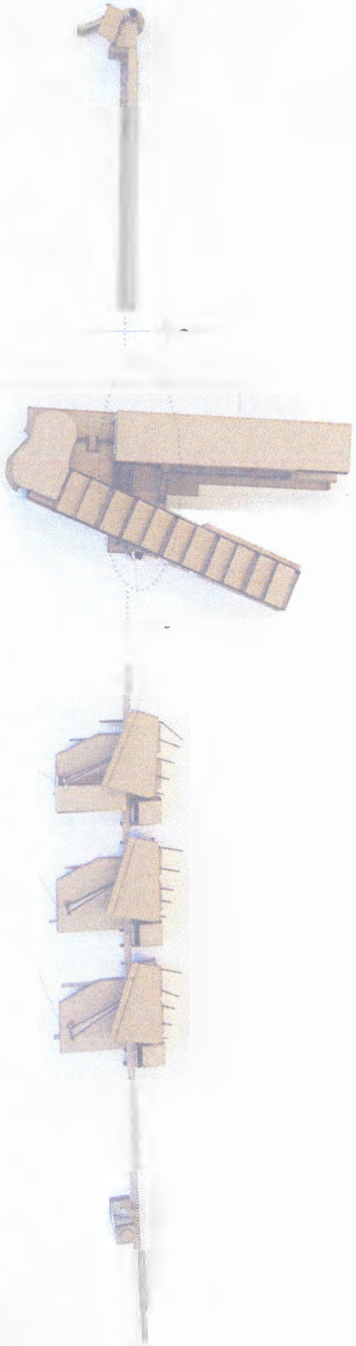
The Water Line:

Research into the peculiar place of the Namib Desert coast

Sarah Pineo



The Water Line:

Research into the peculiar place of the Namib Desert coast

Sarah Pineo

Supervisors: Associate Professor Nic Coetzer, Melinda Silverman
Assisted by: Gemma Robinson

This dissertation is presented as part fulfillment of the degree of Master of Architecture (Professional)
in the School of Architecture, Planning and Geomatics, University of Cape Town
November 2014

"I hereby:
a. grant the University free license to reproduce the above dissertation in whole or in part, for the purpose of research.
b. Declare that:
(i) The above dissertation is my own unaided work, both in conception and execution, and that apart from the normal guidance of my supervisors, I have received no assistance apart from that stated below:
XXXXX
(ii) Except as stated below, neither the substance or any part of the dissertation has been submitted for a degree in the University or any other university.
(iii) I am now presenting the dissertation for examination for the degree of Master of Architecture (Professional)"

Plagiarism Declaration:
1. I know that plagiarism is wrong. Plagiarism is to use another's work and pretend that it is one's own.
2. I have used the Chicago / Harvard convention for citation and referencing. Each contribution to, and quotation in, this report from the work(s) of other people has been attributed, and has been cited and referenced.
3. This report is my own work.
4. I have not allowed, and will not allow, anyone to copy my work with the intention of passing it off as his or her own work.

____

EBE Faculty: Assessment of Ethics in Research Projects

Any person planning to undertake research in the Faculty of Engineering and the Built Environment at the University of Cape Town is required to complete this form before collecting or analysing data. When completed it should be submitted to the supervisor (where applicable) and from there to the Head of Department. If any of the questions below have been answered YES, and the applicant is NOT a fourth year student, the Head should forward this form for approval by the Faculty EIR committee: submit to Ms Zulpha Geyer (Zulpha.Geyer@uct.ac.za; Chem Eng Building, Ph 021 650 4791). Students must include a copy of the completed form with the thesis when it is submitted for examination.

Name of Principal Researcher/Student: SARAH PINEO

Department: ARCHITECTURE

If a Student: YES

Degree: MArch (Prof)

Supervisor: NIC COETZER

If a Research Contract indicate source of funding/sponsorship: NONE

Research Project Title: Uncovering desertscapes: Architecture of temporality in a house of light and colour

Overview of ethics issues in your research project:

Question 1: Is there a possibility that your research could cause harm to a third party (i.e. a person not involved in your project)?	YES	NO X
Question 2: Is your research making use of human subjects as sources of data? If your answer is YES, please complete Addendum 2.	YES X	NO
Question 3: Does your research involve the participation of or provision of services to communities? If your answer is YES, please complete Addendum 3.	YES	NO X
Question 4: If your research is sponsored, is there any potential for conflicts of interest? If your answer is YES, please complete Addendum 4.	YES	NO X

If you have answered YES to any of the above questions, please append a copy of your research proposal, as well as any interview schedules or questionnaires (Addendum 1) and please complete further addenda as appropriate.

I hereby undertake to carry out my research in such a way that

- there is no apparent legal objection to the nature or the method of research; and
- the research will not compromise staff or students or the other responsibilities of the University;
- the stated objective will be achieved, and the findings will have a high degree of validity;
- limitations and alternative interpretations will be considered;
- the findings could be subject to peer review and publicly available; and
- I will comply with the conventions of copyright and avoid any practice that would constitute plagiarism.

Signed b

	Full name and signature	Date
Principal Researcher/Student:	SARAH LOUISE PINEO	25/03/14

This application is approved by:		
Supervisor (if applicable):		25/03/14
HOD (or delegated nominee): Final authority for all assessments with NO to all questions and for all undergraduate research.		25/04/2014

CONTENTS

The existential purpose of building is therefore to make a site become a place, that is, to uncover the meanings potentially present in the given environment

Norberg-Schultz,C[1]

