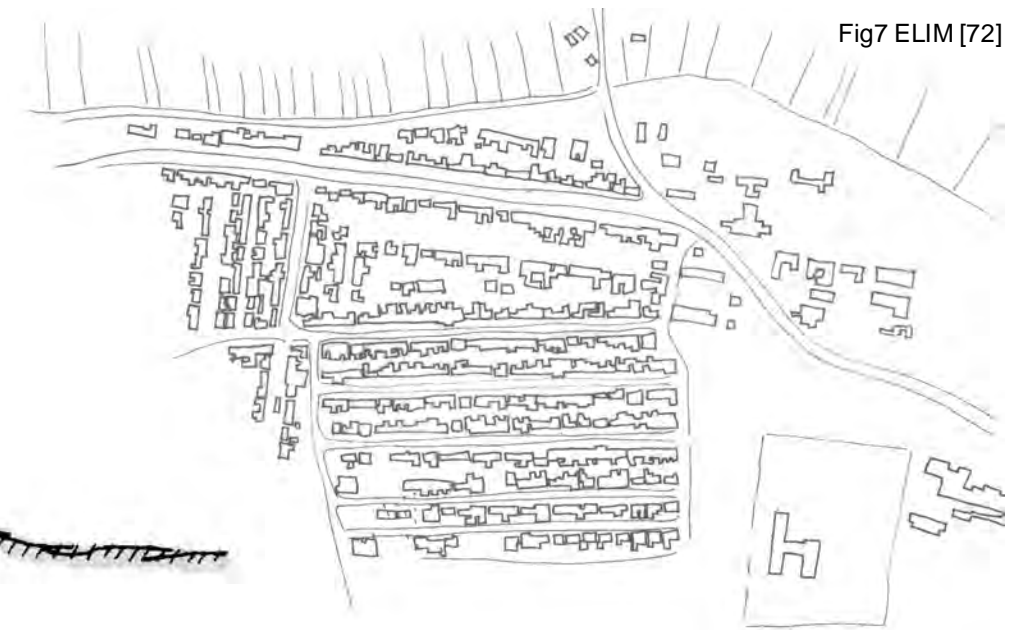


Fig7 ELIM [72]

LESSONS LEARNED:

- Based on Hierarchical Arrangement of Public Spaces with an organic or sometimes random form
- Dominant spaces were Community orientated with sense of education
- Residential elements concentrated on the street, enabling safe environments
- Open space a fundamental element
- Agriculture directly related to town

OPPORTUNITIES PRESENTED BY MISSION SETTLEMENTS

Many Mission Settlements hold great cultural and historical relevance, yet changes in the character of church institutions, poverty and badly managed growth population and violence is leading to the disappearance and deterioration of these places.

The concept that Mission Settlements explore is a valuable one and should be carried further in our future developments. The capitalisation of nature conservation for economic purposes could be explored and it could be associated in the public mind with progress and general community upliftment in South Africa.

In terms of enterprise, economic possibilities that could be considered together with local communities could include:

- Various levels of agricultural production, from subsistence to agri-business. This could include small-scale nurseries to supply local planting and landscaping projects
- Forestry and local afforestation projects in conjunction with state forestry departments
- Small-scale industries
- Periodic markets
- Development of traditional and new arts and crafts activity, eg bakoond bread making, weaving of mats, baskets. This would additionally compliment the promotion of local tourist industries
- Home industries and micro-enterprises, promotion of restoration crafts such as small joinery works, blacksmith shops, that would serve both local and regional needs.
- Tourist related economic activity, including eco-tourism where there are the resources to support it
- Education and health service functions
- production of building materials, such as cultivation of thatching reed,

All of the following would stimulate local employment and community involvement, leading to the creation of a sustainable settlement.

In terms of built settlements, a specific element of the Mission Settlement, the 'werf' has been found to play an important role in the architecture and planning of small settlements in the South Africa.

Translated into English, the word essentially means a 'farm yard' as it usually contained the space between a main farm house and the out-buildings concerned with the workings of the farm itself. However, in terms of Mission Settlements, this elements had a greater meaning, and was conceived as the spiritual centre of the mission station [73].

The *werf* has been described as an abstract and timeless spatial structure... a 'living organism' that has accommodated the changing needs of the times yet a result of material and historical developments over the last two centuries [73]. In the past the werf formed the core of the settlement, and was usually a place of work with a strong association with education.

The structure of the *werf* had a distinct urban quality with a particular socio-economic meaning within the settlement as a whole. Typically, an avenue of oak trees lined the *werf* leading up to a bell-tower usually offset from the main-building. Other landscape features that typically accompanied the *werf* were hedgerows, water furrows, garden walls and fences.

Today, the *werf* has been deprived of its historical education role yet still still remains a significant place of assembly, residence and worship.

In the local context, an example of a farms that still has the typical *werf* is Boschendal. Boschendal was among one of the farms bought by Cecil John Rhodes in 1897 [8]. The main house anchors the 'Werf' with two long parallel rows behind the house, almost creating a street. This great werf with mountains as the backdrop created Boschendal's magnificent

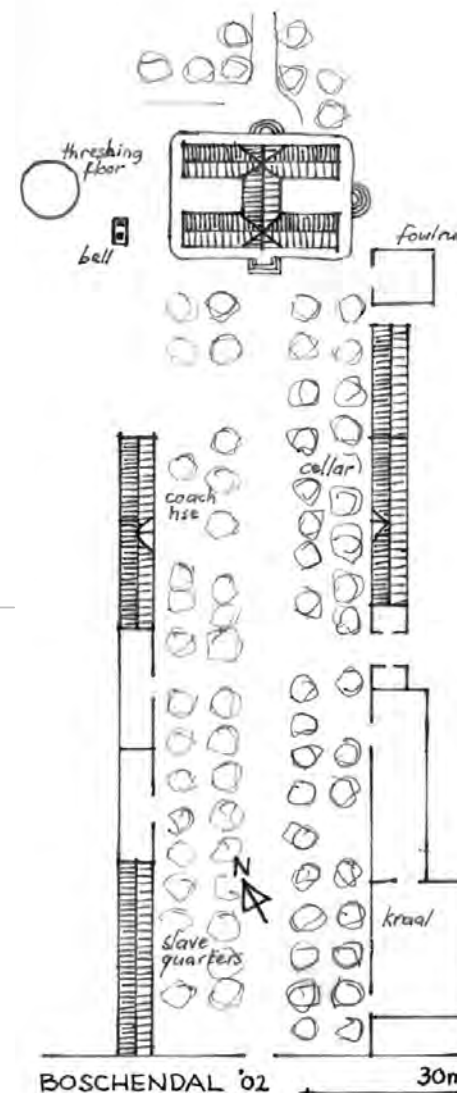


Fig 8 [8] & Fig9[21] Boschendal

DEVELOPMENT ON DAMS

Development of dams on the other hand, has only evolved in the last few decades in South Africa. Vast bodies of water have been said to bring about inner satisfaction and peace to those who behold them [6]. This suggestion is obviously disadvantageous to the environment, as development is often carried out to its detriment.

Through my reading however, it appears that the type of development associated with dams aims to provide exclusive accommodation and recreational opportunities.

MIDMAR DAM

Located on the Umgeni River near Pietermaritzburg in the Midmar Nature Reserve, the dam is highly accessible by a good road network.

MIDMAR PUBLIC RESORT NATURE RESERVE (Fig 10)

Caters for a variety of user-needs providing accommodation varying from chalets, to camping and a caravan park.



Fig 10 [66]

Facilities on the dam include boating, swimming, picnicking, fishing, cycling and hiking.

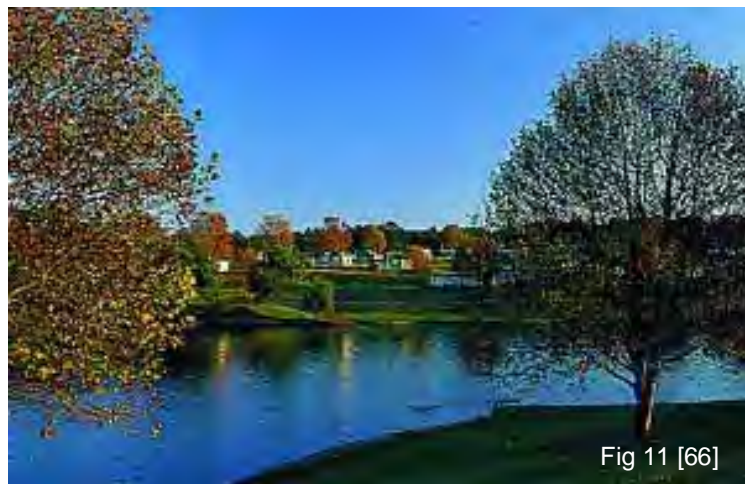


Fig 11 [66]

NOTABLE FEATURES

- Located near Midlands Meander (an association of rural business selling curios)
- 1000ha game-reserve adjoining the dam presents unique game-viewing opportunities
- Midmar Historical village creates added interest- a reproduction of a 19th century redbrick village with tree-lined streets
- The dam stages the world's largest open water swim, the Midmar Mile

VANDERKLOOF

Originally a village built to accommodate the construction workers of the dam about 35 years ago, Vanderkloof was redesigned into what exists today.

Initially consisting of 550 households and 2000 single workers, after being completely uninhabited twice, it was decided to save the town from demolition and create a holiday resort. The town now is home to holiday makers and retired persons and developed its own Municipality in 1980.

Facilities are typical of a small-scale settlement including shops, banks, churches, sports facilities, a post-office and police-station. Accommodation ranges from camping to hotels and exclusive guest houses.

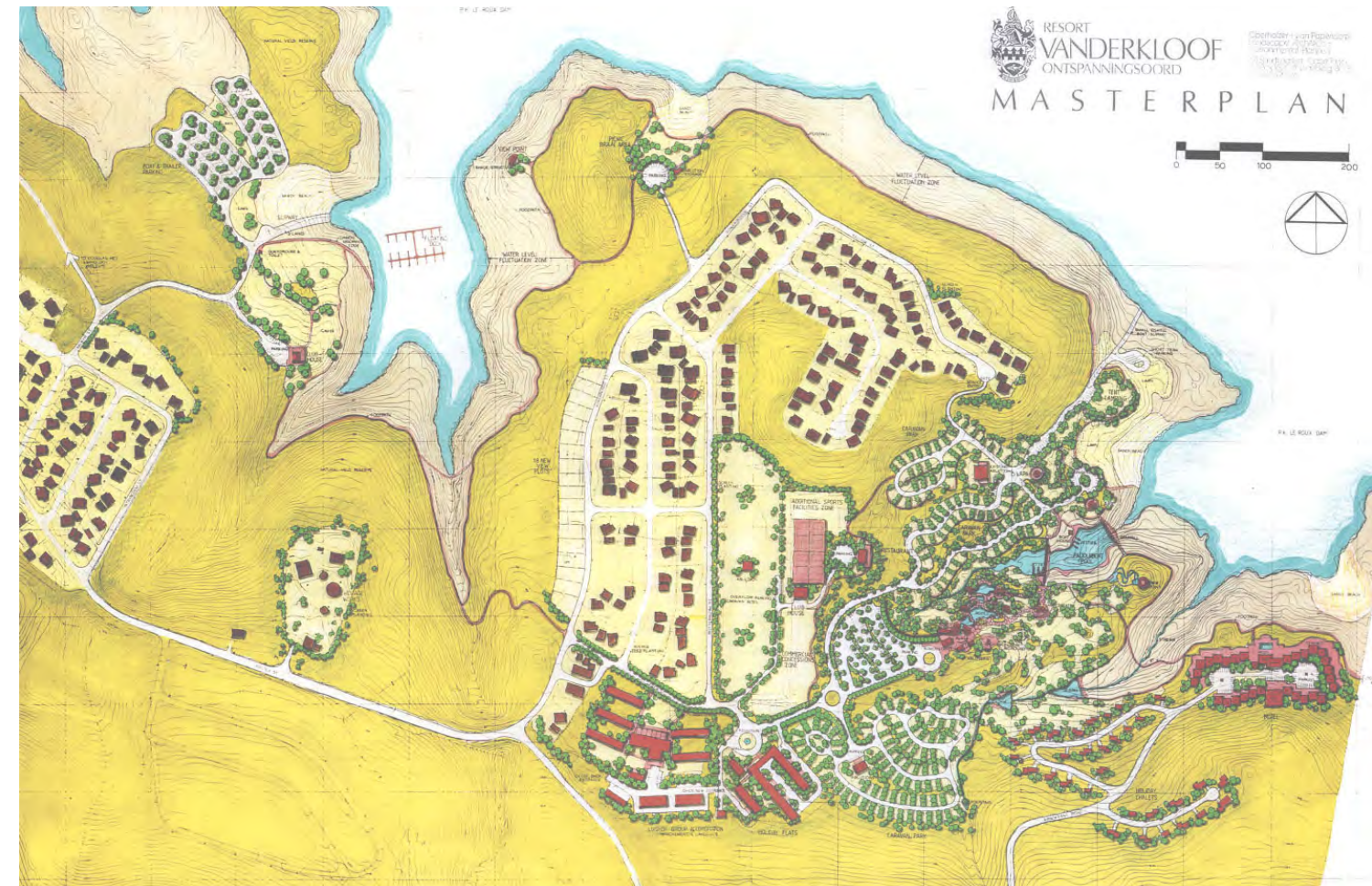


Fig 12 [65]

NOTABLE FEATURES

- Well-accessed in the centre of the country between Bloemfontein and Kimberly
- Close location of Rolfontein Nature Reserve
- Exotic Rock Paintings in the vicinity
- Municipal information centre with information on the history of the town

Fig 13 VANDERKLOOF, DESIGNED BY OVP ASSOCIATI



ECO-TOURISM

With the increased influence of environmental guidelines for Dam Developments, strict stipulations for EIAs are now necessary to be carried out in conjunction with development. Additionally, changes in the global tourist industry has promoted the concept of *Eco-tourism*.

Eco-tourism essentially means *ecological tourism*, where 'ecological' has both environmental and social connotations. Born in its current form in the late 1980s, Eco-tourism came of age in 2002, when the United Nations celebrated the "International Year of Eco-tourism" [42].

The term environment in its broader context has come to include the diverse community activities and cultures of a country's inhabitants, as well as its scarce and sensitive natural resources. Eco-tourism implies tourism practices that would benefit all concerned parties rather than benefit some concerns and neglect others. The term "eco-tourism" has therefore come to include concepts such as

- planning before development;
- sustain ability of resources;
- economic viability of a tourism product, no negative impact on either the environment and local communities;
- responsibility for the environment from developers, the tourism industry and tourists;
- environmentally-friendly practices by all parties concerned; and
- economic benefits flowing to local communities.

A number of attempts have been made to introduce Eco-tourism to Dam Developments, yet these developments again, suspiciously cater for the upper-income tourism-bracket and accommodate large housing units and golf-courses within their designs .

PEBBLE ROCK GOLF ESTATE- Roodeplaat Dam



Fig 15 PEBBLE ROCK [66]

The Pebble Rock Golf Estate, accommodates an 18-hole golf-course and is a popular weekend destination for city-dwellers, located just 25km outside of Pretoria in Gauteng. The tourism initiative behind the resort is particularly boosted by the presence of the Dinokeng Game Reserve, where the Big Five are currently being introduced into 200 000 hectares of bush.

In line with the Eco-tourism concept, Pebble Rock and other developments adjacent and within Dinokeng have been constrained by strict guidelines to avoid environmental despoilment and over-extended infrastructure [79].

Development continues to expand in the area however, and whilst construction attempts to promote economic growth, job creation and social upliftment in the area, the natural setting is unquestionably under threat.

COVES- Hartbeespoort Dam

Described as an 'upmarket holiday village', COVES is situated in the Magalies River Valley with private water-frontage of the Hartbeespoort Dam .

Leisure activities include boating, horse-riding, mountain-biking, golfing and hot-air-ballooning.

The resort is also within close location to the Skeerpoort country base, where users can picn, walk, bird-watch and fish. Additionally, residents have access to 2km of 'private river' for boating.



Fig 16 'COVES' [66]

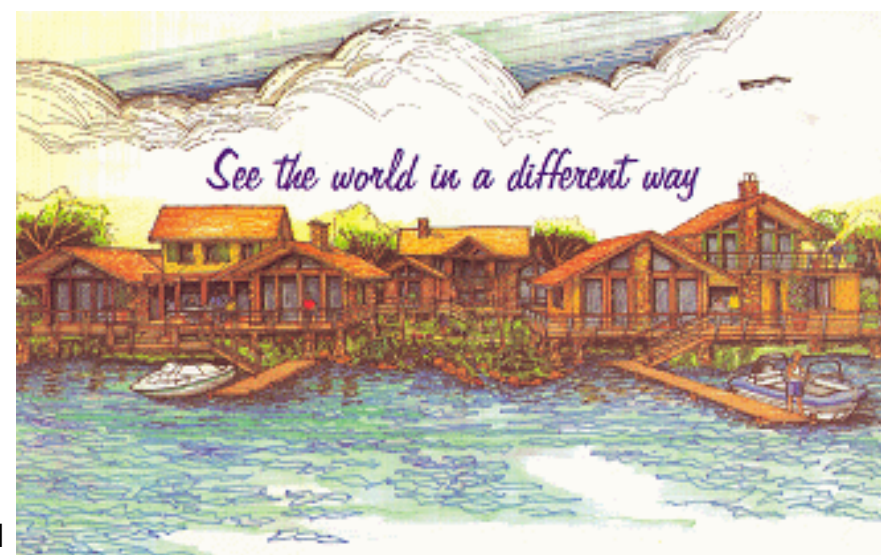


Fig 14 'COVES' [66]



ENVIRONMENTAL EDUCATION

Programmes & teaching initiatives promoting Environmental education are wide-spread both throughout the world and South Africa. Many schools have adopted EE as part of their formal curriculum, whilst several community organisations aim towards educating their local residents, in the hope of creating an awareness for sustainable living.

The linking of 'environment' and 'education' in South Africa is seen as a way of contributing significantly to transformation and development. Environmentally literate citizens with armed with the knowledge of ecological sustainability and an ability to actively work to reverse environmental degradation, and resource mis-management.

Education is said to be improved significantly with the promotion of active learning in and about the environment through outcomes-based education. This is said to effectively deepen the relevance of classroom learning and strengthen school-community links.

Two examples of 'Eco-education' institutes which have been implemented to cater for this need are Maretlwane Bushveld School and SEED, (Schools Environmental Education & Development).

MARETLWANE BUSHVELD SCHOOL

Designed by Plan Practice on the outskirts of Pretoria, this institution is effectively a 'holiday camp' held in the school holidays of July and September. Described as a 'school wilderness farm', the school grounds were donated by Advocate Francois Junod, in his attempt to *bring the needs of mother earth and its cry for help to South Africa and its youth* [80].

SEED- CAPE FLAT PRIMARY SCHOOLS

Outdoor learning environments in the Cape Flats have been constructed through the notion of Permaculture. Permaculture is a unification of the words *Permanent* and *Agriculture* and *Permanent* and *Culture*, suggesting the combination of nature and people. Furthermore, the key idea behind Permaculture aims to produce a higher outcome of energy that it users, creating a highly sustainable situation.



Fig17 Abalemi Bezekhaya, Cape Flats [82]



SEED operates as an autonomous project of Abalemi Bezekhaya (NPO No.015 337) (above)

Other examples of Environmental Education facilities explored can be closely compared with the American 'Summer Camp'.

Facilities typically include:

- Life skills development & training
- Team Building, bonding, relationships, communications, conflict resolution, problem solving
- Leadership identification and development
- Environmental education & wilderness experiences, awareness , concern, responsibility & accountability,
 - Birding, tree identification, snakes & reptiles, insects and a range of environmental themes.
- Nature conservation, practical bush craft & survival skills, observation skills
- Culture & history tours
- Outdoor adventure & extreme sport challenges such as hiking, mountain climbing, abseiling, river crossing, canoeing, raft building and racing, horse trails, obstacle or challenge courses and archery

Clearly, the experience aims to benefit the user and promote environmental education through first-hand interaction with the outdoors.

LESSONS LEARNED:

DAM DEVELOPMENT

- Provision of a wide range of activities with close collaboration to local communities
- Optimal access for all users
- Allowing facilities to perform with the dual-function of servicing both private and public needs
- Harnessing existing natural resources to promote the 'Sense of Place'

ECO-TOURISM

- Integration of the multi-purpose approach of Environmental Management and Tourism promotion
- Promotion of nature-based activities
- Equity of access
- Utilisation of environmental-design and technology with regards to construction
- Enhancement of community opportunity

ENVIRONMENTAL EDUCATION

- Integration of EE with outdoor activities
- Provision of a wide range of activities, promoting communication and interaction between users.
- Promoting awareness of local natural assets through learning



CONSTRAINTS for DEVELOPMENT

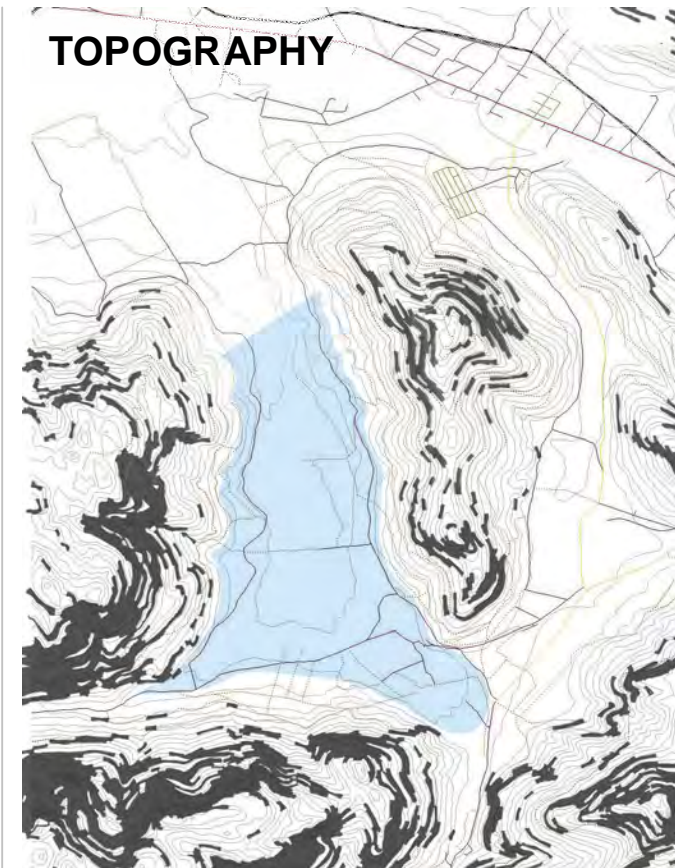
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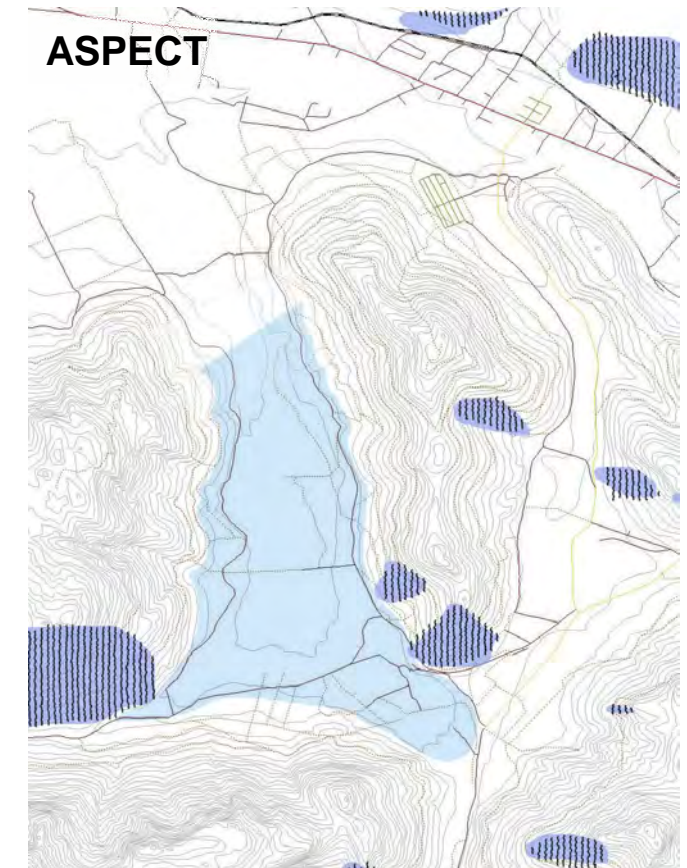
Klipheuvel layers result in Rock Falls



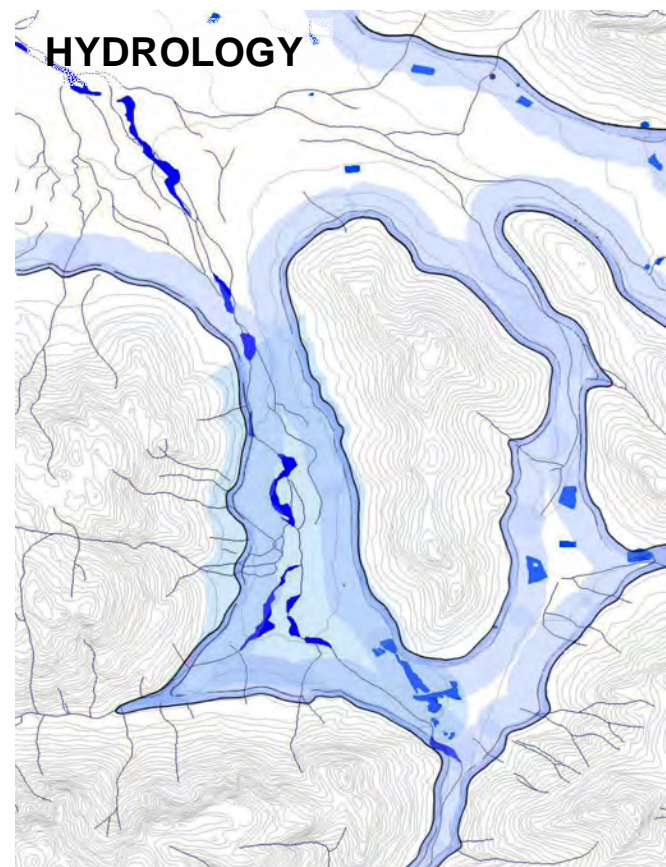
Regional Fault Line through the Dam site



Dominant 1:4 gradient slopes directly around the dam, limit development



Cold South-facing slopes covered mostly in shadow pose as a constraint



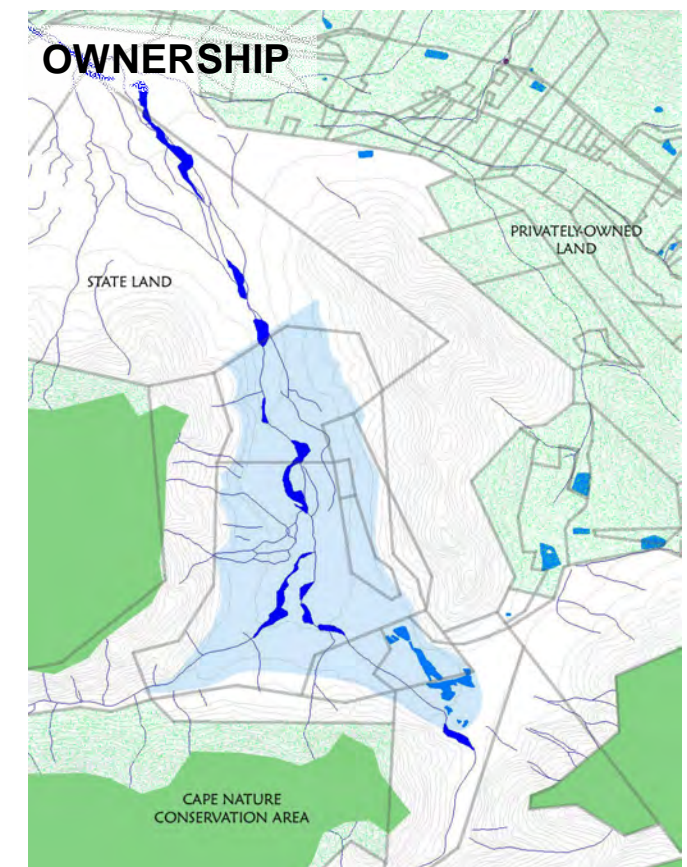
- Nature drainage lines should be avoided
- A potential aquifer in the Robertsvlei area should restrain Development until realised



Areas exposed to strong SE Prevailing winds and NE Winter winds cause discomfort and therefore limit Development opportunities in these areas



- Sensitive riverine systems should be avoided
- Near-pristine vegetation on the SW bank should restrict Development



Private Land and Cape Nature Conservation Areas pose as a constraint



PEDOLOGY



Duplex Soils aligning the 260m contour indicate water-logged areas

INFRASTRUCTURE



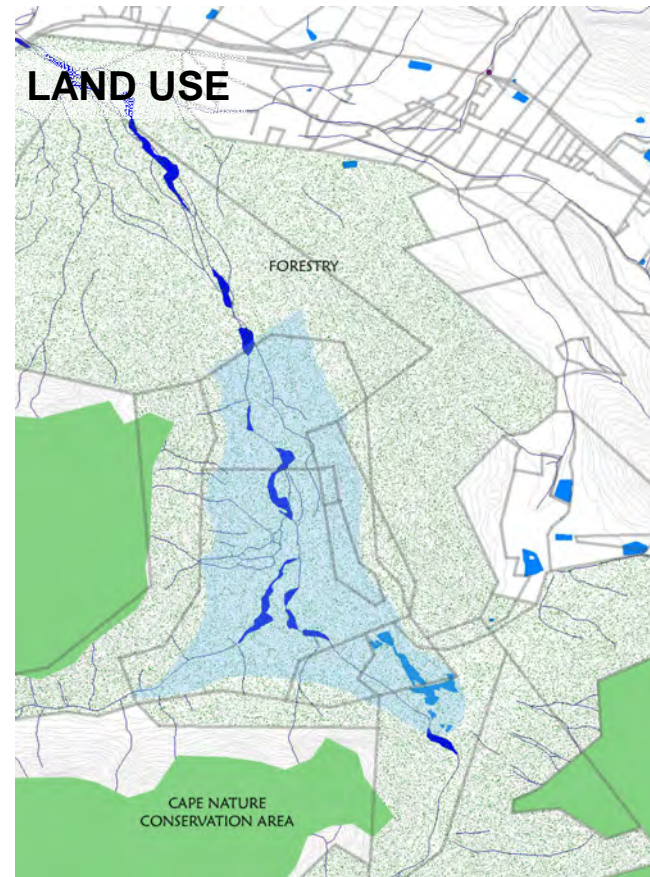
A setback of 30m is necessary from existing powerlines. These also pose as a visual constraint for development.

SUMMARY OF CONSTRAINTS

Having established the Direct issues, problems and Needs associated with the site, a series of Maps illustrates a summary of the major constraints for Development surrounding the site.

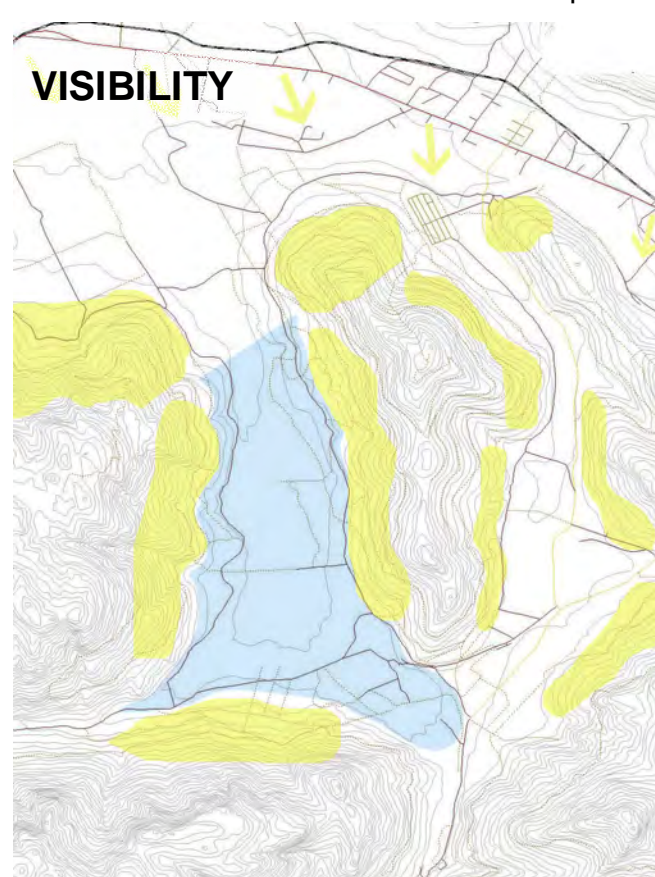
These constraints appear to place large limitation on Development and therefore must be carefully considered in light of the comparative opportunities presented on the site.

LAND USE



Areas zoned as Forestry- what about Roberstviei?

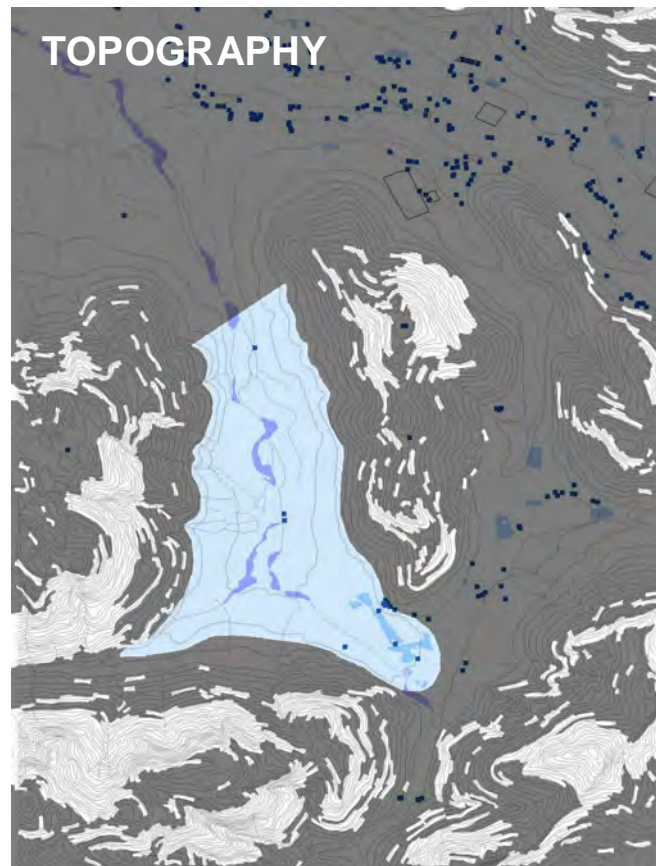
VISIBILITY



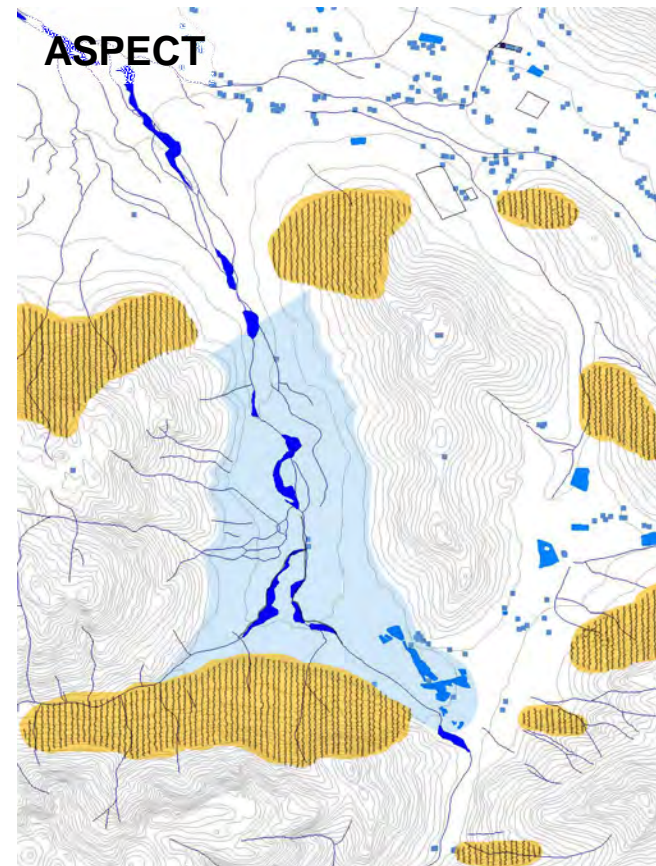
Scenically, the area is associated with the Nature conservation area & Winelands, and therefore development should not diverting from this

OPPORTUNITIES for DEVELOPMENT

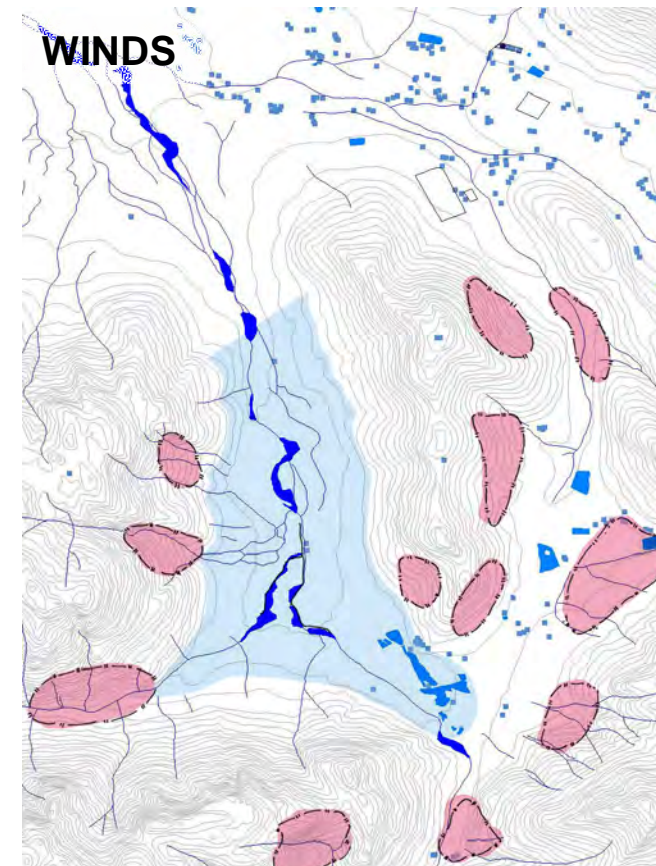
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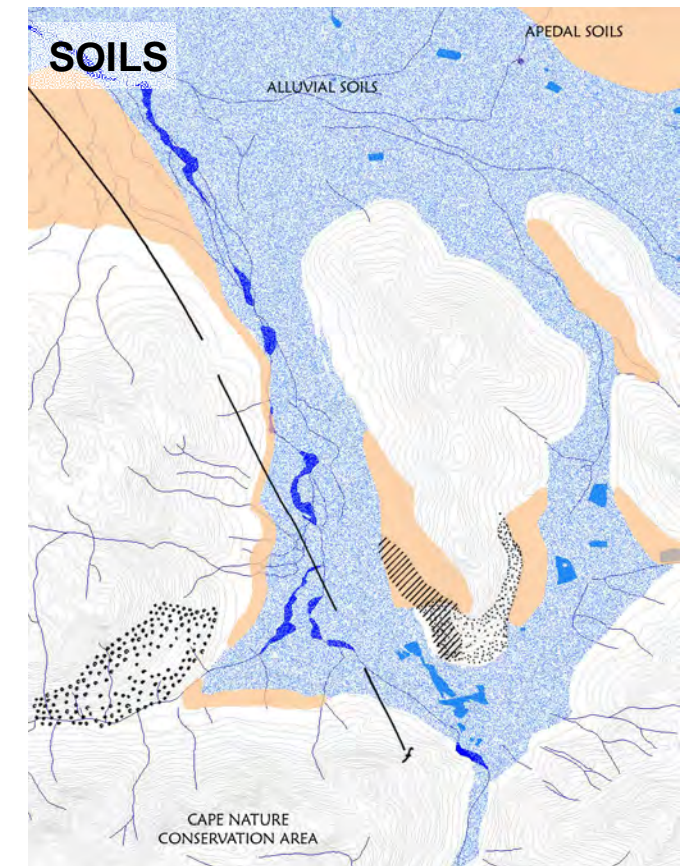
TOPOGRAPHY
Land less than 1:4 gradient is suitable for Development; these sites are found primarily on the south and SE side of the dam



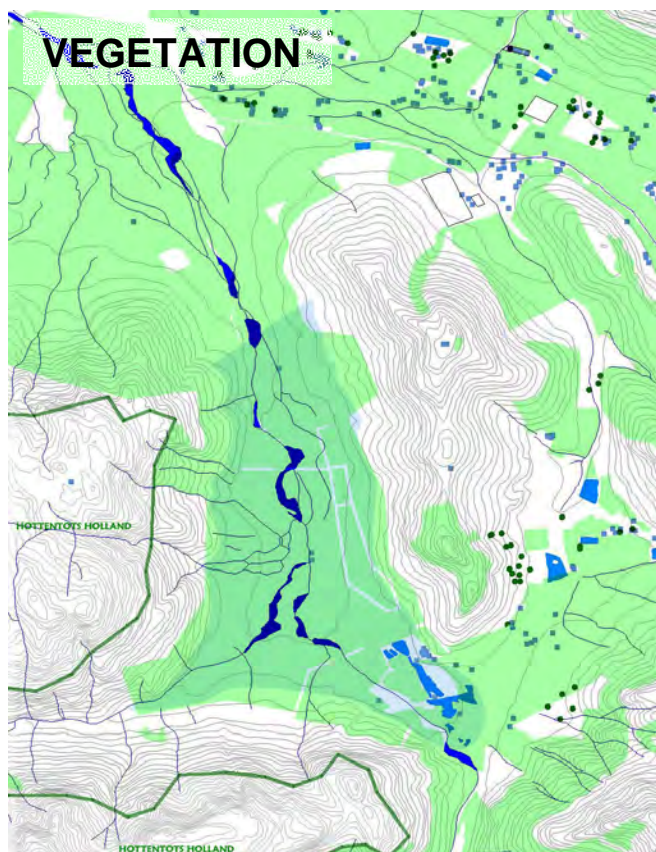
ASPECT
North-facing sites offer optimum Human Comfort and therefore are ideal for Development



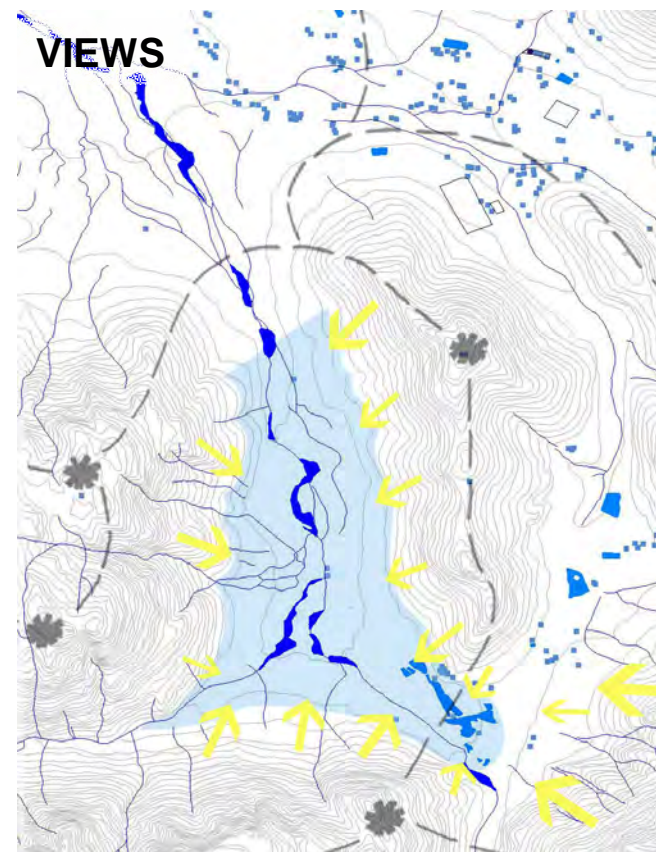
WINDS
Areas sheltered from Prevailing, local and cold katabatic winds are more widespread in the Roberts Valley area



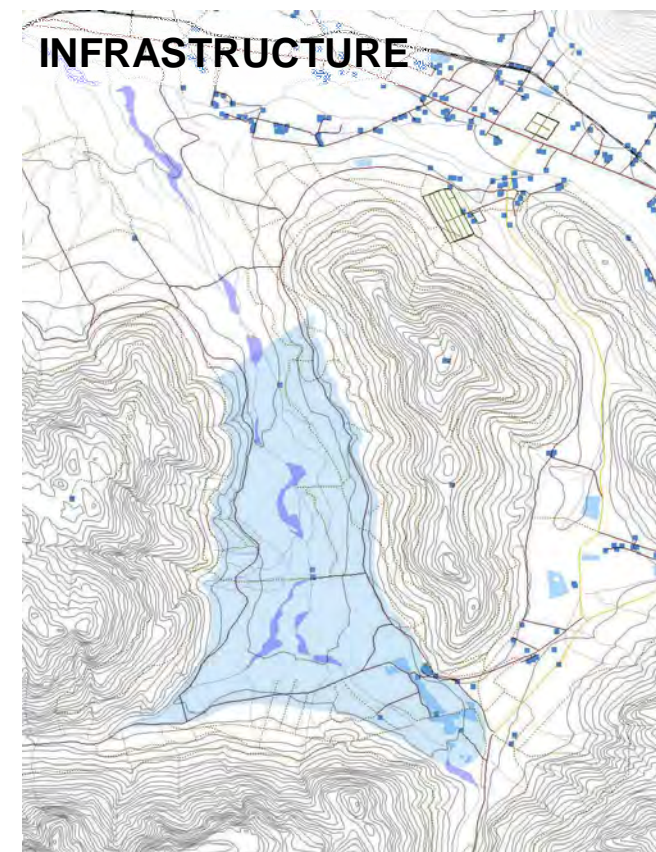
SOILS
Apedal & alluvial soils are best suited for agriculture, development & landscaping



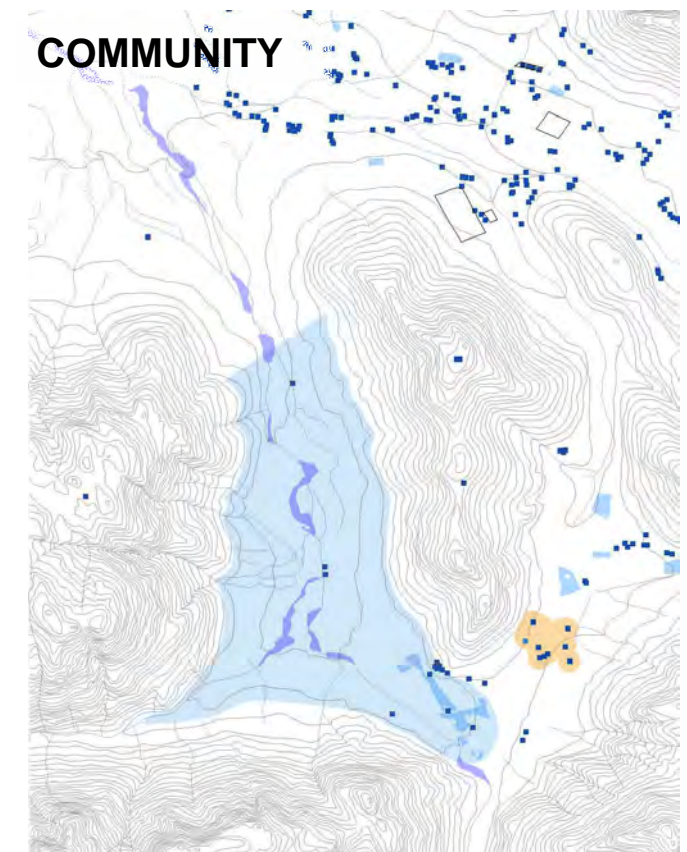
VEGETATION
Previously disturbed land is most suitable for development as involves less impact on near-pristine & recovering indigenous vegetation



VIEWS
Positioning of Development within illustrated view-sheds allows optimal use of these views for scenic enjoyment

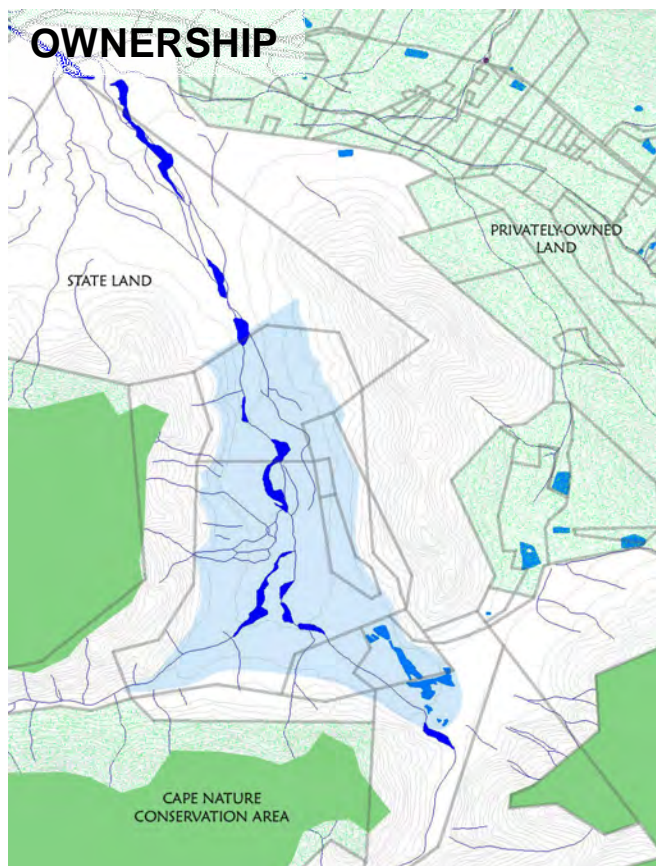


INFRASTRUCTURE
Existing roads & infrastructure offer opportunities in terms of accessing future Development, particularly at Robertsvei

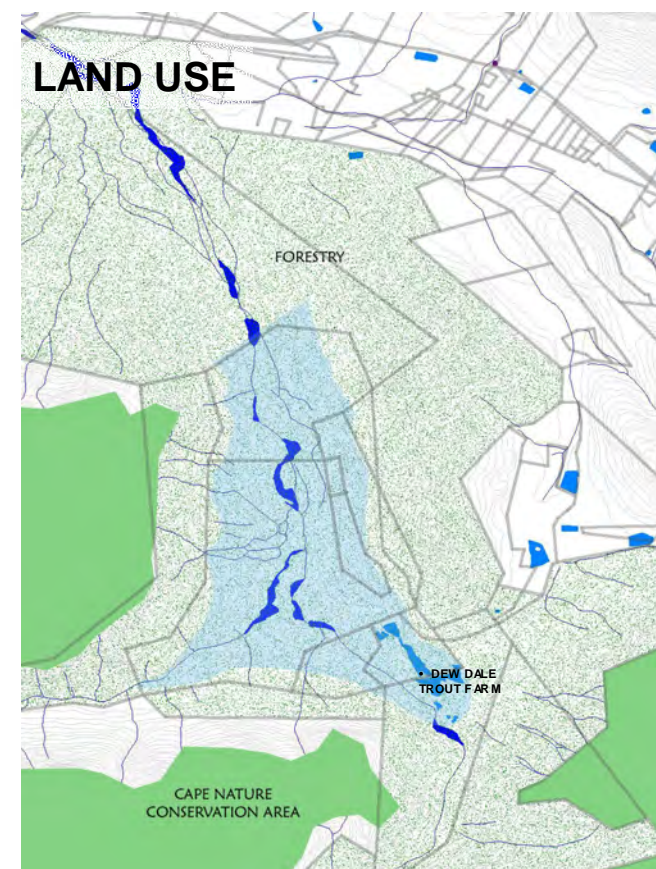


COMMUNITY
The lost community of Robertsvei provides opportunity to incorporate community back into future Development associated with the Dam

Robertsvei
A CATCHMENT
HAMLET



The fact that this area is State-owned indicates possible Community-initiative related opportunities



The location of Dew Dale Trout Farm, suggests the opportunity for future Aqua-culture on the Dam

POSSIBILITIES

RECREATION

Steep dam edges offer opportunities to recreate providing optimal elevated views across the dam with strong connections with the Hottentots Holland Nature Conservation area

AQUA-CULTURE

Fairly flat land with good access to water and existing road network favours this possibility. This concept would have to be in line with an intention to farm indigenous fish, and therefore the likelihood of this type of Aqua-culture being highly profitable is limited. However, the farming of fish for subsistence means could be a strong possibility.

HOLIDAY ACCOMMODATION

Small-scale development in line with Eco-tourism is a strong possibility, given Franschhoek's popularity as an international tourist destination. This would also fill the void currently befalling the local industry.

HOUSING & EMPLOYMENT

With the lack of housing and employment being two of the biggest issues in the local context, any development that is to take place at the dam would need to take this into consideration. As the dam is fairly remote from Franschhoek's main labour-sources and ill-served by public transport services, on-site accommodation of labour will be essential to provide a sustainable means of employment.

AGRICULTURE

The presence of a riverine environment more often than not, indicates high possibilities for agriculture. This is most definitely the case in this instance, however the concept would have to be approached cautiously. Given the history of the Berg's waters and the possibility of pollution from over-irrigating and fertilisers leaching into the soils, better practices of agriculture must be utilised in order to overcome these past problems.

EDUCATION

The complex combinations of natural systems, their disturbance and rehabilitation in some cases, provides high possibilities for research and education in this environment.

THEORETICAL SUMMARY

Evidently, the Berg River Dam has brought about much change and activity in the Franschhoek Valley. Through a synthesis of all the Site Informants, the positives generally outweigh the negatives in the social light. However, the choices surrounding the future management and development of the Berg River Dam, are central to the conservation and restoration of the natural systems in this regard.

As the top priority of the Berg River Dam is the maintenance of a high quality of water for Cape Town, this is found to pose as a massive limiting factor for a broad spectrum of development options.

Subsequently, this prime usage could possibly save the dam from being mass-built by developers and could, in years time, maintain the scenic beauty and the environmental integrity of the surrounds in which the dam lies.

Clearly, any development that should take place is dictated by natural constraints, leaving us with limited opportunities directly on the dam. However, consideration must be made for the needs of those who will effectively be on the receiving end of the 'benefits' that the Dam will provide.

On completion of the Dam, the construction companies would have successfully educated a large portion of the population of Franschhoek and armed them with the tools of skill for the construction industry and other related work. Yet, is this 'benefit' scheme sustainable in a valley that has limited space for future large-scale development and construction work?

What is required, are real benefits to counteract the pressing issues at hand- that of housing and vast unemployment, for example. The possibilities of agriculture, recreation, aquaculture and education occurring in the area, will ultimately stimulate eco-tourism and conservation and bring about a potential solution to these problems.

Precedent has indicated a number of these workable solutions, which will be drawn from and carried forward into the Design Phase. Å

The Project in Context
Problem Diagnosis



Hypothesis
Project Brief



PART 1
Framing the problem on a
Theoretical Basis



PART 2
Application of Theory through
Planning



Site Suitability
Identifying Land for Development
within a Catchment Area



PART 3
Theory Demonstration through
Design Intervention

Principles, Policies & Guidelines
for Development



PART 4
Forming a Design Solution

Programme & Brief



PART 5
Project Feasibility

Conceptual Development



Conclusion

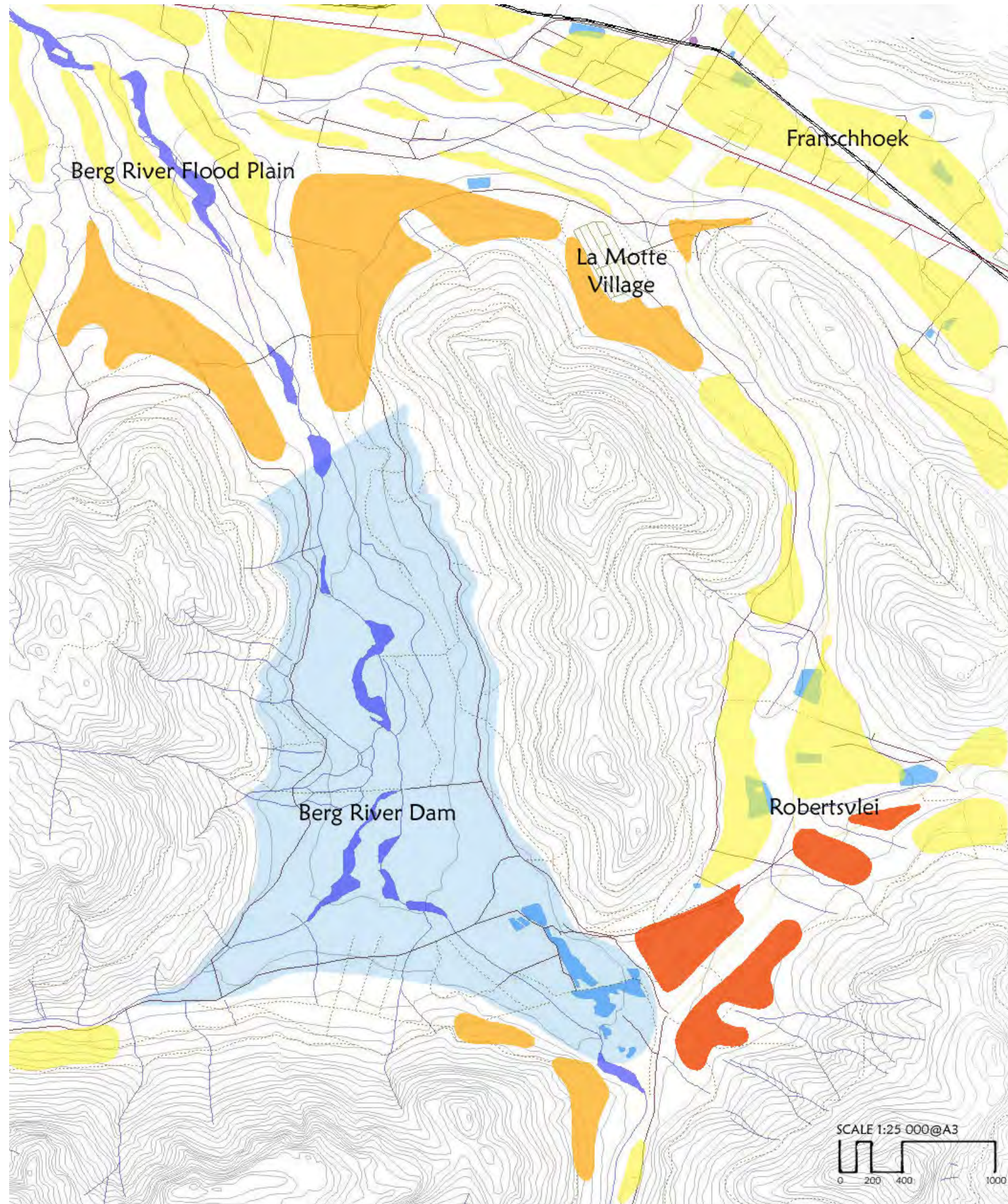
Site Structuring Elements



Conceptual Framework Plan

Theory Application Methodology

SITE SUITABILITY for DEVELOPMENT






Interpretation of the Site Analysis has brought us to a point where we can now identify Potential Nodes for Development. Appropriate Land Uses should be designated according to the value system determined in the Opportunities and Constraints outlined previously.

The following diagram illustrated all potential nodes throughout the area; based on the following criteria:

- Natural Hazard possibilities
- Impingement on Riverine Systems and Dam Catchment Area
- Degree of exposure to natural elements
- Whether the site has been previously disturbed
- Intrusion of sensitive vegetative areas
- Proposed Visual-impact
- Accessibility to the Public
- Existing infrastructure
- Land Ownership
- Resources available to sustain a living environment
- Relationship to Dam water-body
- Designated Land Use

KEY

-  HIGH SUITABILITY
-  MEDIUM SUITABILITY
-  LOW SUITABILITY



Based on the Suitability Map, a High, Medium and Low suitability has been illustrated as follows:

HIGH SUITABILITY

- Low-elevation with least visual impact
- Outside of direct dam-catchment area
- Suitably sheltered
- Previously disturbed land
- Highly accessible to the public
- Existing infrastructure with potential to upgrade
- Publicly-owned land
- Opportunity to form relationship with inundated area
- Potential resources available to expand a settlement's economic base

MEDIUM SUITABILITY

- Slightly elevated with visual impact implications
- Increased exposure to natural elements
- Limited infrastructure and public access
- Within close location of flood-plain
- Hazardous area due to down-stream location from dam wall

LOW SUITABILITY

- Areas with increased elevation with visual impediments
- Located within a river flood-plain
- Highly hazardous areas due to downstream location from dam wall
- Privately-owned
- Zoned for alternative usage

APPROPRIATE DEVELOPMENT

As distinguished in the Suitability diagram, the area of Robertsvlei (Fig 2) appears to hold High Suitability in terms of meeting the criteria defined for Suitable Development sites. With this established, the question of 'appropriate development' must now be explored with the aforementioned possibilities in mind.

•RECREATION & EDUCATION

Ultimately, Development of this kind would have to be located within close proximity to the water's edge, creating strong links with the surrounding mountains as well as the Dam itself. Robertsvlei offers the chance for this type of development to take place. Positioned and implemented sensitively, this type of development would have the potential to be a precedent for sensitive environmental design.

•AQUA-CULTURE

The existing site at Dew Dale Trout-farm is ironically well located in terms of accessing the dam's water during all levels of fluctuation. Furthermore, the site has been strategically chosen for its sheltered position from the cold winter winds. Given that a 'No Motor-boat' Policy has been adopted for the Berg River Dam, aqua-culture will have to be carried out in ponds, similar to Dew Dale, or through the use of a Cage-Culture, which can be accessed by rowing boats. This situation would be ideal for locals, with a wish to farm fish for the sustenance of the local community.

•HOLIDAY ACCOMMODATION

The concept of Eco-tourism is seen as the ultimate option here, in terms of appropriate development. Accommodation could cater for a variety of users, including Hikers, with the close location to the mountains. Interaction with the Dam itself would also create an attractive holiday destination.

•COMMUNITY HOUSING

There are few sites suitable for residential development, with good orientation, gentle slopes, good foundation conditions, out of flood plains and away from frost pockets and protected from winds. Land with low agricultural value is ideal to build on leaving the valley sides available, which have a high scenic value. The economic base of any proposed community would in this instance have to be strongly dependant on recreation related to the dam, as well as agriculture, due to limited land available.

•SUITABILITY FOR AGRICULTURE

Agricultural potential at Robertsvlei is most definitely viable with the presence of the Robertsvlei River seepage, and rich underlying alluvium soils. Soils elsewhere around the Dam itself are thin, stony, erodible and unproductive. The flat land lends itself well to the cultivation of row-crops, whilst the steeper slopes on each side of the valley are better suited for orchards and vines. The fact that the fall of the slope here drops away from the dam is an asset to this area, as it does not directly conflict with the water-quality of the Dam. Fertilisers and Herbicides will have to be utilised sparingly however and strict guidelines enforced to avoid any pollution of the valley's ground water. Additionally, irrigation intentions should be carried out responsibly, with adequate recharge of the under-ground aquifer.



DESIGN GUIDELINES

Guidelines define the performance criteria necessary to drive the design of a site and maintain it at a specified level. Guidelines should relate to the need for the site in question, and respond and react to the immediate context.

In this instance, guidelines have been stipulated to provide flexible reinforcements to formalised planning procedures, allowing the opportunity to create environments with finer detail.

In line with 'Appropriate Development', the following guidelines have been drawn up, from the over-all Planning Level, down to the finer details of infrastructure and the creation of workable spaces for communities and individuals alike.

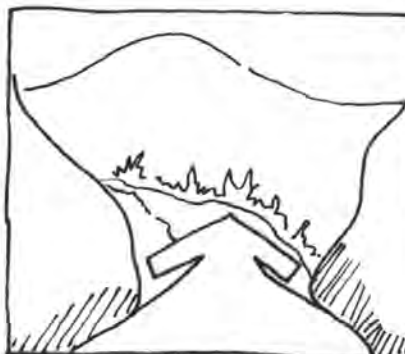
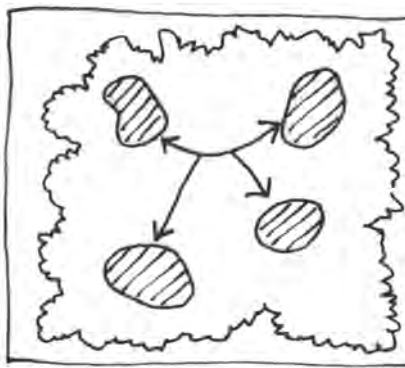
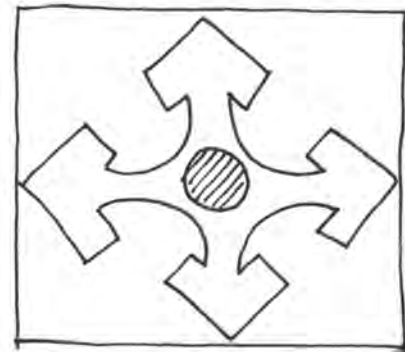
These drive behind these guidelines is ultimately, to protect the natural environment and improve the form

PLANNING & LEGAL POLICY

Adopt a Low-impact, Low technology, Ecological Planning Approach that will enable development to respond to natural processes

GUIDELINES

- Utilise small-scale interventions & de-centralised efforts by planners to minimise unforeseen consequences
- Concentrate intensive land-uses into Nodes to avoid unnecessary intrusion into natural areas
- Create unique environments, with their own sense of meaning. Avoid 'add-on' building to settlements, which creates fragmentation and discontinuity (Fig 3).
- Built settlements with a Hierarchy of distinctive public places, creating a heart to the community.
- Avoid developing in areas where there is a high visual impact- restrict development to sheltered low lying areas out of the visual corridors around the dam
- preserve all views, vistas and visual corridors and restrict development to areas below the 260m contour line to minimise visual impact



“Successfully performing environments are necessarily complex: they contain a variety of overlapping conditions and activities, they provide the opportunity for the spontaneous and the unexpected to occur, and they accept conflict.” [27]

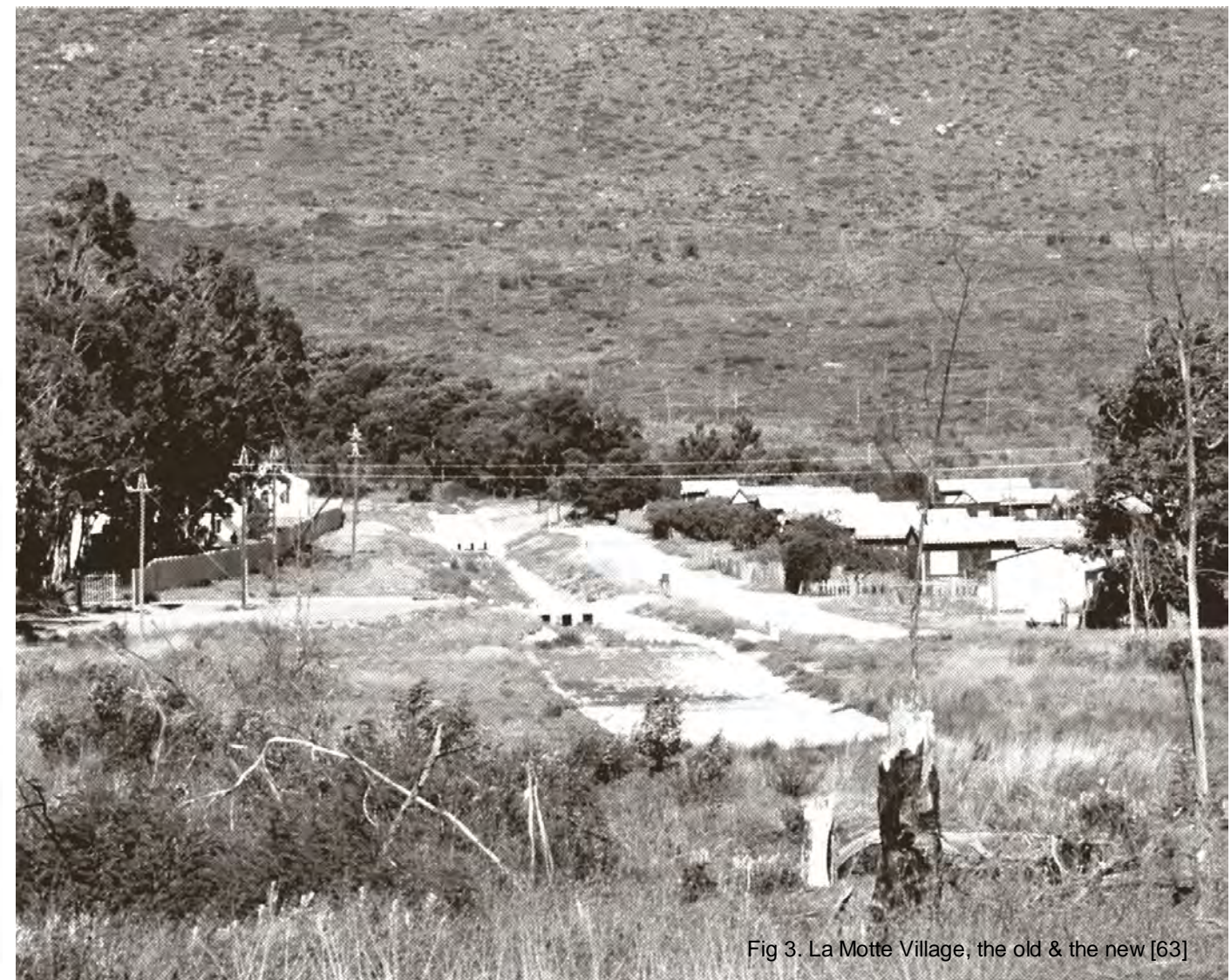


Fig 3. La Motte Village, the old & the new [63]



ENVIRONMENTAL POLICY

Employ a Conservation & Protection ethic in order to restore Environmental integrity and promote bio-diversity, through sensitive development and management of resources

GUIDELINES

• Ensure no development in critical environments, which pose hazardous to humans, such as areas where there may be flooding, fault lines, rock-falls. In this instance, development below the dam-wall should be avoided due to suggested seismic occurrences.

• Use a system of earth-moving to create berms and swales allowing scenic diversity in the landscape, as well as protect areas from winds and screen unsightly structures from elevated surrounds.

• Avoid development in very steep areas which are vulnerable to erosion, making access difficult and building costly.

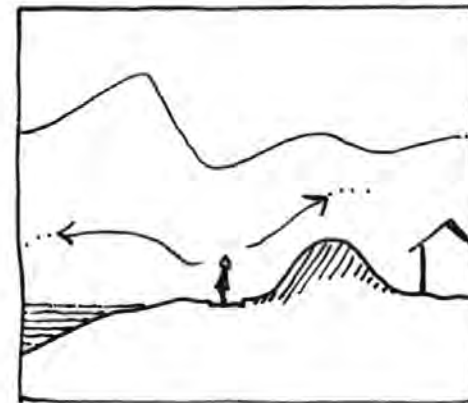
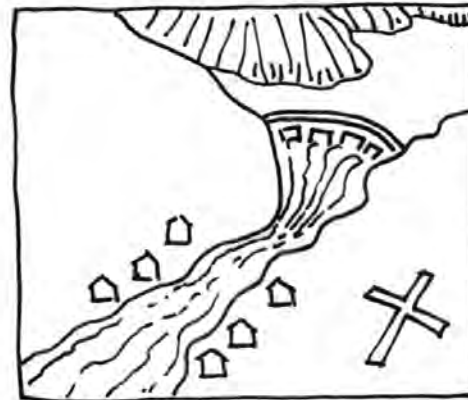
• Where steep areas cannot be avoided, create terracing for buildings to avoid erosion and landslides, with minimal disturbance to natural vegetation

• Maintain the natural drainage system, through the use of permeable hard-surfacing and sufficient vegetative cover so as to reduce run-off in the area.

• Further minimise run-off and resultant sedimentation of the water-body through the manipulation of drainage with earth-works and retention ponds above the high water mark.

• Protect surface and ground-water bodies from pollution, through sensitive sewerage treatment and the adoption of a non-fertiliser approach to management of green areas.

• Conserve Areas of endemic or near-pristine habitat and develop opportunities to connect these pockets with a larger Bio-Diversity network, such as one promoted by Cape Nature Conservation



• Rehabilitate disturbed areas through the removal of alien species and replacement of an indigenous vegetative cover, so as to reduce run-off and resultant erosion as well as promote the 'water conservation ethic'.

• Clearing of Alien Vegetation should be strategic & gradual so as to limit affects of erosion

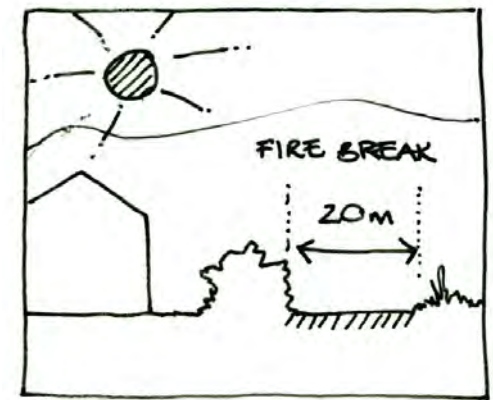
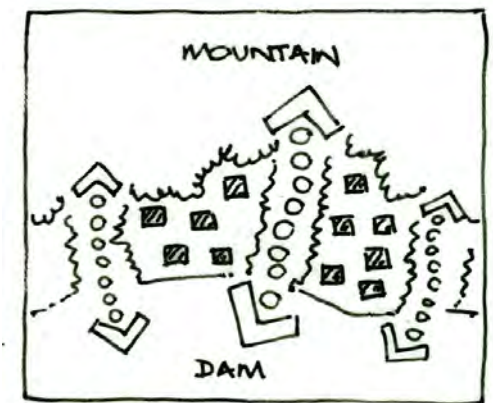
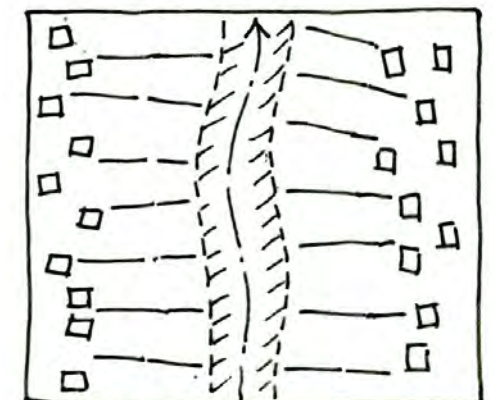
• Maintain agriculturally-rich farmland in river-valleys, integrating these this land into a Network of Green Open Space. Utilise the multi-use approach of sustainable harvesting of natural resources within this zone.

• Avoid development in the sensitive riverine zone. Development should pay heed to the 'Buffer Zone' created with the inundation of the area and the resultant fluctuating levels of the dam. A set-back distance of 50metres shall be imposed in sensitive wetland areas, whilst a 30metre setback imposed around the Dam Edge.

• Create habitat, and a system of green-corridors for faunal movement. Shelter-belts and ecological niches such as pools and runs with the introduction of substrate diversity, can provide refuge areas for endangered and protected endemic species, such the Cape galaxia fish shoals in the river.

• Restore and manage the natural renewable resource-base so as to enable sustainable living. Encourage ground-water recharge and use of local materials for building purposes. Promote the concept of 'sustainable fishing communities'.

• Areas highly susceptible to fire must utilise a system of fire-breaks for protection. Activities such as smoking, braaing and cooking on open-fires should be restricted to designated areas only.

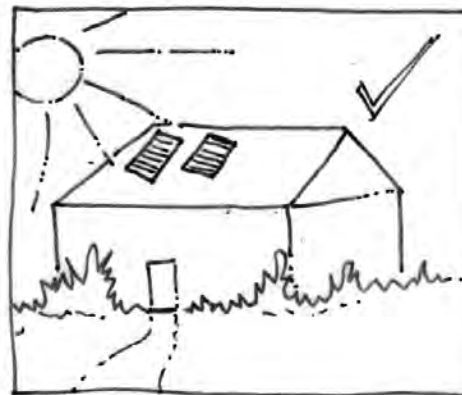
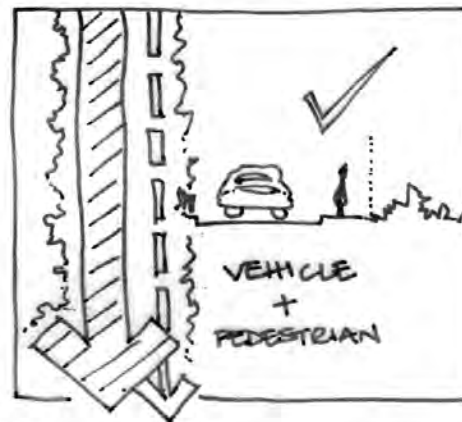
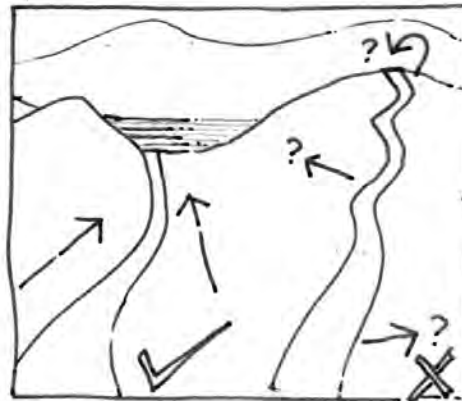
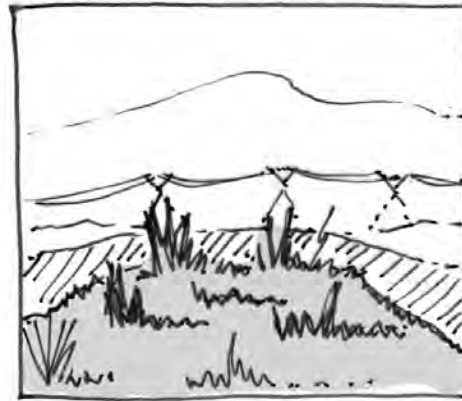


INFRASTRUCTURE POLICY

Maximise the opportunities presented in this unique setting, while ensuring the protection of natural and scenic resources is not compromised

GUIDELINES

- Infrastructure in sensitive or productive ecological areas to be minimised and implemented on the periphery of these areas.
- Roads to be utilised as visual corridors, lying comfortable in the landscape, so as not to be intrusive.
- The multi-use approach must be adopted through the consolidation of Road Hierarchies into systems that allow for both pedestrian and vehicular movement. This will additionally limit impact of the site.
- Built fabrics must be scale to the pedestrian accommodating its users on direct routes of convenience
- Utilise existing infrastructural components to avoid additional costs, allowing for future infrastructure upgrade.
- The implementation of 'Green Energy' systems of solar-heating and wind-power should be encouraged at every opportunity.
- Storm-water drainage should not be impaired in any way, and crossing of drainage channels with Roads or pathways should include culverts/ pipes to allow suitable drainage and free movement of animals
- Locate utilities along existing roads, beneath the ground-surface where possible to as to reduce visual impact on the site. Utilities above ground should follow the lie of the land, so as not to break the sky-line.
- A choice of transport nodes should accompany a proposed road network, providing affordable mobility to all users within the area.



• The promotion of a coherent movement system must be established through appropriate signage that is neither obtrusive or overwhelming in the landscape. Signs should blend into the landscape with the use of planting back-drops and low-positioning, as as not to break the sky-line.

• A comprehensive hierarchy of public spaces should accommodate transition and choice between most public to more private spaces. Spaces ranging from relief and relaxation to places of exchange and interaction will create pulses of activity and generate interest

• Public services should be made accessible by positioning along major transport routes.

• Consolidation of services increases eligibility of place.

• Vernacular Architecture must be employed to reflect local identity and distinctiveness.

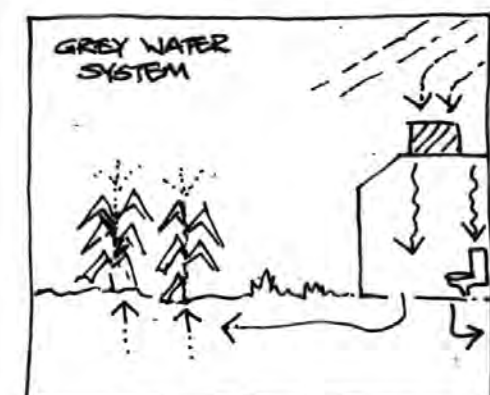
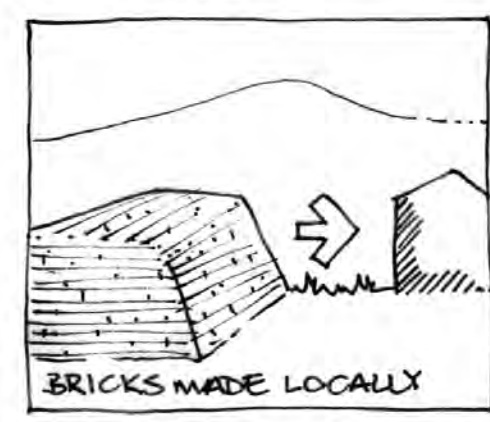
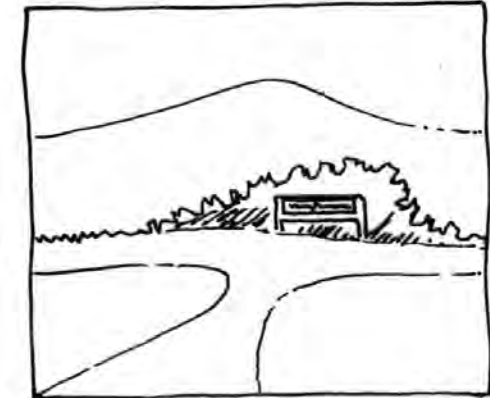
• Allow segments of a settlement to function symbiotically, promoting each individual sense of place, whilst creating a support system which strengthens the settlement as a whole.

• Implement infrastructure that is appropriate to the 'Sense of Place' through the use of local materials

• Locate space for ancillary services such as deliveries and parking so as not to impair the scenic integrity of the site.

• Water reticulation and waste water disposal shall be dealt with on a very local level and re-cycling of grey-water used at every possibility.

• Sewerage disposal to be carried out on site without degrading the ground-water quality. Setbacks from the Dam must be implemented and environmental measure of disposal utilised at all costs.



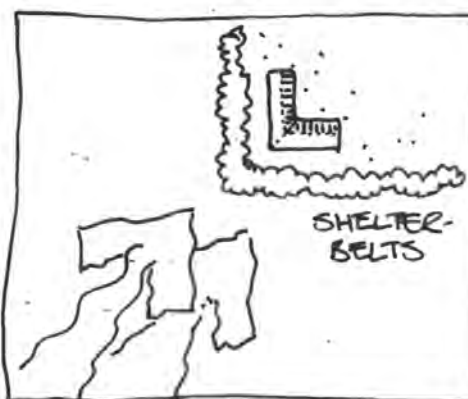
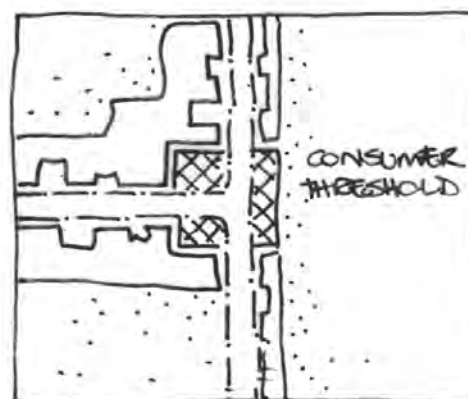
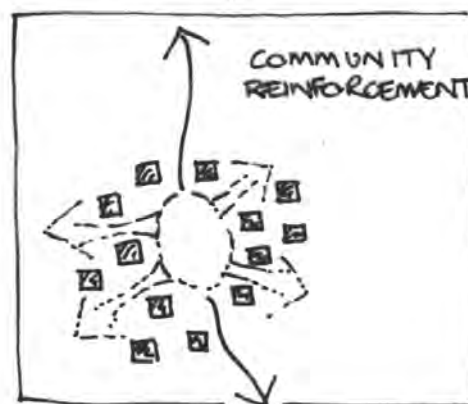
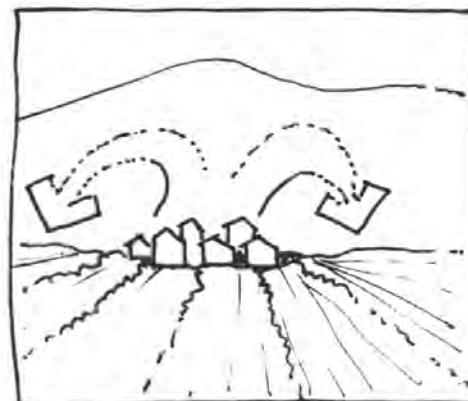


SOCIO-ECONOMIC

Promote sustainable Living Environments through working communities that are self-sufficient, diverse and dignified

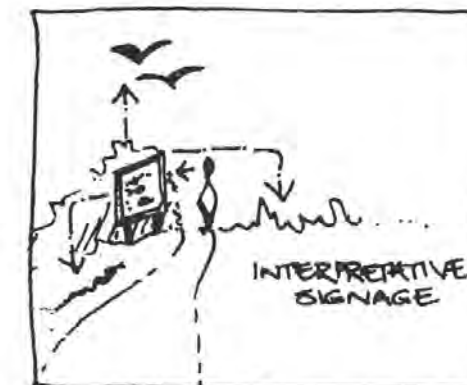
GUIDELINES

- Promote ownership and responsibility within local living environments, in order to attain local identity and the concept of community.
- Allow communities the rights to their surroundings, and through public involvement create awareness of the accountability of these communities through mismanagement of their environs.
- Allow communities to be self-reliant and self-sustainable, with access to external income-opportunities
- Create unique and dignified environments, that are specific to the 'Sense of Place' and further enforce a sense of belonging within the local context.
- Foster a collective entrepreneurial spirit in the community that is attached to an established value system, encouraging local production and economic stability.
- Enable movement systems to pass through consumer thresholds, enabling the community to benefit from outside income-earners.
- Incorporate public market spaces at points of greatest access, increasing economic opportunities and creating bustling working environments.
- Offer adequate densities of living environments to support proposed facilities and services, enforced by a comprehensive transport network.
- Incorporate Open Public Spaces with utility areas, such as storm-water catchment and irrigation services.
- Promote safe and secure environments by suitable street-surveillance, through creating tightly-knit built fabrics that provide sheltered and enclosed spaces. Placing of built fabrics as wind-protection should be considered as well as the use of vegetative buffers in the landscape.



• Provision of Environmental Education is necessary to promote awareness on such measures as water-saving, recycling and using natural resources sustainably.

• Interpretative Signage must be utilised for the promotion of this awareness, in the hope of creating an understanding of the surrounding natural environment and its integrated systems.



PROGRAMME & BRIEF

As touched on in the Analysis, according to various Planning Policies, the dam has a number of development options. Stellenbosch SDF proposes Conservation as a priority, with the possibility of extensive agriculture, providing an EIA is carried out and it is proved appropriate. Another option proposed is Research and Environmental Education, which has previously been recognised as a strong possibility for the study area.

The SUP supports these proposals with additional options of aquaculture, accommodation of various kinds, as well as sport and recreation.

Having taken all of this and the comparative analysis synthesis into account, we can begin to formulate a brief for the study area.

BRIEF

With the immediate need for housing, employment, education and open-space in the area, the prospect of a development on the Berg River Dam is favourable, providing these needs are addressed.

The area of Robertsvlei has been assessed as 'most suitable' in terms of development adjacent to the dam, although there are concerns for the water-quality. With sensitive planning, what is proposed is the creation of a holistic community that is held directly accountable for its relationship with the environment.

A housing element of 80 units, as prescribed in TCTA's mandate to 'give back to the community'; will form the heart of a rural community, better known as a 'hamlet'. Agricultural land will support this hamlet, with proposed access to an agreed amount of water drawn from the dam.

The community will hinge on a tourism component envisaged along the line of 'eco-tourism' which will thrive on a direct relationship with the Berg River Dam and its surrounds.

Furthermore, a node hosting an element of environmental-education will perform as a 'gateway' into the Cape Nature Conservation area and the precious Berg riverine corridor that must be treated with utmost sensitivity.

The aim is to create a unique sustainable living environment, through resurrection of a community once lost at Robertsvlei.

PROGRAMME

Each individual node requires access; public nodes with easy access to the main road and the more private nodes with limited access.

Residential Node

- 80 local-labourers cottages closely incorporated into existing built fabric
- Communal vegetable gardens
- agricultural lands adjacent, with sustainable-irrigation scheme connecting to dam
- Agricultural practices shall incorporate the growing of water-wise crops and the organic concept of natural pesticides
- central community space, incorporating a Market-Square with parking provided for out-siders
- Set-backs from the dam must apply, however, easy access to the water frontage-area must be provided for.
- Recreational spaces

Community Aqua-culture Node

- A sustainable subsistence aqua-culture unit shall hinge on existing infrastructure at Dew Dale trout farm.
- The unit shall be based on the cage-culture fishing of indigenous fish to primarily feed the Robertsvlei market
- Non-motorised boats will be used to access these cages, launching to be allowed for
- Buildings for processing fish and an area for drying must be provided

Eco-tourism Node

- Requires a good viewing point into the dam, ideally should be encumber the views from across the other side of the dam.
- Number of over-night visitors should be assessed further in terms of carrying-capacity
- A range of choice in accommodation to meet users needs, shall be provided, in line with that lacking in Franschhoek as a hole.
- Good connections with water & water-related activities, such as non-motorised water-sports and fishing.
- Good connections with surrounding mountainous areas, for hiking purposes
- Access to Robertsvlei riverine-corridor for bird-watching and 'nature-appreciation' opportunities.
- Designated picnic and braai area, suitably placed away so as not to become a fire-hazard

Environmental Education Node

- Primarily viewed for children, this node requires access and relationship with water & associated riverine-systems
- Environmental Outdoor Centre to be incorporated into existing house remaining after the dismembering of Dew Dale Trout Farm
- Node will run on a system of green-energy and optimal drainage management wherever possible, as an example to environmental planning
- Additional dormitories to sleep 70 children will be situating within close vicinity of the main house, providing views over the dam
- Landscaping will involve a system of nature-trails & bird-watching opportunities
- Recreative space, both on and adjacent to the water should be provided.