Wlotzkasbaken Beach- author

Introduction

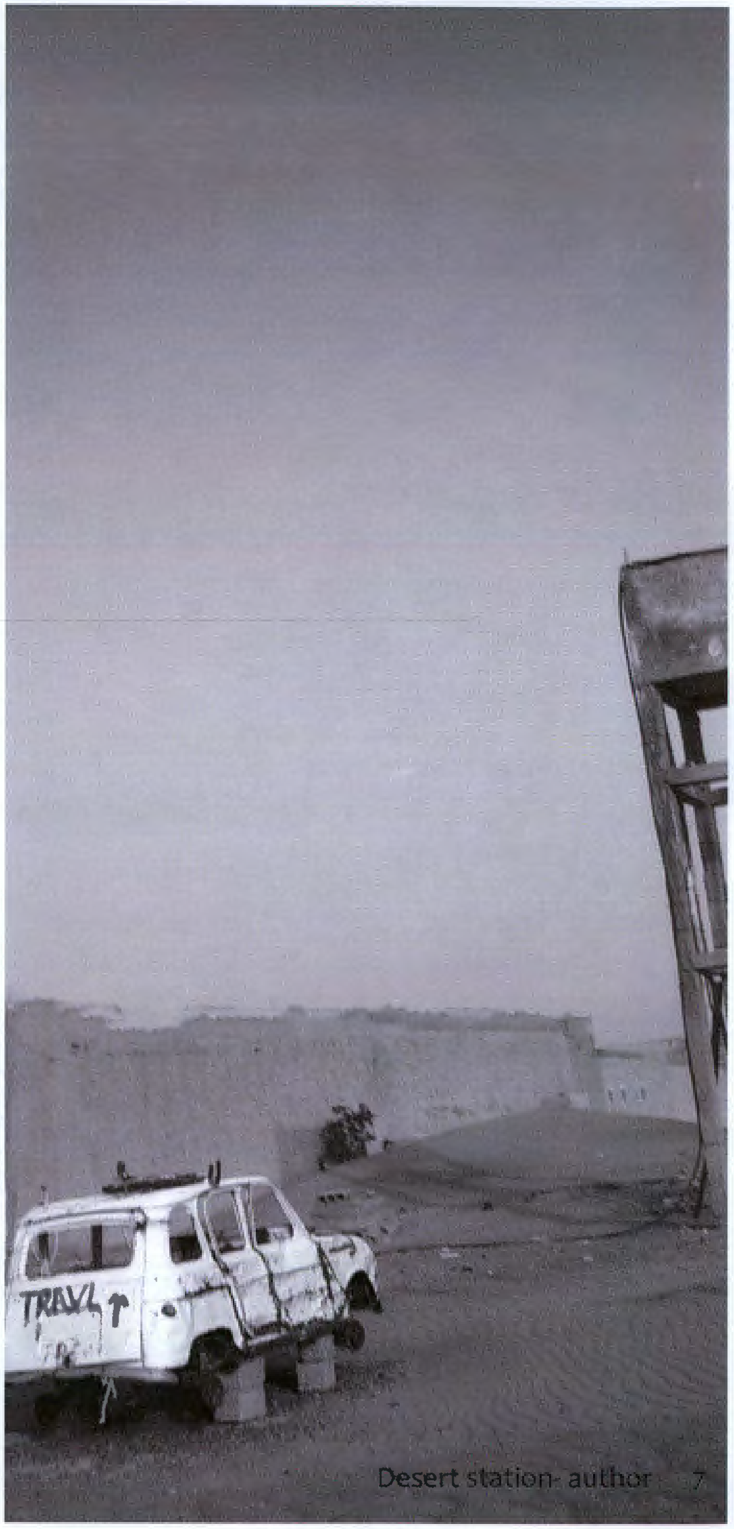
This dissertation began as a study of a portion of the coastal Namib Desert that I am particularly inspired by and with which I formed a personal connection over the course of many childhood coastal excursions. From these studies a site within the salt pan mine concession outside of Swakopmund was chosen. Stretching from the ocean to the edge of an existing natural-industrial salt pan, this site becomes the location for my architectural intervention, the Water Line. This intervention is a testing space for a small scale solar desalination and fog catching system that services a hydrology research center base, as well as attempting to incorporate a more public exposure to this form of technology and the water resource potential it provides.

Before design within this landscape could be considered, both a more poetic and pragmatic understanding of this peculiar place and its extreme conditions was necessary. In considering the landscape and celebrating the natural-human idiosyncrasies of this particular landscape, and a specific site within it, the hope of invoking and advocating for the singularity of local phenomena is attempted through design.

Throughout this dissertation the understanding of context and character of place was viewed as a means by which the architectural possibilities of the intricacies, peculiarities and experience of a space and landscape could be questioned. It was, and remains, a journey of discovery and understanding of place.

The intention of this document is to highlight the many aspects of the environment; from historical, human and biological interrogations to its experiential and functional clues. Understanding context and landscape through multiple layers and scales is vital in this space of eternal contrasts. It is in a sense the only way to obtain a greater understanding of "sitedness" of this project. The existing responses to environment and place-making within this context also provide clues to how to capture a unique response to the singularities of this space, without succumbing to the ease of uniformity. Within this understanding is the theoretical questioning of what the architecture of this space could become.

1. Place of the desert coast



Desert station- author

Broader context mapping-
Underlay sourced from google earth + Robertson and et al, 2012

1.1 "The wide place"

"The vast place" or "The place that God made in anger"[2] is an apt naming of the Namib Desert, yet in simplicity, these monikers fail to portray the depth of experience concealed in the Namib's varied mosaic of landscapes and the associated living adaptions contained therein. They also do not describe part of its fundamental geographical and qualitative attributes, in that it is the space where the desert meets the sea, the space where two vast horizontal planes collide and simultaneously touch the sky.

The desert's relationship to the sea defines it. Geographically the cold Atlantic both keeps the entire linear edge of the country arid, as well as provides its lifeline in consistent advective fog.[3] This fog belt, described as "the mist is down", is a temporal "drawing of the curtains" characteristic of this vast space which can define a completely different spatial experience. In a schizophrenic moment a vast, warm, unbound landscape turns into a claustrophobic, cold, grey engulfing experience.

It is easy to be overwhelmed by the sheer scale and harshness of the place and its landscape. One can simply not know where or how to respond to it. In an attempt to gain an understanding of context and formulate a responsive approach, inspiration and lessons were taken from research into different characteristics of this coastal environment.

Despite the fact that many of these lessons and descriptions apply broadly across the whole Namib Desert (as any intervention within this space was invariably linked to a vast inland and sea-based resource network), focus is given in reference to a specific part: the coastal area in which this thesis is based. This region is broadly described as part of the coastal gypsum gravel plains. It is a stretch of desert coastline trapped between the mouths of two ephemeral rivers, essentially between the town of Swakopmund (Swakop river) and Henties Bay (Omaruru river). It is "the in-between," beyond the iconic sand dune sea of Walvis Bay and before the seemingly unending sandy wilderness of the Skeleton Coast. Protected by the occasional major flash of inland river waters, these plains are sheltered from the tide of the wind driven sand dunes from the south[4] and as such this area holds its own unique variety of landscapes and conditions across this desert-coastal cross section.

Some of the clues of the site's inspirational character were broadly sought and explored in numerous aspects of this environment; in its history, human orders, resources, climate, biological adaptions, technology, architectural manifestations and materiality. In a search for conciseness, many of these aspects of the studied area are generalized in the following outlines, but begin to provide an image of the human and natural conditions that define the coastal desert-scape.