CONCEPTUAL DEVELOPMENT

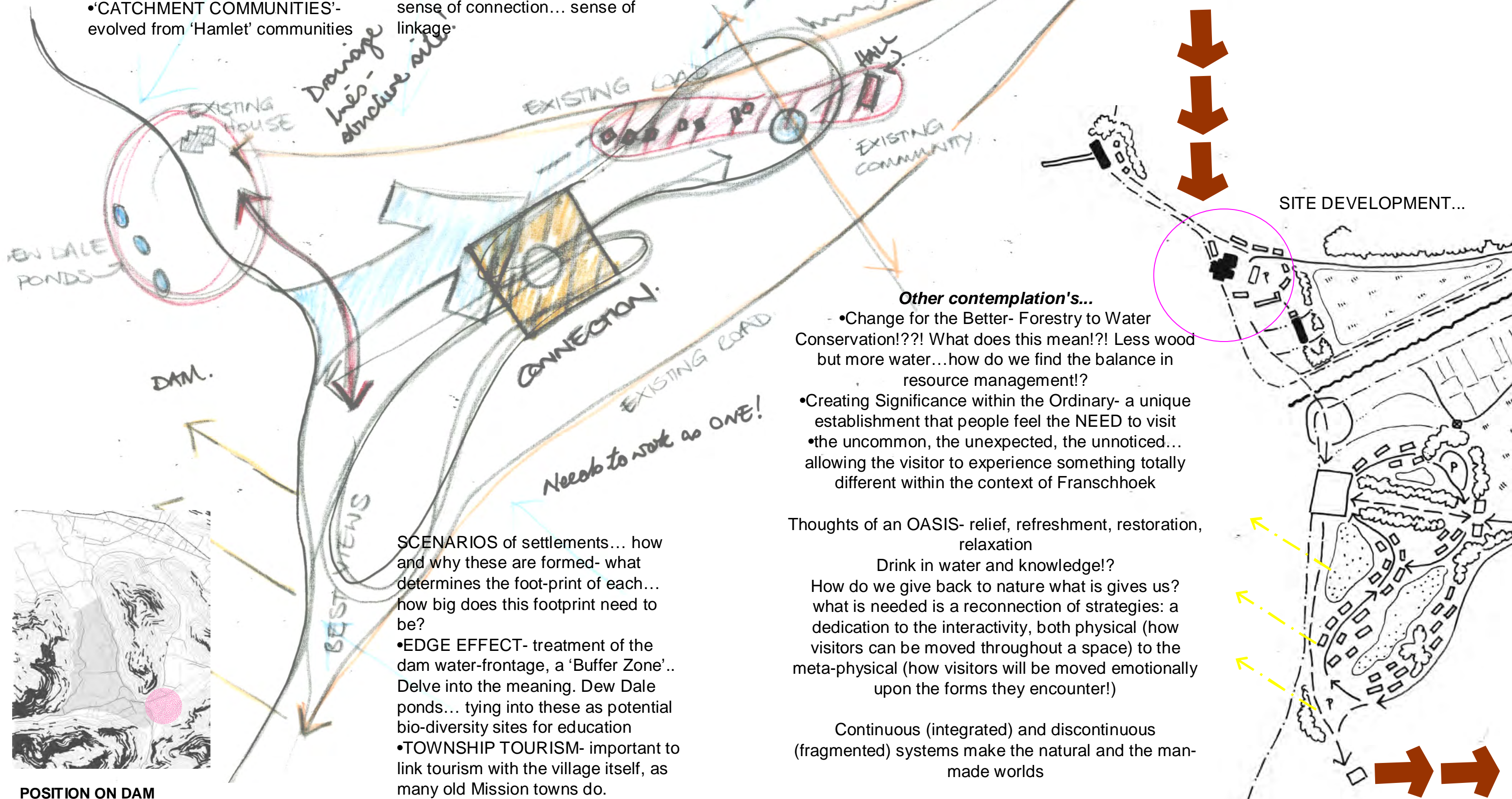
SCALE 1: 5000@A3

On entering the concept stage, the following notions are at the fore-front of the author's mind...

- Create a SENSE of PLACE/ SENSE OF COMMUNITY
- the concept of ECO-TOURISM- what does this entail?
- 'CATCHMENT COMMUNITIES'- evolved from 'Hamlet' communities

Looking at EXISTING TRAILS- were these utilised in the past for animals- could they create a system of green-corridors that structure the site?

- NODES WHICH MEET USERS NEEDS... individual and different, yet formed as one- establish the sense of connection... sense of linkage



POSITION ON DAM

SCENARIOS of settlements... how and why these are formed- what determines the foot-print of each... how big does this footprint need to be?

- EDGE EFFECT- treatment of the dam water-frontage, a 'Buffer Zone'.. Delve into the meaning. Dew Dale ponds... tying into these as potential bio-diversity sites for education
- TOWNSHIP TOURISM- important to link tourism with the village itself, as many old Mission towns do.

Other contemplation's...

- • Change for the Better- Forestry to Water Conservation!?! What does this mean!?! Less wood but more water... how do we find the balance in resource management!?
- Creating Significance within the Ordinary- a unique establishment that people feel the NEED to visit
 - the uncommon, the unexpected, the unnoticed... allowing the visitor to experience something totally different within the context of Franschoek

Thoughts of an OASIS- relief, refreshment, restoration, relaxation

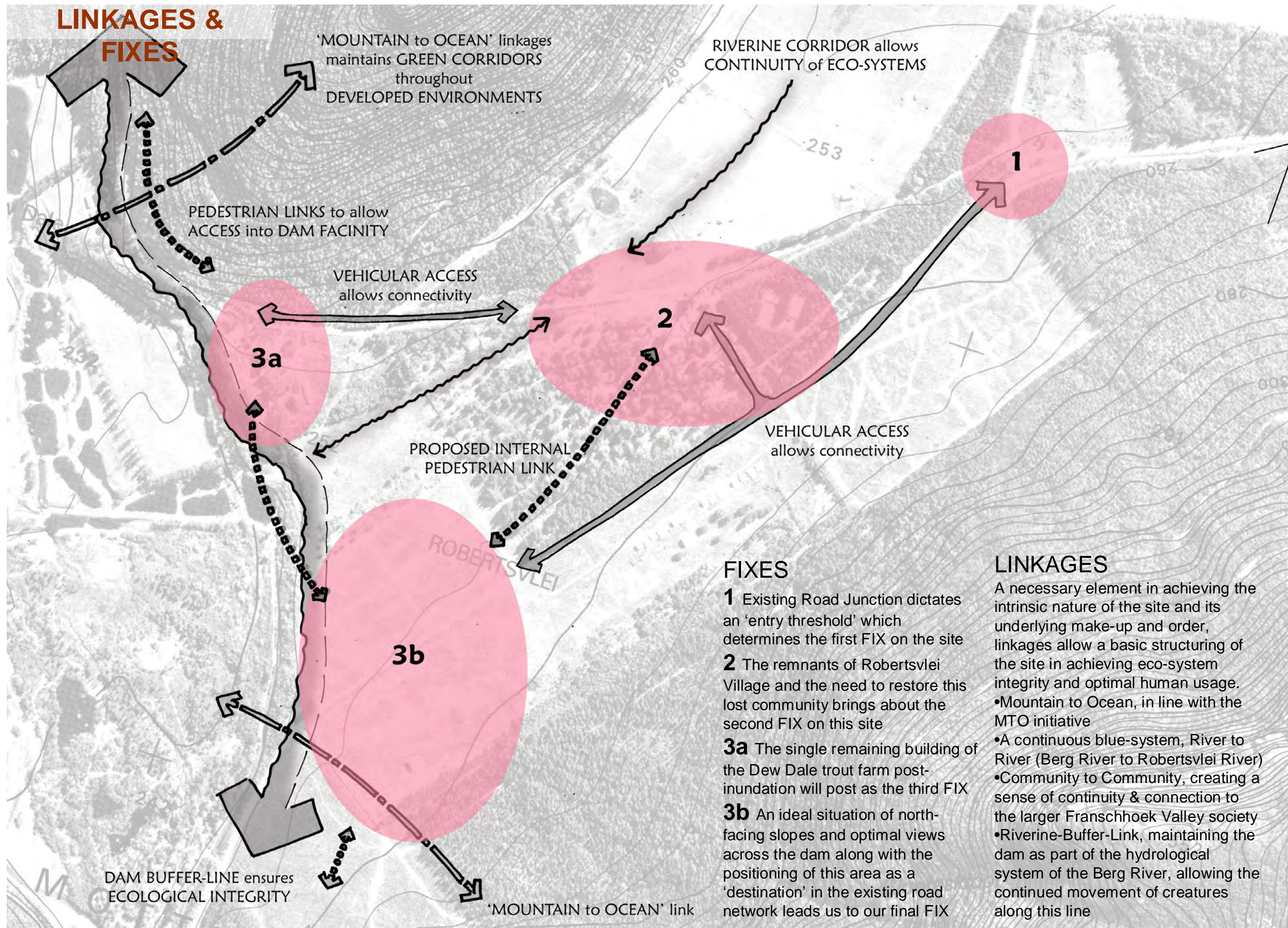
Drink in water and knowledge!?

How do we give back to nature what is gives us? what is needed is a reconnection of strategies: a dedication to the interactivity, both physical (how visitors can be moved throughout a space) to the meta-physical (how visitors will be moved emotionally upon the forms they encounter!)

Continuous (integrated) and discontinuous (fragmented) systems make the natural and the man-made worlds

SITE DEVELOPMENT...

LINKAGES & FIXES



FIXES

- 1** Existing Road Junction dictates an 'entry threshold' which determines the first FIX on the site
- 2** The remnants of Robertsvlei Village and the need to restore this lost community brings about the second FIX on this site
- 3a** The single remaining building of the Dew Dale trout farm post-inundation will post as the third FIX
- 3b** An ideal situation of north-facing slopes and optimal views across the dam along with the positioning of this area as a 'destination' in the existing road network leads us to our final FIX

LINKAGES

A necessary element in achieving the intrinsic nature of the site and its underlying make-up and order, linkages allow a basic structuring of the site in achieving eco-system integrity and optimal human usage.

- Mountain to Ocean, in line with the MTO initiative
- A continuous blue-system, River to River (Berg River to Robertsvlei River)
- Community to Community, creating a sense of continuity & connection to the larger Franschhoek Valley society
- Riverine-Buffer-Link, maintaining the dam as part of the hydrological system of the Berg River, allowing the continued movement of creatures along this line



Scenario 1

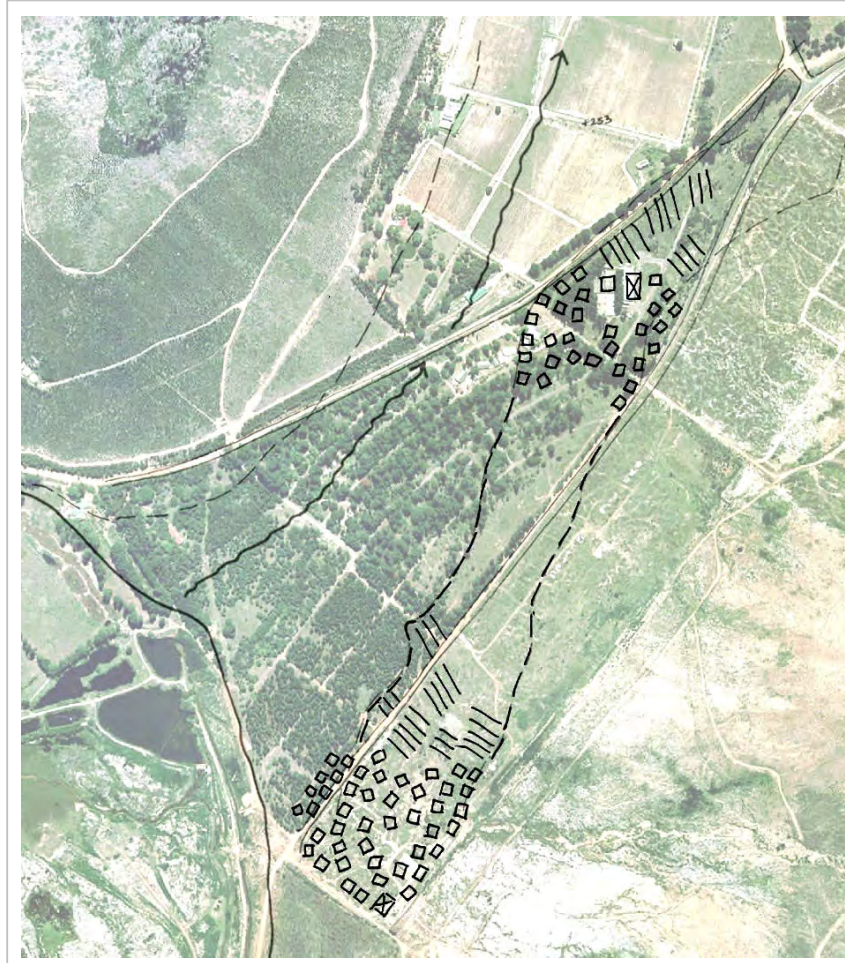
VISUAL DETERMINANT

Pockets of Development within the landscape are found to have less visually impacting on the surrounds.

The aim is to provide a hierarchy of nodes with different functions, allowing both the resident and the visitor a rich variety of experience and services meeting their every need.

Each Node will have access to an area of open-space, used for either recreation or small-scale cultivation. These green spaces will form vital links throughout the precinct as a whole, creating a valuable ecological and human community throughout Robertsvlei.

In terms of the existing road system the community acts as the initial 'gateway' to the dam. The disadvantage of this scenario is the fragmentation of spaces resulting in a possible sense of disorientation for the user.



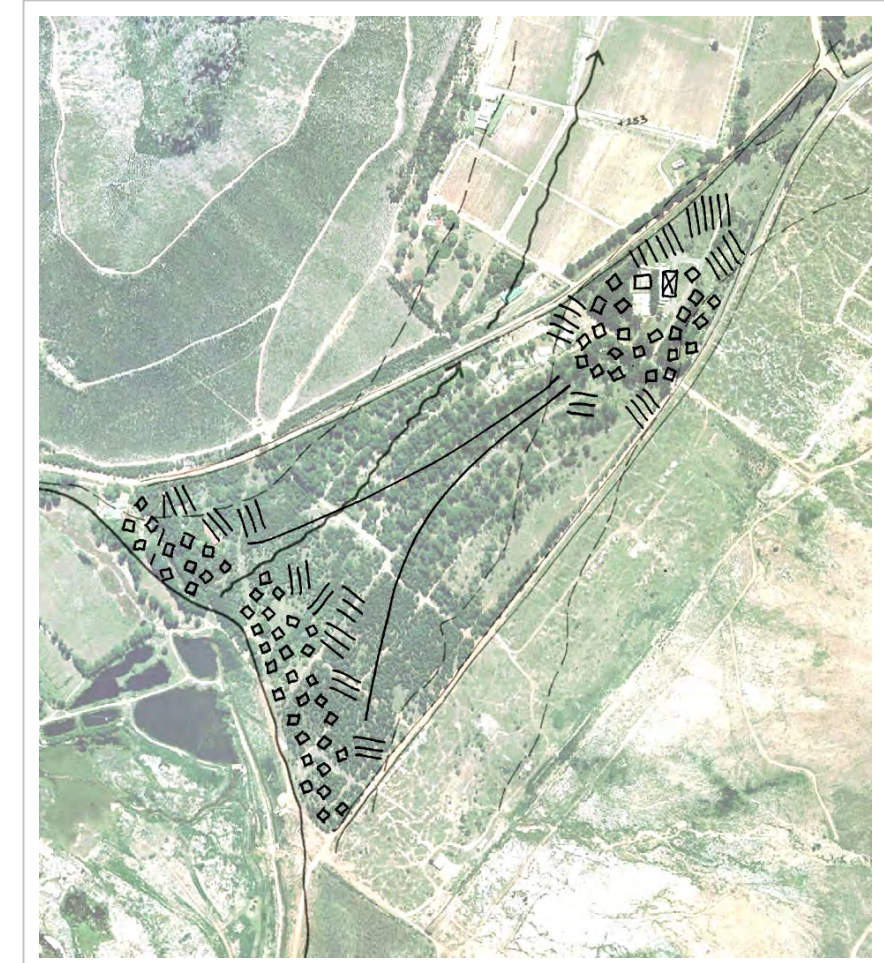
Scenario 2

ELEVATION DETERMINANT

In this case, the Development operates as a dual-function-settlement contained in a linear form between the 260m and 255m contours with the existing road system acting as the anchor-point.

The 'entrance' node is envisaged to perform as a community-space whereas the corresponding node has greater potential for tourism and education with a closer relationship to the dam edge and the foothills of the Berg River itself.

The disadvantage of this scenario is that optimal interaction with the water-edge of the dam is not achieved.



Scenario 3

INFRASTRUCTURE DETERMINANT

Strongly held within the arm of the existing road infrastructure and the high-water level of the dam, this scenario attempts to attain a balance between two different settlement nodes.

A central core settlement again acts as the anchor-point allowing a sense of entrance into the space as a whole. Feeding from that is a linear form of settlement allowing optimal usage of the natural 'water-front' of the dam and hence opportunities for eco-tourism and recreation.

An extensive open space connecting the two has great potential for the promotion of bio-diversity and recreation as well as a powerful pedestrian link between the two nodes.

The disadvantage here will be the concentration of development along a water-line that is only seasonal.

SCENARIOS... continued



Scenario 4

PILOT/ CATCHMENT DETERMINANT

An alternative scenario to Scenario 3; this scenario revolves around the idea of one major dominant settlement, feeding and fed by small pilot projects in a symbiotic relationship.

Structured again by the existing infrastructure, the core node will perform primarily as a community settlement, self sufficient with peripheral opportunities for small-scale agriculture.

The waters-edge to the dam will be utilised with miniature pilot-developments tending to the needs for education, eco-tourism and outdoor recreation.

A strong link is necessary to connect the pilot nodes with the main node maintaining the sense of open-space between the core and the central pilot node.

The disadvantage once again is the waters-edge can only provide seasonal interest.



Scenario 5

HYDROLOGICAL DETERMINANT

This scenario is based upon the wetland corridor remaining after the diversion of the Berg River thousands of year ago.

Compounded by the northern road axis, what this Scenario proposes is a main public node at the entrance to the site. The linear arrangement of a secondary node will stretch from this main node down the length of the once existent riverine corridor to end at the high-level water-mark of the dam.

Potential for small-scale agriculture will be provided for, in plots aligning the wetland corridor with the idea of incorporating education with the bio-diversity presented by this rare eco-system.

The disadvantages in this instance include a lack of 'water-front' utilisation as well as pore linkage to the adjacent Cape Nature Conservation Area.



Scenario 6

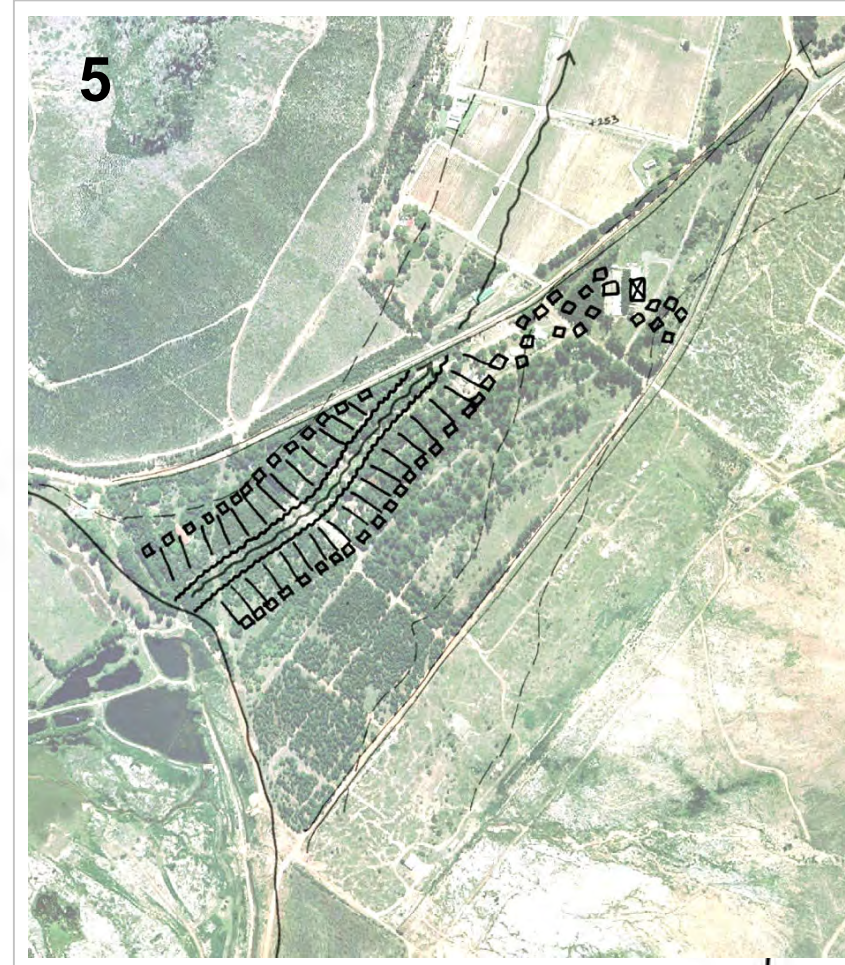
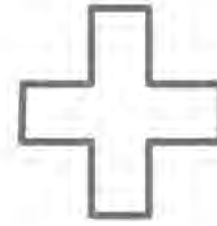
WATER & EQUITY DETERMINANT

For the optimal functioning of the site, it is imperative that water is integral to the design. Scenario 6 proposes a system of connected water-points directly through the centre of the site. As well as enabling equitable access to water for all users, these water points are envisaged as public celebration spaces.

The water may be drawn up directly to the point of access into the site. This alignment does however, defy gravity, and much energy will be required to pump water from the dam to this point.

Although the concept of water and equity is a valid one, this particular scheme will have to be reworked in order to be successful.

Selected Scenarios

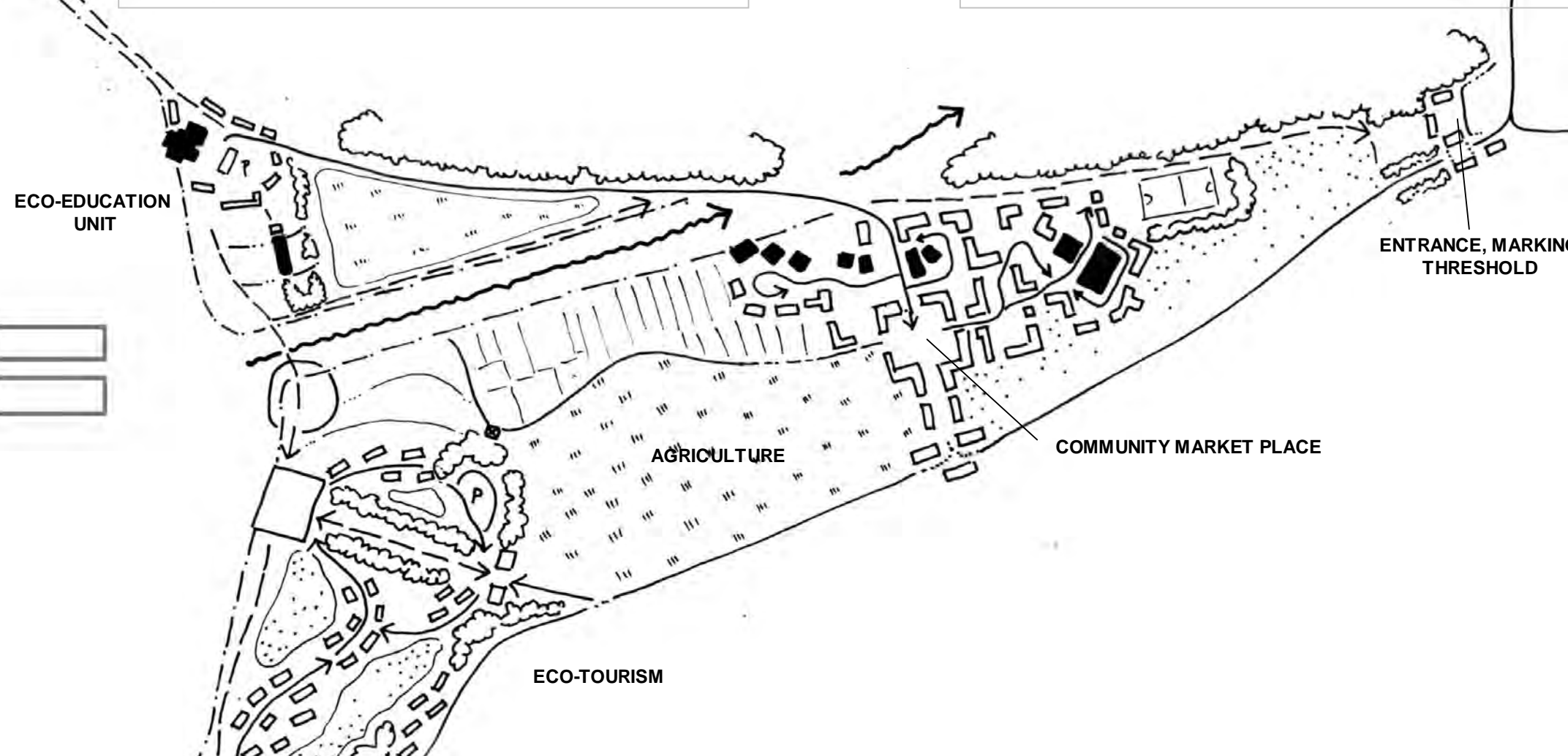


'A CATCHMENT COMMUNITY'

A combination of these two particular scenarios is seen to provide the 'Optimum Fit' for the Robertsvlei Hamlet. Scenario 4 is found to contain the sense of community at the core, with support through the connections of pilot nodes. These links will effectively provide the user with the necessary needs associated with conservation, aqua-culture, recreation and environmental education.

Scenario 5 only reinforces the link of the community to the dam, along a valuable line of rich-agricultural land. It is only fitting, that the community resource-base should connect them to their livelihood, which is the dam.

Ideally, what the design seeks to achieve eventually, is a balance of land uses, in keeping with the Optimum use of the land.

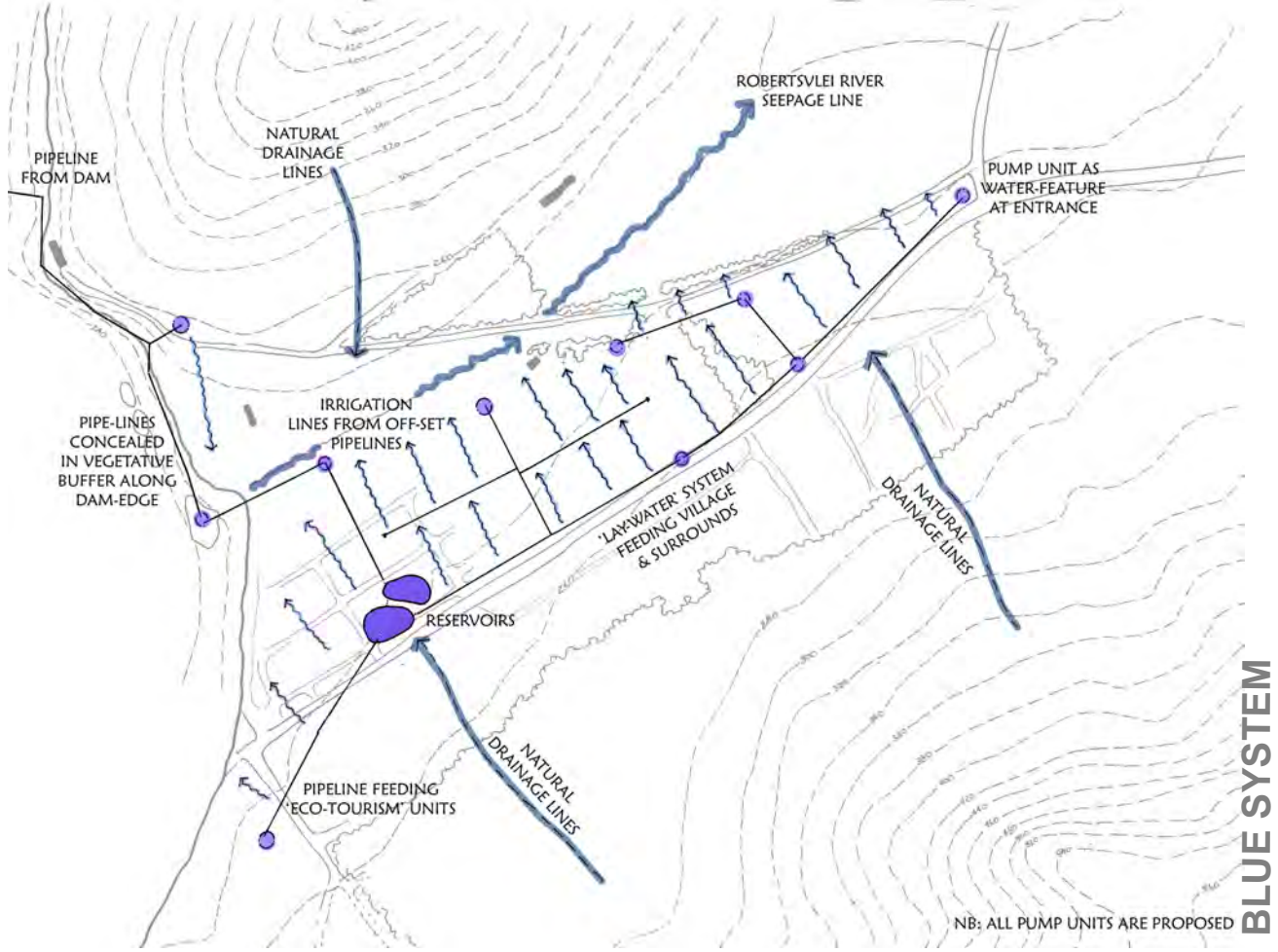
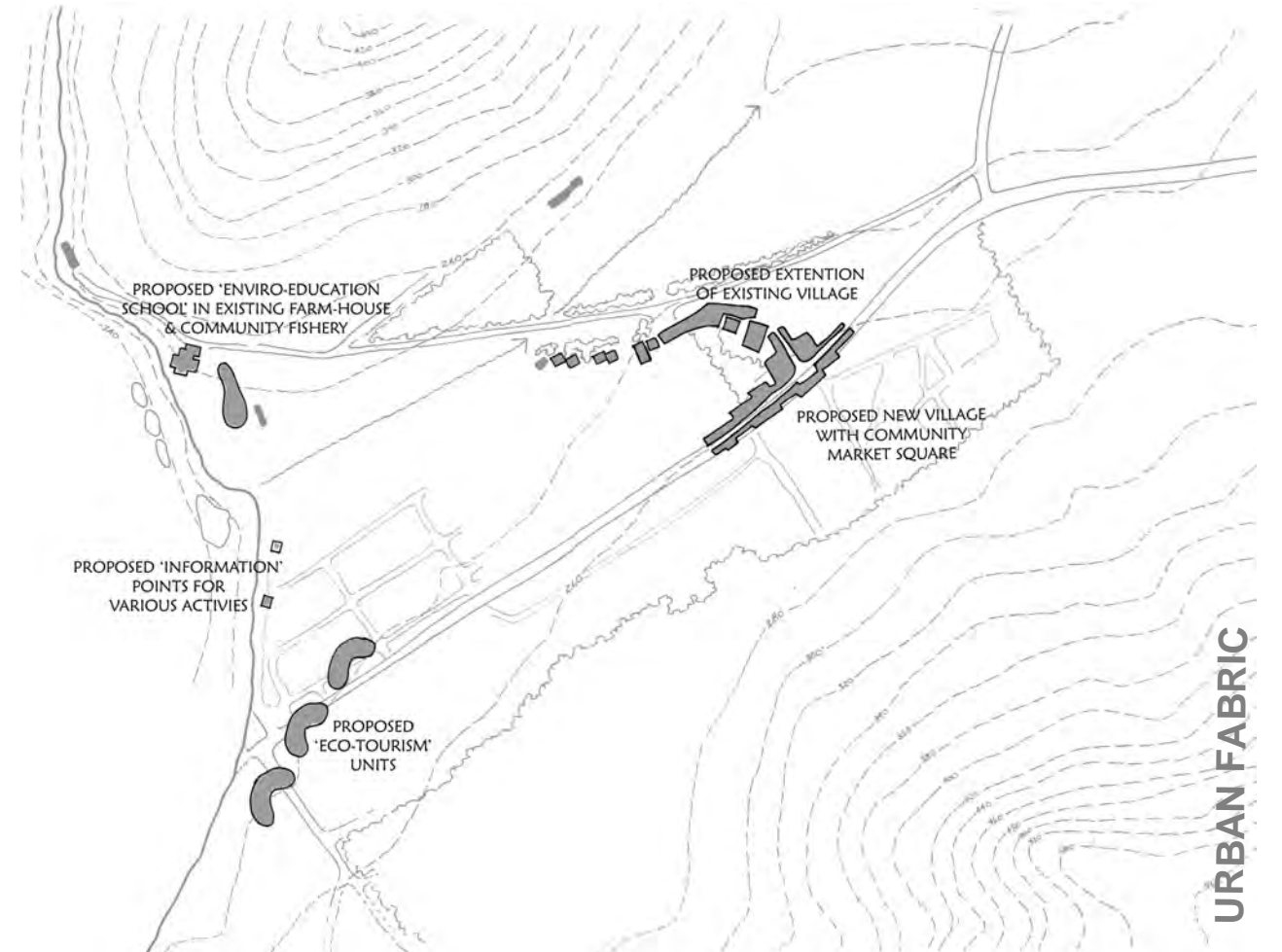
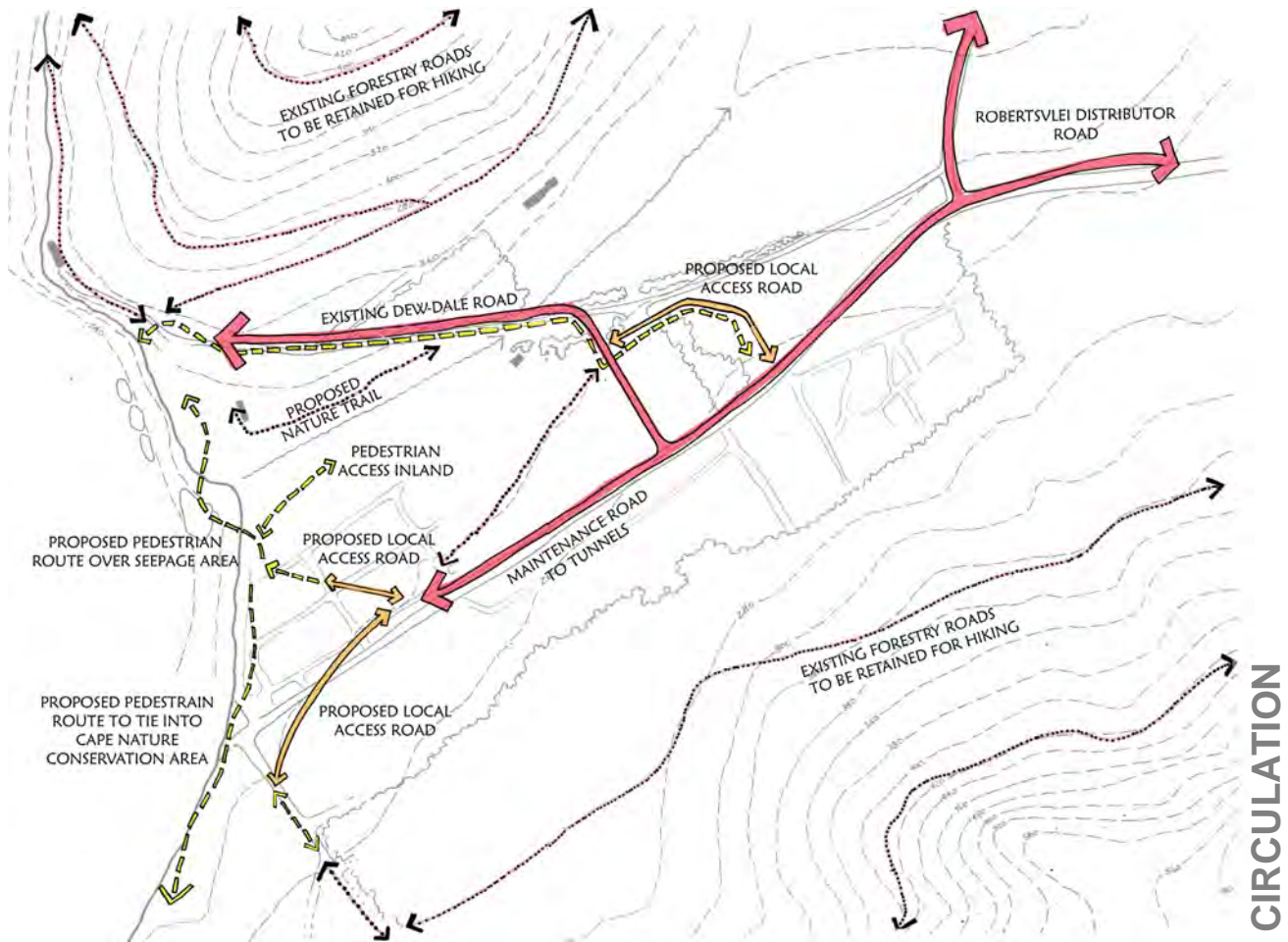


STRUCTURING ELEMENTS

In order to gain some insight into the workings of the plan, a series of structuring elements have been prepared illustrating Circulation, Drainage, Green spaces and the proposed Urban Fabric...

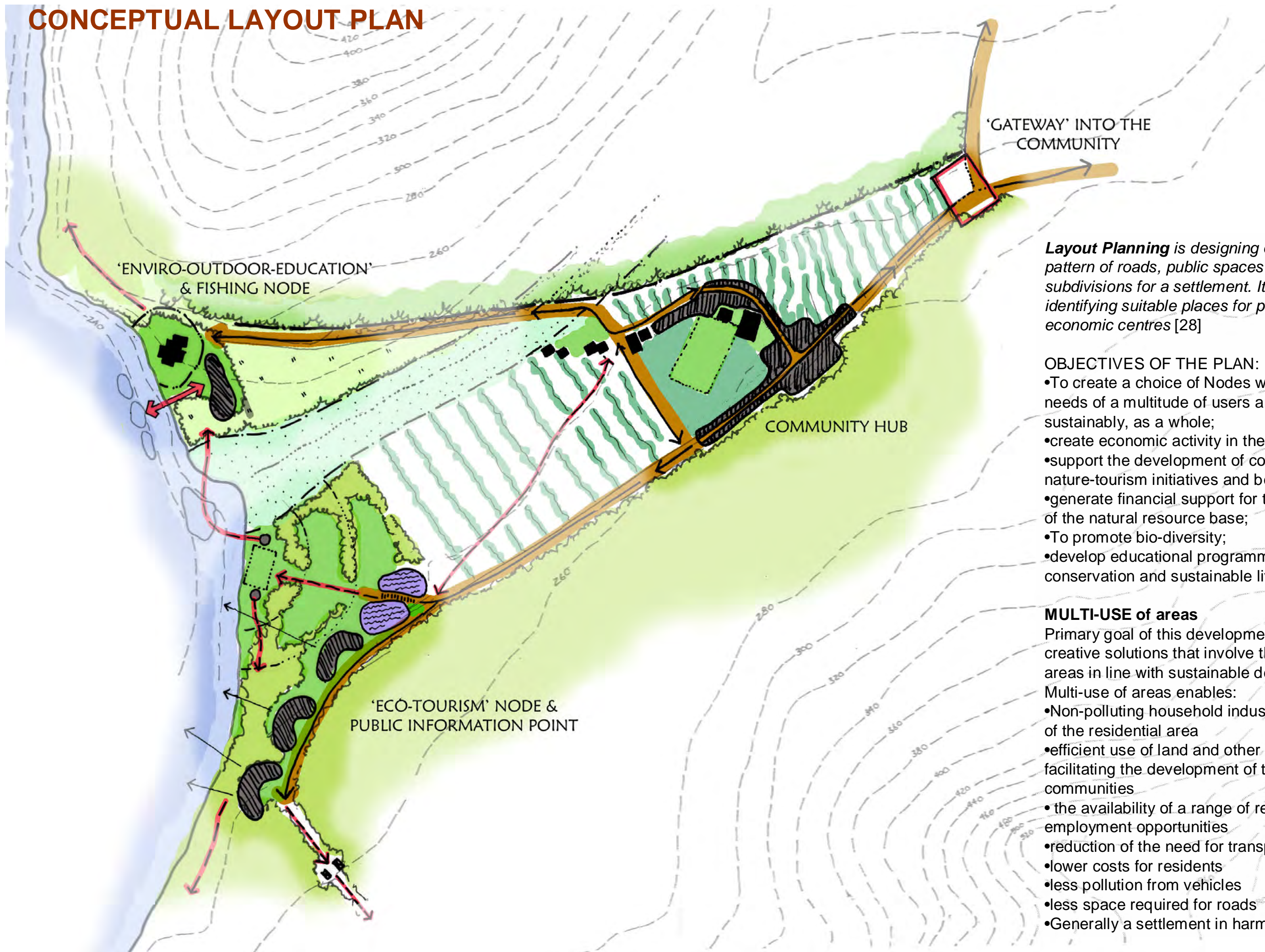
STRUCTURING ELEMENTS

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Robertsvlei
A CATCHMENT
HAMLET

CONCEPTUAL LAYOUT PLAN



Layout Planning is designing on a plan the pattern of roads, public spaces and plot subdivisions for a settlement. It includes identifying suitable places for public facilities and economic centres [28]

OBJECTIVES OF THE PLAN:

- To create a choice of Nodes which meet the needs of a multitude of users and function, sustainably, as a whole;
- create economic activity in the area;
- support the development of community based nature-tourism initiatives and benefits;
- generate financial support for the management of the natural resource base;
- To promote bio-diversity;
- develop educational programmes in line with conservation and sustainable living.

MULTI-USE of areas

Primary goal of this development is to seek creative solutions that involve the multi-use of areas in line with sustainable development. Multi-use of areas enables:

- Non-polluting household industries to form part of the residential area
- efficient use of land and other resources; facilitating the development of thriving communities
- the availability of a range of residential and employment opportunities
- reduction of the need for transport
- lower costs for residents
- less pollution from vehicles
- less space required for roads
- Generally a settlement in harmony with nature



SITE SUITABILITY: A summary

Declaring a site suitable for development is a daunting task. With countless considerations to think about in terms of opportunities and constraints, and the added ingredient of needs to be met, the process is complex.

Yet what we have thus far, is the makings of a settlement. *Robertsvei Hamlet* is a demonstration of the optimal-use of land through community involvement and public participation. The next part of the project delves deeper into the detail of this settlement and the inner components that determine its function as a whole.

The underlying theory has been applied throughout the conceptual process. An original concept of new found dam-development has been attempted, one that intends to bring the community right to the heart of Dam construction and the benefits it pertains to bequeath on surrounding communities. Å

The Project in Context
Problem Diagnosis



Hypothesis
Project Brief



PART 1
Framing the problem on a
Theoretical Basis



PART 2
Application of Theory through
Planning



PART 3
Theory Demonstration through
Design Intervention



PART 4
Forming a Design Solution



PART 5
Project Feasibility



Conclusion

Theory Application



Demonstrating

'Robertsvei Hamlet'
Contextual Analysis



Setting the Rules
•Carrying Capacity
•Municipal: Location & Role
•District: Accessibility, Institutional
Significance
•Local: Connections, Public
Participation
•Site: Goals/ Governing Principles,
Opportunities & Constraints



DEVELOPMENT FRAMEWORK
PLAN 1:2500
•Residential Node
•Eco-tourism Node
•Educational Node



Core Site Selection

ESTABLISHMENT OF A 'HAMLET'



The workings of a development plan thus far provide a concept for an ecologically-based settlement in a natural mountainous setting.

Given the sensitive issues directly surrounding the settlement, strict rules must apply in order to maintain the concept of sustainable design and allow the settlement to function to its optimum.

CARRYING CAPACITY

The concept of carrying capacity was initially developed in the fields of range and wildlife management and was based on the notion that an organism can survive only within a limited range of physical conditions [86]. This is as much applicable to humans, as it is to organisms

Robertsvei Hamlet will have multiple carrying capacity's, depending on the breakdown of land use in the area. However, management of resources is imperative to the sustainability of the settlement. Uncontrolled growth in population will place extra pressures on the resources available and diminish the earth's ability of sustain life.

Additionally, without strict measures in place as to the developmental capacity of the site, our vision of a small-scale rural Hamlet could be made to look like something quite to the contrary.

In determining the Carrying Capacity of a site McHarg (1969) speaks of obtaining a degree of compatibility through *Optimum Multiple Land Uses*. A complex process of defining the *intercompatibility* of land uses is carried out, considering the *natural determinants for their occurrence and the consequences of their operation*. What is said to result is the *maximum potential of co-existing and compatible land uses for the entire area*.

Although a comparatively more simple attempt has been made at this process, the theory is a valuable one and should be kept in mind.

Some basic stipulations of Carrying Capacity for the site are as follows:

HOUSING

- Due to the location of the site in relation to the Hottentots Holland Nature Conservation Area; a very close-knit, low density of dwellings is desired to preserve this setting.
- The number of housing units in the Hamlet should remain as is, with a maximum of 5 inhabitants per house.
- Each house in the Hamlet shall have access to 100 square metres of land for agriculture, with additional access to 100 square metres of shared common land.

AQUA-CULTURE

- In intensive *tilapia* cage farming, the ecological footprint for feed production is 10 000 times larger than the area of the cages [85]. As the Berg River Dam has a capacity of approximately 48 million cubic metres, there is ample carrying capacity for subsistence cage culture to provide food for the community.

RECREATION & EDUCATION

- Recreational 'highs' in this setting will most likely be seasonal due to the fluctuation water-levels of the dam and therefore carrying capacity is not see to be a concern. The provision of accommodation throughout the site has catered for users, in line with carrying capacities of natural conservation areas; this includes:
 - Dormitories to sleep 75 children
 - Outdoor centre to accommodate 5 adults
 - Fishery to accommodate 1 manager
 - Eco-tourism facilities to accommodate a total of 74 guests including children.
- Day-trippers to the site should be in the region of a 200 maximum, including hikers who arrive on foot.



MUNICIPAL LOCATION & ROLE

Given its close vicinity to all major access routes, to the Cape Town metropolitan, and other large towns within the Municipality, the site has the ability to play an important municipal role. This would obviously be on condition that local and district transport services are up-graded, allowing access to the site for all users, utilising both public and private transport means.

Nevertheless, Robertsvlei could provide a unique tourist facility in the area. It offers the perfect isolated setting to 'get away' to and a range of outdoor pursuits on offer, which are somewhat limited in the municipal area.

DISTRICT: Accessibility, Institutional Significance

The draining of the dam each Summer season is suggested as holding great potential to create a number of annual and permanent water-bodies and vleis. These hydrological components will host a large variety of avian and aquatic species, some of them of which could be endemic. The opportunity this poses for the purpose of education and research is vast.

In order to preserve the bio-diversity in the area, small-scale farmers would be encouraged to incorporate their farms into a Wetland Special Management Area Initiative, working towards establishing a sustainable ecology in harmony with farming in the Robertsvlei Wetland Eco-system.

This initiative would be in line with the preservation of the unique flora and fauna of the Hottentots-Holland 'Buffer' zone. A largely sustainable ecology could be created, ensuring the protection and enhancement of the heritage and culture of the sub-region.

Robertsvlei's matrix of mixed land-uses would be a place that offers access to all. It would hold great importance in terms of an institution, setting an example of how to meet social and environmental requirements, whilst encouraging community lifestyles compatible with environmental sustainability.

LOCAL: Connections & Public Participation

Within the local context, one the possibilities posed by Robertsvlei it to overcome the current limitations in terms of education and public open space within Franschoek itself. Again, these possibilities will hinge strongly on the improvement of local transport routes, with the introduction of a formalised bus-service in the area as a start.

In terms of services, as previously established, the extension of Franschoek's sewerage-treatment works is only a possibility and if so, a long-term planning objective. The remoteness of Robertsvlei from the mainstream services within the valley calls for the need to practice alternative sewerage-treatment practices, clearly, ones which pose least impact to the quality of the dam water.

Public participation is essential for the successful functioning of a rural Hamlet. As this Hamlet is for the purpose of the community, the community must be involved at every stage from initial planning to design and implementation. The onset of this process would have to determine which residents take up homes in the Robertsvlei Hamlet. A system of criteria must be set up, in terms of accessing those with agricultural skills as well as those with formal training in environmental education, water-related activities and tourism.

Increased activity during the 'high season' months at the time will result in additional labour demands. The process of recruitment would theoretically provide a connection to Franschoek.

Fig 2 Robertsvlei Community Hall [63]



SITE GOALS & GOVERNING PRINCIPLES

The prime goal of the site is to develop a complex matrix of land-uses that will compliment and reinforce each other. A Governing principle will guide development, with the support of the previously established policies for the site.

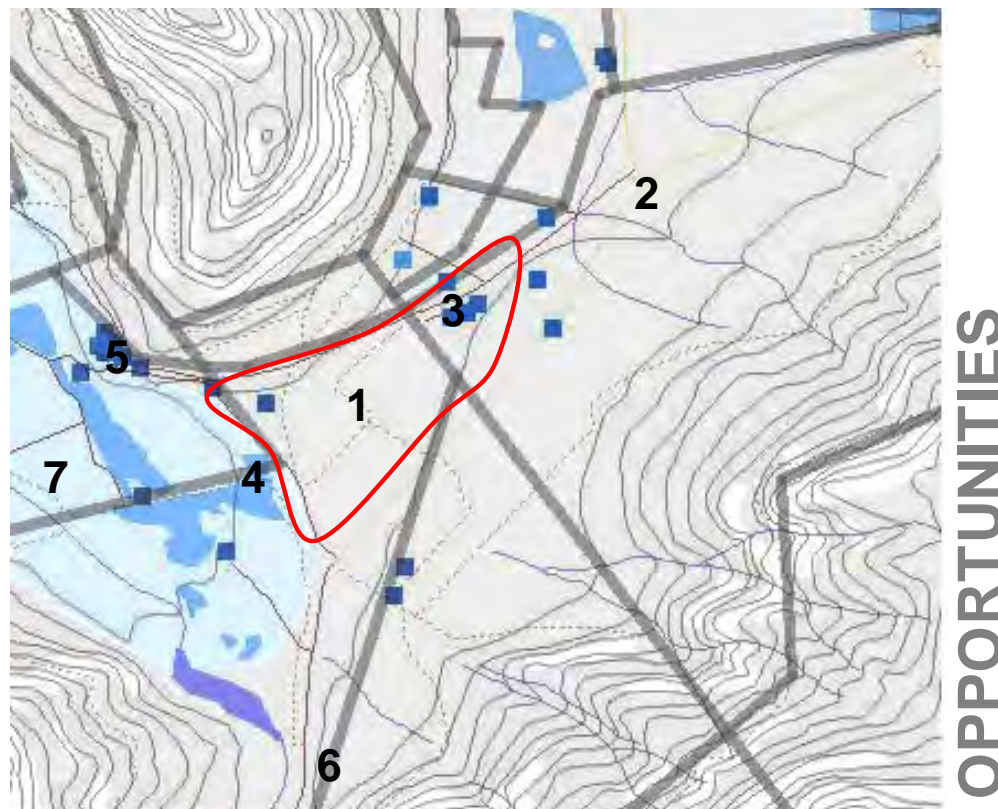
OVERRIDING POLICY:
TO PROTECT THE NATURAL ENVIRONMENT & IMPROVE THE FORM OF DEVELOPMENT WHICH TAKES PLACE IN THAT ENVIRONMENT

PLANNING & LEGAL POLICY
Adopt a Low-impact, Low technology, Ecological Planning Approach that will enable development to respond to natural processes

ENVIRONMENTAL POLICY
Employ a Conservation & Protection ethic in order to restore Environmental integrity and promote bio-diversity, through sensitive development and management of resources

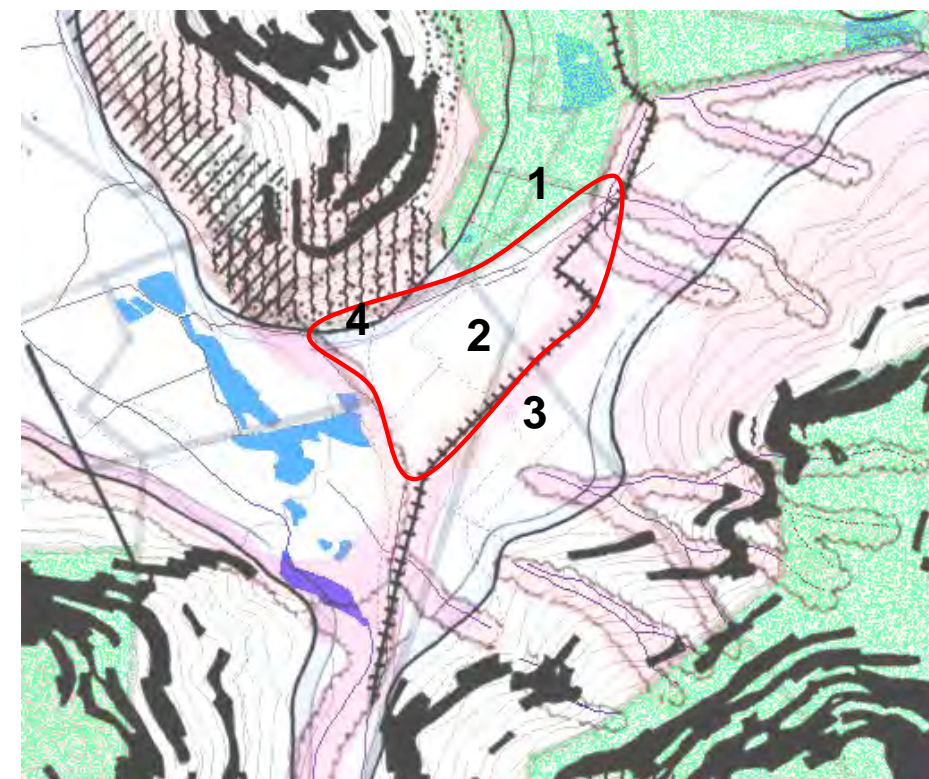
SOCIO-ECONOMIC
Promote sustainable Living Environments through working communities that are self-sufficient, diverse and dignified

INFRASTRUCTURE POLICY
Maximise the opportunities presented in this unique setting, while ensuring the protection of natural and scenic resources is not compromised



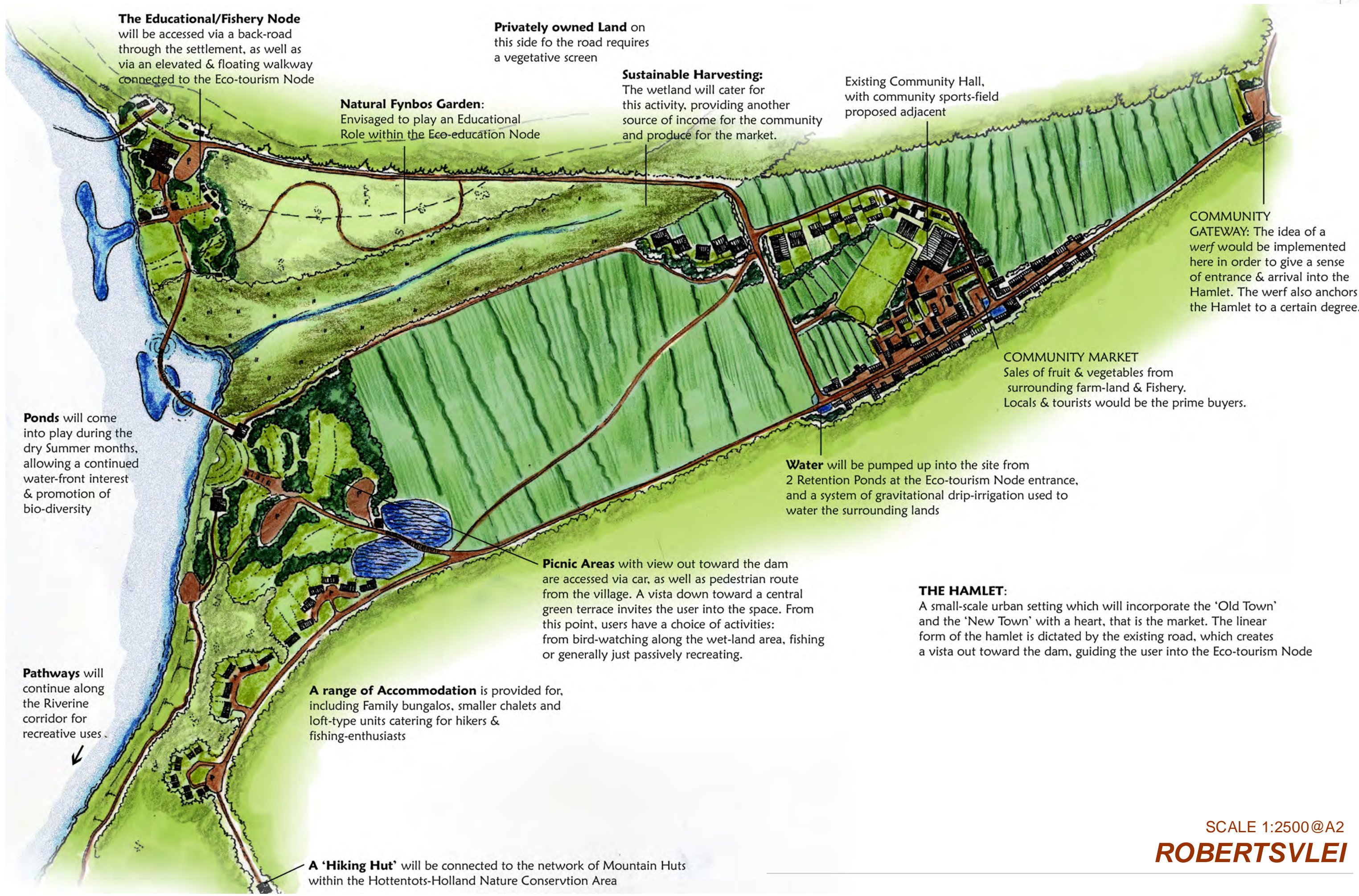
OPPORTUNITIES

1. Opportunities to farm rich alluvial soils
2. Well-established infrastructure
3. Existing community
4. Close relationship to dam
5. Existing aqua-culture unit
6. Close proximity to the Hottentots-Holland Nature Conservation Area.
7. Access to water.



CONSTRAINTS

1. Site borders privately-owned wine-farm
2. Potential aquifer-recharge area
3. Existing power-line- also an opportunity
4. Steep slopes with duplex soils



The Educational/Fishery Node
will be accessed via a back-road through the settlement, as well as via an elevated & floating walkway connected to the Eco-tourism Node

Privately owned Land on this side of the road requires a vegetative screen

Natural Fynbos Garden:
Envisaged to play an Educational Role within the Eco-education Node

Sustainable Harvesting:
The wetland will cater for this activity, providing another source of income for the community and produce for the market.

Existing Community Hall, with community sports-field proposed adjacent

COMMUNITY GATEWAY: The idea of a werf would be implemented here in order to give a sense of entrance & arrival into the Hamlet. The werf also anchors the Hamlet to a certain degree.

COMMUNITY MARKET
Sales of fruit & vegetables from surrounding farm-land & Fishery. Locals & tourists would be the prime buyers.

Ponds will come into play during the dry Summer months, allowing a continued water-front interest & promotion of bio-diversity

Water will be pumped up into the site from 2 Retention Ponds at the Eco-tourism Node entrance, and a system of gravitational drip-irrigation used to water the surrounding lands

Picnic Areas with view out toward the dam are accessed via car, as well as pedestrian route from the village. A vista down toward a central green terrace invites the user into the space. From this point, users have a choice of activities: from bird-watching along the wet-land area, fishing or generally just passively recreating.

THE HAMLET:
A small-scale urban setting which will incorporate the 'Old Town' and the 'New Town' with a heart, that is the market. The linear form of the hamlet is dictated by the existing road, which creates a vista out toward the dam, guiding the user into the Eco-tourism Node

Pathways will continue along the Riverine corridor for recreative uses

A range of Accommodation is provided for, including Family bungalows, smaller chalets and loft-type units catering for hikers & fishing-enthusiasts

A 'Hiking Hut' will be connected to the network of Mountain Huts within the Hottentots-Holland Nature Conservation Area

SCALE 1:2500@A2
ROBERTSVLEI

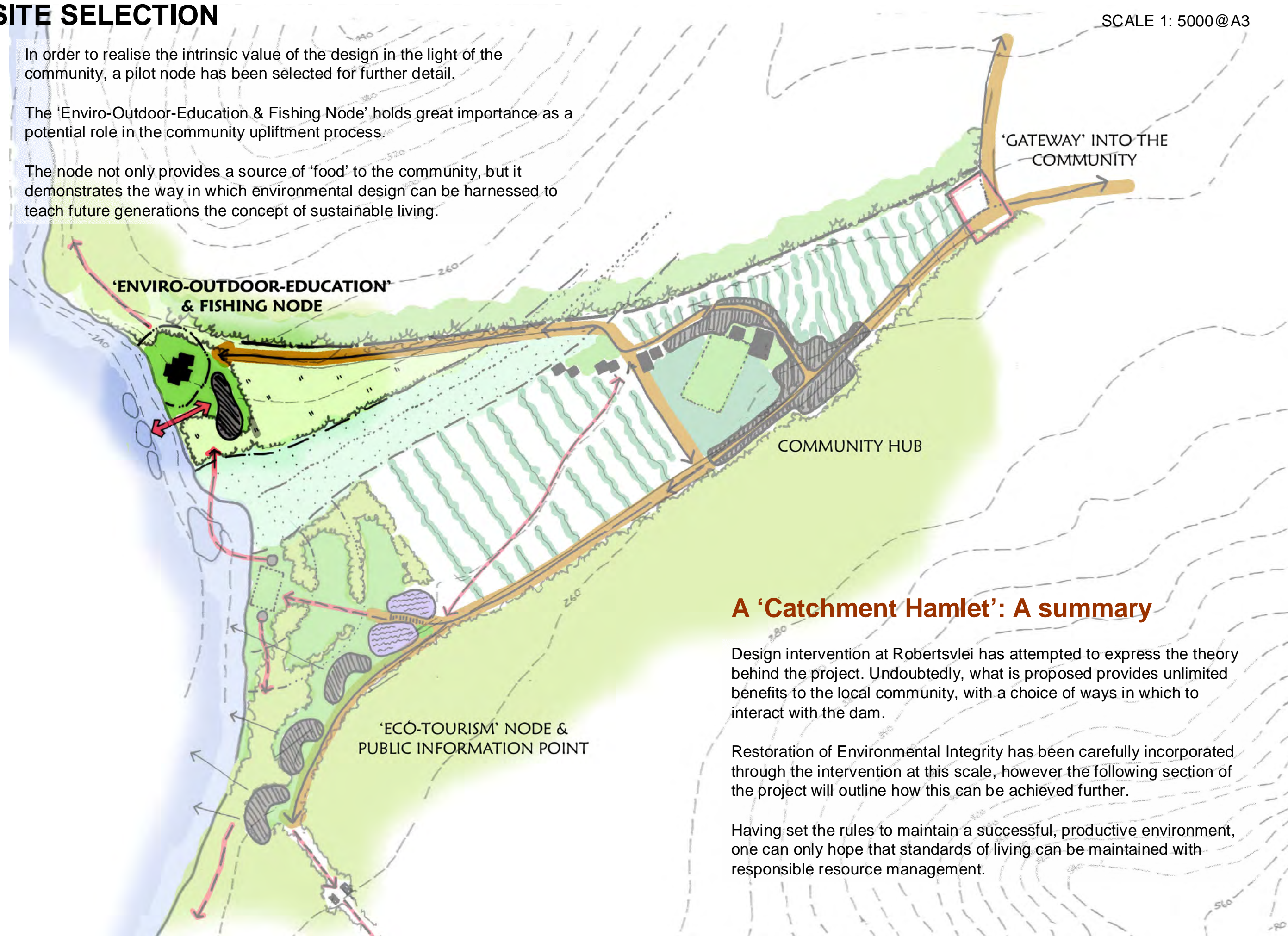
SITE SELECTION

SCALE 1: 5000@A3

In order to realise the intrinsic value of the design in the light of the community, a pilot node has been selected for further detail.

The 'Enviro-Outdoor-Education & Fishing Node' holds great importance as a potential role in the community upliftment process.

The node not only provides a source of 'food' to the community, but it demonstrates the way in which environmental design can be harnessed to teach future generations the concept of sustainable living.



A 'Catchment Hamlet': A summary

Design intervention at Robertsvei has attempted to express the theory behind the project. Undoubtedly, what is proposed provides unlimited benefits to the local community, with a choice of ways in which to interact with the dam.

Restoration of Environmental Integrity has been carefully incorporated through the intervention at this scale, however the following section of the project will outline how this can be achieved further.

Having set the rules to maintain a successful, productive environment, one can only hope that standards of living can be maintained with responsible resource management.

The Project in Context
Problem Diagnosis



Hypothesis
Project Brief



PART 1
Framing the problem on a
Theoretical Basis



PART 2
Application of Theory through
Planning



PART 3
Theory Demonstration through
Design Intervention



PART 4
Forming a Design Solution



PART 5
Project Feasibility



Conclusion

Resolution of landscape Elements

Core Site Design Brief & Programme

**Site Informants
Opportunities & Constraints**



Core Site Design Proposal
Design Principles &
Concept Plans
Precinct Site Components 1:1000
CIRCULATION
OPEN SPACE
NATURAL & STORM WATER DRAINAGE
LAND USE



Development Precinct 1:500
•GRADING PLAN
•DRAINAGE PLAN
•HARD LANDSCAPE PLAN
•SOFT LANDSCAPE PLAN
•STREET FURNITURE THEMES &
POSITIONING
•LIGHTING EXAMPLES &
POSITIONING
•SIGNAGE EXAMPLES &
POSITIONING
•ILLUSTRATIVE PLAN

Detailed Plan 1:250
•ILLUSTRATIVE PLAN
•Detailed Sections 1:20/1:50
•PAVING PLAN 1:250
•PLANTING PLAN 1:250
•Landscape Construction Details

Core Site Design Brief & Programme

BRIEF

A node representing the juxtaposition of community fishing infrastructure with the working components of an Environmental 'Field School' is proposed for the site.

An aqua-culture facility is to enable access to the dam in the form of a slip-way for use by non-motorised boats. Boat-sheds and workshops associated with the running of this unit shall be incorporated, as well as space for drying racks for fish, preferably located in a sunny-position.

Manager's accommodation shall be provided for in this establishment.

A strong connection of natural elements must be central to the site layout, catering for storm-water run-off and limiting sedimentation into the dam. Additionally, barriers from wind and possible flooding should be considered.

An Environmental Educational institution shall include both private and public access, complete with parking and a strong network of pathways connecting the site to the Hamlet, as well as to the Eco-tourism Node.

It is vital that a comprehensive recreative link is made with the dam, both during high and low water levels. The educational component should be in tune with these levels, enabling bio-diversity to be placed at the fore-front of the school curriculum.

The management of resources however, must be central to the concept of the school. Environmentally-friendly energy-usage shall be practised in all cases, and re-cycling of both water and waste, integral to the workings of the Node.

PROGRAMME

Main Building:

- Kitchens with Herb Garden adjacent
- Laundry Facility
- Cafeteria, (available for public use) with outdoor sun-deck, providing views across dam and areas adjacent to building requiring surveillance (children's playground)
- Class-rooms for 'Environmental Education'
- Games area
- Ablutions
- Re-cycle unit

Educational Facilities:

- Outdoor classrooms, extending from existing building, incorporating 'quiet areas' for social-interaction and passive recreation such as board-games
- public Exhibition space for school creations
- Historical section of learning spaces, incorporating traditional arts & crafts & skills such as 'thatching' etc
- Junior children's eco-play area with trampolines
- Falconry Classroom & Avery's adjacent to mountain
- Elevated viewing platform with observatory facility
- 'Woodland walk' incorporating various species and families of fynbos extending into adjacent natural Fynbos area east of site
- Obstacle-courses for outdoor activities
- Bee-keeping area
- Bird-watching hide verging the Robertsvlei wetland area (also accessible to public)
- Wetland-education point, elevated above Robertsvlei wetland

Accommodation:

- Dormitories & ablution blocks for 75 children

Services & structural elements of the site are to include:

Water-supply:

- On-site 20m diameter storage reservoir positioned at elevated point of site to supply buildings & Aqua-culture facility
- Surface Water Drainage allowed for through entire site into the Dam
- Incorporation of eco-friendly grey-water treatment works on site
- Grey-water re-cycling unit incorporated into all buildings

Power-supply:

- Solar-panelled power-supply, located on the roofs of each individual building

Access:

- Bus & car Drop-off point directly in-front of Main building
- Utility Vehicle access to north side of building & Aqua-culture facility
- Pedestrian access throughout site, with strong connection south-wards towards 'Eco-tourist Node'
- special-needs access provided for

Parking:

- parking for 20 Cars, 6 Staff cars & 2 Special-needs parking adjacent to Main Building & Dormitories
- parking for 4 vehicles in Aqua-culture facility

Flood Control:

- water-front treatment shall be designed accordingly.

Fire Buffer:

- In an area prone to bush-fires, a 20metre buffer zone must encompass the entire site. This zone must constitute closely-mown grass species that are less susceptible to fire

N.B. All area to be adequately and strategically lighted at night so as not to waste renewable-energy



Other associated activities:

RECREATION

- Canoe & Swim Zone with controlled access and life-guard stand. Canoe zone will require space for boat-storage and canoe-shoot into Dam. Swim-zone will incorporate 'beach-like' water-frontage with floating raft off-shore and 'foofy-slide' for enjoyment
- First-aid facility with a central location
- Central Information point with Tuck-shop facility, (accessible to the public) central to the site with drinking-fountain, bins and seating adjacent
- Small performance space (also accessible to public) with adjacent space for food-stalls and braaing facilities in the event of cake-sales or 'pantomime' type events; possibly maximising views across the dam
- 'Kick-about' space
- Fisherman's walkway from 'Eco-tourist Node' to continue along the length of the 'Environmental Education' Node northwards along the edge of the dam
- Site should allow for passage of hikers along designated paths. Trails should incorporate 'resting points' with views across dam, in keeping with the over-all network of hiking-trails surrounding the dam, adjacent Nature Conservation Areas and the proposed 'Berg Riverine Trail' downstream of the dam wall.

SITE FURNITURE & SIGNAGE

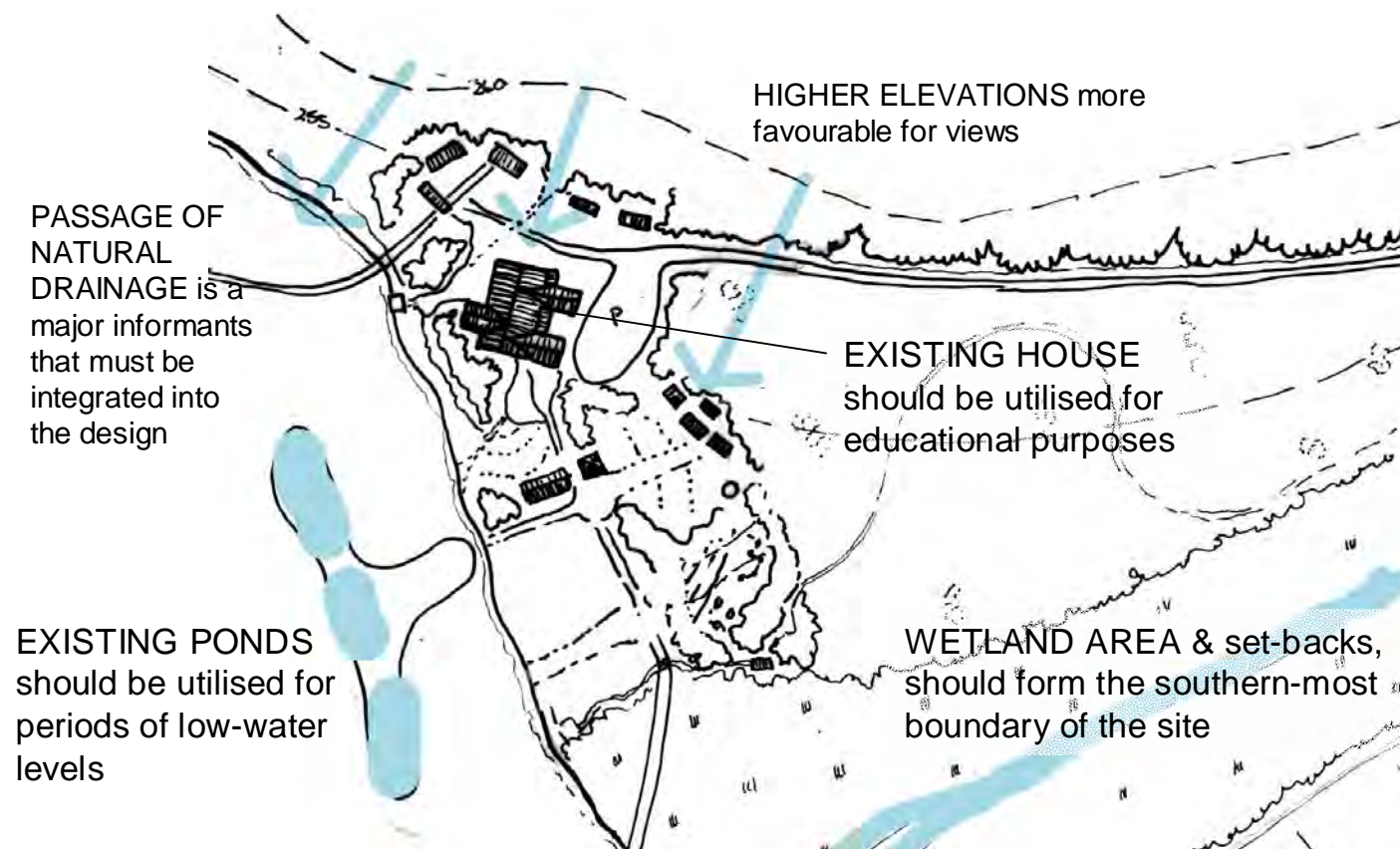
- 'Site furniture' such as seating areas & bins placed strategically throughout the accommodate a variety of users, both young and old
- Interpretative Signage to be place strategically so as to guide both students and public users carefully through the site

PLANTING

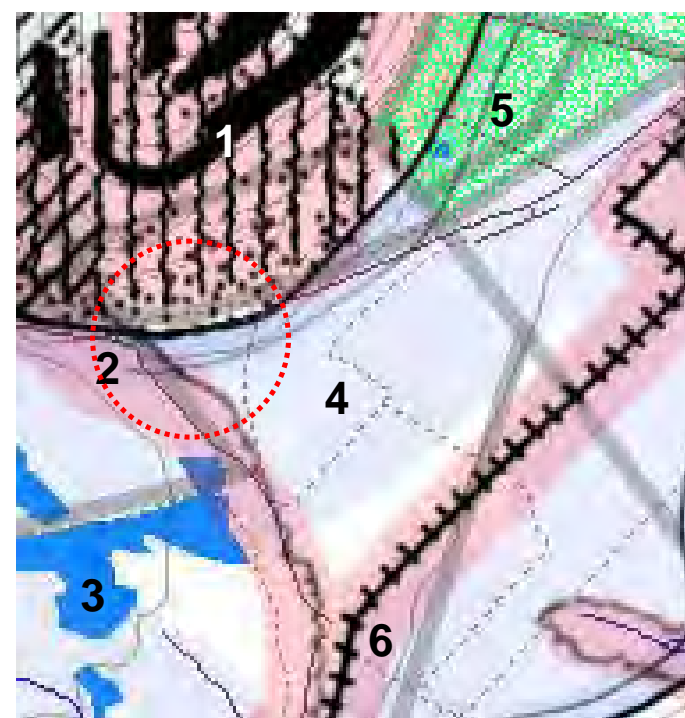
- All planting should be strictly indigenous in keeping with the 'water-wise' concept of Landscaping.
- Shade should be provided for in 'transitional' spaces where possible
- Irrigation for planting with be purely natural, with troughs and channels placed throughout site directing surface run-off into planted areas.

LOW-WATER-LEVEL SCENARIO

- incorporation of fish-breeding in ponds at low-level attached to Aqua-culture facility
- Adequate drainage lines allowed for into these ponds throughout the site



INFORMANTS



CONSTRAINTS

- 1 Steep Slopes, south-facing aspect & duplex soils
- 2 Presence of a 'Buffer Zone' around the dam
- 3 Fluctuating levels of the dam
- 4 Potential Aquifer site



OPPORTUNITIES

- 1 Opportunity for close interaction with dam
- 2 Presence of a 'Buffer Zone' allows promotion of bio-diversity and environmental education
- 3 Fluctuating levels of the dam will result in ponds, which will be explored for both recreative & educative purposes
- 4 Existing building in good condition and can be easily converted into an environmental school.

Core Site Design Proposal

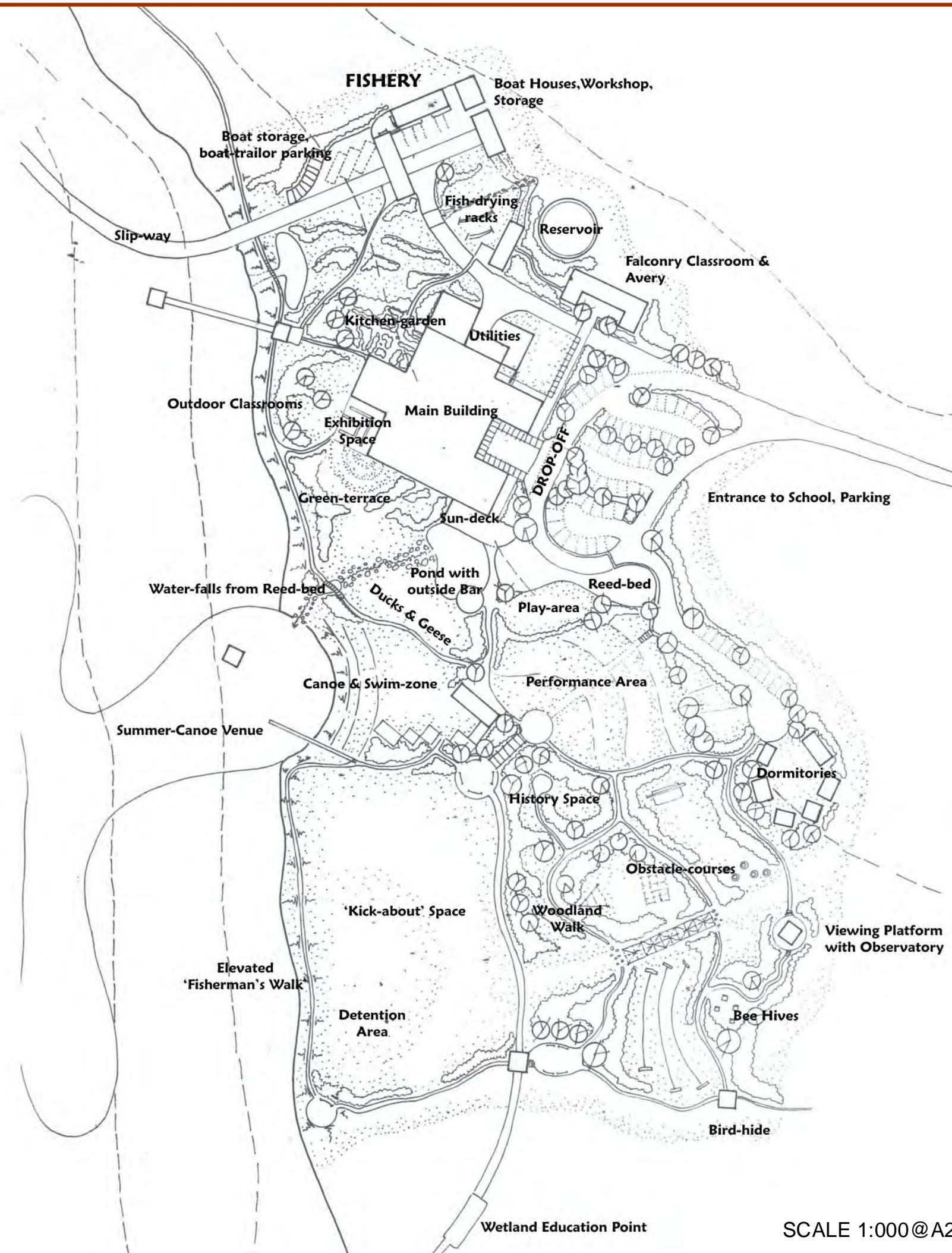
VISION

Robertsvei Outdoor Centre is set against the slopes of Middelberg with view over the Berg River Dam towards the Hottentots Holland Nature Reserve. The built fabric of the centre is designed and positioned in such a way that it becomes an integral part of the natural setting. Nature colours and tones of materials will help reinforce this notion of blending into the environment.

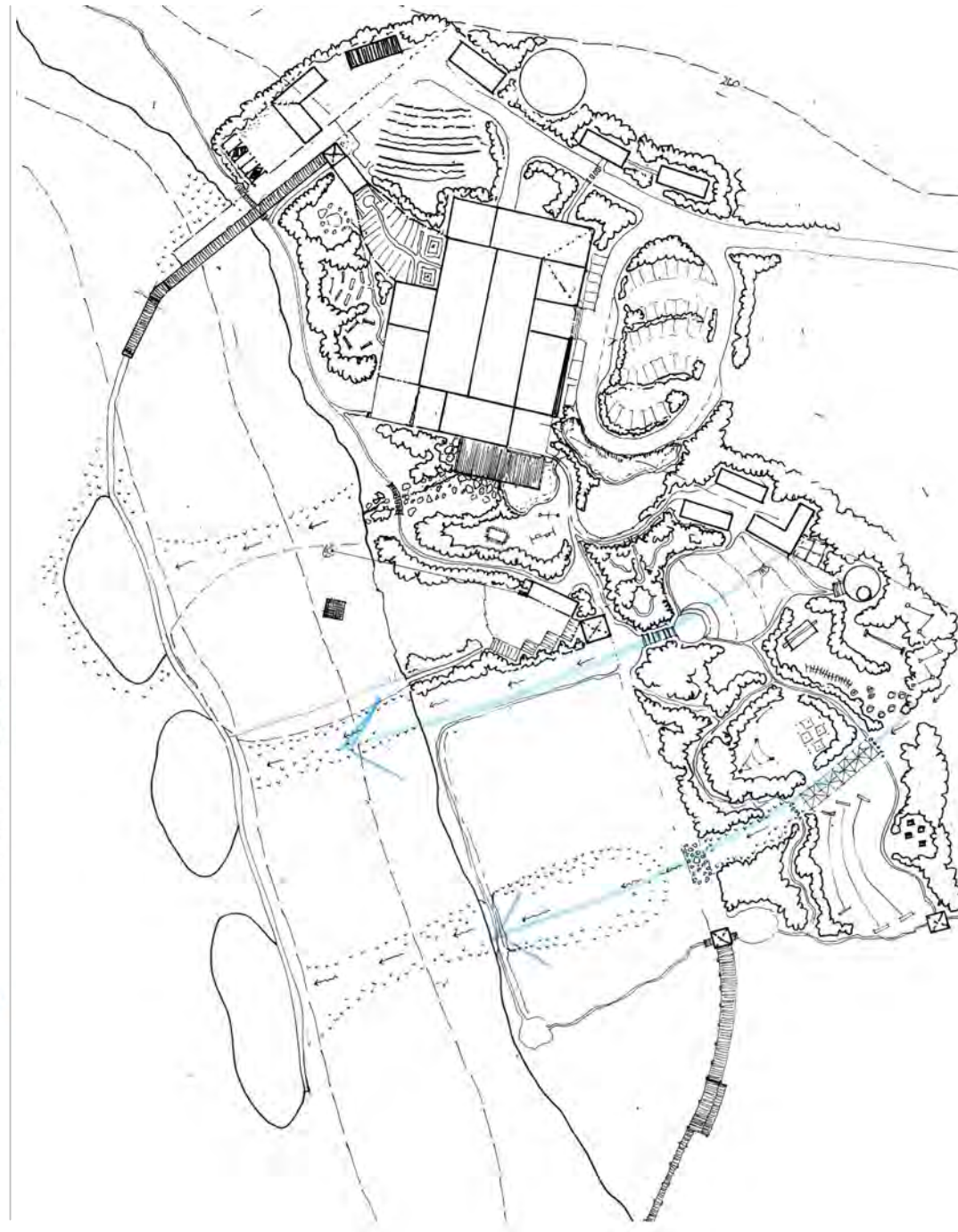
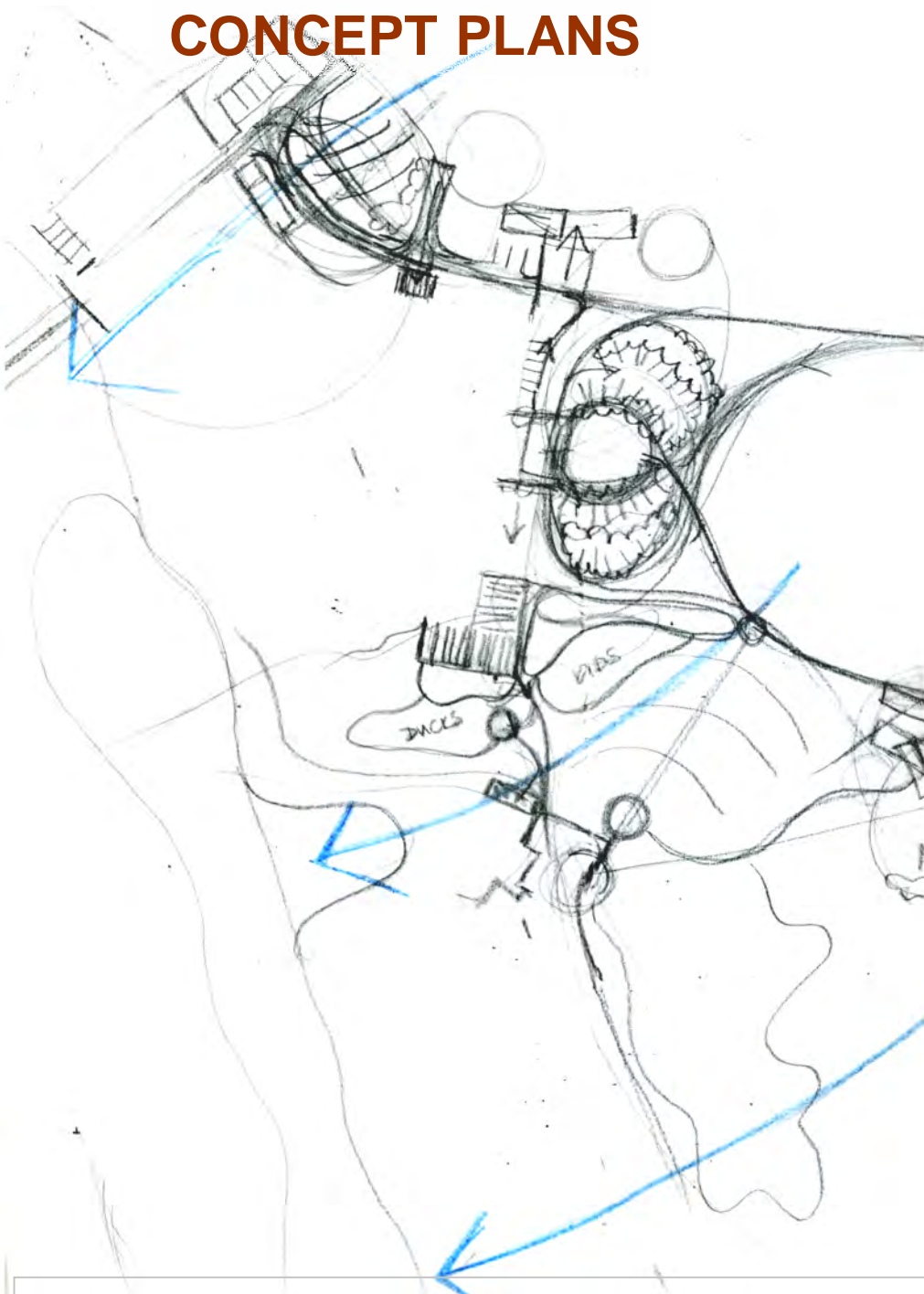
Buildings should be positioned so as to create intimate sheltered and enclosed spaces, protected, yet optimising views across the dam. The landscape surrounding this built-fabric should be seen as an extension to the constructed spaces, enriching and complementing the buildings, yet providing its own sense of purpose in both an educational and recreational role. The design of these external spaces should seek to fulfil the missing natural link that has been severed with the inundation of this area, restoring the integrity of the place and yet developing an aesthetic meaning that enforces that of the dam itself.