Image: author

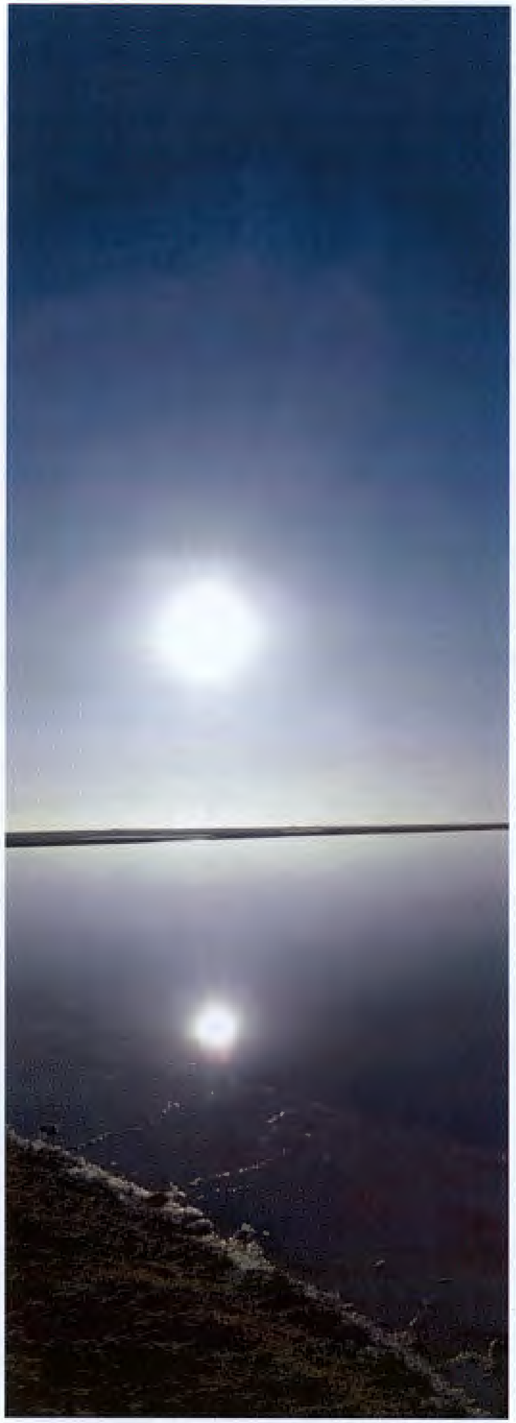


 Image: author

1.2 Climatic clues: Water, fog, sand, salt, sun and wind

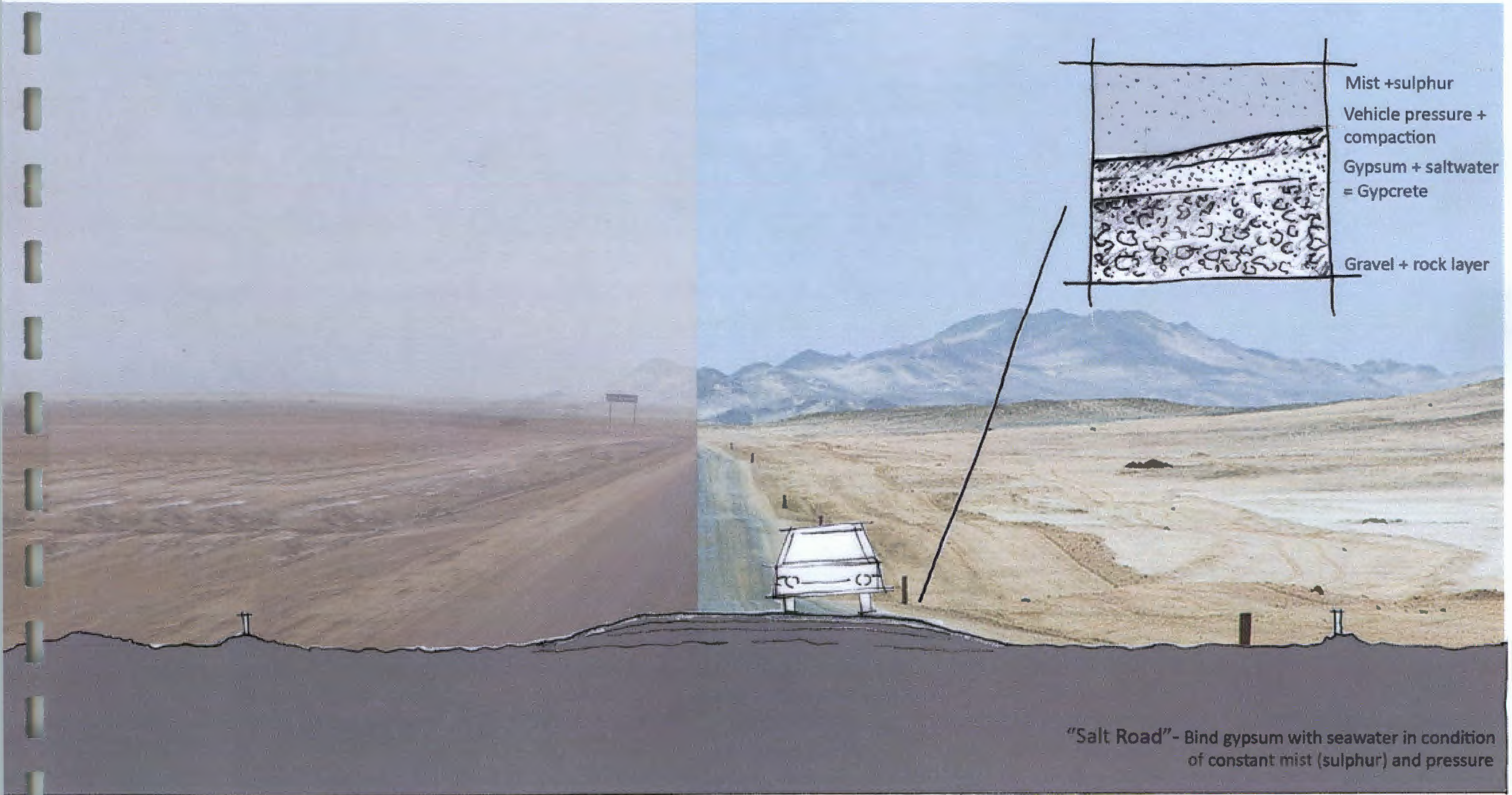
Seasons are not easily distinguished in the coastal desert. With the strong influence of the ocean, temperatures are mild year-round, rarely exceeding 20 degrees Celsius, much lower than the inland desert.[5] The hottest days of the year are actually found during "winter" as it is only during one or two winter months that strong desert sand-carrying winds occur.[6]

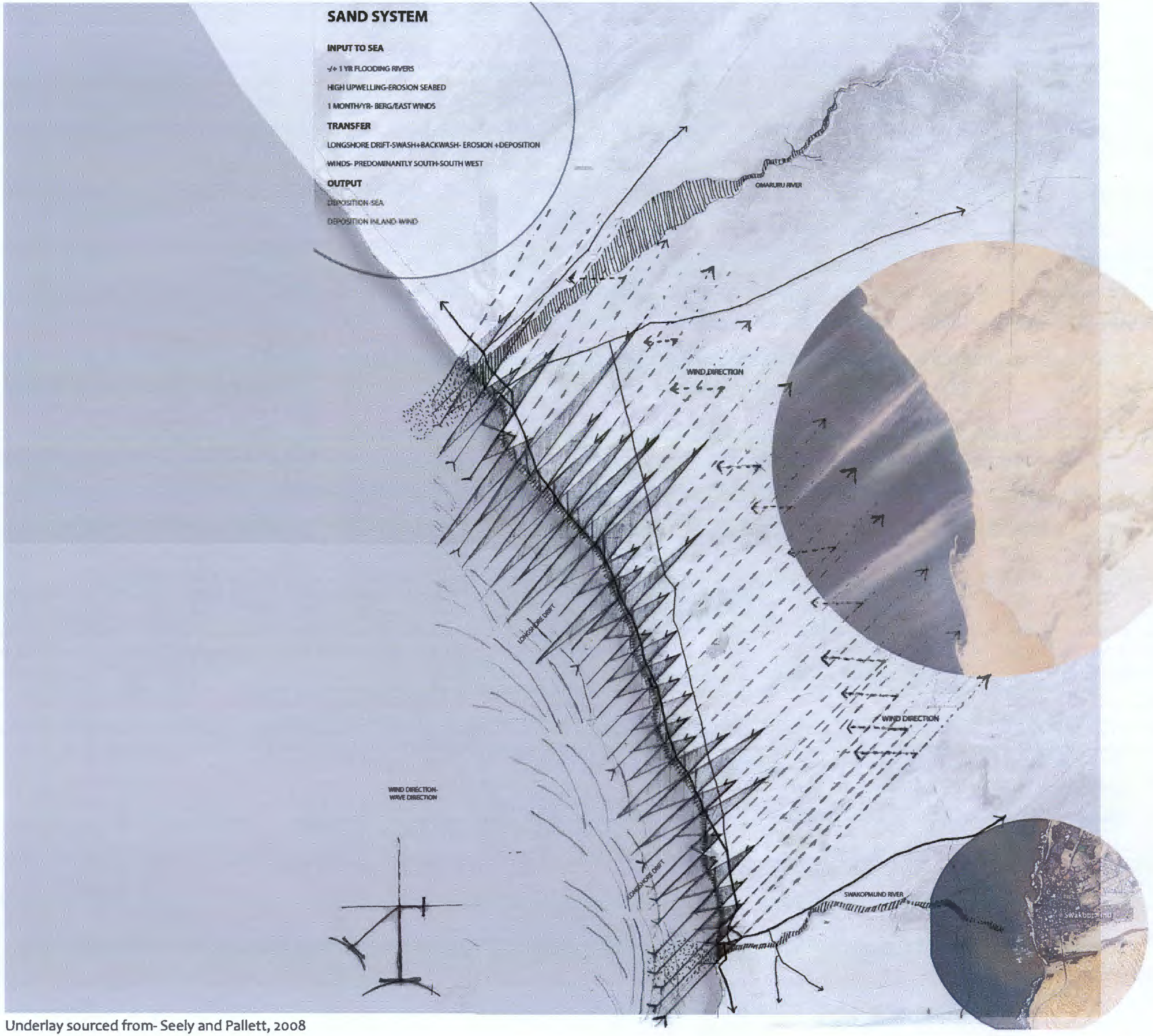
The ecology of the desert coastal region is entirely dependent on its pattern of water resources. With an average rainfall of approximately 20mm a year, the region is mainly defined by fog patterns (map page 13). These patterns allow for the high number of endemic, highly adapted and specialized, life forms found living in this otherwise arid environment.[7] The fog patterns are also directly related to the daily wind and temperature, rather than specific times of the year. They can occur for a few hours in the mornings and evenings, typically dissipating as the day progresses and the harsh sun takes its toll.[8]