PRINCIPLES:

- Permit only nature-related recreation-activities on the water's surface shall be limited to controlled canoeing & small paddle-powered fishing vessels
- Develop a system of cohesive trails with interpretative signage to maximise recreational opportunities on the Dam
- Where steep areas cannot be avoided by development, create terracing for buildings to avoid erosion and landslides, with minimal disturbance to natural vegetation
- Adopt a system of grey-water re-use, gutter-harvesting & reed-bed reticulation
- Practice storm-water management throughout the design.
- Allow opportunities for 'Green Corridors'
- Re-cycle in every aspect
- Allow for direct connection with water with least impact



CONCEPT PLANS



ALL PLANS SCALE 1:1000@A2

EARLY CONCEPT

The idea of creating drainage channels through the site was implemented at the start. These channels were seen as incorporating the development within the existing landscape, providing opportunities for optimal drainage and the passage of animals.

The existing house developed the main axis, presenting opportunities to create a vista from the point of entrance, down toward the water.

The next issue was dealing with the fluctuating dam-levels. Initially, the idea was to use existing ponds to breed indigenous fish, as a secondary function to the fishery. This did not seem practical however, as rising dam-levels would cancel any progress made in this respect.

INTERMEDIATE STAGES OF THE DESIGN

The concept of ponds still had potential at this point, with the view to provide educational-access via a floating walk-way in the Summer season. These ponds began to structure the drainage lines more, and a jetty was placed so as to enclose the water-frontage of the centre. Dormitories were proposed, with a performance space beneath, which would be accessible by people arriving from the Eco-tourism node. A canoe-swim zone appeared to be too cramped at this stage, lacking in definition. The Fishery area also lacking a 'heart' or definitive enclosed space.

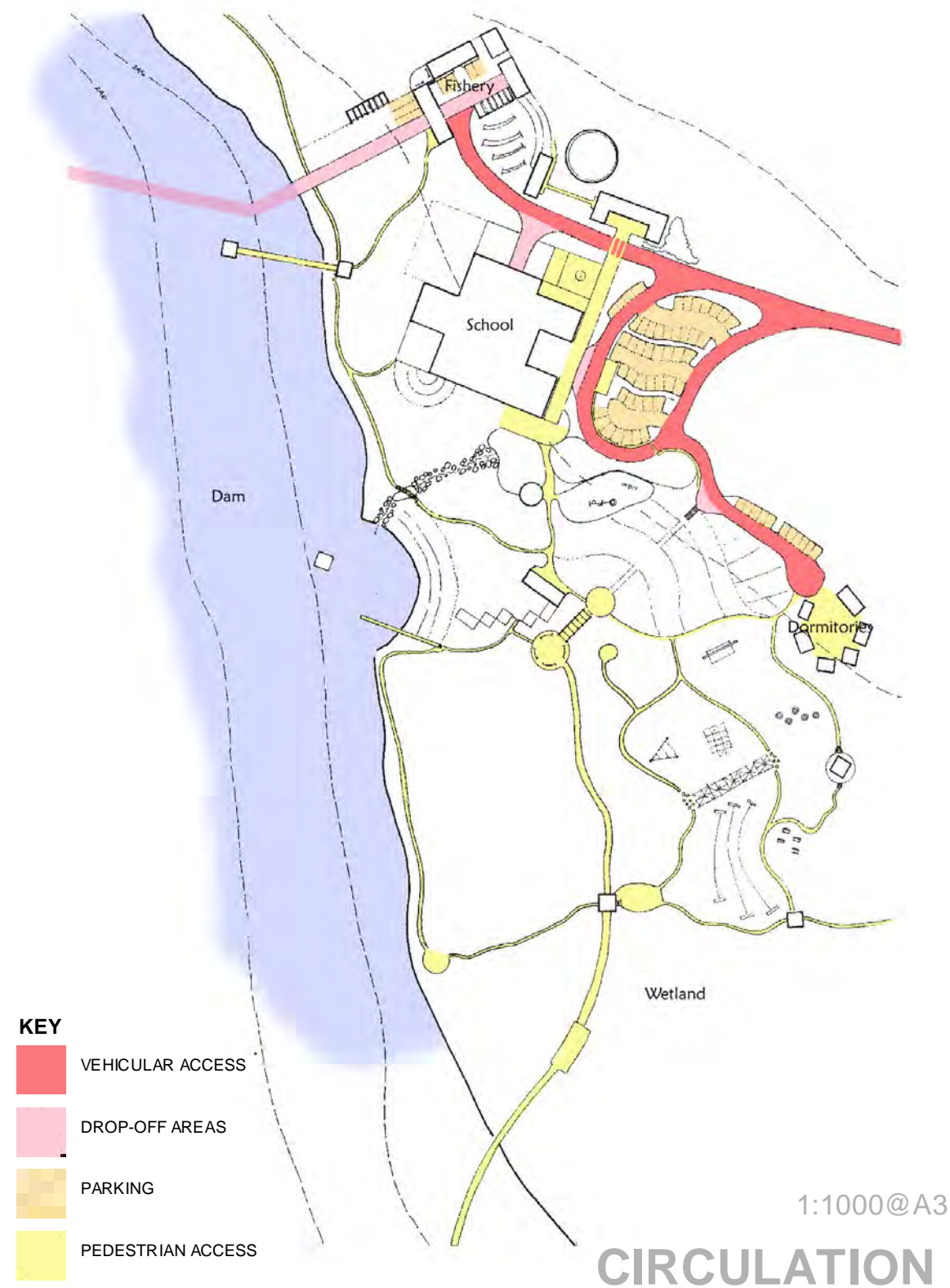
Evidently, much was yet to be resolved at this stage of the design process.

FINAL STAGES

Stronger spaces were beginning to form a more comprehensive layout. A more formal entry point at the drop-off point was to become the visitor's initial impression of the place. The reed-bed was allowed more visual dominance from the car-park, while the performance space was angled more toward the car-park, where guests would inevitable arrive.

A canoe & swim zone was to dominant the water-frontage, with the doing-away of the formalised pond-system. The Fishery became a more enclosed, more intimate space, whilst dormitories were also allocated more space, further from the main building and in a better position to access the rest of the site.

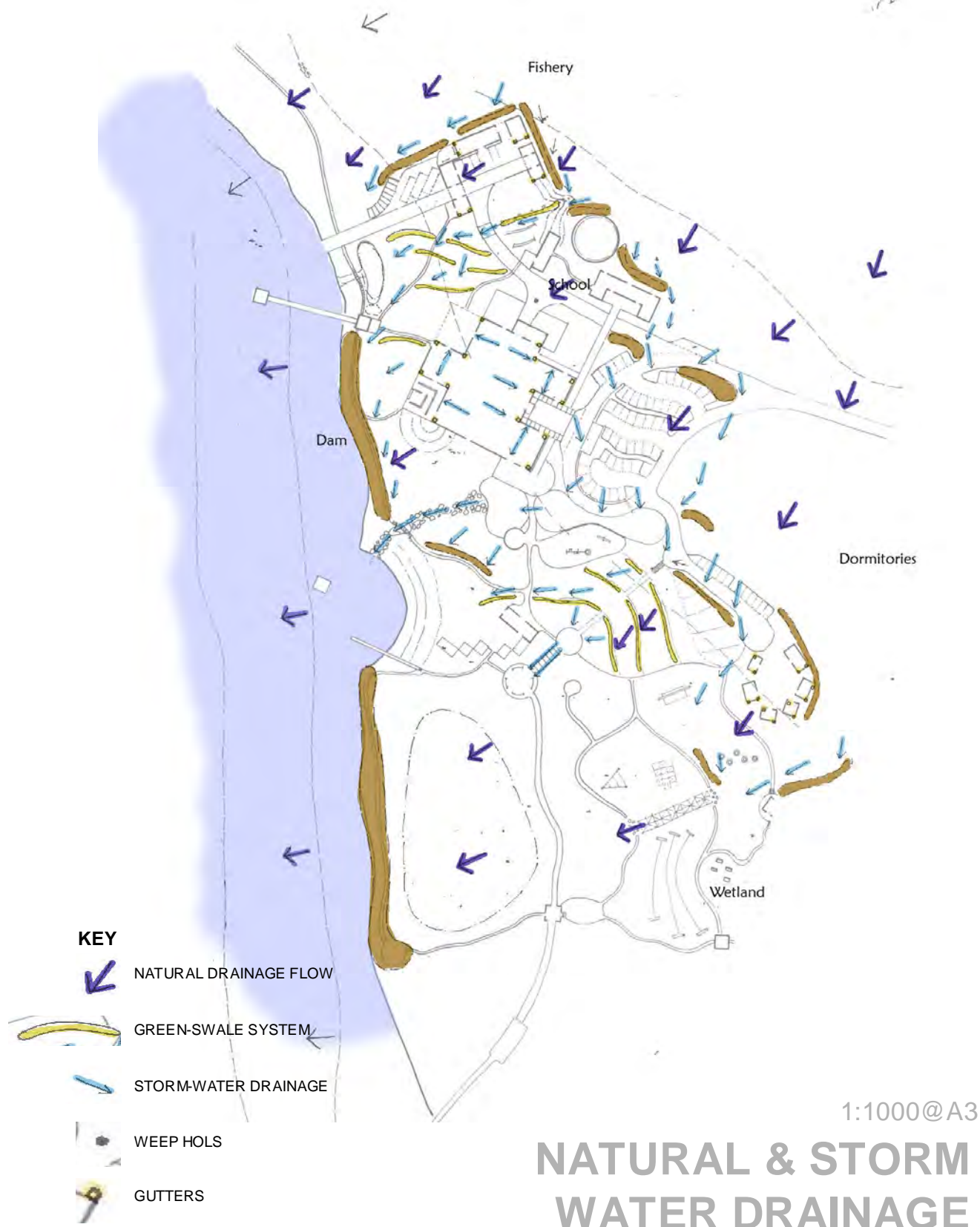
DEVELOPMENT PRECINCT • SITE COMPONENTS



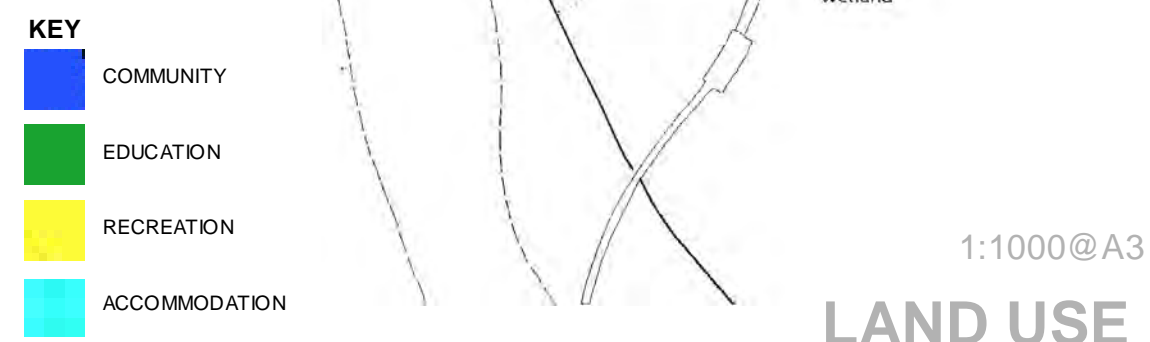
Circulation within the site is prioritised to the pedestrian and vehicles will have restricted access to Parking areas & a slip-way in the Fishing area. A cohesive network of pathways seeks to cater for the different user needs, be they children with a desire for direct and convenient pathways, or hikers or day-trippers, happy to wander the take everything in. Fishermen are catered for with an elevated path along the water-frontage area, this has the dual function of a scenic walk and flood-control barrier.



Open Space throughout the site will be structured and enclosed with shelter-belts in some cases, whilst large areas are open lawn. Trees should be used sparingly to minimise water-uptake and all plants are to be indigenous. A 'fire-buffer' of 10m around the entire site will consist of low-cut grass to safeguard against sudden fires. The adjacent wetland will be utilised for educational purposes, setback of 100m has been stipulated.

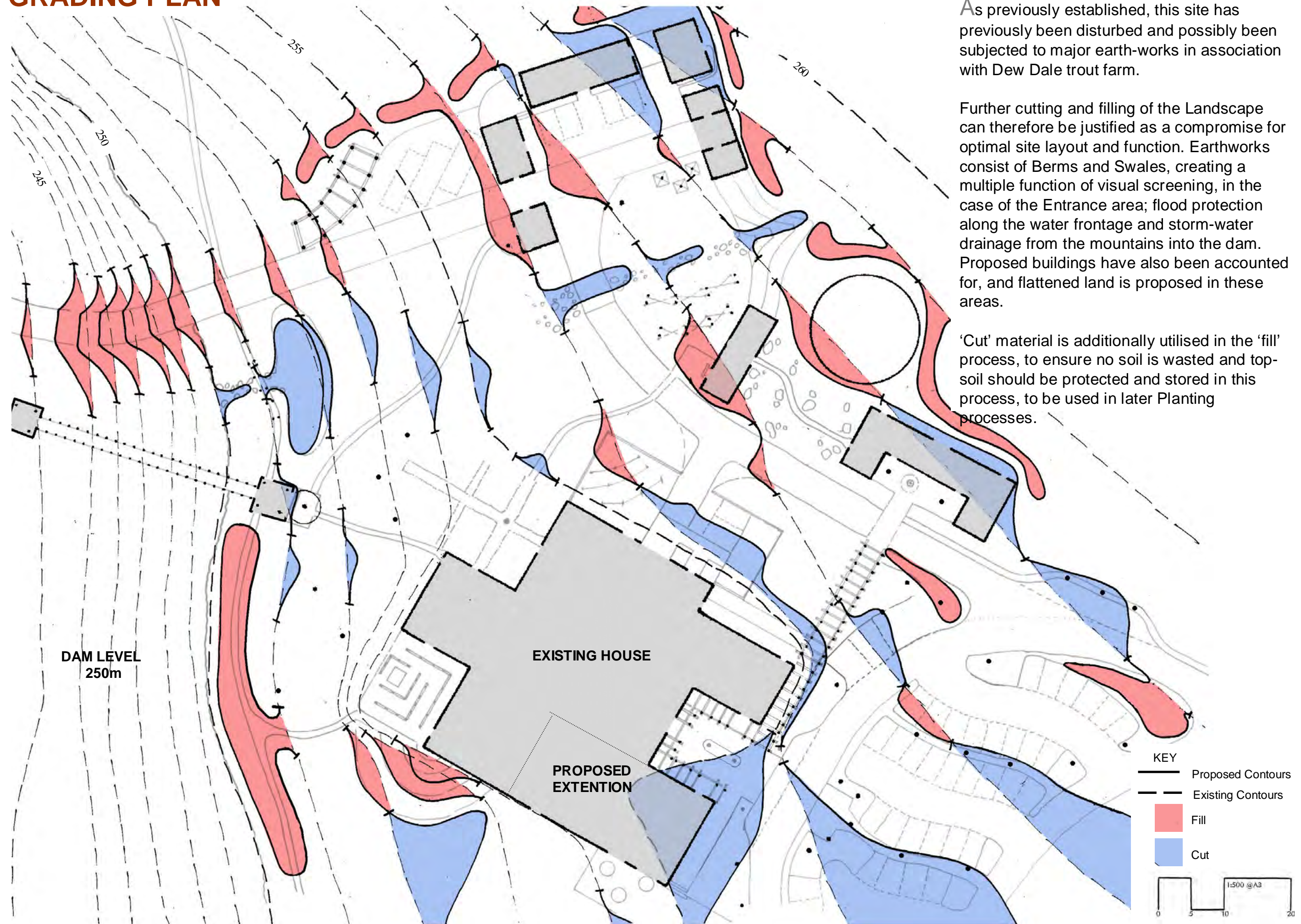


A 'Grey-water-system' should form an integral part of the design, directed into a reed-bed adjacent to the house which will collect surface run-off from the car-park as well. Water will filter down toward to dams, through a system of berg and swales, allowing it to drain freely into the soil. This will limit sedimentation into the dam as well as ensure that all water on site is utilised fully.



Proposed land-use indicates a central location for the buildings concerned with education. This, as well as the recreative buildings are placed so as to provide easy access for both the site users and day-trippers visiting from the Eco-tourism node or the mountains. Accommodation is placed higher up to allow views, as well as within easy reach of the main buildings and the rest of the centre. The community element is tucked away to a certain degree, allowing a sense of privacy, as this is a working node.

GRADING PLAN

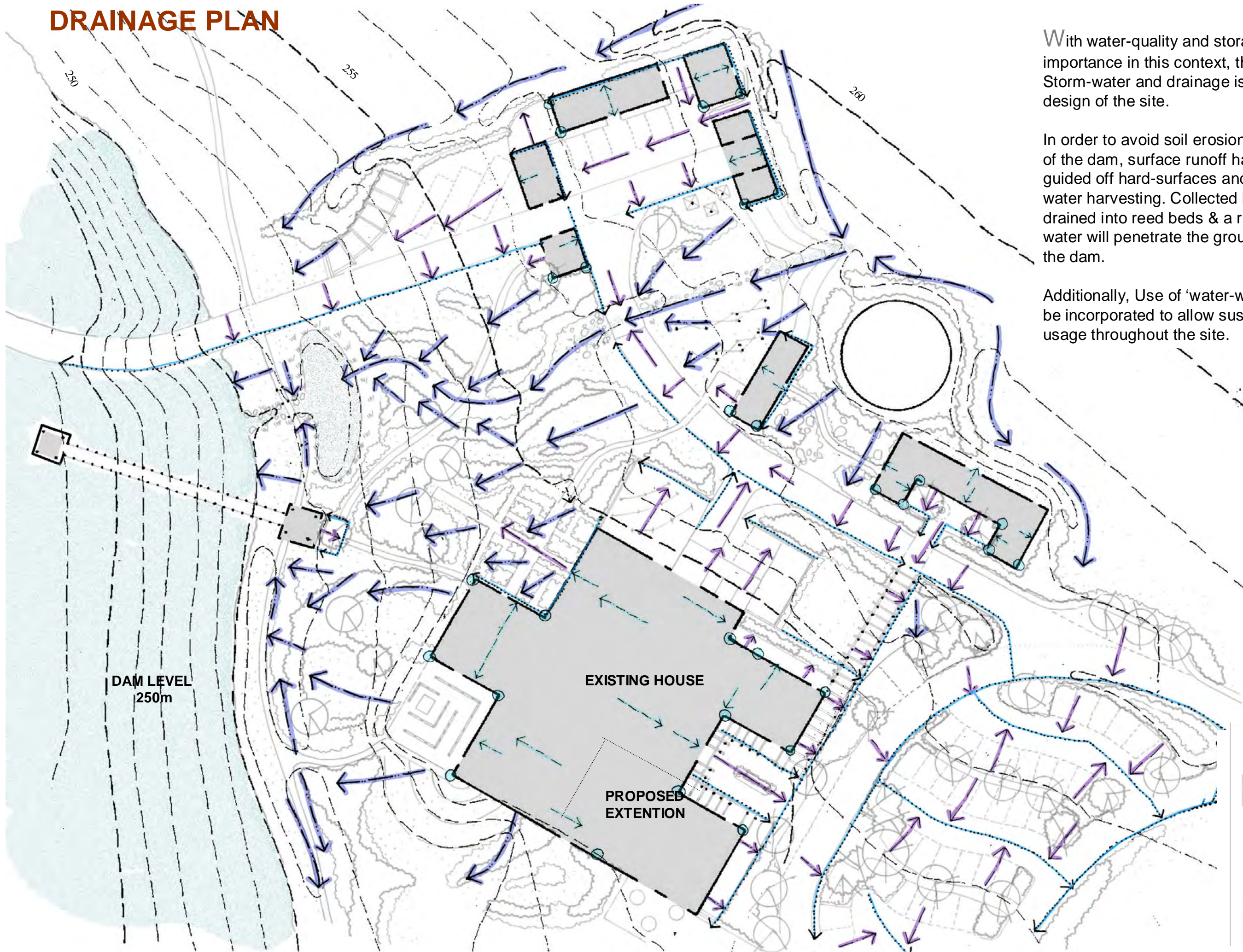


As previously established, this site has previously been disturbed and possibly been subjected to major earth-works in association with Dew Dale trout farm.

Further cutting and filling of the Landscape can therefore be justified as a compromise for optimal site layout and function. Earthworks consist of Berms and Swales, creating a multiple function of visual screening, in the case of the Entrance area; flood protection along the water frontage and storm-water drainage from the mountains into the dam. Proposed buildings have also been accounted for, and flattened land is proposed in these areas.

'Cut' material is additionally utilised in the 'fill' process, to ensure no soil is wasted and top-soil should be protected and stored in this process, to be used in later Planting processes.

DRAINAGE PLAN



With water-quality and storage being of vital importance in this context, the management of Storm-water and drainage is foremost to the design of the site.

In order to avoid soil erosion and sedimentation of the dam, surface runoff has strategically been guided off hard-surfaces and roofs via rain-water harvesting. Collected in green swales and drained into reed beds & a retention pond, the water will penetrate the ground before entering the dam.

Additionally, Use of 'water-wise' planting should be incorporated to allow sustainable water-usage throughout the site.

KEY

- Roof Drains
- Roof fall
- Paving Drains
- Hard Drainage
- Soft Drainage

0 5 10 20
1:500 @ A3

HARD LANDSCAPING

Hard landscaping in this context is a sensitive issue, as it increases surface run-off and hence sedimentation of the dam. An attempt has been made to use paving with a permeable finish, which allows surface drainage,

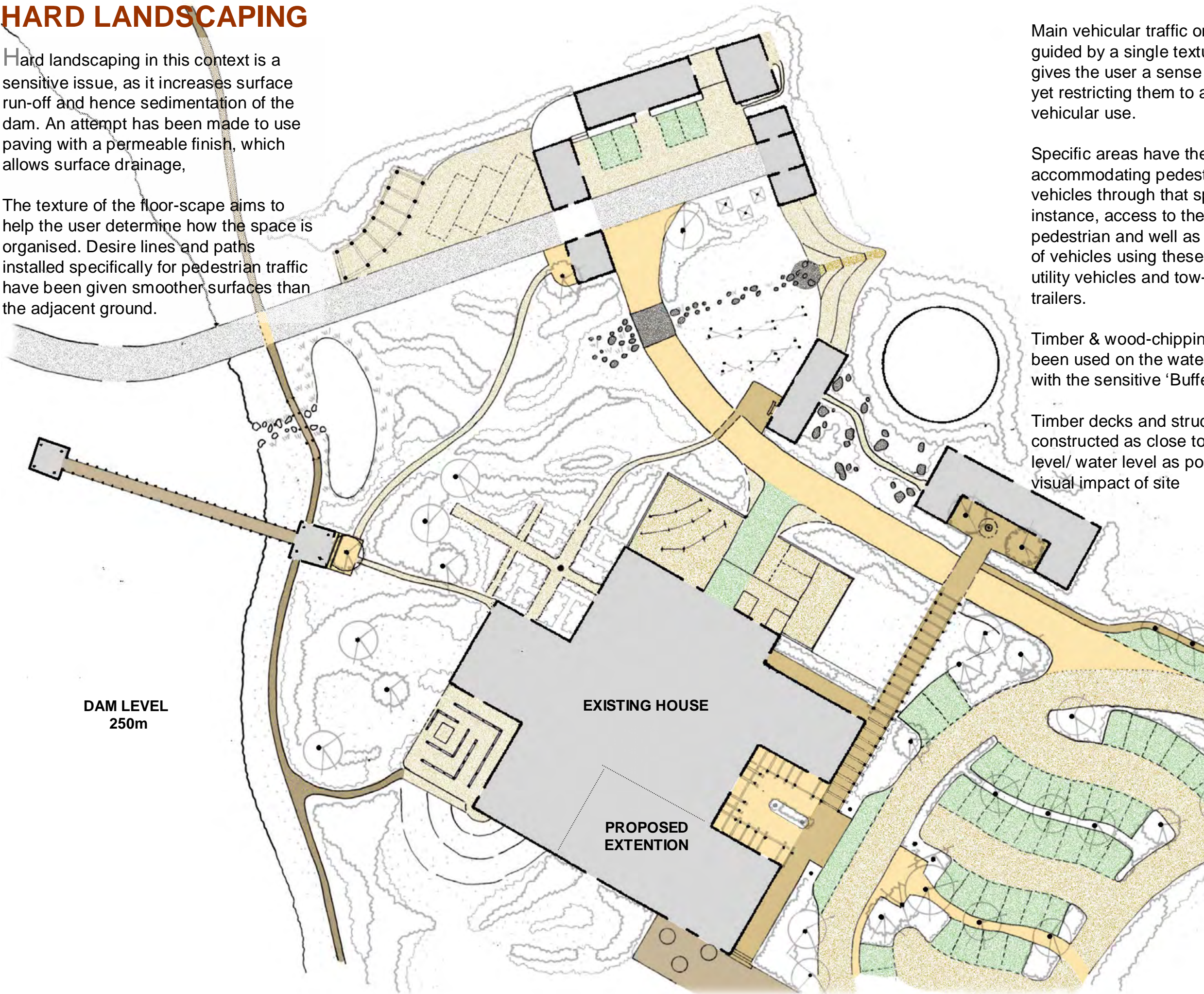
The texture of the floor-scape aims to help the user determine how the space is organised. Desire lines and paths installed specifically for pedestrian traffic have been given smoother surfaces than the adjacent ground.

Main vehicular traffic on the other hand is guided by a single textural finish, which gives the user a sense of continuity, guiding yet restricting them to areas designed for vehicular use.

Specific areas have the dual function of accommodating pedestrians as well as vehicles through that space. In this instance, access to the 'Fishery' promotes pedestrian and well as a gentle limited flow of vehicles using these spaces, such as utility vehicles and tow-vehicles with boat trailers.

Timber & wood-chipping shavings have been used on the water-frontage, in keeping with the sensitive 'Buffer Zone'.

Timber decks and structures should be constructed as close to the natural ground level/ water level as possible, so to limit visual impact of site



KEY

- Wood-chip Shavings
- Timber
- Gravel
- Concrete
- Roadstone, Type B
- Roadstone, Type A
- Grass-crete
- Laterite Surfacing

1:500 @ A3

0 5 10 20



SOFT LANDSCAPING

A variety of plant material has been proposed with the view to create seasonal interest when the dam water levels are at their lowest as well as harness the Education element that is central to the design concept.

Structured with the careful use of trees, due to high water consumption, shaded and sheltered areas are created, particularly around the water-frontage, where wind is a concern.

Shade is provided by Evergreen trees around areas of seating and within parking areas, whilst deciduous trees allow the sunlight in during the cooler winter months.

The concept of the 'Veldkos Garden' has been incorporated into the design, adjacent to the kitchen. This could promote education of plants in a more practical way for children.

Planting plays the role of screening, in the case of the reservoir, yet other beds are placed specifically to soften the hard landscaping elements and therefore limit the visual impact of the site.

However, primarily, waves of planting have been proposed so as to guide and assist in limiting surface runoff. All planting is indigenous, along the line of the 'water-wise' concept.

Lawn areas, 30metres wide, surrounding the entire site, for the sake of fire-protection. These lawns should be mown frequently for this purpose.



KEY

- Lawn
- Water plants
- Ground covers
- Hedging
- Shrubs
- Deciduous Trees
- Evergreen Trees

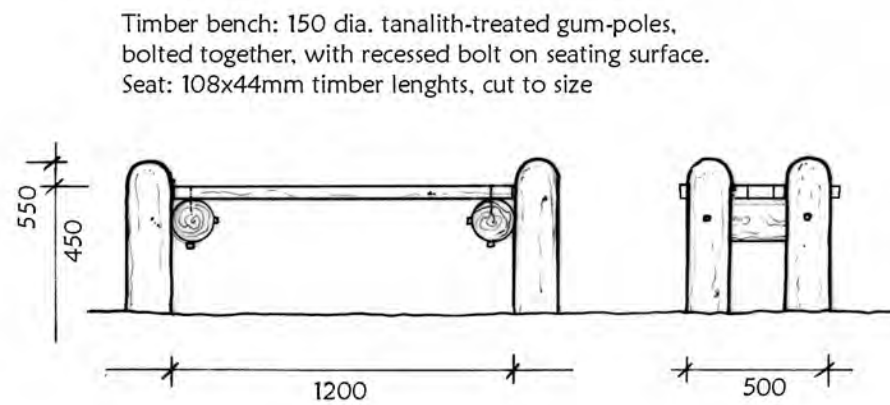
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FURNITURE: Proposed Theme

A family of furniture elements includes two different seating types and a drinking fountain, designed with the hierarchy of spaces in mind. The *Timber Bench* will primarily be used in the softer spaces, surrounding the main buildings, whilst the *Stone & Timber Bench with Bin* shall be installed within major pedestrian zones, where hard-landscaping is dominant.

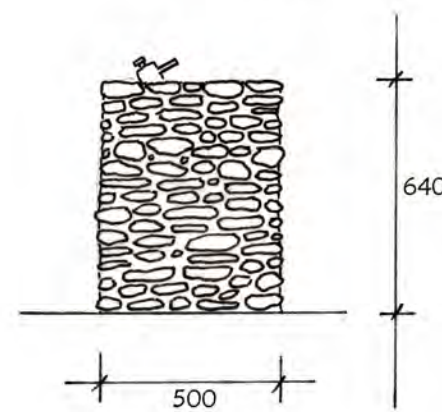
The *Drinking-Fountain* will be placed in more remote areas, away from the building yet adjacent to pathways, to enable an accessible water-source for passing Hikers and other day-users.

All furniture is designed to remain 'rustic' and in keeping with the natural surroundings of Robertsvei.



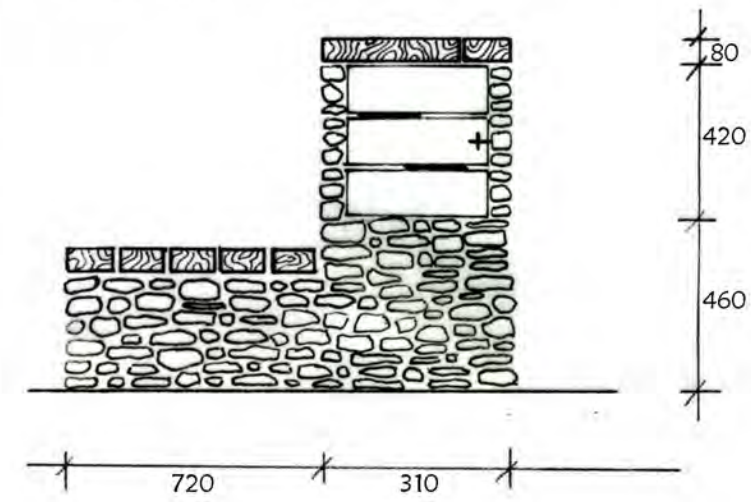
Timber Bench

Stone-clad base, to meet that of seating.
Complete with water-proof plastered outlet,
& 'Walcro' Brass drinking tap



Drinking Fountain

Bench: stone clad base with timber beams secured with steel-bars for seat. Bin structure to be fitted with timber-door, fixed onto stone cladding with bolt-lock for security. Bin to be fitted with removable bin tray for cleaning purposes.



Stone & Timber Bench with Bin

ALL DRAWINGS 1:20

FURNITURE POSITIONING PLAN

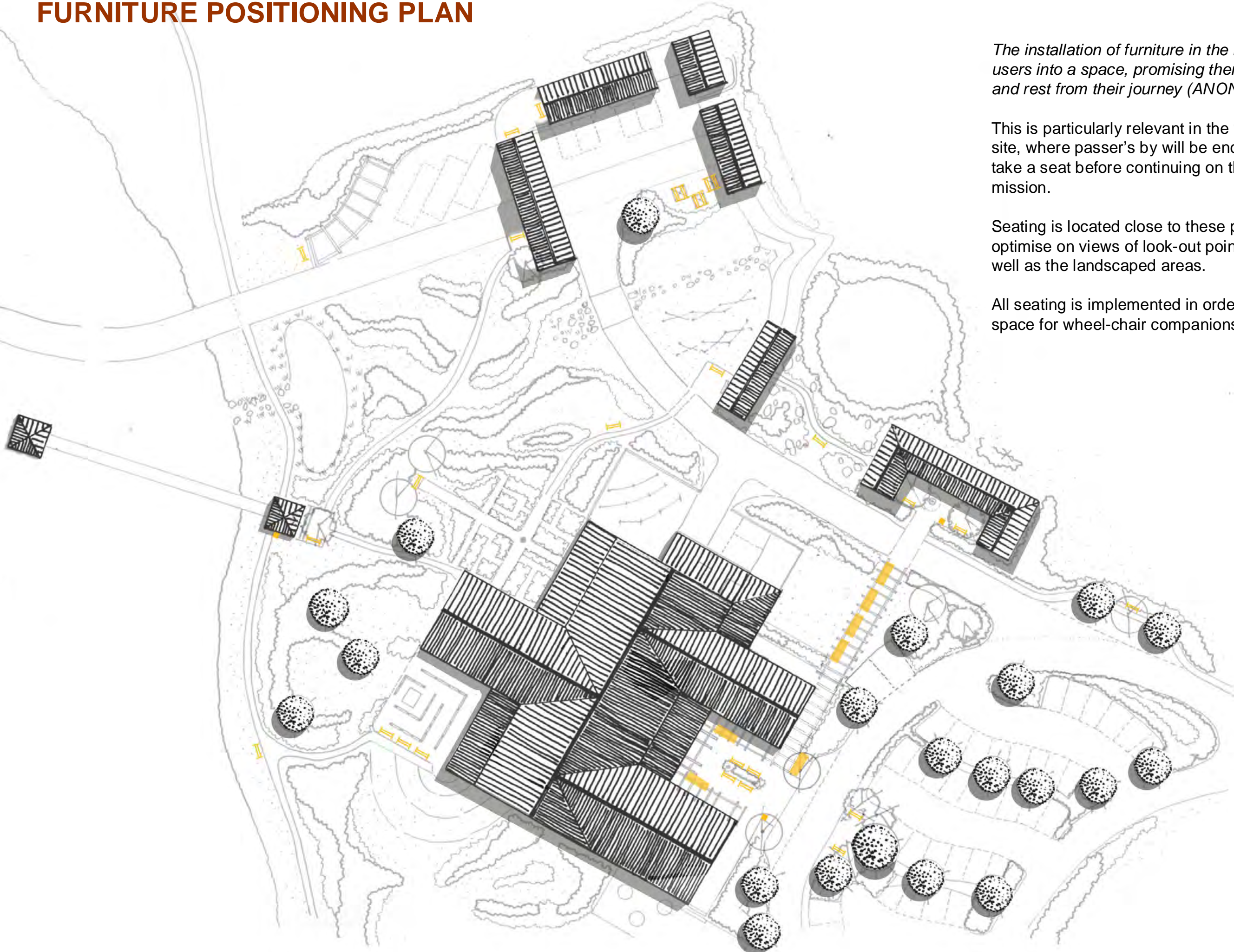


The installation of furniture in the landscape attracts users into a space, promising them the chance to stop and rest from their journey (ANON)

This is particularly relevant in the 'Buffer Zone' of the site, where passer's by will be encouraged to stop and take a seat before continuing on their hike or fishing mission.

Seating is located close to these paths, with the aim to optimise on views of look-out points across the dam as well as the landscaped areas.

All seating is implemented in order to accommodate space for wheel-chair companions.

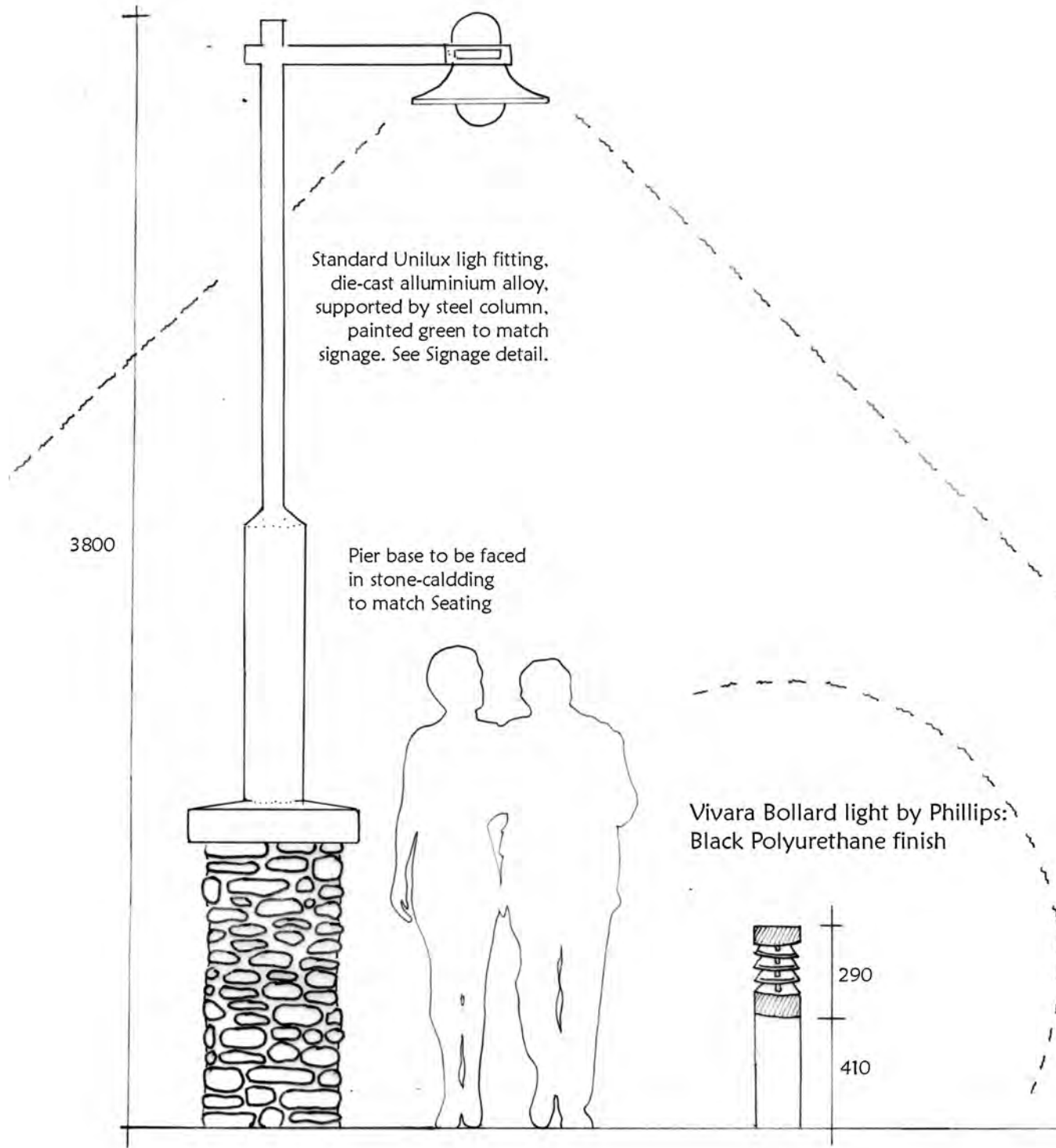


KEY

- Drinking Fountain
- Timber Bench
- Stone & Timber Bench with Bin

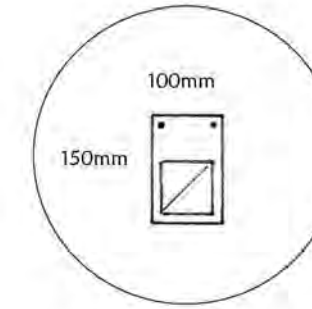
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LIGHTING: Proposed Theme



Vehicular Level Light

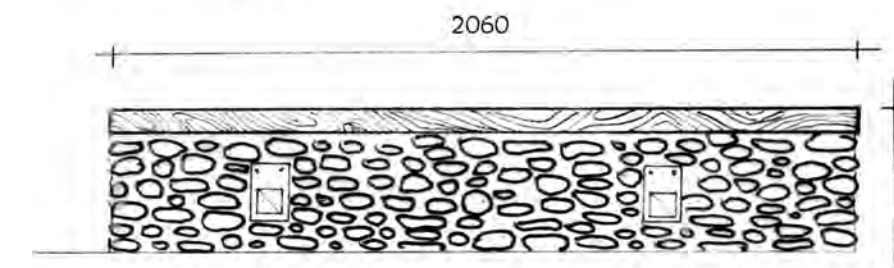
Bollard Light



Standard Recessed Light by Phillips
1:10

Pedestrian Lighting Detail

2 lights placed on the front and backs of all stone & timber Benches (500mm on horizontal)

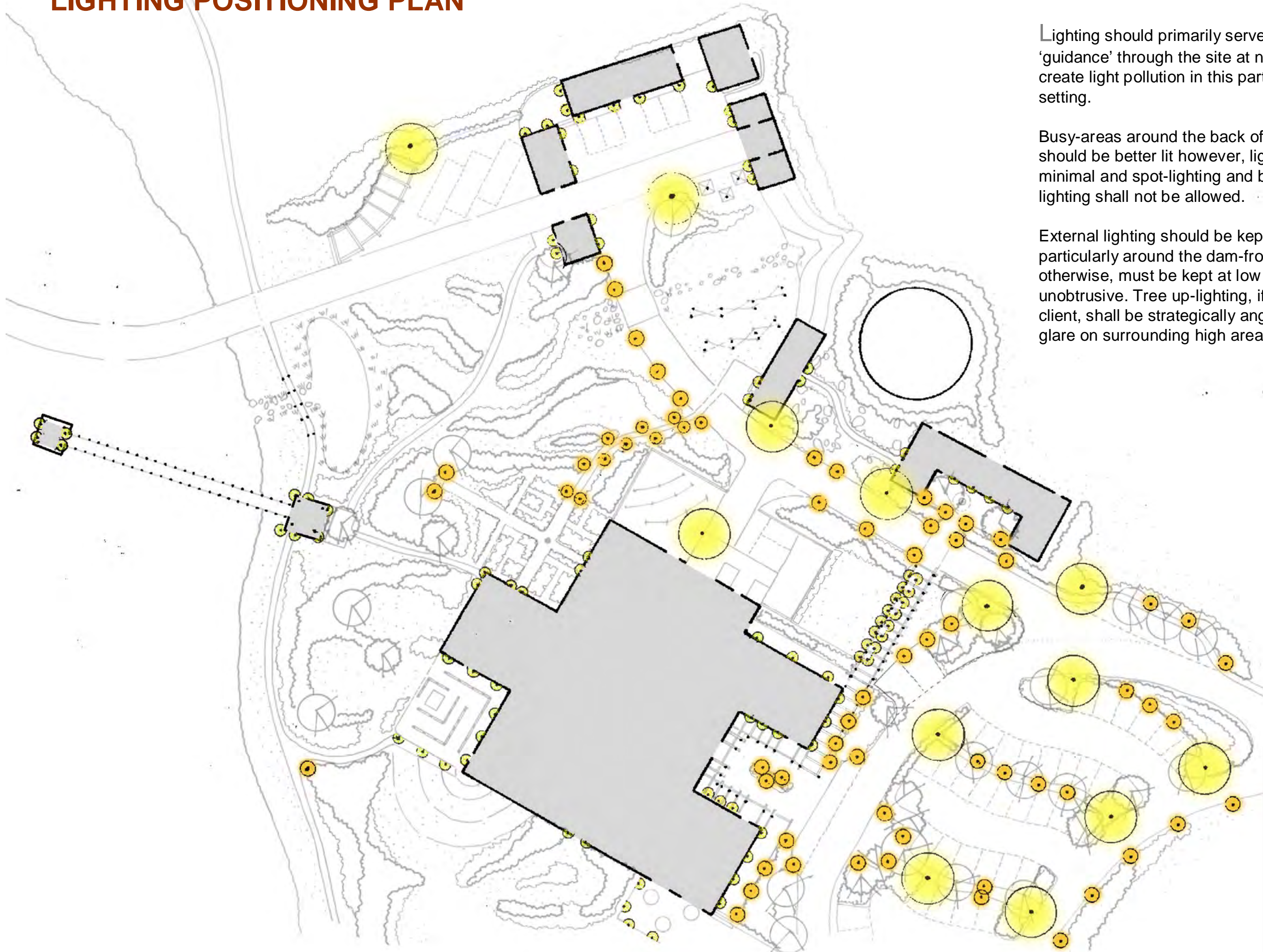


Pedestrian Lighting

ALL DRAWINGS 1:20

Kerry-Ann Sole • MLA 2006

LIGHTING POSITIONING PLAN



Lighting should primarily serve the purpose of 'guidance' through the site at night so as not to create light pollution in this particularly rural setting.

Busy-areas around the back of the building should be better lit however, lighting should be minimal and spot-lighting and bright security-lighting shall not be allowed.

External lighting should be kept to a minimum, particularly around the dam-frontage area, and otherwise, must be kept at low levels and remain unobtrusive. Tree up-lighting, if desired by the client, shall be strategically angled, so as limit glare on surrounding high areas.

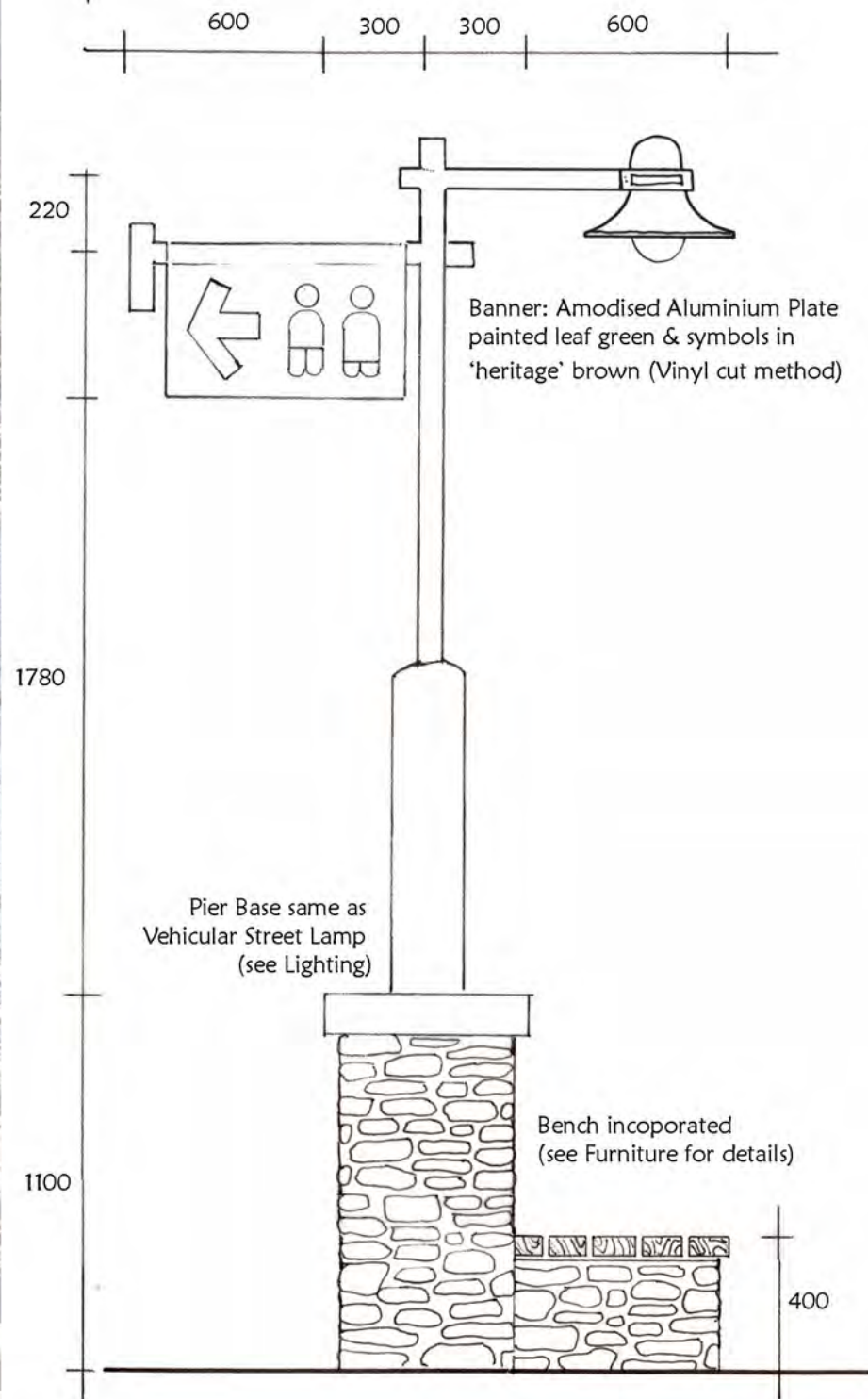
KEY

- Pedestrian Lighting
- Bollard Light
- Vehicular Level Light

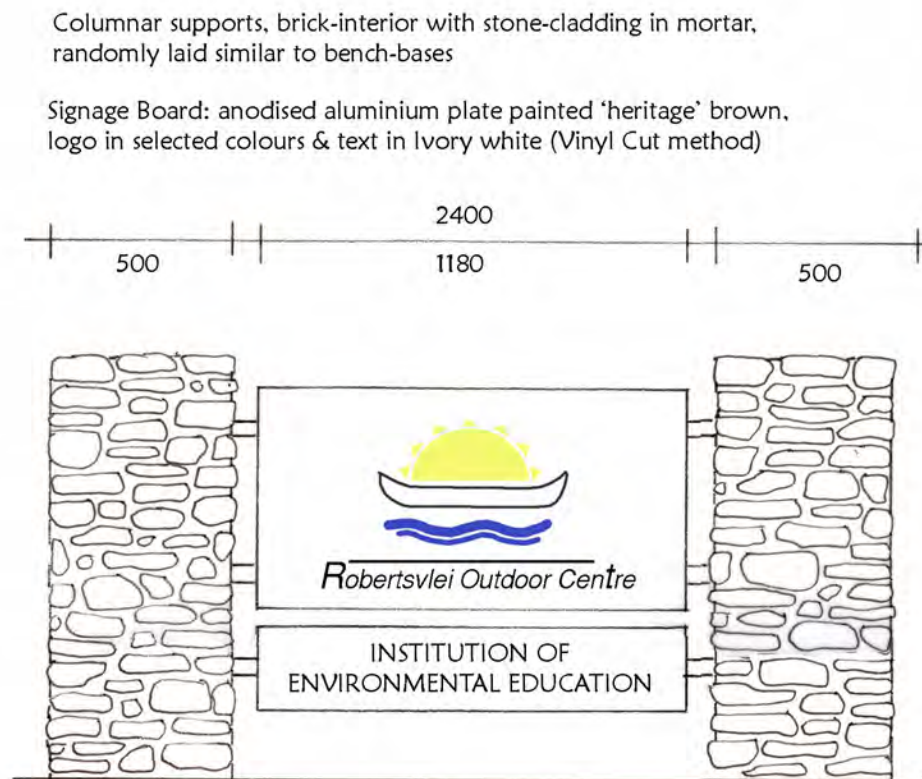
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SIGNAGE: Proposed Theme

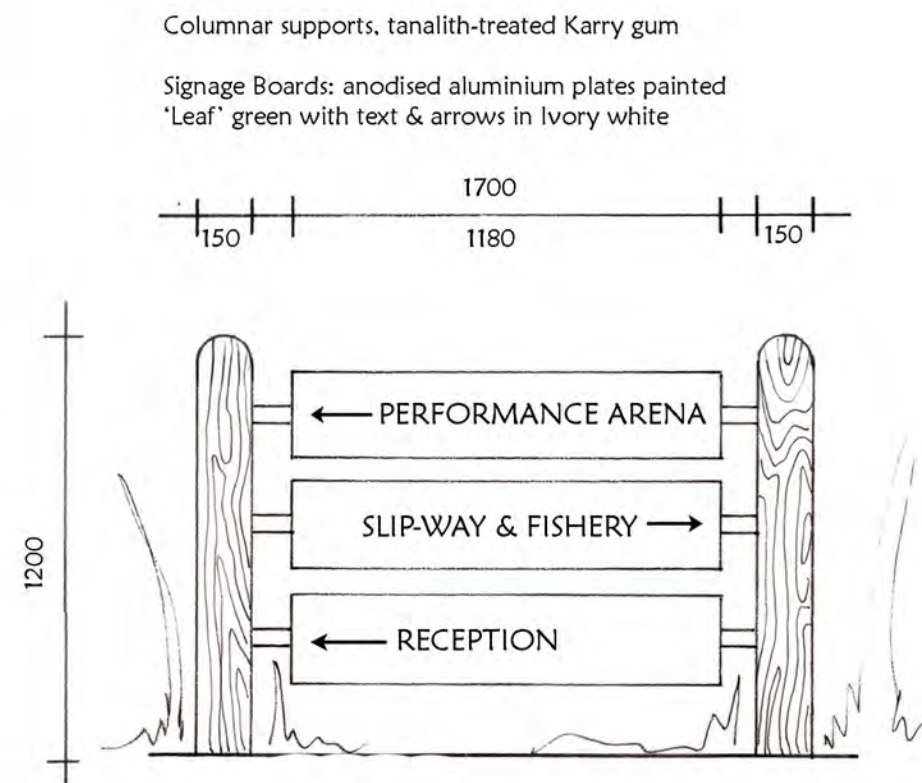
"Chaotic environments overwhelm our ability to discern which information is relevant"[27]



Banner & Street Lamp incorporated



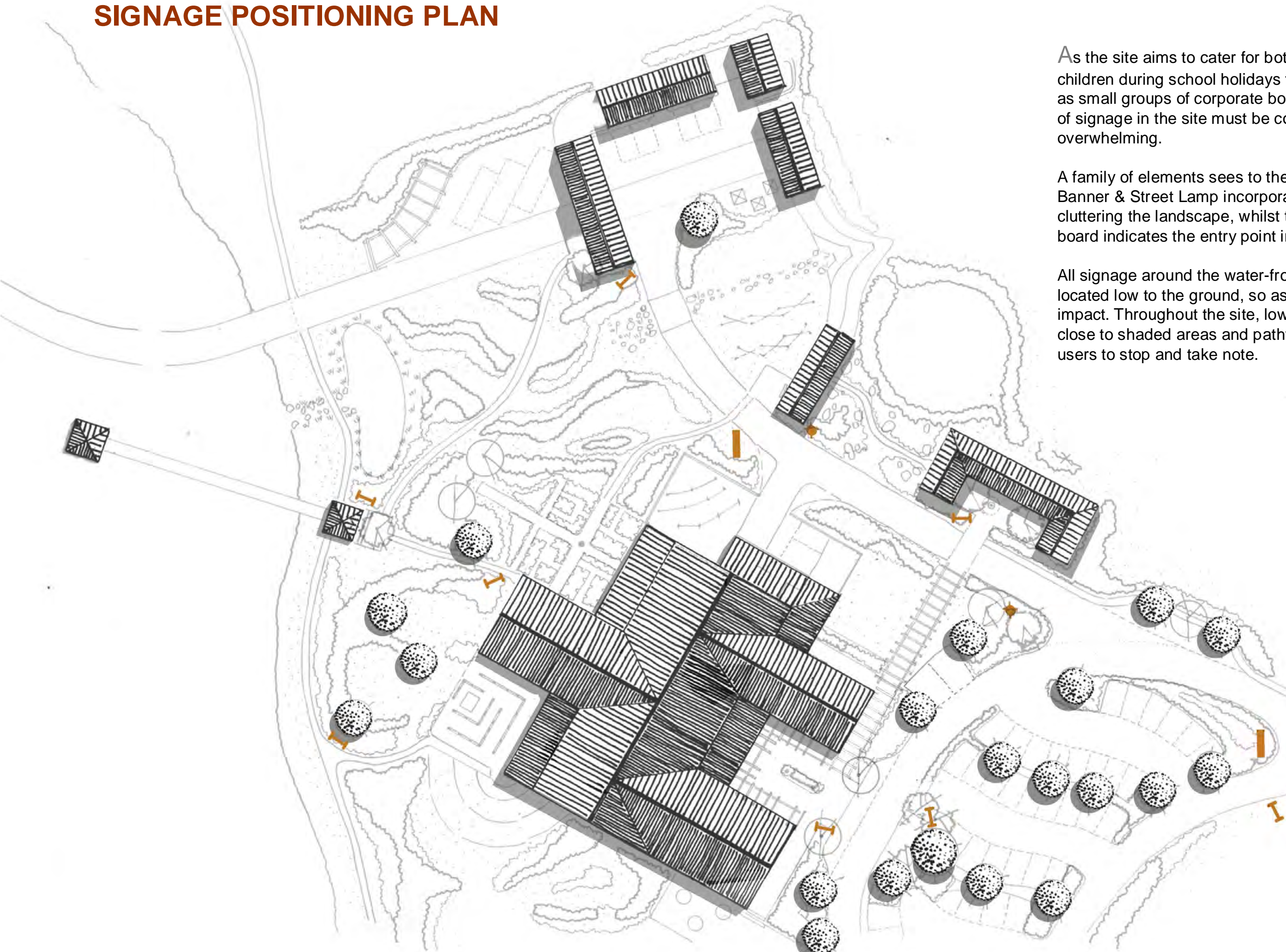
Main Signage Board with Site Logo



Multiple Signage Board

ALL DRAWINGS 1:20

SIGNAGE POSITIONING PLAN



As the site aims to cater for both large hoards of children during school holidays for instance, as well as small groups of corporate bodies, the installation of signage in the site must be conspicuous yet not overwhelming.

A family of elements sees to these needs. The Banner & Street Lamp incorporated helps to limit cluttering the landscape, whilst the main signage board indicates the entry point into a space.

All signage around the water-frontage area shall be located low to the ground, so as to limit visual impact. Throughout the site, low signage is located close to shaded areas and pathways, to encourage users to stop and take note.

KEY

- Multiple Signage Board
- Main Signage Board
- Banner & street lamp incorporated

0 5 10 20
1:500 @A3

ROBERTSVLEI OUTDOOR CENTRE

A demonstration of optimal use of facilities, with the integration of an educational institution with a working Community space.

A rich hierarchy of spaces aims to provide opportunities for interaction in the natural processes occurring throughout the sight as well as provide amenities that appeal to both private as well as public users.



DETAIL PLAN: Robertsvlei Outdoor Centre



Fishery Manager's House & Outdoor Space

Fishery Office

Passive Zone

Boat Launch & Storage Zone

Planting to screen Boat-racks

Softened Path, connecting to Local Hiking Route Network

Water-loving Plants to frame Retention Pond, & create interest for Hikers & students

Drainage of cleansed storm-water into Dam

Tractor Parking

Fishery Parking

Community Fishery

Fish-processing

Slip-way

Retention Pond

Green Drainage Corridor

Waves of Planting help direct Natural Drainage

Dam 'Look-out'

Boat-Workshop

Staff Rest Area

Drift

Green Garden

Reservoir

Large-scale Planting to screen reservoir

Rock Garden

Fishery Drying Racks

Fishery Classroom

Drainage Terrace with Pebble Pond

Robertsvlei Promenade

Utility Access

Laundry

Recycle & Utility Area

Vaidkos Garden

Rest Area, with shade & seating

Classrooms with enclosed courtyard

The Berg Pergola Walk

Green space with adjacent seating

Open-air Exhibition Space

Entrance to Fishery

Kids Corner

Artists Corner

Trees provide shade & interest at Entrance area

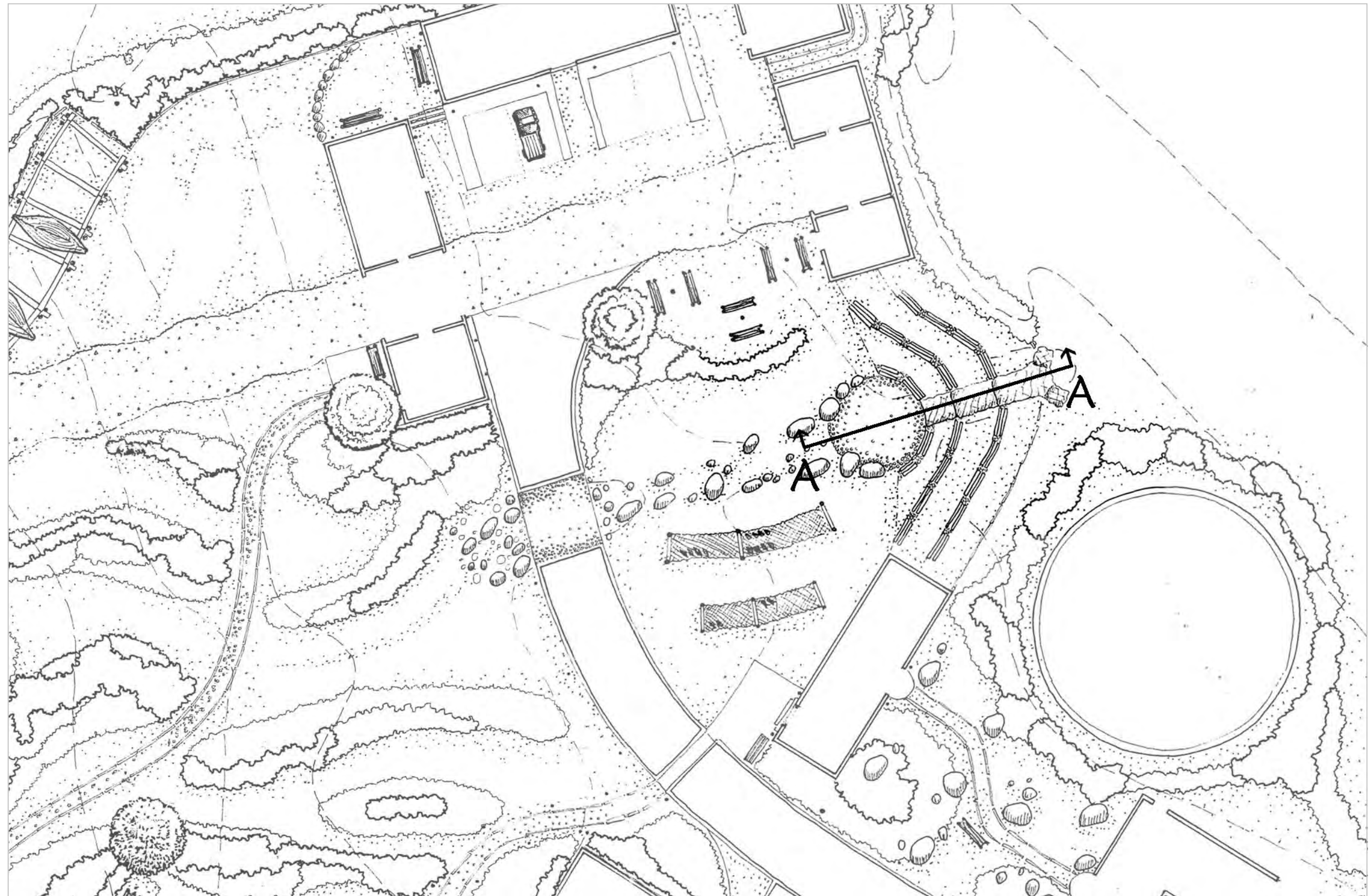
Bus Parking

The Robertsvlei Outdoor Centre

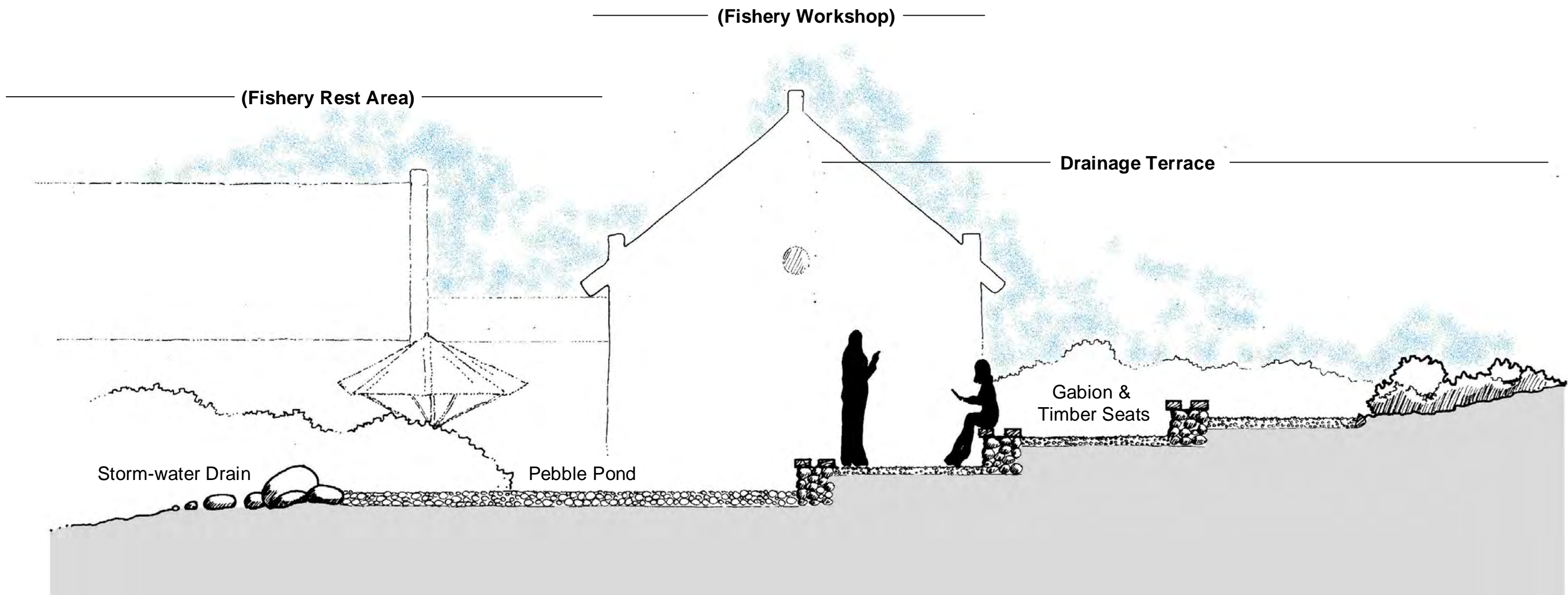
including indoor classrooms, kitchens, rest-rooms & cafeteria

DETAIL PLAN: SECTION A-A

SCALE 1:250@A1



Section A-A depicts the slope fall within the Drainage Terrace area. Storm-water will filter down through the centre of this terrace, on a bed of 'Gabion'-baskets, to finally settle and filtrate the ground within the Pebble Pond. The area has the ability to play an important role in the curriculum surrounding the school and allow students the opportunity to experience the contemporary treatment of storm-water management.

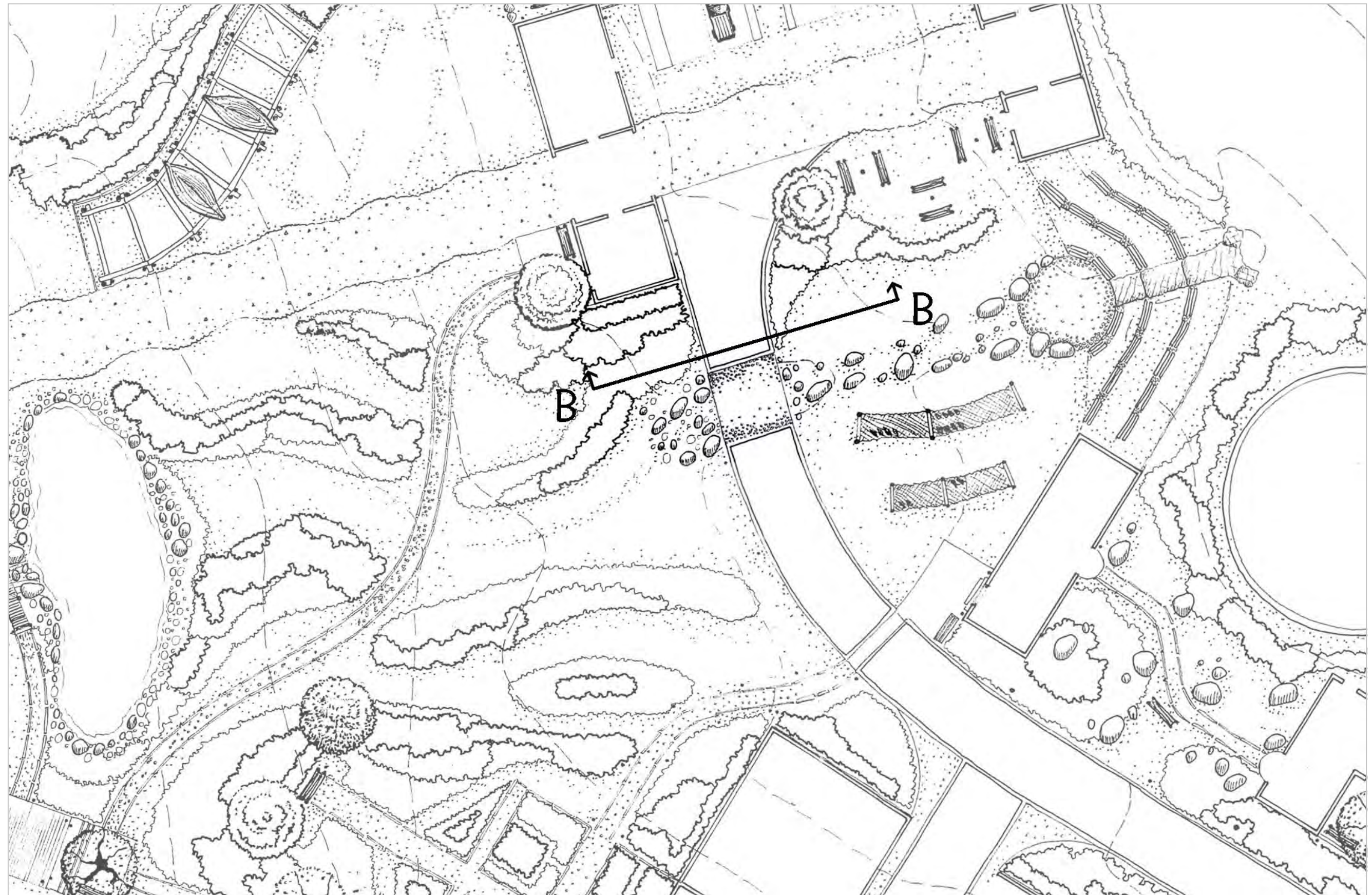


1:20

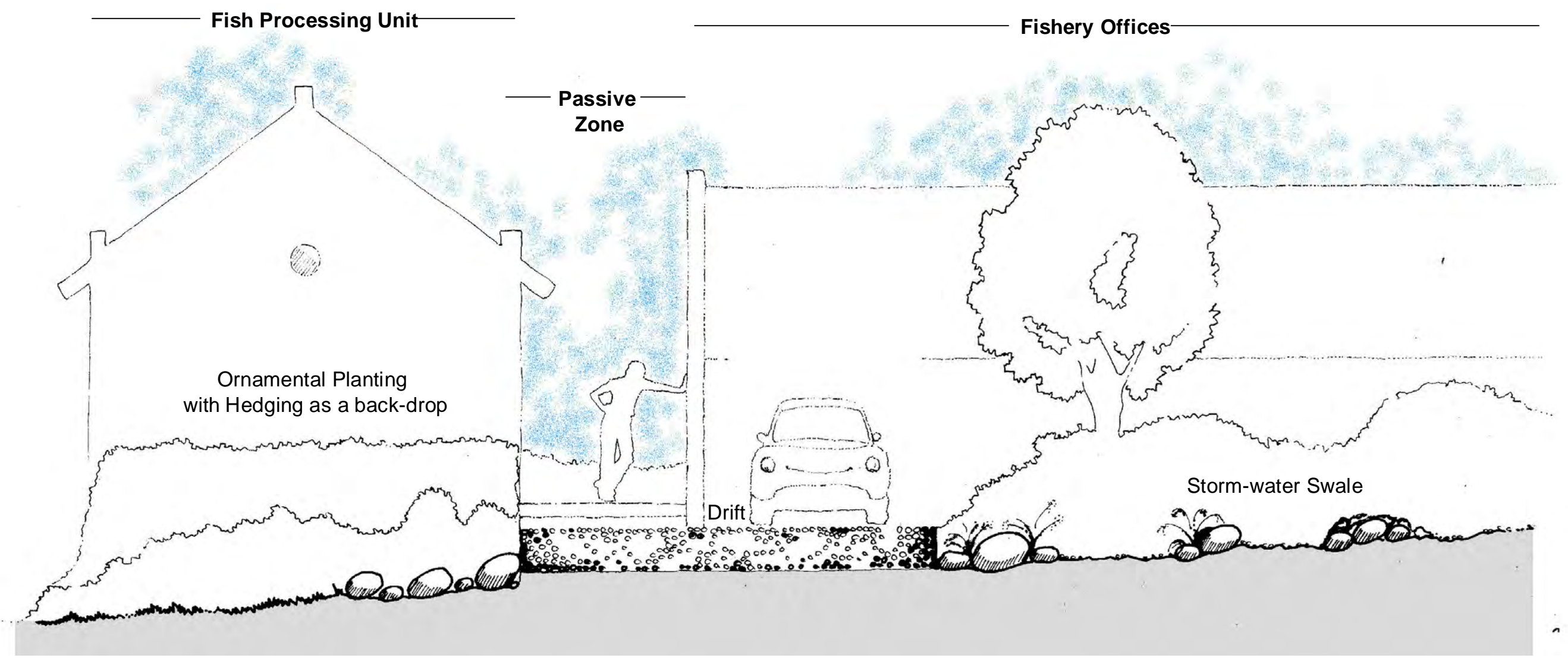
SECTION A-A

DETAIL PLAN: SECTION B-B

SCALE 1:250@A1



Section B-B illustrates a Drift crossing in the road toward the Fishery. This is again, along the lines of effective storm-water management and is seen as a limited impact element in the landscape. As the drift dips down below ground-level to accommodate the passage of storm-water, there is no visual obstruction in the space. Furthermore, pedestrians will have the opportunity to walk through water when the drift is flooded. This is envisaged to be a highly popular crossing point for children during the wet-season.

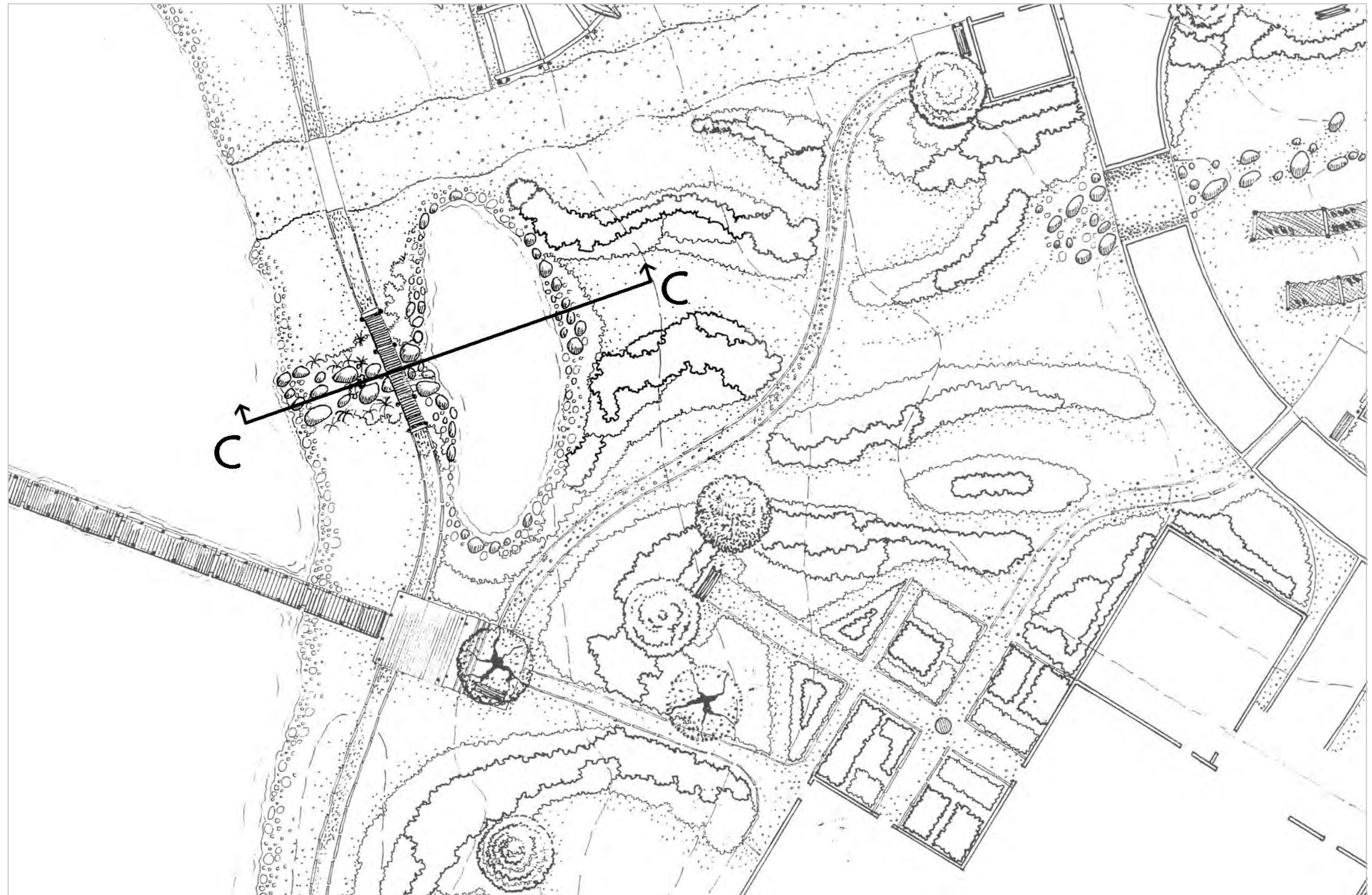


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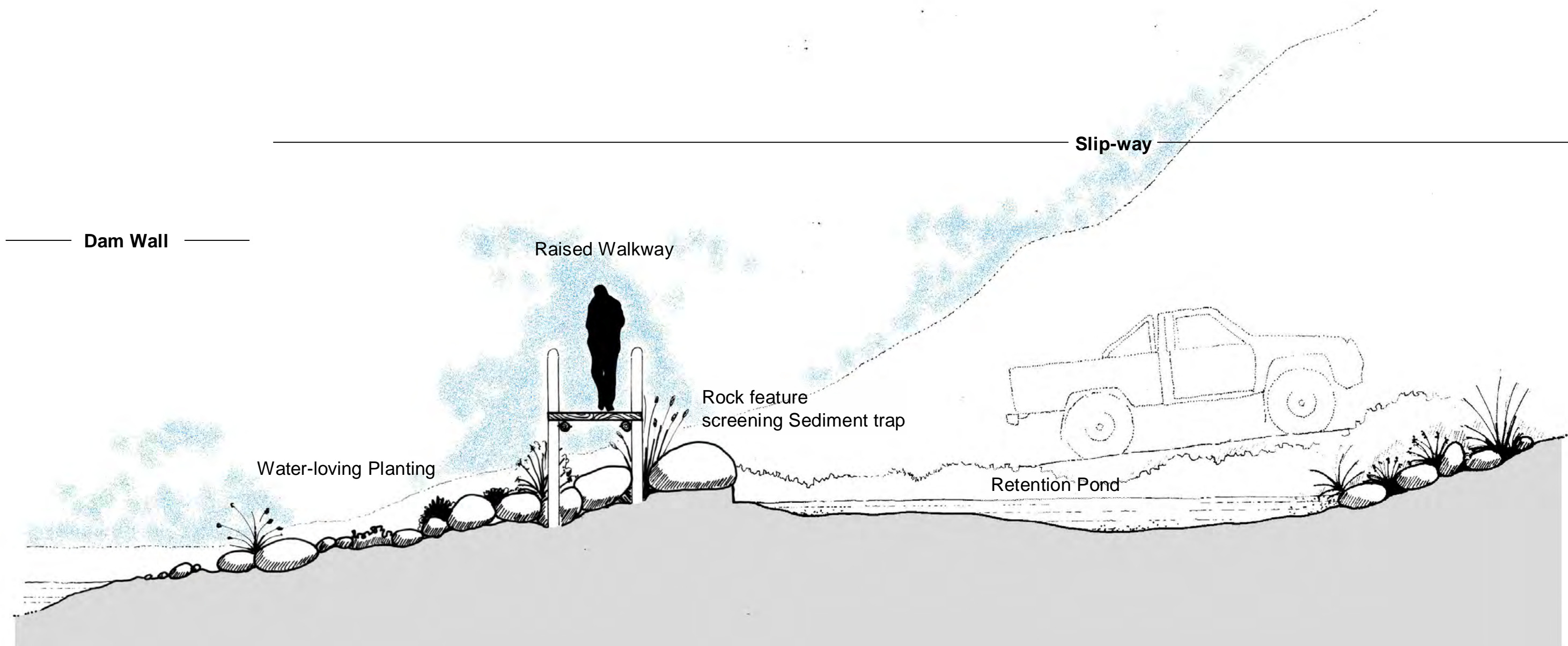
SECTION B-B

DETAIL PLAN: SECTION C-C

SCALE 1:250@A1



Section C-C is taken through the Retention pond at the base of the detail area. Water is manipulated down through the sight via the grading of the land, to result in it collecting at this point, prior to draining down into the dam. As sedimentation of the dam is such a relevant concern for the quality of the water, every effort should be made to reduce run-off and encourage penetration into the ground on the dam periphery. This feature also creates the added interest of a pond-environment. Water-loving plants will thrive in these conditions, providing a valuable teaching resource as well as aesthetically-pleasing point in the landscape.

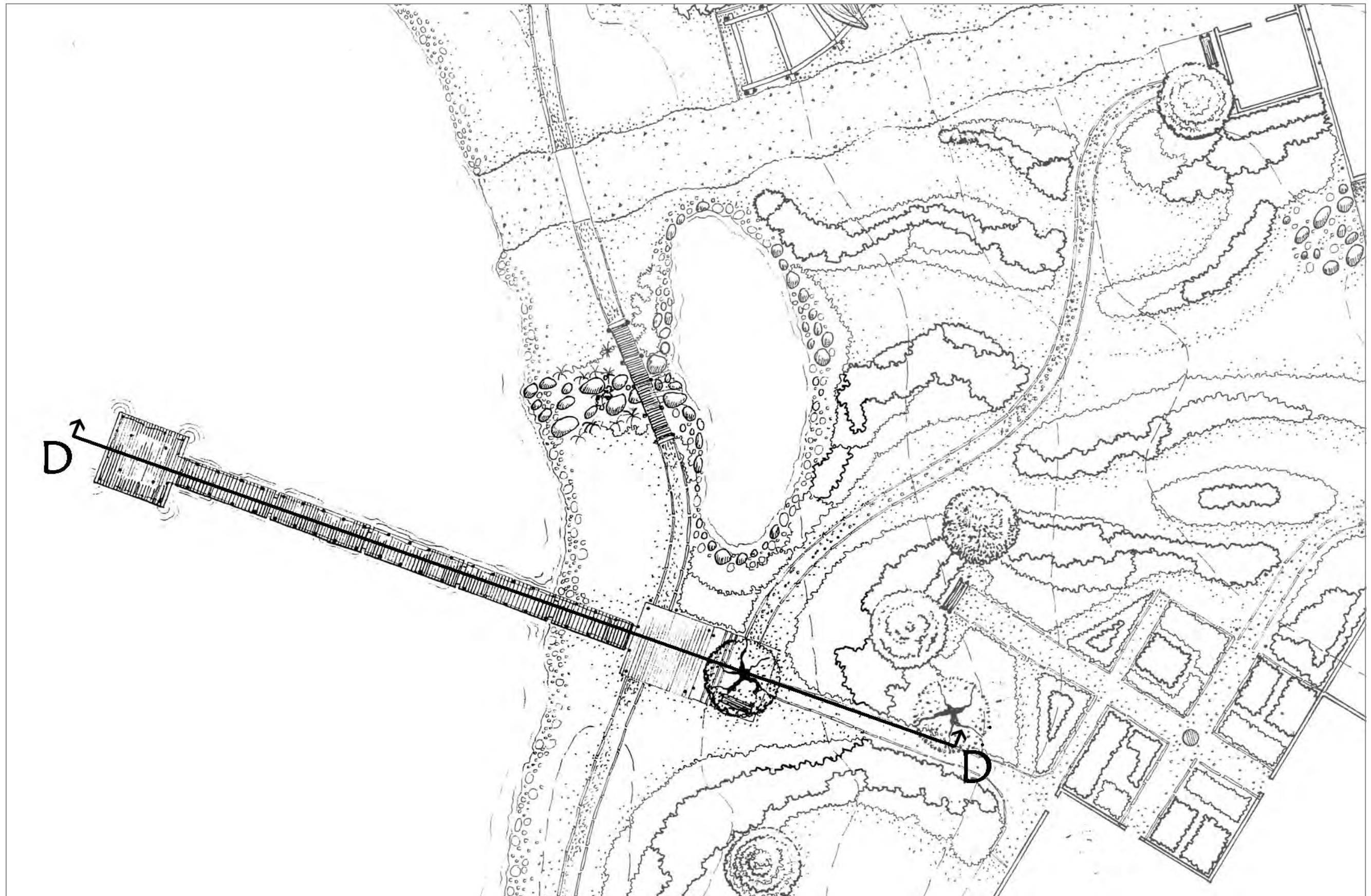


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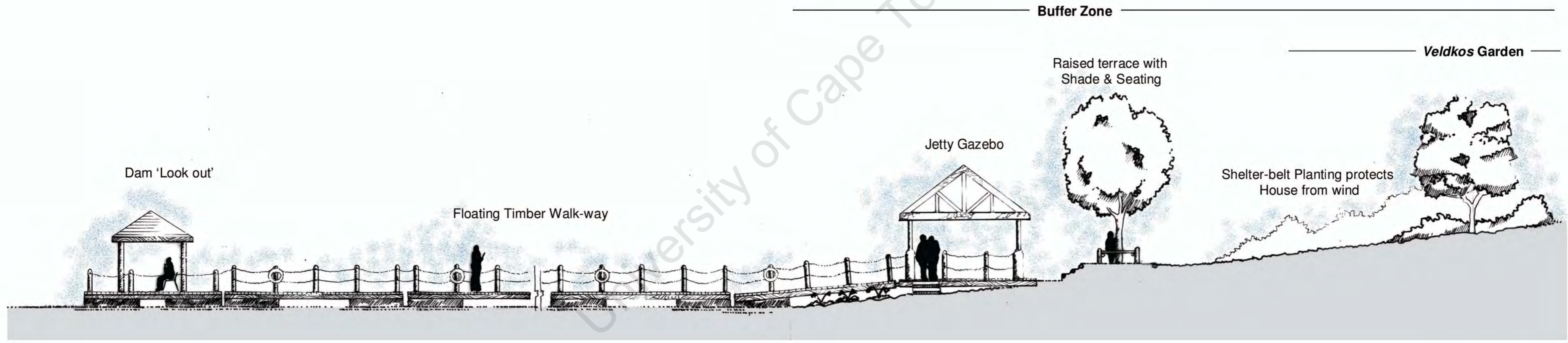
SECTION C-C

DETAIL PLAN: SECTION D-D

SCALE 1:250@A1



Section D-D illustrates the elevation of the jetty, from within the gardens surrounding the house, out toward the dam, providing an attractive setting. The jetty is visualised to be a place where passing hikers and day-trippers will stop to rest and take in something of the school and its gardens. As the jetty abuts the 'Buffer Zone', care has been taken to minimise the impact on this zone. Construction Details will follow.



1:50

SECTION D-D

DETAIL PAVING PLAN

PAVING CHARACTER

The appearance of a vertical plane effects the way in which people experience a place. The sense that one can easily pass through an area is one of the key components of a person feeling comfortable within the setting [55]

All hard-landscaping materials are appropriate to the nature of the site and have been chosen to invoke tranquillity and understanding.

Roadways and areas of high pedestrian usage are designed so as to retain the natural character of the site, defined by paving patterns and colours differentiating between vehicular and pedestrian usage.

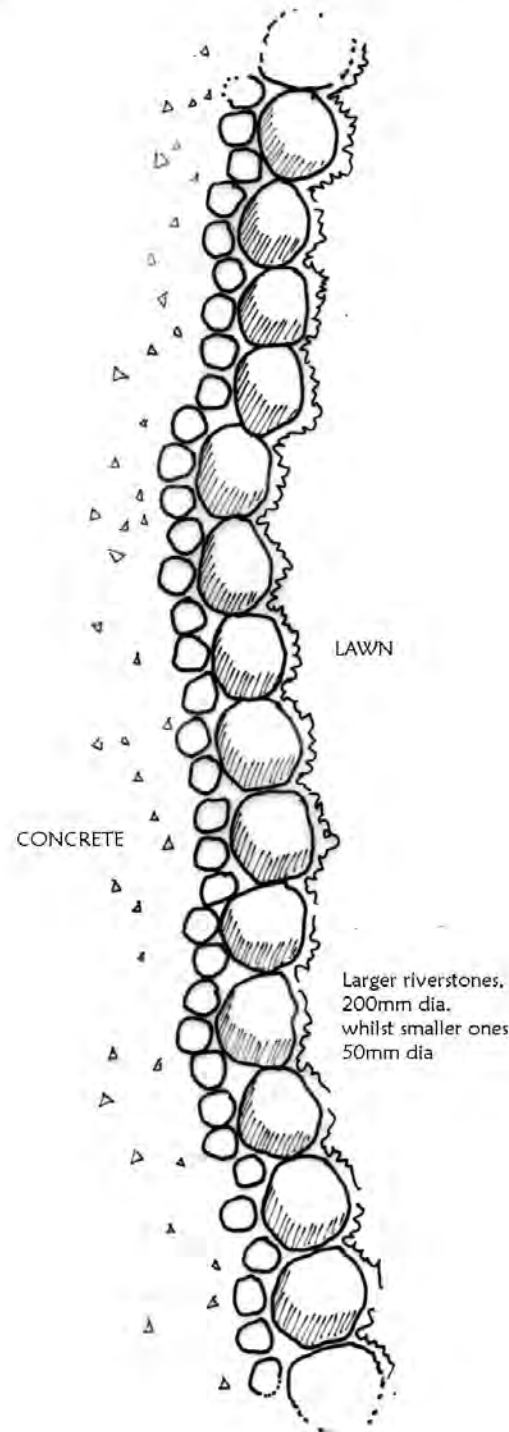
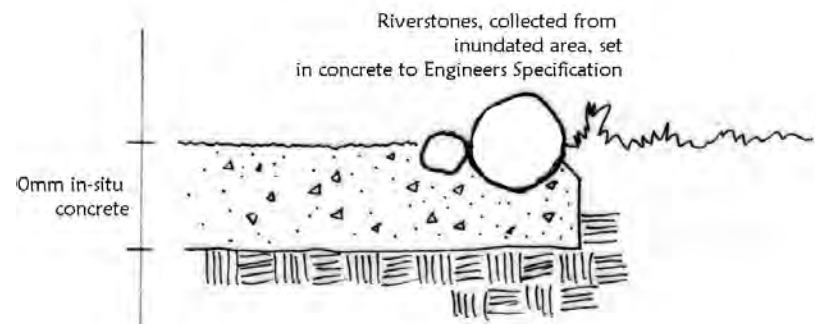
The 'Buffer Zone' area shall be defined with the use of 'Wood-chip shavings' as a surface layer, creating a softer effect around the dam-frontage. These will be contained by a timber-edging according to the detail indicated.