Wind is ever-present along this coastline, and although it is easily assumed that it blows directly off the ocean (westerly), it in-fact blows up the oblique coastline from the south, being deflected to create an almost daily occurrence of south-westerly winds.[9] These water-cooled prevailing winds not only create the fogs and keep the temperatures fairly low but are integral to the sand-cycle of the desert. Sand is forced up the coastline by the ocean currents and blown inland by the consistent winds, with its only chance of return in the occasional berg wind or inland flood (map page 12).[10] The connection between wind, sand and ocean is linked through further complex chemical reactions, one of which is the formation of the gypsum plains itself in the reaction between fogs, wind born sea sulphur and the calcium-rich sands.[11]

Salt, sand and water are the eternal corrosive elements of this environment. While salinity is relatively low (34-36 grams/kilogram of water) ,[12] strong oceanic upwellings makes for fertile seawater, rich in organic life and matter. Although harsh, the land-climate conditions are relatively predictable and makes for a sharp contrast to the wild and erratic ocean conditions, in which unpredictable natural factors such as red-tide and sulphur eruptions can lead to a shifting ocean condition.[13]

In living with and responding to this climate, a vast array of biological adaptions have occurred. In human terms, protective shelter and an attempt at a measure of service security are the natural responses to it. Rarely do the climatic, landscape and human needs come together in specific adaptions that appear to respond and belong to all three (an example that is seen on page 11). Although difficult, the opportunities of this context can be found, with hopefully more examples of such adaptions presenting in the future.


Mist +sulphur
Vehicle pressure + compaction
Gypsum + saltwater = Gypcrete
Gravel + rock layer
"Salt Road"- Bind gypsum with seawater in condition of constant mist (sulphur) and pressure



Underlay sourced from- Seely and Pallett, 2008

Images: author

1.3 Historical and human clues:
Narrative of place

The tale of the two sailors

Settler oral history from: Jan Knappert[14]

A strange fate befell two men who strayed into diamond land many years ago. Sole survivors of a shipwreck, they were cast up on a rocky shore whose shell covered boulders grazed their hands, as they crawled over them, exhausted, to the safety of dry land. After resting awhile they started walking inland through the hills along the coast. The rocky slopes tore the skin from their feet until they were forced to stop and sleep. When morning came they found themselves in the desert and as the sun rose higher it shed a radiant light which reflected off a million glassy pebbles lying scattered all around.

The two sailors rubbed their eyes in the intense glare and wondered what it was they were walking on. Suddenly they realized- diamonds! Countless numbers of them! They had only to pick up a few and they would be the richest men in the world. So busy were they collecting the largest stones and stuffing them in their pockets that they had forgotten how thirsty they were. The whole day passed, then the night, and the following day saw them weighed down, wandering around with their load of diamonds, but now crazy with thirst. Too late they realized that water was even more precious than diamonds and that they should have found it first. Throwing away all their new-found wealth they ran towards the distant hills in search of a spring or a small pool. Alas all they found were dry rocks. They would have exchanged all the diamonds in the world for a drink of water. There they died, amid their untold fortune, their bleached skeletons still lying amongst the diamonds.

The narrative of both the ancient and current history of this entire region can be mostly described through a repetitive historical pattern of both resource extraction ventures and the access and control of fresh water. Human history is also important but human livelihood in this context has generally been shaped by the lure of wealth hidden in the landscape and subsistence.

Image : Remnants of a strandloper hut
Smith and Kinahan, 1984

Image : Remnants of nomadic settlements
Wallace and Kinahan, 2011

Image : Remnants of diamond mine in Sperrgebiet
http://stories.namibiatourism.com.na/:blog/?Tag=Luderitz
03/09/2014

Conceptual image- historical nomads

1.3 Narrative of place:

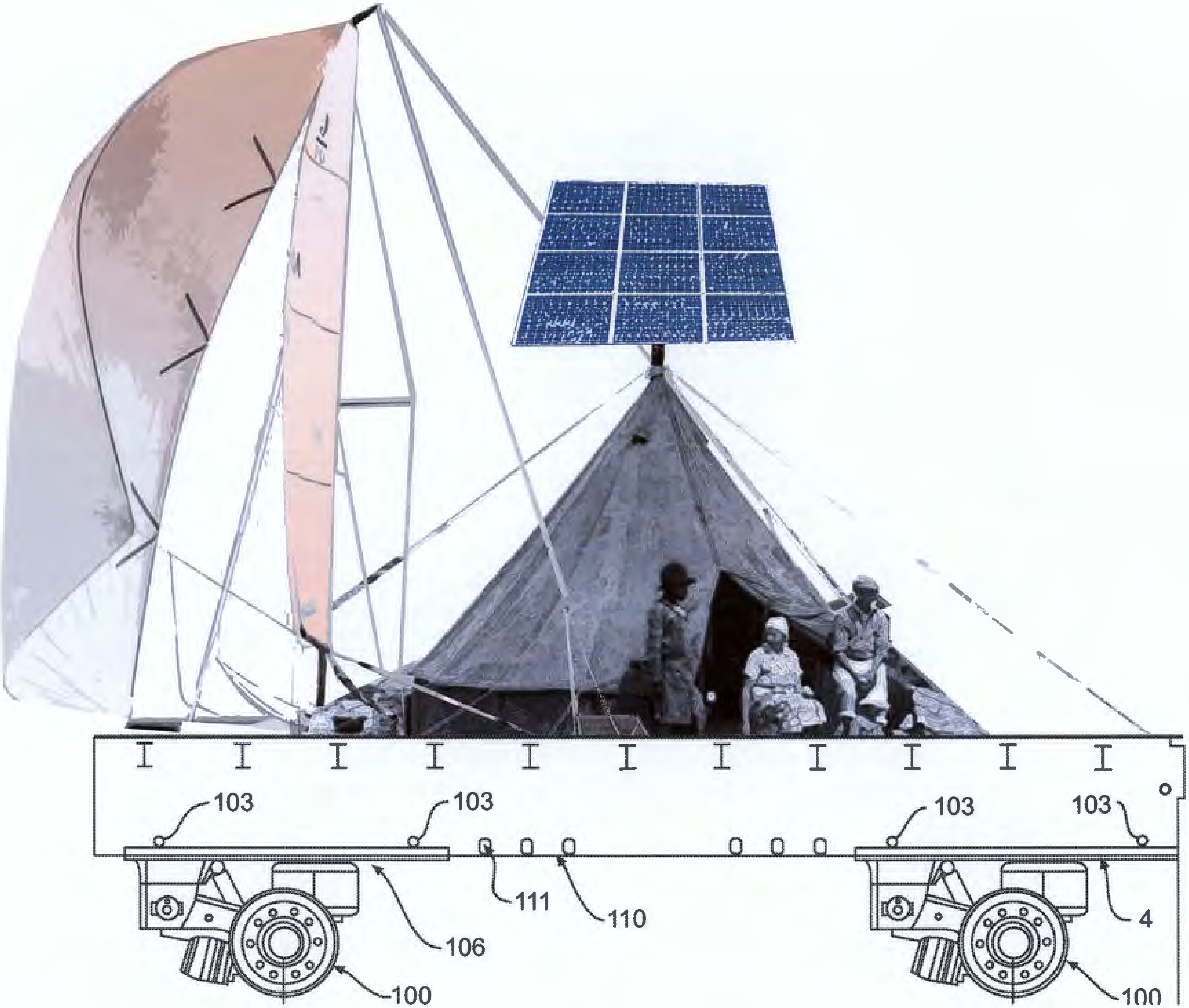
1.3.1. Nomads

The archeological ancient narrative of the coastal Namib describes a space which was virtually uninhabited by humans. This being said the ancient human historical narrative is not unimportant. It describes a pattern of human movement, adaptability and resourcefulness that was not only highly environmentally responsive is still visible today in the ways in which the coastline is temporarily occupied through migrant industrial communities and visitors.

Generations ago the desert was inhabited by highly adaptive nomadic peoples. The Namib plains were home to small hunter-gathering communities succeeded over time by small stock pastoralists, many of whom were identified as the coastal 'strandlopers' by the earliest explorers.[15] These communities were present only when they were able to penetrate the deepest desert with exceptional rains and or the carrying of water rich !Nara melons.[16] Archeologically speaking even these temporary communities seemingly disappeared from the desert-coastal routes in the increasing aridity sometime between the 13th and 15th century.[17] The only remaining ancient communities inhabiting an area of the Namib Desert space is the Topnaars (Aonin), implied descendants of the strandlopers, who survive as pastoralists, living off the Kuiseb riverbed.[18]

The Namib Desert environment has been described as a protective "impenetrable shield" to the onslaught of initial colonization.[19] Portuguese explorers landed in the few natural bays along the coastline from their earliest voyagers of the 1400s. Similarly other European explorers and trading vessels moved up and down the dangerous shores, wisely never fully attempting to access the desert-space. Instead they relied upon the trading points found in a few safe bays and the natural harbor and Kuiseb water point of Walvis Bay.[20]

In response to the politics of the time and many a rapid resource rush following the colonization of Namibia, initially by Germany and thereafter by mandated South Africa, the coastline slowly developed a number of small coastal desert settlements.[21] These small strategic bases were almost always related to a mine or industry and, if possible, situated near to a natural water source.[22] Many of the more isolated settlements, mines, industries and infrastructures failed, due to many factors, most of which stem from the cost of access; with difficulties transporting water and goods through the sands, and their utter dependence on foreign markets, imported resources and labor.[23] Many of these developments were abandoned to the desert, serving as reminders of the dominance of the harsh sea-sand environment, and in recent times acting as curiosities and popular tourist attractions to landscape adventurers.