Gravel creates a more formal feel for the pedestrian path network throughout the site, whilst it is used in the Fishery as an alternative to the more harsh road-stones. Whilst no alternative material has been sought for the slipway, the harsh concrete slab has been softened by the use of a river-stone edging as indicated.

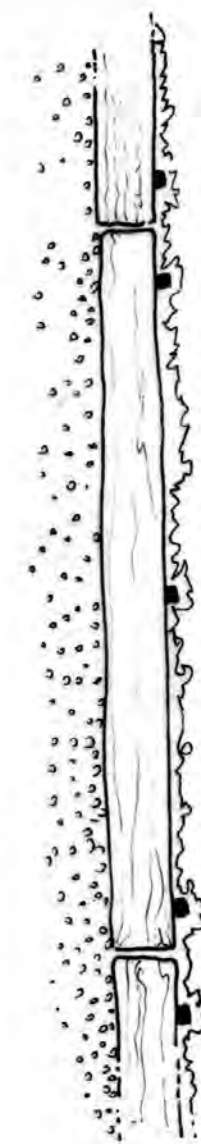
Grass blocks are utilised in all parking areas, to limit the hard-surfacing to an extent, whilst allowing drainage and a 'greener feel'.

Paving types and materials are specified further on the DETAIL PAVING PLAN.

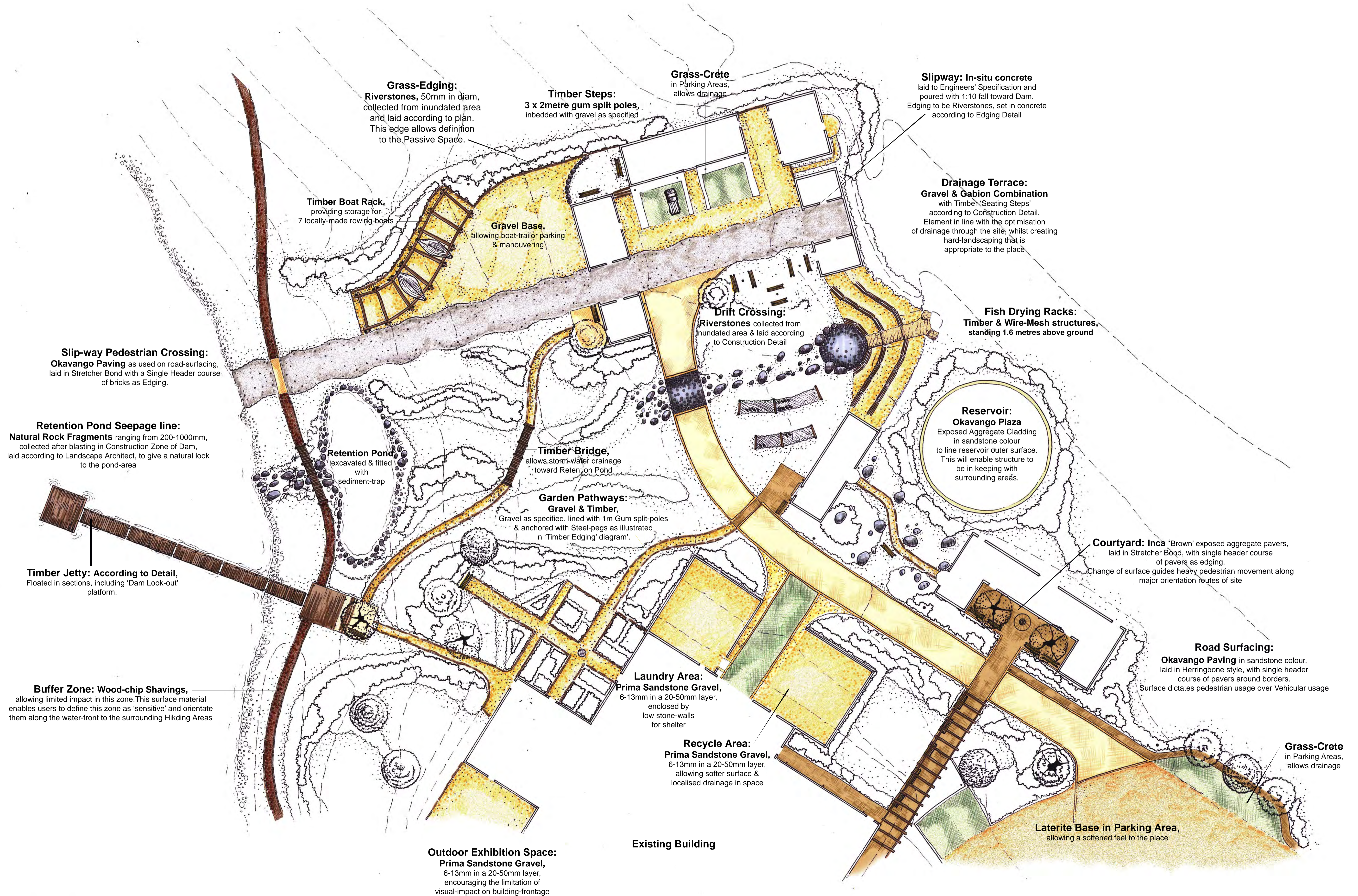
PEBBLE EDGING 1:20



TIMBER EDGING 1:20



Hard Landscape Plan



DETAIL PLANTING PLANS

PLANTING CHARACTER

The planting theme is primarily water-conservation friendly, better known as a 'Xeriscape'; strictly indigenous, with the addition of traditional 'Cape' plants. All species should be non-invasive with no exotic species allowed on site. Plant species have been chosen for their wind-tolerance and their sense of being 'in keeping' with the sense of place, in this case, this is defined as 'indigenous and rustic'.

Trees, climbers and shelter-belts are encouraged to cover walls, create shade and soften and screen the hard edges of buildings to minimise visual impact on surrounding areas.

The rescuing of existing plants from areas to be inundated must be prioritised and care taken to re-establish these species on the site.

The planting style is a combination of 'Drift Planting' and 'Interlocking & over-lapping planting' creating beds of mixed species. The aim is to maintain the natural setting of the place and develop a mutually supportive matrix of plants that are easily maintained.



THE VELKOS GARDEN

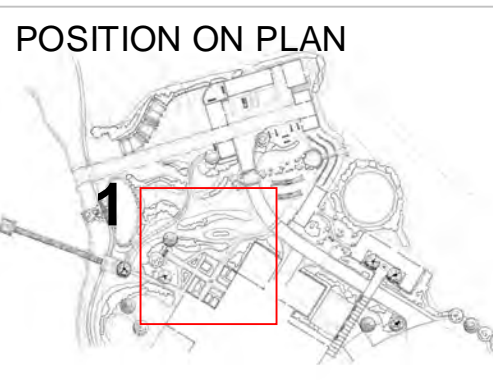
Based on the concept of 'Food from the Bush', the Veldkos Garden in this context, is a working garden. A basic structure of plans dictates the formal layout, depicting a traditional English kitchen garden. The form and layout could be integrated into the school curriculum, sowing the seeds in the minds of future Landscape Architects!

A trail of fragrance, leads the user into the space from the house, with *Lavendula dentata* (See Fig 1) lining the pathway.

Scientific name	Common Name	Use
<i>Physalis peruviana</i>	Cape Gooseberry	Eaten raw or cooked.
<i>Cucurbita pepo</i>	Pumpkin tops	Boil till soft in water or added to meal porridge.
<i>Mesembryanthemum</i>	Sour fig	Sticky seeds sucked from dried flowers.
All acacia species	Gums [resins]	Eaten raw as a sweet.
<i>Scotia afra</i>	Karoo boer bean	Eat green or roast in pan.
<i>Acacia karoo</i>	Thorn tree	Roast seeds and grind to make coffee.
<i>Quercus ruber</i>	Acoms	Grind and roast to make coffee.
<i>Opuntia ficus-indica</i>	Prickly pear	Grind, wash and boil to make soup.
<i>Citrullus lanatus</i>	Tsama melon	Seeds eaten raw.
		Pulp eaten for water. Boiled and eaten.
		Cooked in meat stews.
<i>Vigna unguiculata</i>	Cow pea	Whole seeds pounded to meal.
<i>Harpephyllum caffrum</i>	Wild plum	Seeds and leaves eaten raw or cooked.
<i>Sclerocarya birrea</i>	Marula	Fruit eaten raw when ripe.
		Fruit eaten raw when ripe.
		Nuts eaten raw or cooked.
<i>Carissa macrocarpa</i>	Num Num	Fruit eaten when ripe.
<i>Colocasia antiquorum</i>	Arum lily potatoes / Elephants ear [madumbe]	Underground stem is cooked or roasted.
<i>Zantedeschia aethiopica</i>	Arum lily	Leaves sliced, boiled and added to porridge.
<i>Ipomoea batatas</i>	Sweet potato	Boiled roasted or baked.
<i>Rubus rigidus</i>	Brambles	Fruits eaten raw.

Other plants that could be included are included in the following list (left).

The seat at the pinnacle of this garden offers a passive aspect to the space.



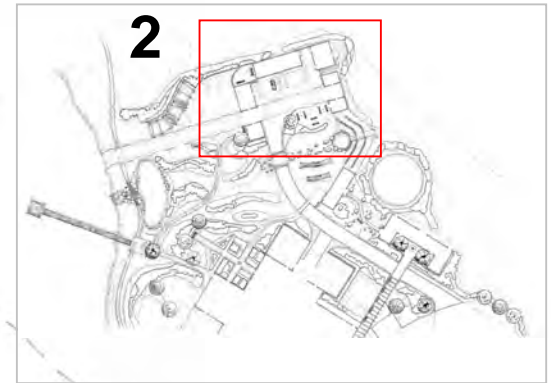
	Plant Name	Plants/ m2	Size of Plant	
Shrubs	RC	Rhus crenata	2	4kg
	SAL	Salvia africana-caerulea	2	4kg
Hedging	CHRYS	Chrysanthemoides monillifera	3	4kg
	DOD	Dodonea angustifolia	2	10kg
	ERIO	Erioccephalus africanus	2	10kg
	LAV	Lavandula dentata	4	4kg
Groundcovers	AGA	Agapanthus sp.	5	6pk trays
	CRASS	Crassula capensis	3	4kg
	EC	Erica capensis	3	4kg
	PELA	Pelargonium butulinium	5	6pk trays
Lawn	STEN	Stenotaphrum secundatum		roll-on lawn



Fig 1. Lavendula dentata

PLANTING PLAN 2

This part of the School landscape is characterised by berms around the outer edge of the Node, in order to assist the Planting to screen the Fishery Buildings from surrounding natural areas.



POSITION ON PLAN

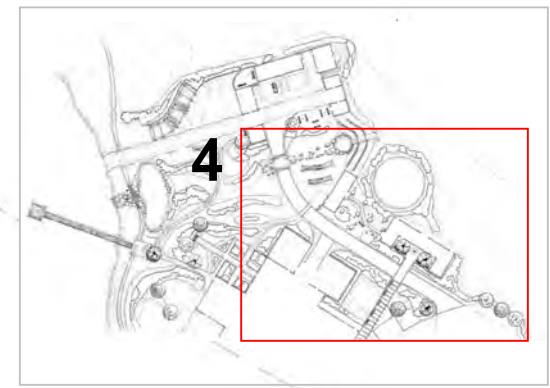
Plant Schedule			
Plant Name	Plants/ m2	Size of Plant	
Trees			
Deciduous			
SCHOT	Schotia brachypetala	1	50kg
Evergreen			
CUN	Cunonia capensis	1	50kg
Shrubs			
AGA	Agathosma ciliaris	4	4kg
BAU	Bauhinia galpanii	1	20kg
BUD	Buddleia saligna	3	10kg
CHON	Chondropetalum tectorum	1	10kg
COL	Coleonema album	2	10kg
DG	Diets grandiflora	3	4kg
FEL	Felicia filifolia	1	10kg
HEL	Helichrysum petiolare	3	4kg
LEUCO	Leucospermum cordifolium	1	10kg
LEU	Leucadendron salignum	3	4kg
GREW	Grewia occidentalis	3	10kg
MET	Metalasia muricata	2	10kg
NYM	Nymanlia capensis	1	10kg
PLEC	Plectranthus ecklonii	1	10kg
PLUM	Plumbago auriculata	1	20kg
POL	Polygala myrtifolia	2	10kg
PROT	Protea natida	1	10kg
RA	Rhus augustifolia	2	10kg
RC	Rhus crenata	2	4kg
SAL	Salvia africana-caerulea	2	4kg

Hedging			
CHRY	Chrysanthemoides monilifera	3	4kg
DOD	Dodonea angustifolia	2	10kg
ERIO	Eriosephalus africanus	2	10kg
LAV	Lavandula dentata	4	4kg
Water-loving plants			
JK	Juncus kraussii	3	10kg
TYPHA	Typha capensis	1	10kg
Groundcovers			
AGA	Agapanthus sp.	5	6pk trays
CARP	Carpobrotus edulis	6	6pk trays
CRASS	Crassula capensis	3	4kg
EA	Erica albetina	3	4kg
EC	Erica capensis	3	4kg
EL	Erica laeta	3	4kg
LAM	Lampranthus faiciformis	5	6pk trays
PELA	Pelargonium butulinum	5	6pk trays
SCAB	Scabiosa africana	3	4kg
Climbers/ Scramblers			
TEC	Tecomaria capensis	1	10kg
PLUM	Plumbago auriculata	1	10kg
SEN	Senecio tamoides	1	10kg
Bulbs			
ORN	Ornithogalum thyroides	3	Corms
CRIN	Crinum bulbispermum	2	Corms
CROC	Crocsmia aurea	1	Corms
Lawn			
STEN	Stenotaphrum secundatum		roll-on lawn

PLANTING PLAN 4

Plant Schedule			
Plant Name	Plants/ m2	Size of Plant	
Trees			
Deciduous			
RL	Rhus lancea	1	20kg
Evergreen			
BRACH	Brachylaena discolor	1	50kg
DOV	Dovyalis caffra	1	20kg
KIGG	Kiggeteria africana	1	20kg
OL	Olea europaea subsp. Africana	1	20kg
POD	Podocarpus falcatus	1	50kg
Shrubs			
AGA	Agathosma ciliaris	4	4kg
BAU	Bauhinia galpanii	1	20kg
BUD	Buddleja saligna	3	10kg
CHON	Chondropetalum tectorum	1	10kg
COL	Coleonema album	2	10kg
DG	Dietes grandiflora	3	4kg
FEL	Felicia filifolia	1	10kg
HEL	Helichrysum petiolare	3	4kg
LEUCO	Leucospermum cordifolium	1	10kg
LEU	Leucadendron salignum	3	4kg
GREW	Grewia occidentalis	3	10kg
MET	Metasia muricata	2	10kg
NYM	Nymanlia capensis	1	10kg
PLEC	Plectranthus ecklonii	1	10kg
PLUM	Plumbago auriculata	1	20kg
POL	Polygala myrtifolia	2	10kg
PROT	Protea natida	1	10kg
RA	Rhus augustifolia	2	10kg
RC	Rhus crenata	2	4kg
SAL	Salvia africana-caerulea	2	4kg

Hedging			
CHRY5	Chrysanthemoides monnifera	3	4kg
DOD2	Dodonea angustifolia	2	10kg
ERIO	Eriocephalus africanus	2	10kg
LAV	Lavandula dentata	4	4kg
Groundcovers			
AGA	Agapanthus sp.	5	6pk trays
CARP	Carpobrotus edulis	6	6pk trays
CRASS	Crassula capensis	3	4kg
EA	Erica albetina	3	4kg
EC	Erica capensis	3	4kg
EL	Erica laeta	3	4kg
LAM	Lampranthus falciformis	5	6pk trays
OSTEO	Osteospermum jucundum	5	6pk trays
PELA	Pelargonium butulinum	5	6pk trays
SCAB	Scabiosa africana	3	4kg
Lawn			
STEN	Stenolaphrum secundatum		roll-on lawn



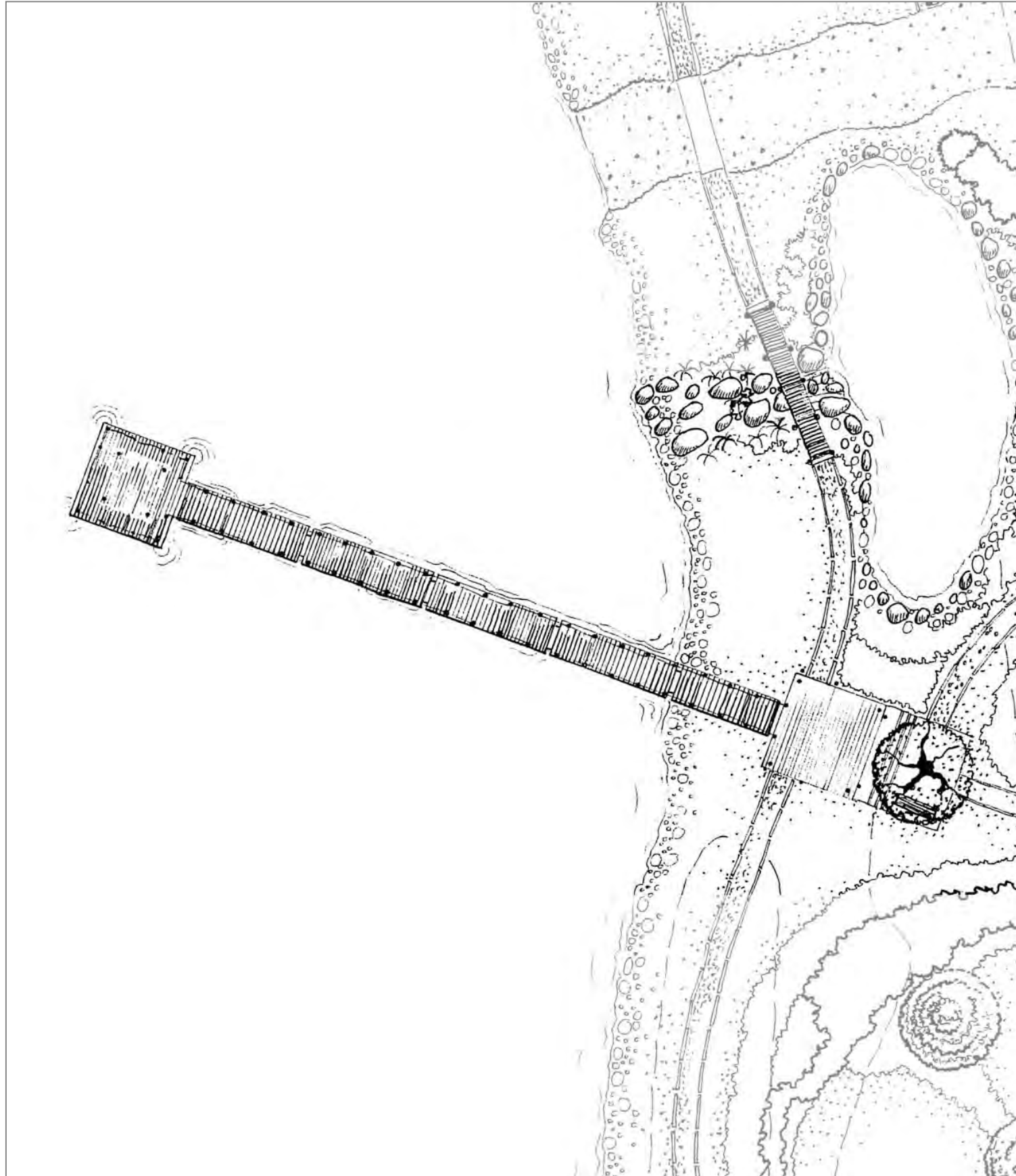
POSITION ON PLAN



Fig4. Podocarpus falcatus [63]

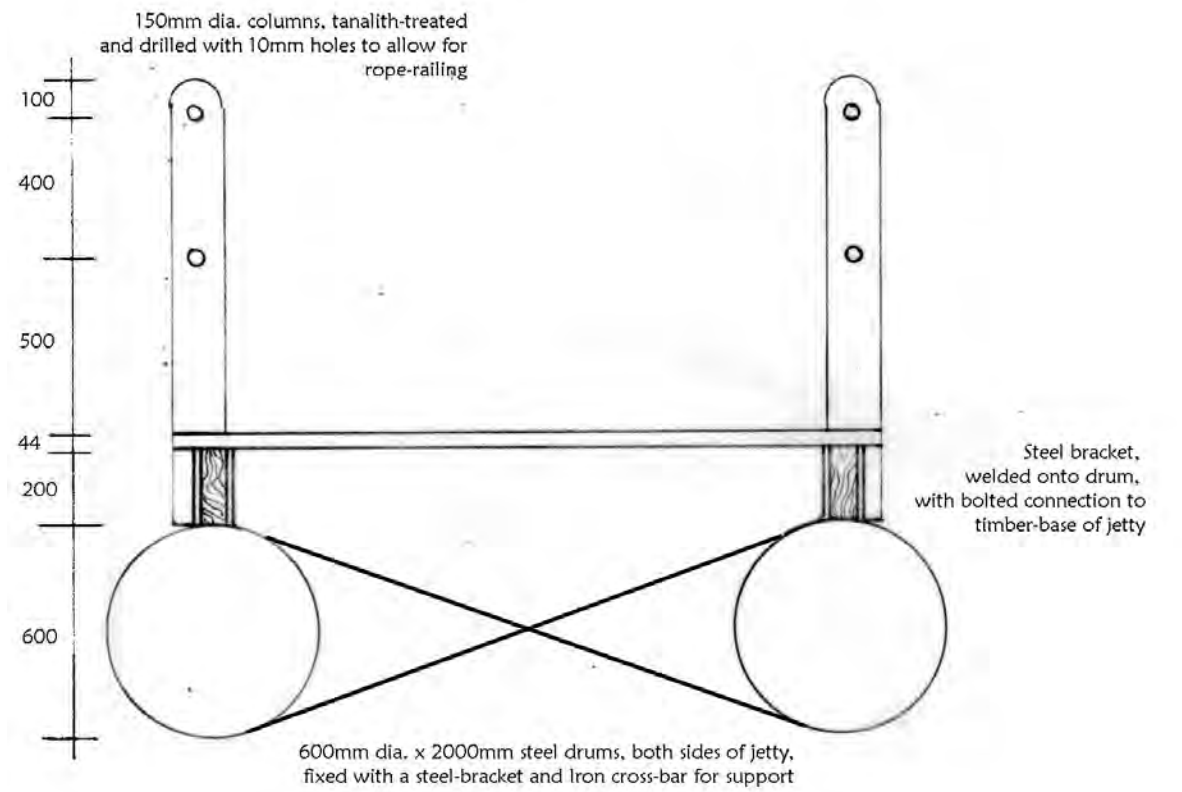
ALL PLANTING PLANS SCALE 1:250 @A1

CONSTRUCTION DETAIL 1

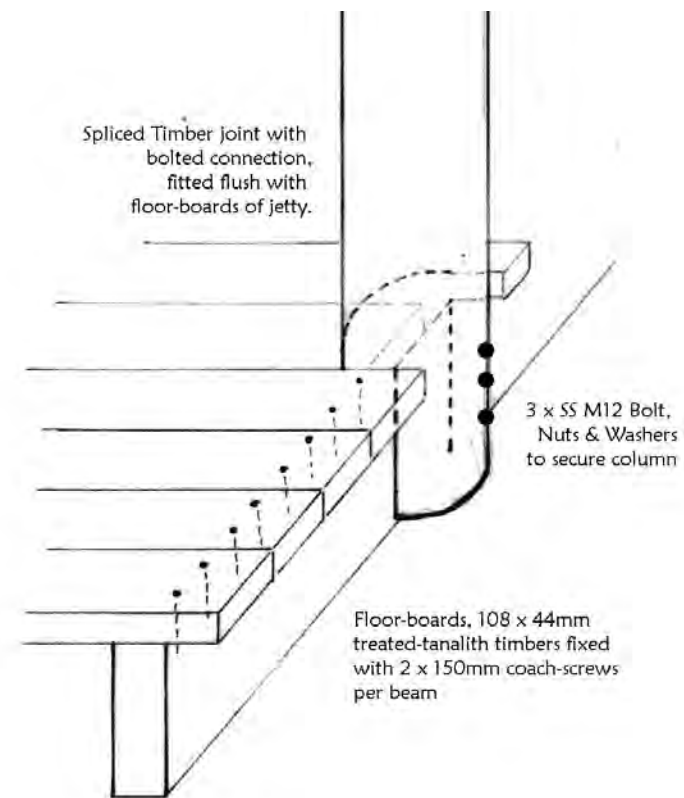


1:250@A1

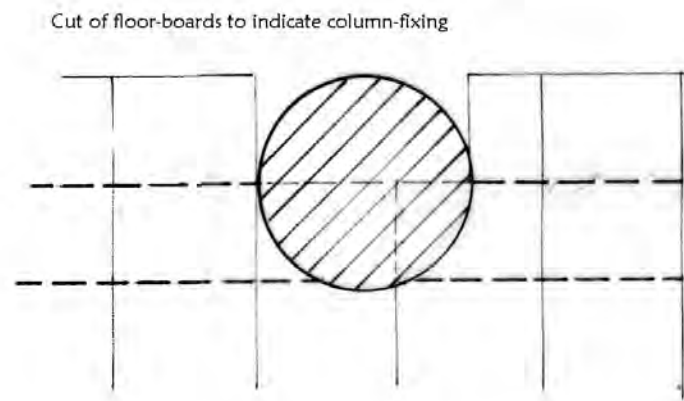
FLOATING JETTY



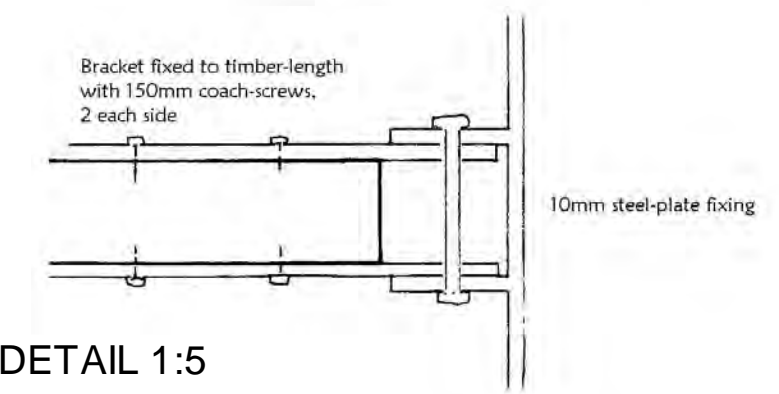
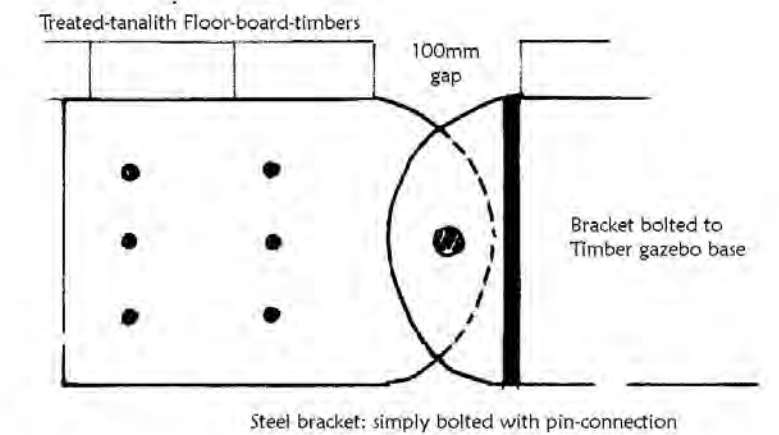
JETTY CROSS-SECTION 1:20



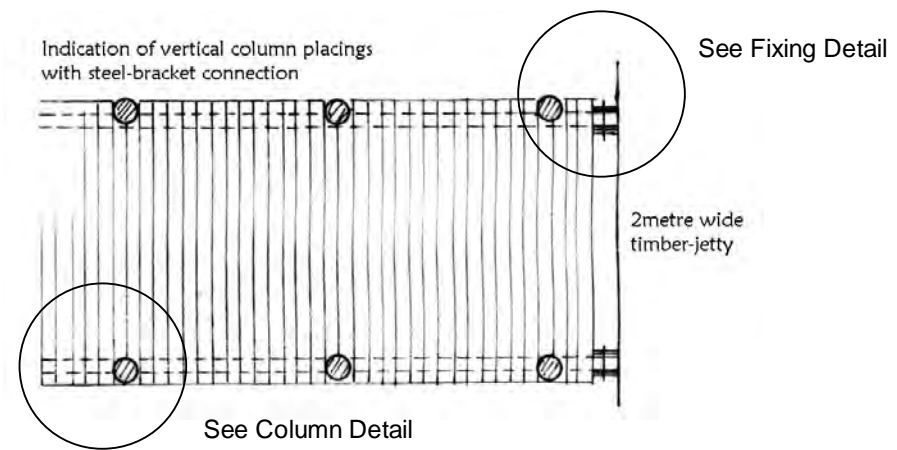
COLUMN DETAIL 1:10



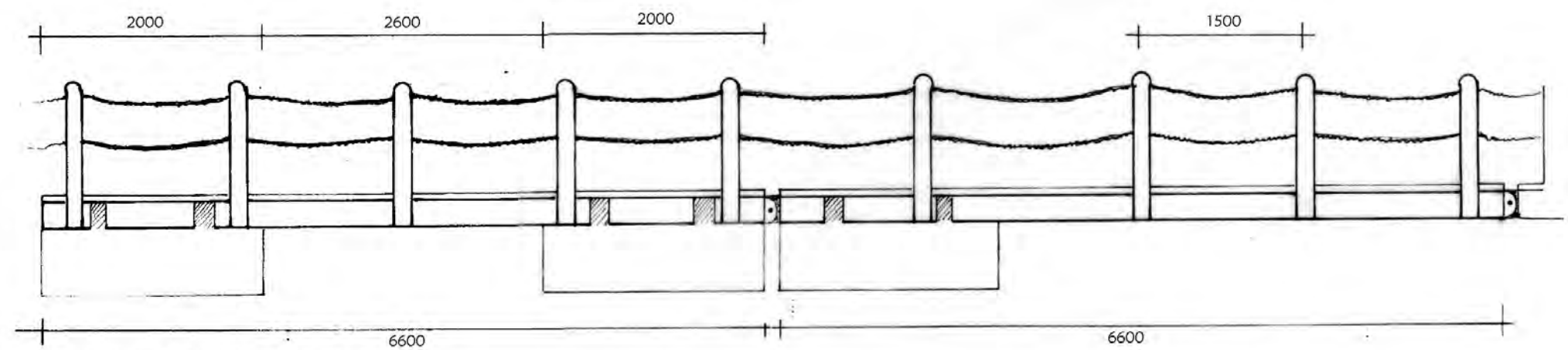
COLUMN DETAIL PLAN 1:5



FIXING DETAIL 1:5



JETTY PLAN 1:50

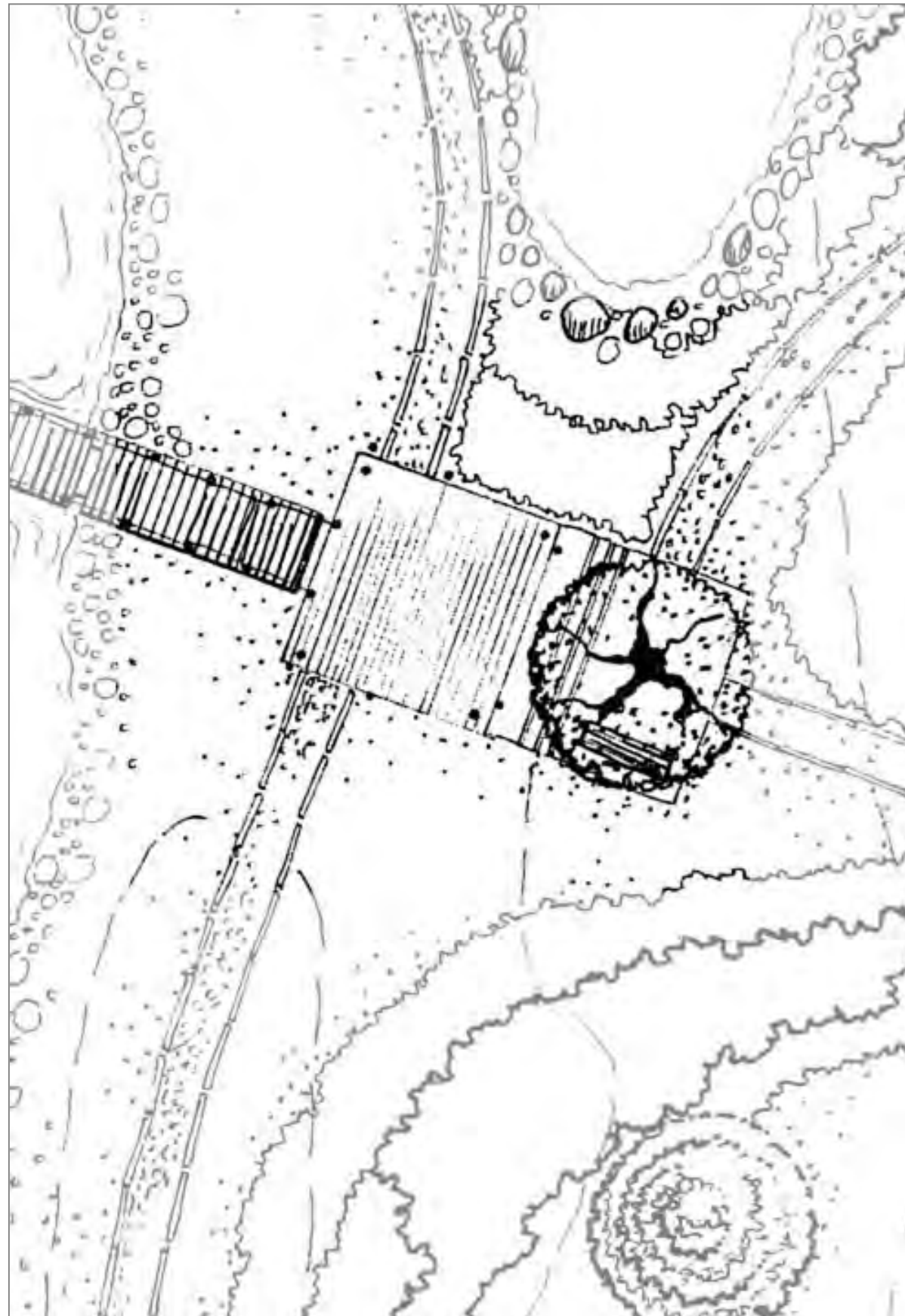


JETTY ELEVATION 1:50

Jetty components, fitted with 4 steel-drums for floats. Connected with detailed steel-bracket connection.

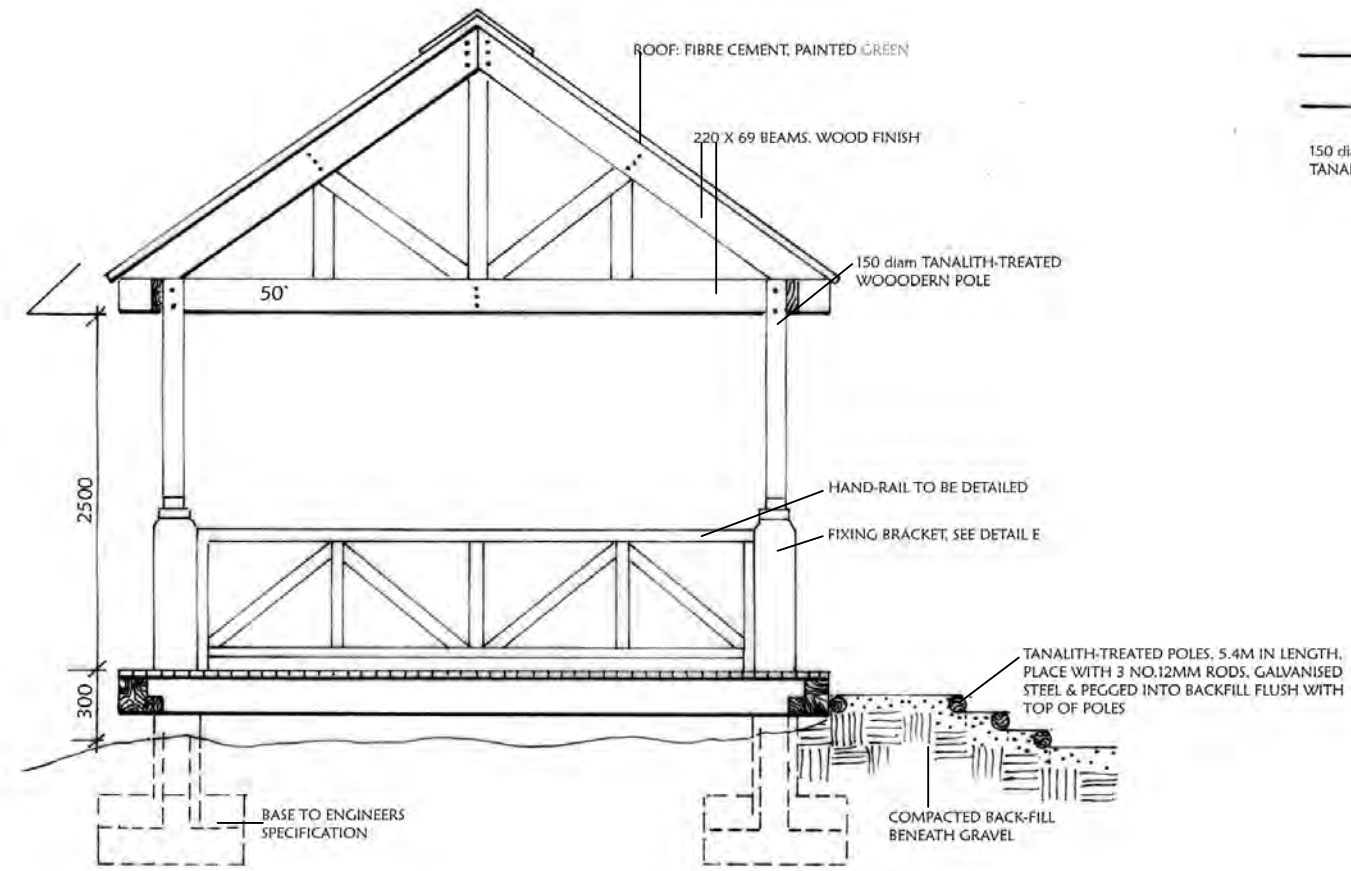
FLOATING JETTY

CONSTRUCTION DETAIL 2

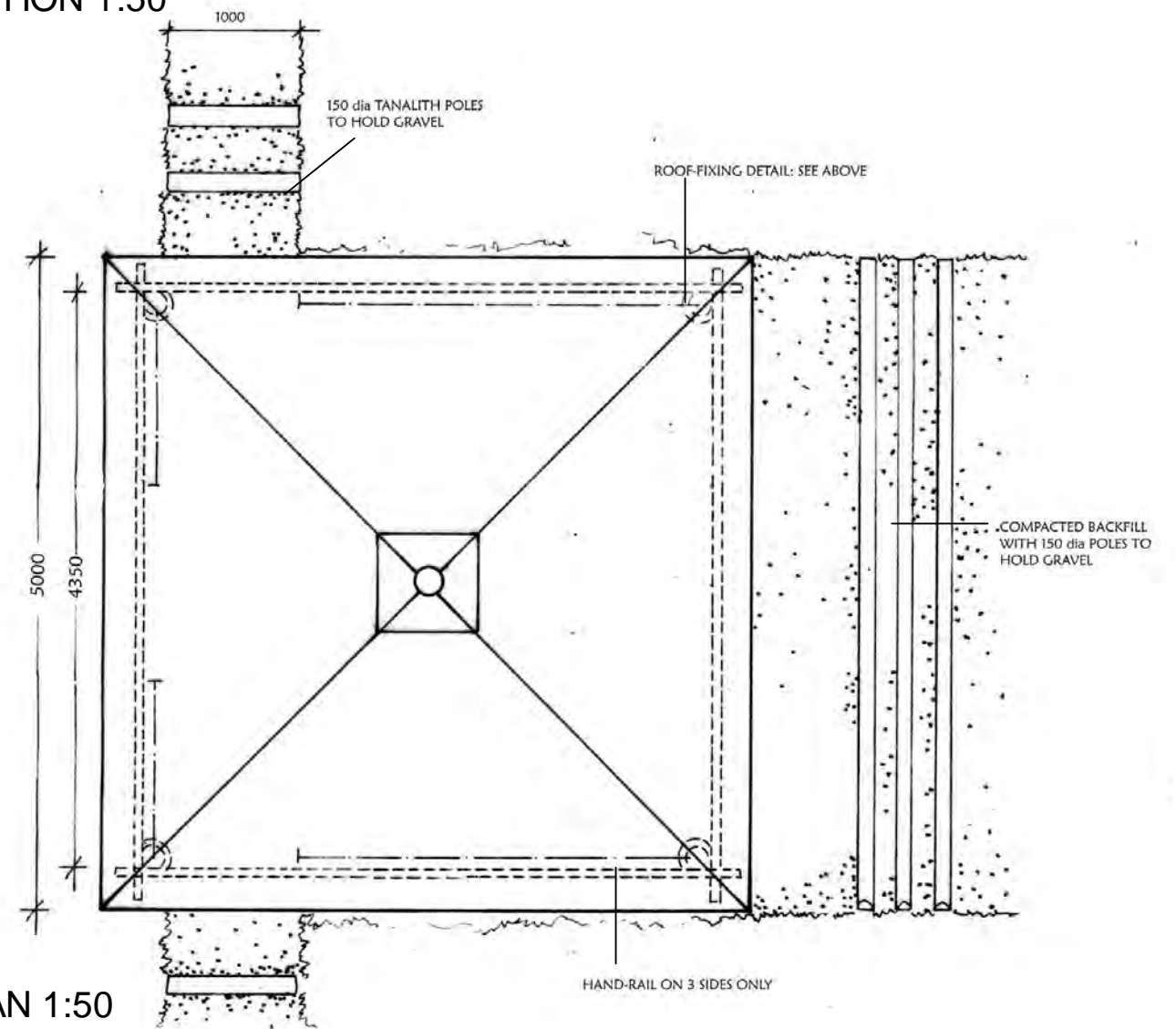


JETTY GAZEBO

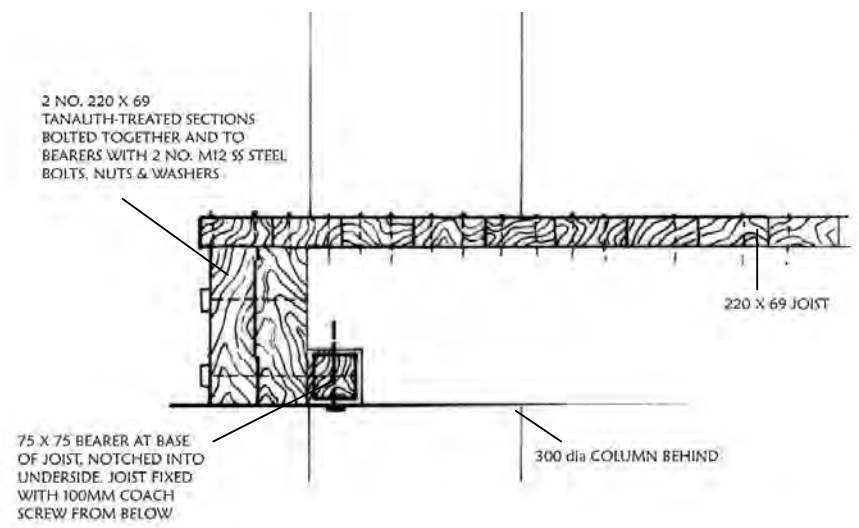
1:125@A1



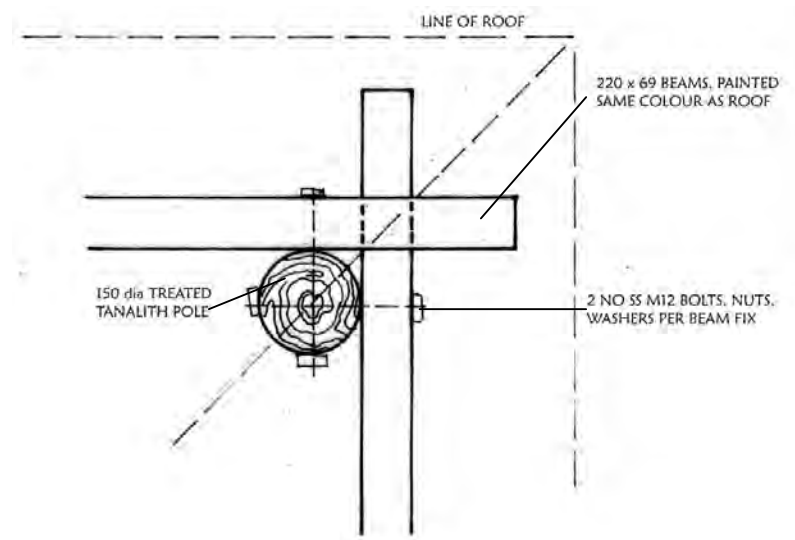
ROOF SECTION 1:50



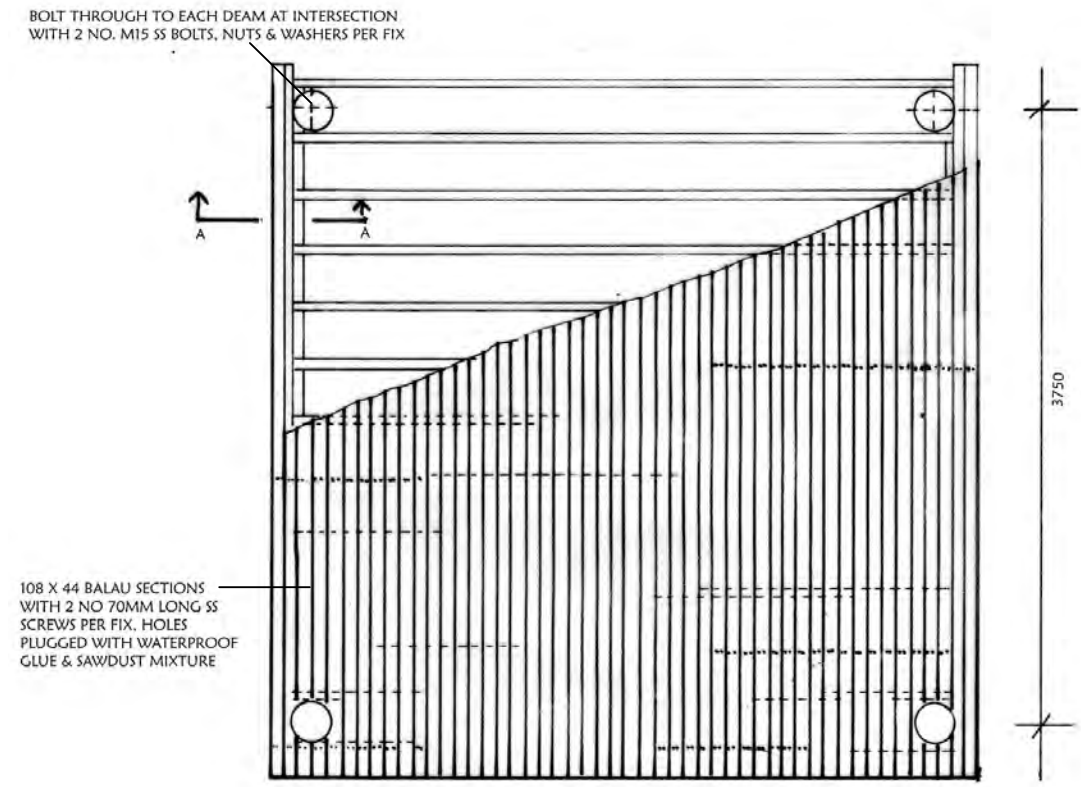
ROOF PLAN 1:50



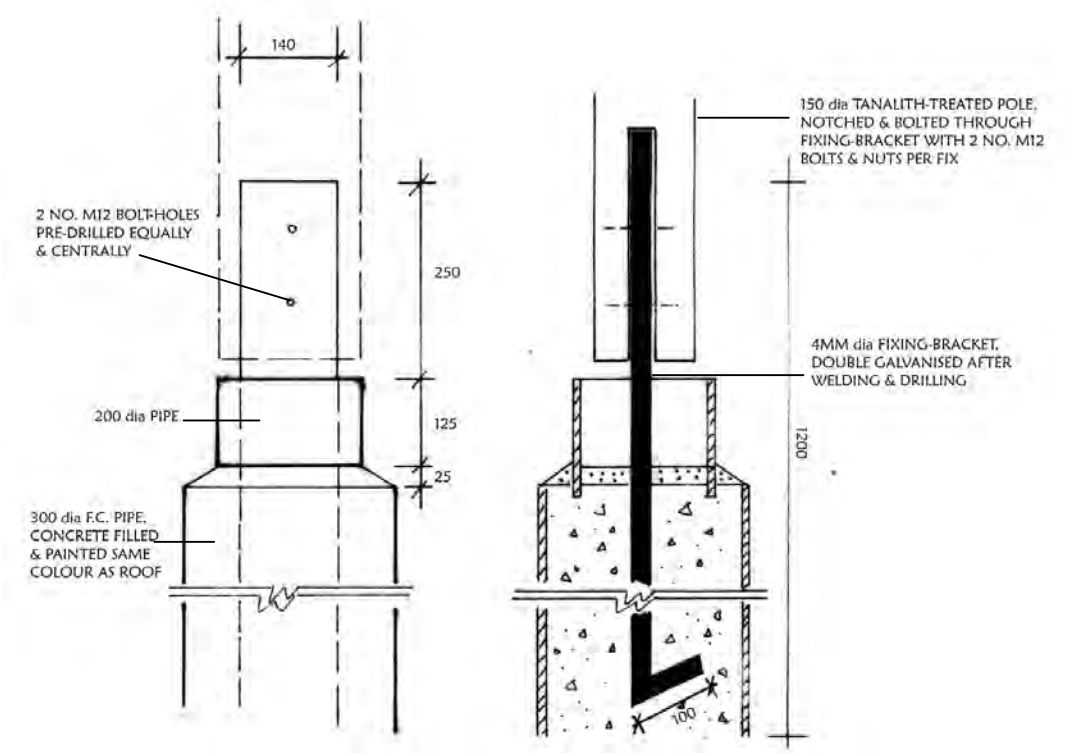
SECTION A-A 1:10



ROOF-FIXING DETAIL 1:10



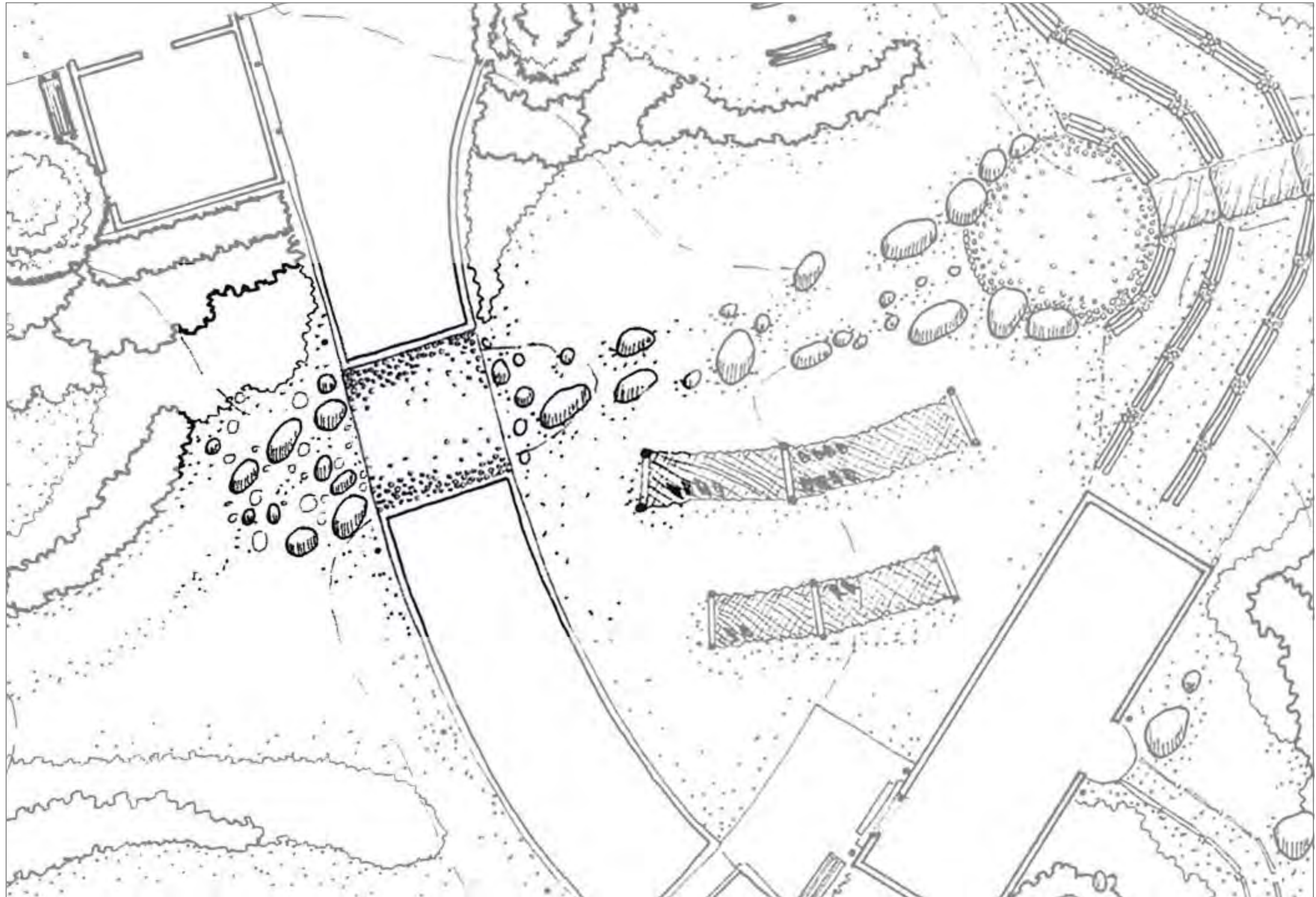
DECK PLAN 1:50



COLUMN-FIXING DETAIL 1:10

JETTY GAZEBO

CONSTRUCTION DETAIL 3

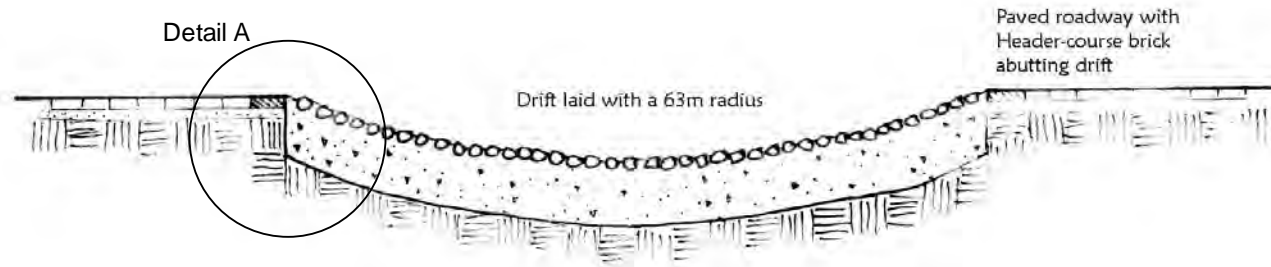


DRIFT

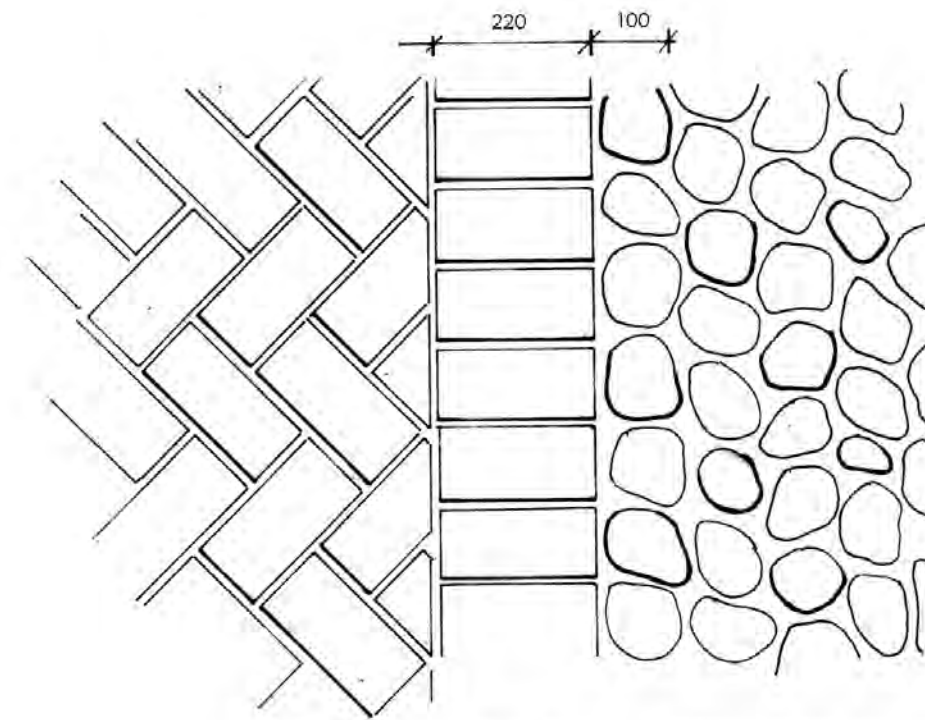
1:125@A1



River Stone Pebbles [63]



DRIFT IN SECTION 1:50



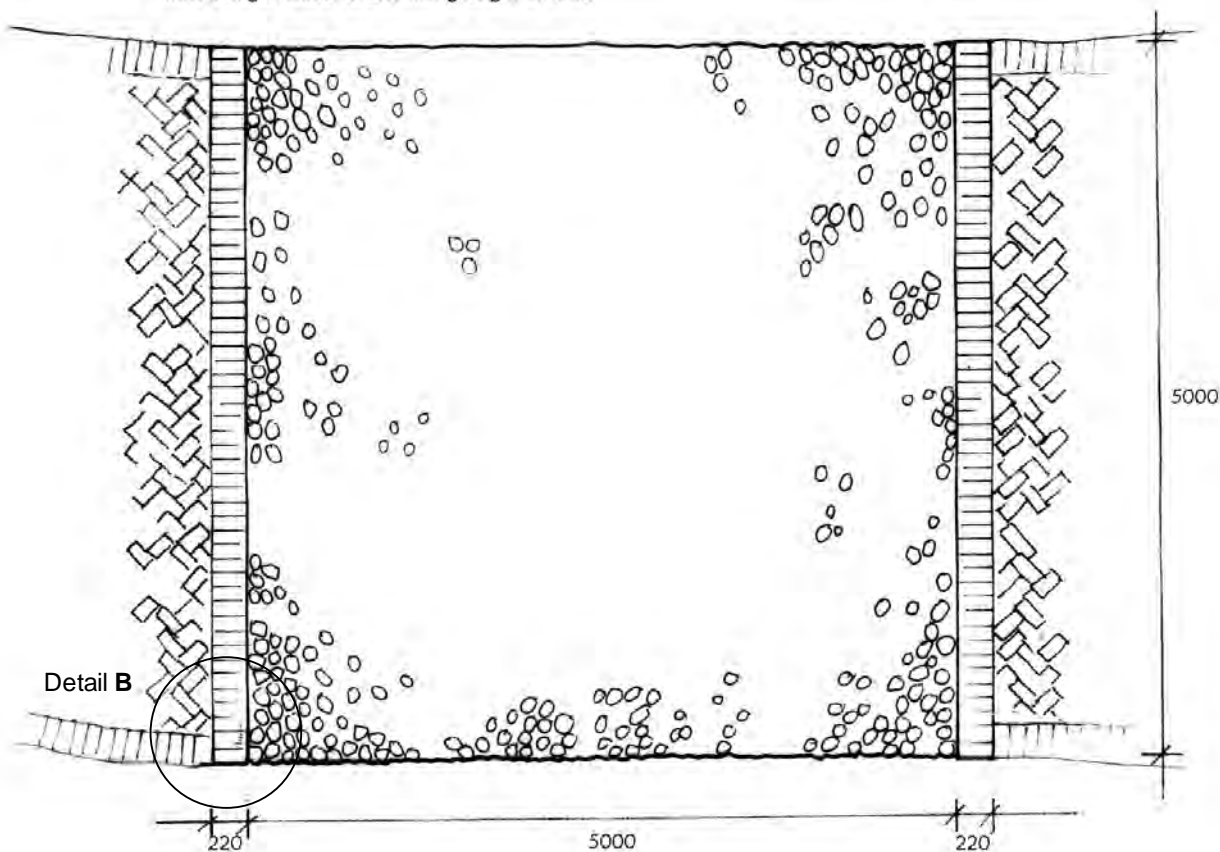
Okavango paving, laid in Herringbone style

Header Course, Okavango Paver

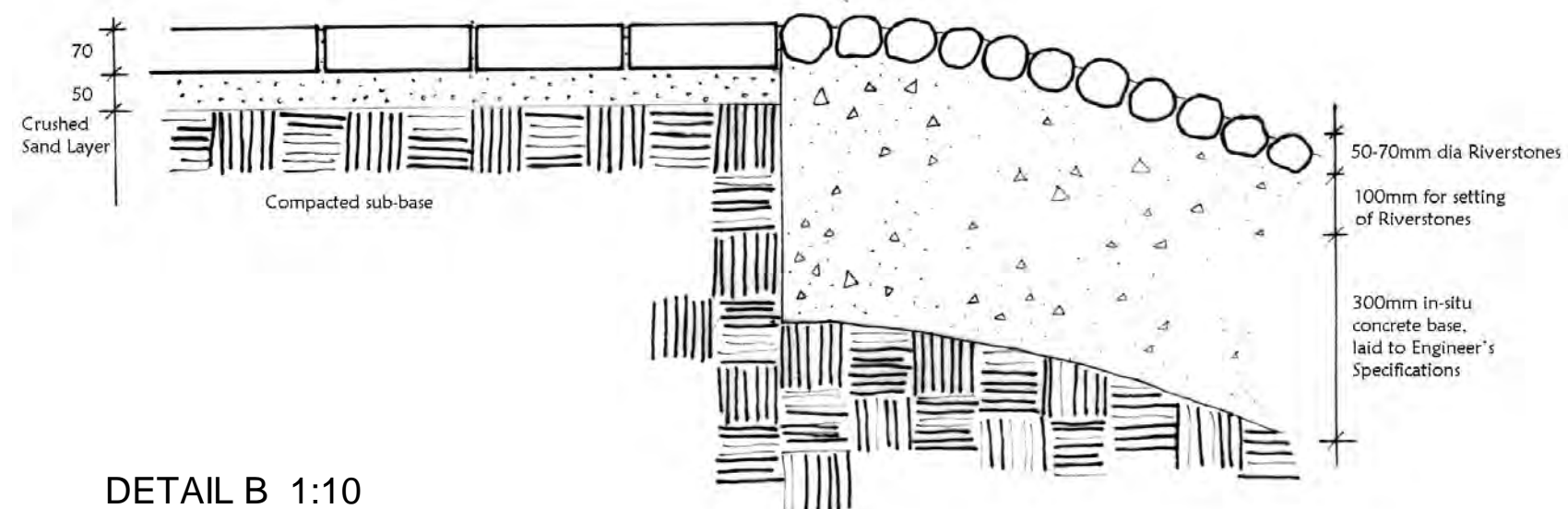
Riverstones, collected from inundated area

DETAIL A 1:10

Okavango Paving, according to Hard Landscape Plan, laid in Herringbone style along road-way, with a single header course lining length of drift.



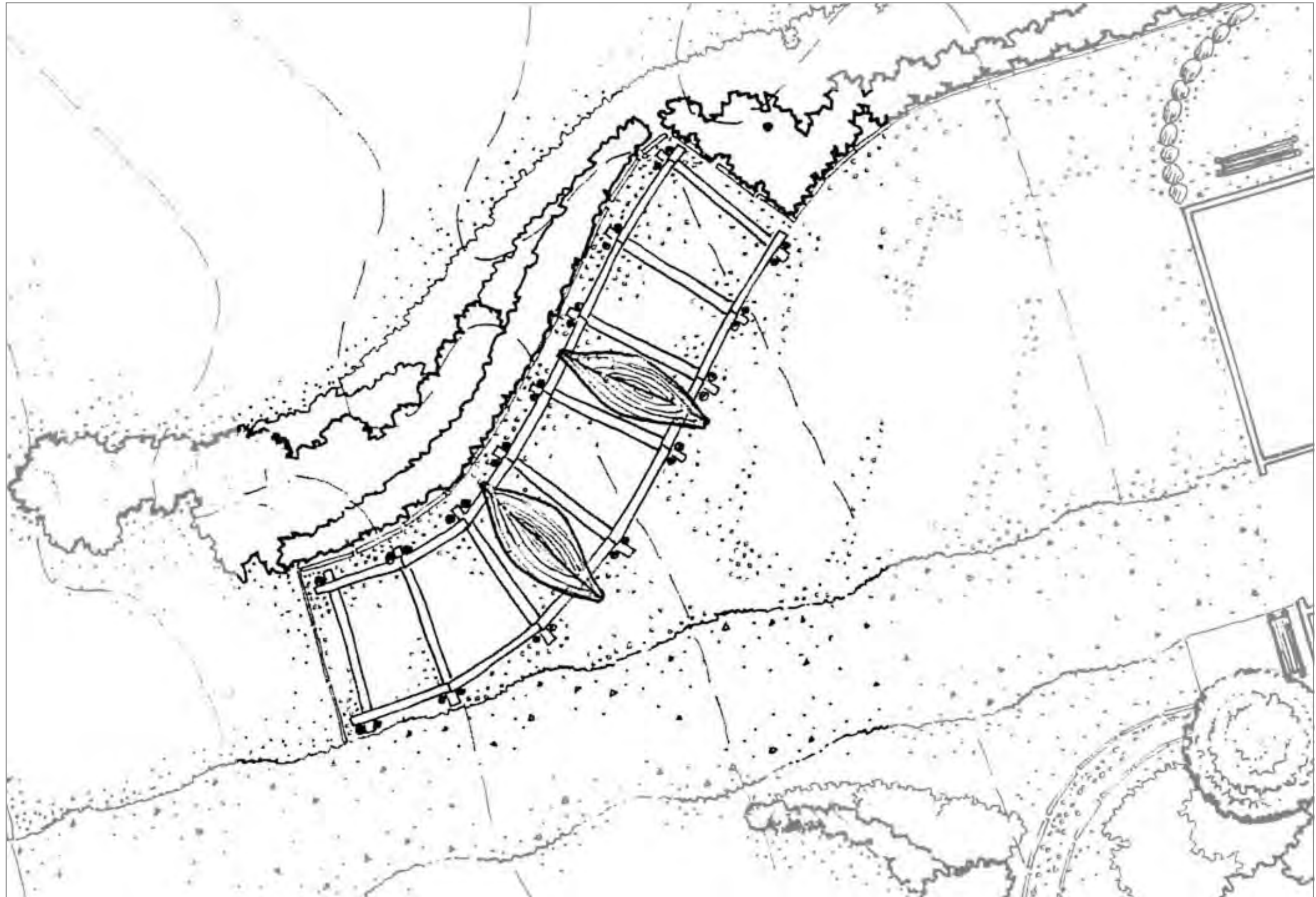
DRIFT IN PLAN 1:50



DETAIL B 1:10

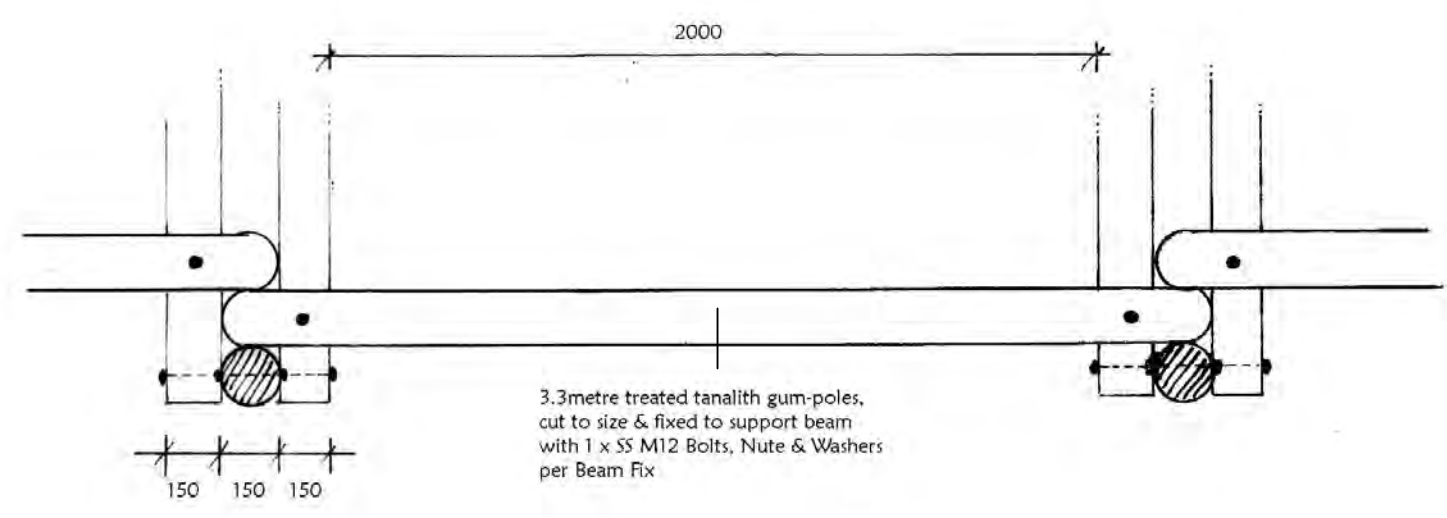
VEHICLE DRIFT

CONSTRUCTION DETAIL 4

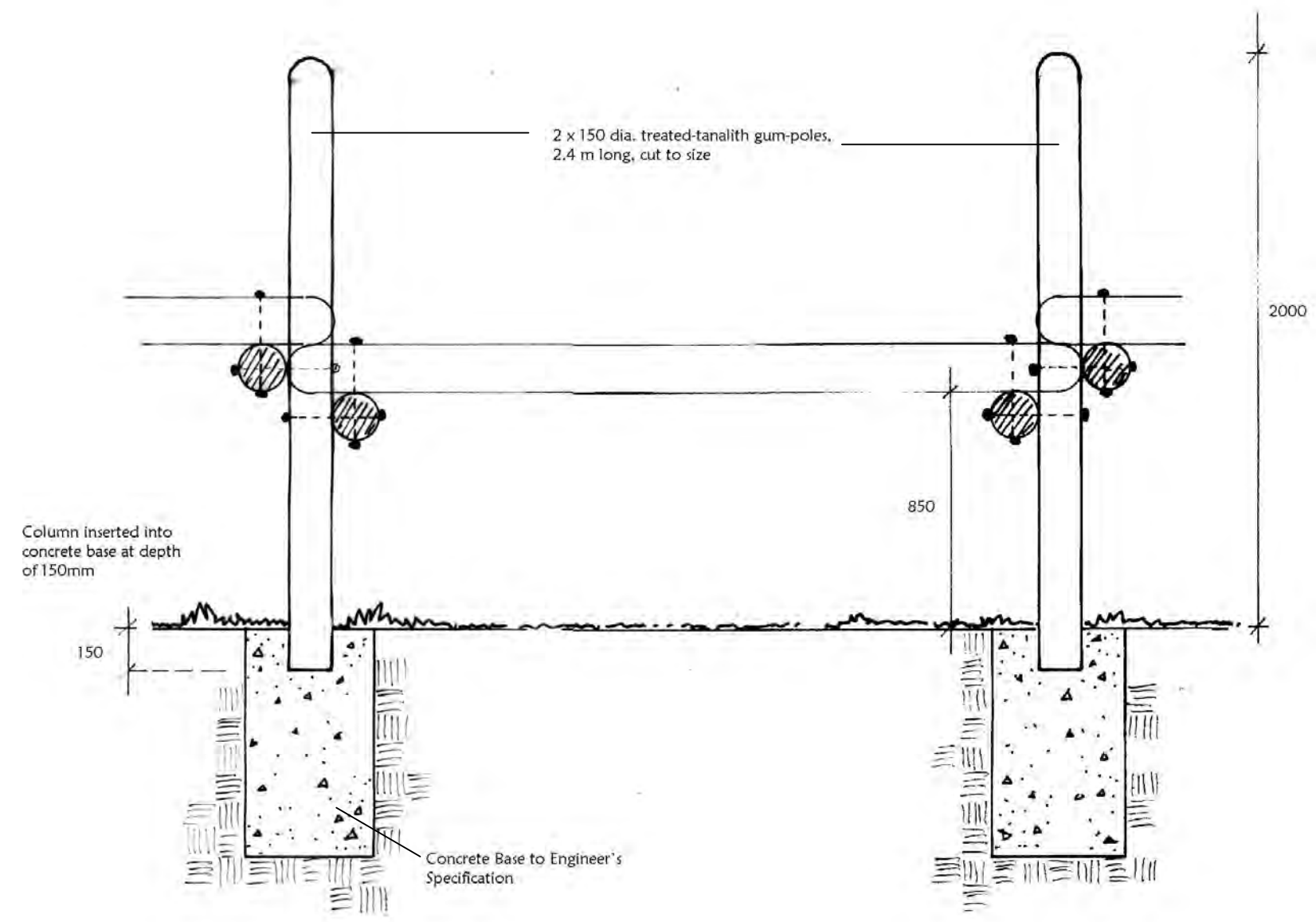


BOAT RACK

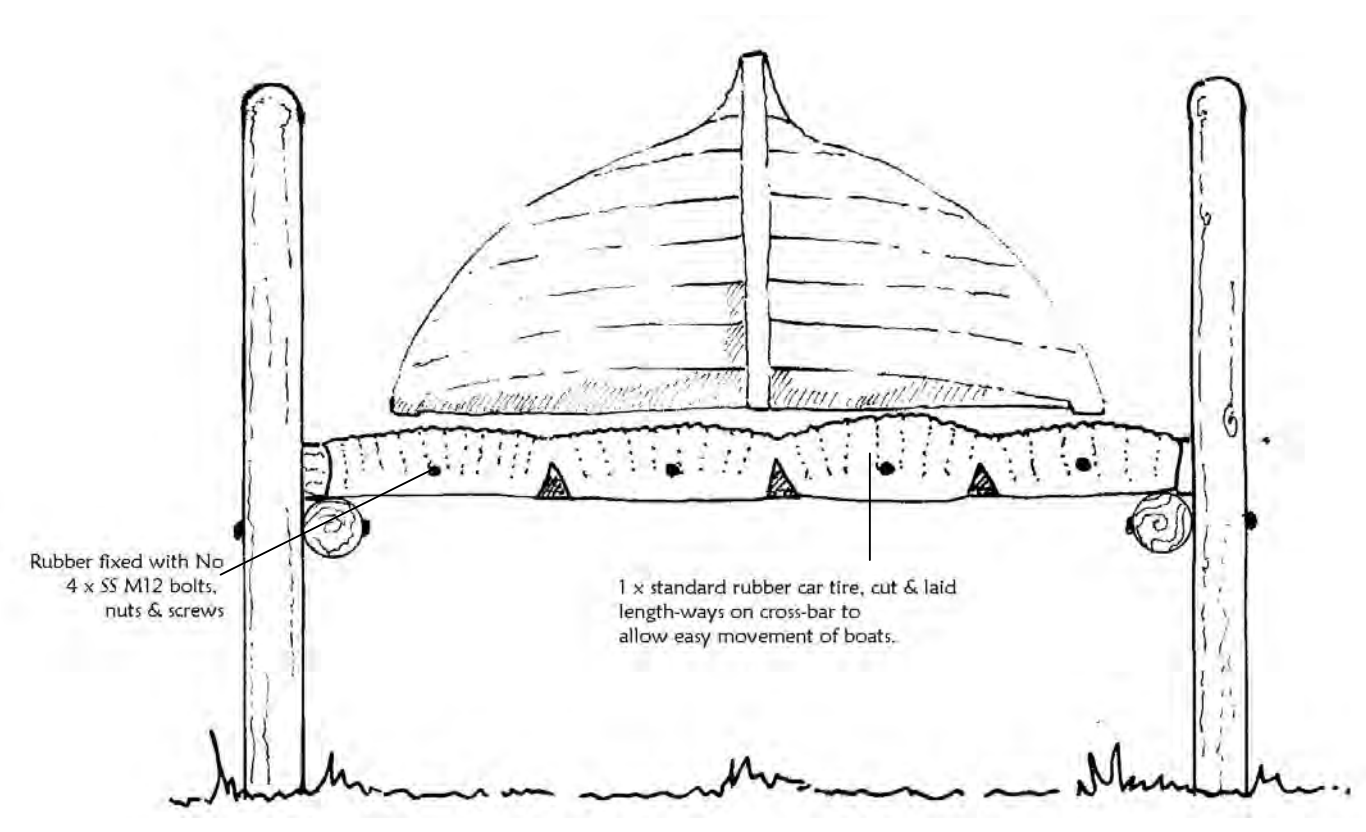
1:125@A1



RACK FIXING DETAIL
PLAN 1:20



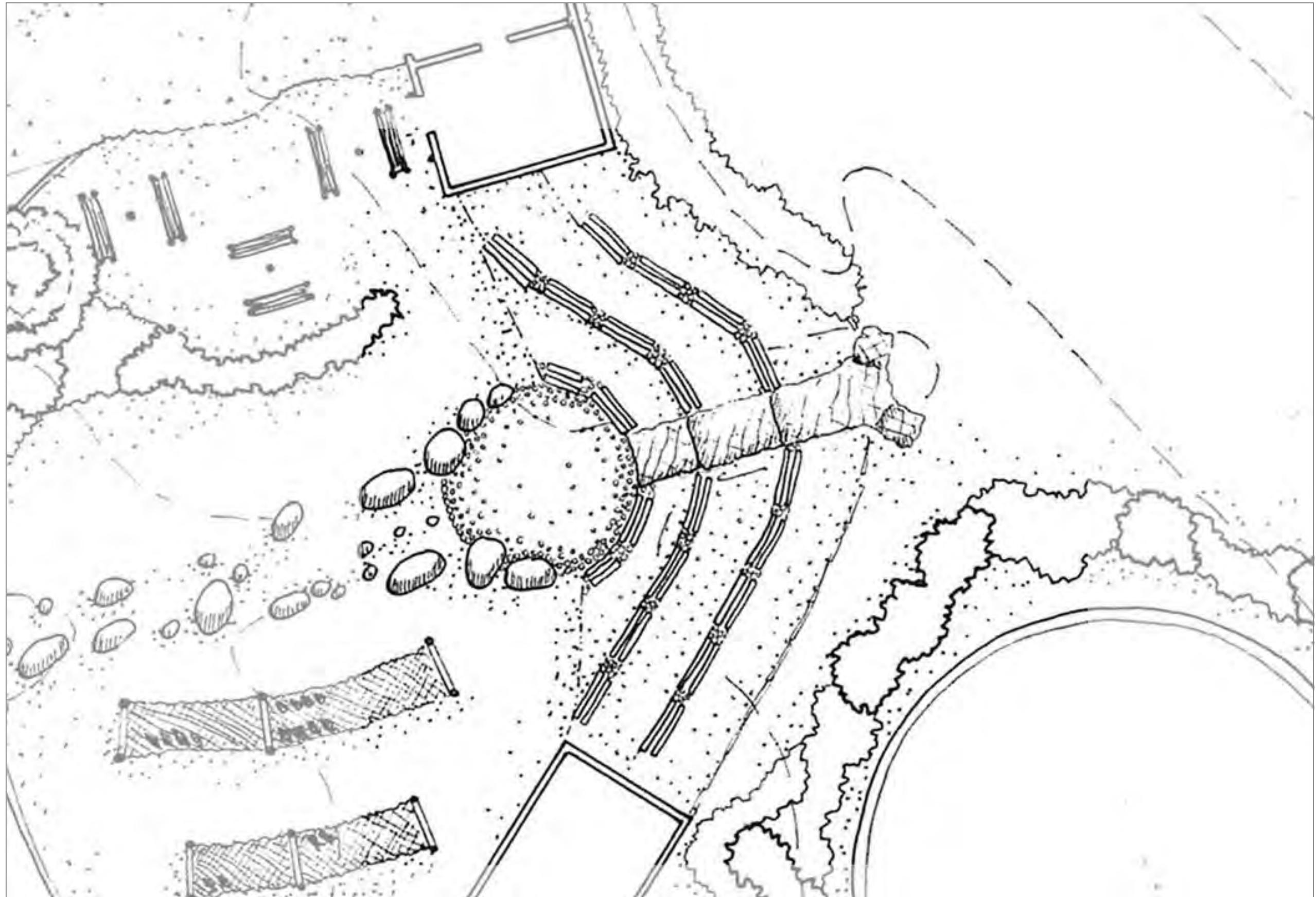
RACK FIXING DETAIL
SECTION 1:20



ELEVATION 1:20

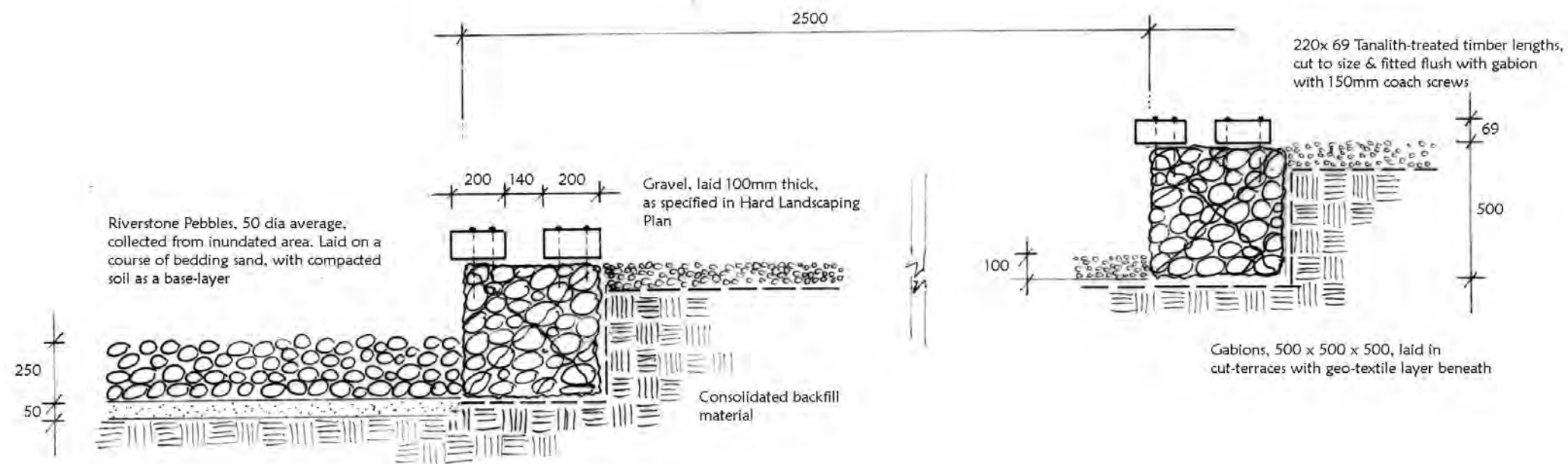
BOAT RACK

CONSTRUCTION DETAIL 5

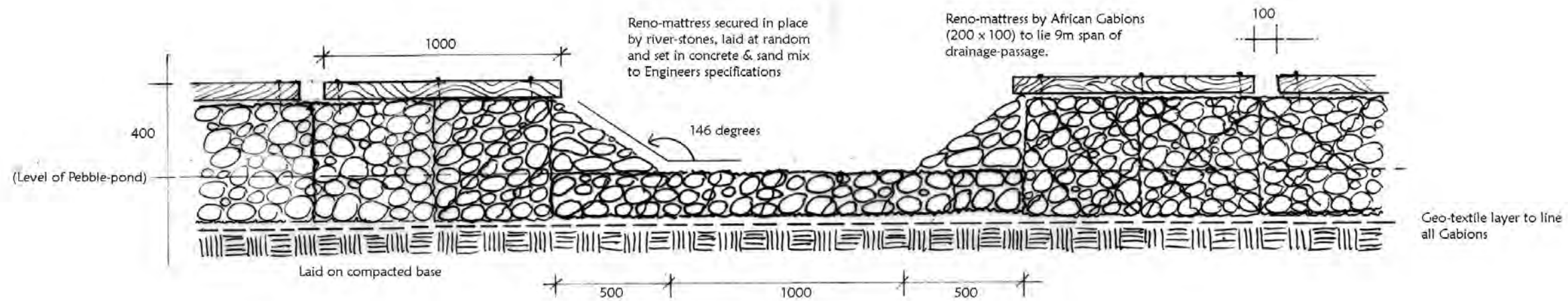


DRAINAGE TERRACE

1:125@A1



TERRACE CROSS-SECTION 1:20



STORM-WATER CHANNEL ELEVATION 1:20

DRAINAGE TERRACE

The Project in Context
Problem Diagnosis



Hypothesis
Project Brief



PART 1
Framing the problem on a
Theoretical Basis



PART 2
Application of Theory through
Planning



PART 3
Theory Demonstration through
Design Intervention



PART 4
Forming a Design Solution



PART 5
Project Feasibility



Conclusion

STAGES OF IMPLEMENTATION:

In tackling the implementation of such a settlement, much forward planning should be anticipated before the project gets off the ground.

1. In the case of Robertsvlei, the Hamlet itself would come first in the building process, as this is the community that the settlement will depend on as a whole. Existing infrastructure would need to be upgraded and the basic road layout created for the entire settlement.

Public transport improvements would need to accompany building works, allowing Robertsvlei to become an integral part of the extended Franschoek community.

2. During the first phase, education involving sustainable agricultural practices should be underway, and the building of the Community Fishery on the Berg River Dam. This will allow the community to become self-sufficient at the onset of its creation.

4. Giving the community time to establish itself, preparations should be made for the implementation of the Eco-Education Node. At this stage, the Robertsvlei Hamlet should be functioning and training would begin for the locals to become informed of the workings of this type of institution. Outside assistance would obviously be required and management methods implemented.

6. With the introduction of amenities and water-related activities, the final stage of building the Eco-tourism Node would be initiated. Marketing strategies would need to be put in place by the Franschoek Tourism Board, allowing the proposed development exposure to the local, regional and international markets.

7. Strict management measures would have to be implemented with every scheme, with continued assessment of Water Quality within the Berg River Dam.

This will ensure a sustainable living, working and recreational environment for all concerned.

Implementation Strategies

The Project in Context
Problem Diagnosis



Hypothesis
Project Brief



PART 1
Framing the problem on a
Theoretical Basis



PART 2
Application of Theory through
Planning



PART 3
Theory Demonstration through
Design Intervention



PART 4
Forming a Design Solution



PART 5
Project Feasibility



Conclusion

How we as a society view the natural world, our place in it and our relationship to it affects every facet of our life experience and the health of the land

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Sustainable design implementation serves to create a link between humankind and the environment. In the past, Dam construction is often seen to sever that link, resulting in dysfunctional natural systems and disconcerted communities.

Clearly, dam development is by no means, on the way out. Seen as a short-term solution to a long-term problem, Dams create the perfect revelation to meeting the needs of the larger population. Yet the local communities are often forgotten and their needs neglected.

The proposal of a Hamlet at Robertsvlei is seen to bring the built and the natural environment together, creating compatibility and synthesis. The entire proposal relates to the concept of social-justice, but also to that of responsibility and accountability. The optimal utilisation of resources is seen to ensure financial viability, whilst maintaining environmental integrity and economic stability.

The whole idea behind sustainable design implementation is culminated in the profession of Landscape Architecture. It is therefore vital that Landscape Architects develop the ability to view infrastructure holistically and developing methods to enumerate future impacts on the environment.

Until there is a proven alternative for dam development, we cannot deprive communities of the benefits offered by Dams. Yet, what should be proposed is development with a difference, with the view to serve future generations.

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