Conceptual image- visitors

HISTORICAL WATER LINES
ACCESS, TRANSPORT, BASES

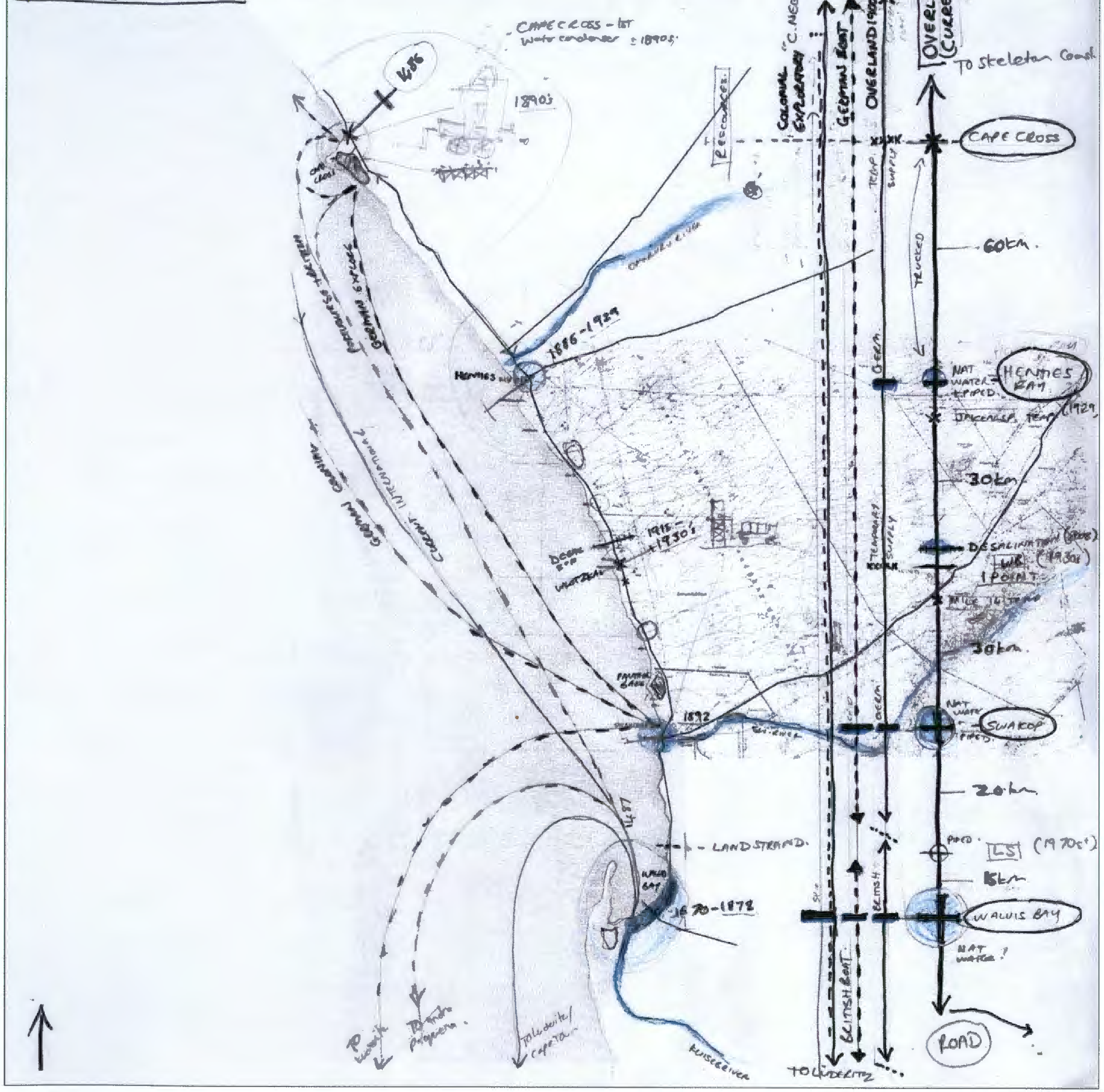



Image : Abandoned mine in Sperrgebiet
http://stories.namibiatourism.com.na/blog/bid/307846/Pomona-Namibia-s-Forgotten-Ghost-Town
accessed:03/09/2014


Image : Oil Rig Skeleton Coast
http://www.getaway.co.za/travel-ideas/abondoned-sites-southern-africa/ accessed:03/09/2014

MAPPING COAST: INDUSTRY-TOURISM-ROUTE

1.3.2. Water and rescources

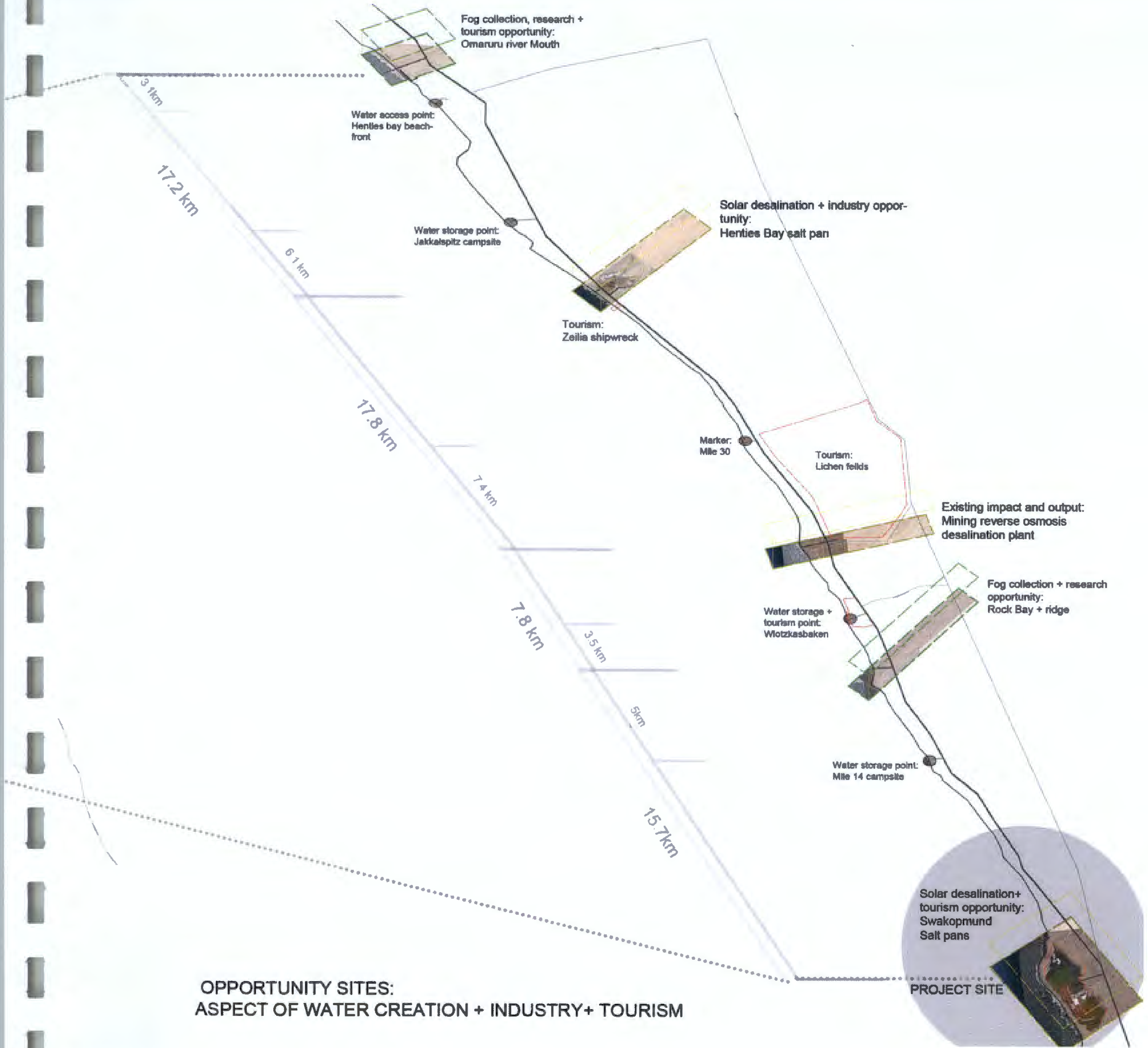
At first, some semblance of permanence could only really be obtained at naturally strategic points within the Namib, based solely on a measure of water security. These "water bases" or settlements formed the basis for desert developments, but the harsh environmental factors and their isolation kept them small and difficult places to inhabit.[24] With rapid growth in mining and industry as well as migrating settlers the reliance on these ancient aquifers grew, as did the technology allowing water pumping, piping, storage and transport. With permanent water pumps found above the aquifers of the three major rivers and a slowly developing system of inland dams, water availability was beginning to allow for expansion and exploration.[25] Like the original nomadic people, more isolated, temporary communities could begin to survive in this landscape by simply carrying and storing water with them. This system essentially began to open up the desert to recreational tourism, creating an industry that today is the second largest coastal income generator after mining.[26]

From as early as the 1960's the intense pressure on the natural coastal water resources began to highlight the costs of growing populations and mining ventures.[27] To combat this, modern infrastructural ventures such as water reclamation plants and aquifer recharge dams were implemented.[28] These schemes helped temporarily reduce the growing cost on the existing resources.[29] The current situation of coastal development, especially in the Swakopmund area, shows the continuing cycle of resource exploitation, dependence on foreign markets, nomadic experiences and intense water demand. Amidsts these constants, what has shifted is the perceived environmental attitude, with conservation tourism and environmental research highlighted as important factors in the continual survival of coastal settlements.[30]

In a cyclical way the desert coastline settlements are still equally dependent on foreign and temporary resources and infrastructural developments. With a uranium rush beginning in 2007, the majority of major investments in terms of infrastructure and especially in temporary water security have originated from majority-owned foreign uranium mining companies, primarily to benefit mines with an average 20 year lifespan.[31] The entire coastal desert economy can be made entirely worse off in any shift of global price or opinion in uranium, as investment is halted and the mines go into hibernation.[32] Equally any slump in tourism can have severe wide-spread economic effects in this area.

Currently the country's public water supplier, NamWater, has indicated that the only long term solution to the water security of the coastline lies in water creation, namely desalination, as current resources can in no way supply the sizable new uranium industry.[33] Similarly it struggles to support recreational tourism increases during holiday seasons as well as swelling populations accompanying the shifting mining labor forces.[34] Although a large industrial plant appears to be the simplest solution to water security, it appears that the municipalities would struggle to access and afford the water from currently proposed desalination plant typology.[35]

MAJOR WATER CREATION OPPORTUNITY SITES
Map underlay sourced from google earth



OPPORTUNITY SITES:
ASPECT OF WATER CREATION + INDUSTRY+ TOURISM

1.3.3. The nomad-fixed dichotomy of place

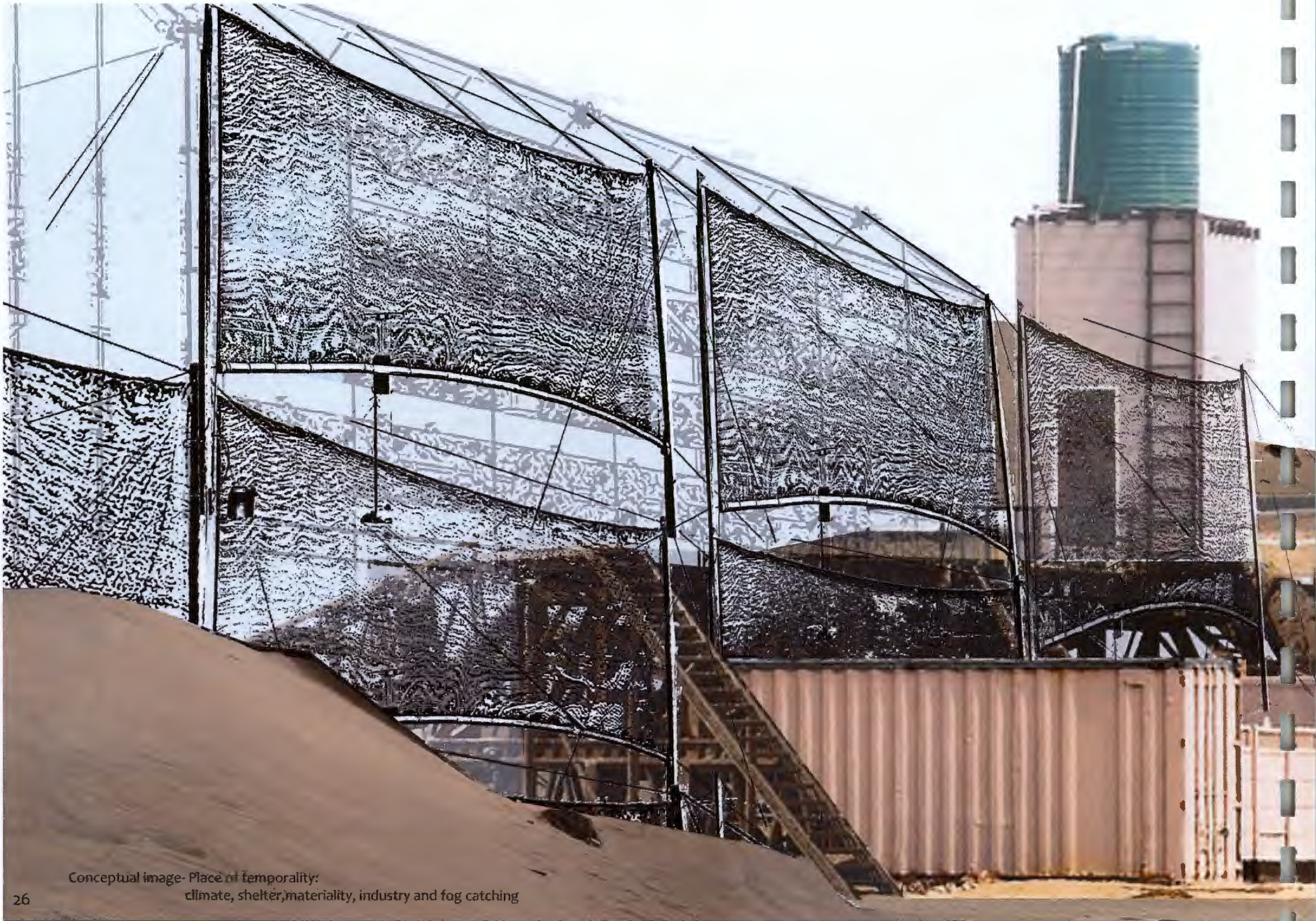
"Before the coming of the missionaries these people (the Nama) wandered about from fountain to fountain seeking pasture for their stock. Large permanent fountains, or pools in river beds were claimed as their property by the different groups, rather than areas enclosed by definite territorial boundaries."

Hornele,W [36]

Even within the current water-security situation of the coastal desert, the narrative of place is continuing to highlight the nomad-fixed dichotomy of the desert space. This dichotomy highlights the past and present inhabitation requirements of the foundational "fixing" of an aspect of the spatial experience, be it in the solid infrastructure, resources, supply base or the historical knowledge of the natural locations of the !Nara fields. Although there is a permanent population base in the desert, it is generally a group of people that still moves a great deal, be it up and down the coast searching for the best subsistence or recreational fishing holes, inland or from place to place for employment or services.[37] The setting up of a home-base point with daily excursions up and down the vast coastline and to the major desert and wildlife tourist attractions, or even the full transport of ones resource base in the form of camping, is a major aspect of the tourist population's linear desert-coastal pattern and experience.[38] Thus in both the local and visiting human experience, movement through the desert space and identification of "fixed" base points, or "places" within the vastness of space becomes vital.

Another important aspect of this dichotomy is the understanding of time and materiality as they relate to this specific climate. In terms of any "fixed" aspect there is often the acceptance of short active lifespans, incredible understanding of maintenance and pre-planning or recognition of the inevitable material failure of any built human intervention. This can make for an especially defeatist character of place, yet it is also strangely liberating, renewing and poetic. Not only does the contrast between the constantly shifting, highly fertile marine environment and ancient unchanging, barren desert plains speak to a different understanding of time and place, so does the understanding of the human-material-natural condition or the notion of reliance on the "fixed" or "mobile" aspects of the space .

Conceptual image: Place of temporality-
tourism, recreation and water collection (fog catching)



Conceptual image- Place of temporality:
climate, shelter,materiality, industry and fog catching

1.4 Architectural clues:
Theoretical perspective

The desert-scape is an environment in which any man-made intervention or human experience can be peculiarly viewed as something that is either jarring, as a stark counterpoint to the landscape, alien in fact, or interventions, forms and experiences that are curiously harmonic when contrasted against or nestled within the vast vistas of the unbounded space. Strangely, either of these responsive approaches to the desert experience, "the alien" or "the nestled", can positively create a greater understanding of the peculiarities of this desert place and its people. Neither necessarily provides meaningful or even beautiful architecture, but is in some way intriguing and responsive to its character.

When examining architecture as responsive interventions in landscape, the first impulsive reaction may be a purely imitative one. In imitation, this type of architecture is as nestled or hidden within the space as possible. Similarly when dealing with such an extreme climate, a functional bio-mimetic response may be sought. In contrast, a completely alien character can be sought; one which highlights the landscape through counterpoint; for example in this vast horizontal landscape exemplifying the vertical line. Some of the most interesting interventions seem to contain a cocktail of these architectural approaches to place-making, which rationally may appear to be in contradiction of one another. The ability to begin to understand the ambiguity which allows for both the distinct aspect and blending aspect of architecture (or "the alien" and "the nestled"), or their combination, to appear at home in this landscape was questioned through an investigation of the theory of camouflage.

This is not camouflage in the traditionally understood sense of purely blending in, but in the contemporary reading of camouflage as the "urge to stand out" from the environment, as a tactical response to place that still presupposes the urge to blend in and vice versa.[39] In a sense it is the theoretical understanding on a need to visually both "articulate identity and difference" as well as assimilate to and perceive ones place within an environment as harmonious.[40] The following section theoretically attempts to understand place, through the seeming paradoxes of behavior and architecture of divergence and of blending in, as it looks at mimicry, distinction and camouflage as theoretical ideas that have influence in architectural moments seen within this desert landscape.

Desert Images : author
Wlotzkasbaken house 2- camouflage

1.4 Theoretical perspective:

1.4.1. The art of camouflage

Mimicry and camouflage theory

Mimicry, arising from the word mimesis, is a philosophical term that has been utilised throughout different fields in an effort to explain the role of "the representation" or "replication," first highlighted in classical theory in relation to "truth" and commonly used to debate the position of art in aesthetic theory.[41] The term mimicry, or mimetic, is described in numerous theoretical writings, but Rodger Caillois, Neil Leach and to an extent Jacques Lacan, relate camouflage as its result and in instances its intention. Mimicry, to these authors, is the physical, behavioural and psychological connections and adaptations to the environment (or other people, organisms and objects) which can result in a camouflage response.

Mimicry and distinction

In describing mimicry as a biological and anthropological theory, Rodger Caillois, addresses the relationship between organisms and their surroundings. Using examples of animal mimicry Caillois challenged classic Darwinian approaches to express the notion of mimicry, not as an act of survival, but as a connection and disconnection to nature, through entering into its logic.[42] Thus mimicry is a form of "sculpture photography" or "prestigious magic" fixed at its culmination point.[43] This action is the intermediate stage in a search for "the similar" where the ultimate objective is to assimilate to the surroundings.[44] Although he recognises the anthropomorphic danger, Caillois uses natural mimetic examples to identify human behaviour and relation to our environment. For humans, mimicry is nothing more than an urge to lose ourselves in the full awareness of space.[45] But the act of mimicry in normal society is, for Caillois, inevitably tied with the act of distinction, as "there is assuredly none more clear-cut than that between the organism and its surroundings."[46]

Lacan also recognises this relationship but highlights the active nature of mimesis in both assimilating to and remaining distinct from our surroundings, that results in camouflage. For Lacan:

> Mimicry reveals something in so far as it is distinct from what might be called an itself that is behind. The effect of mimicry is camouflage, in the strictly technical sense. It is not a question of harmonising with the background but, against a mottled background, of becoming mottled...[47]

Therefore, to Lacan, mimicry is not only a desirable end in and of itself, it is also a means to an end.

Camouflage and responsiveness

Caillois seperates and identifies the effect of mimicry in three categories:

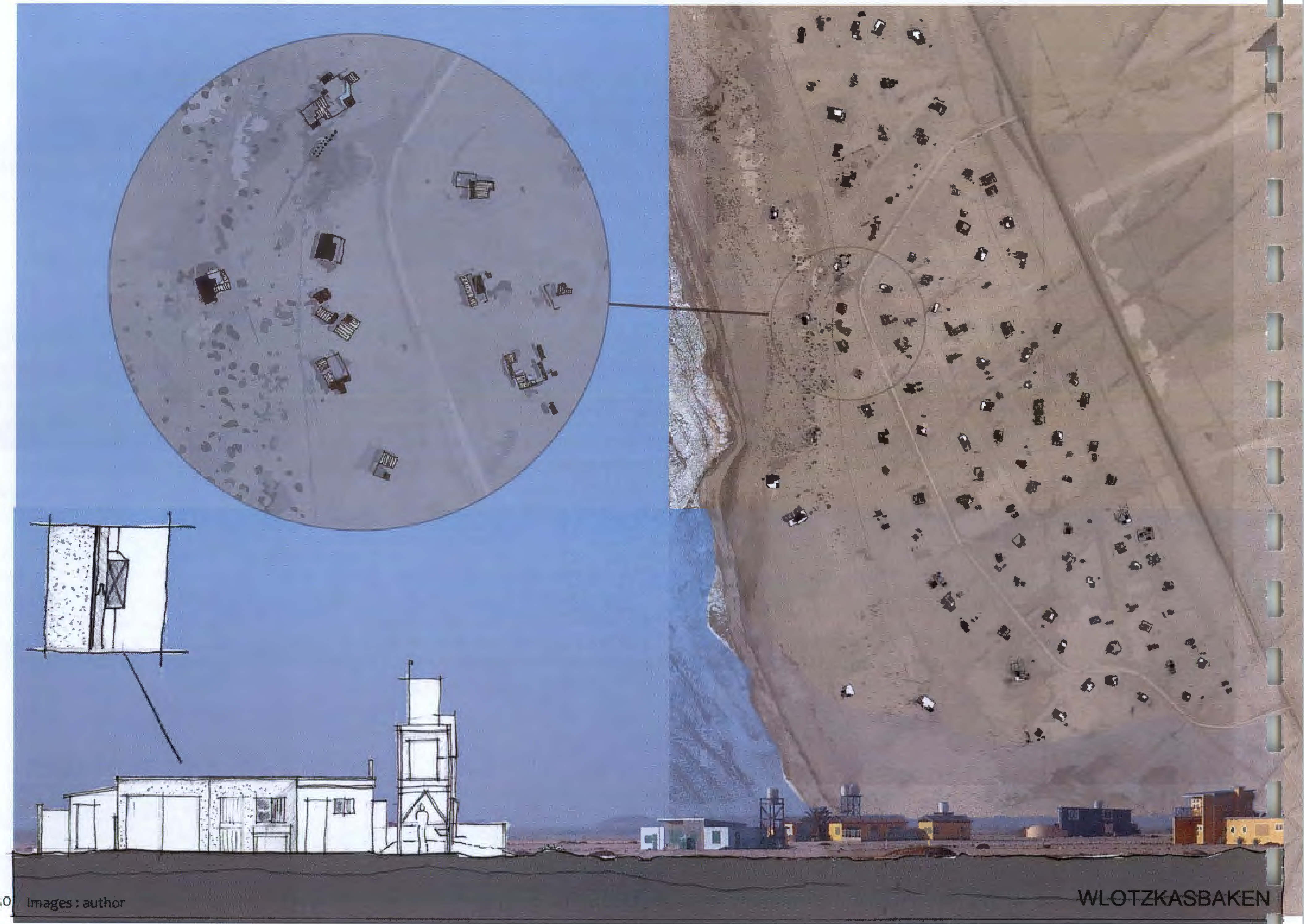
> Disguise is essentially imitation, that is to say the taking of a definite, deceptive appearance , one that can not only be identified but will also put the creature seeing it on the wrong track. Camouflage is a disappearance, an artificial loss of identity; it makes the creature fade into its background so that the observer can no longer mark it down. Intimidation is an appearance or action tending to produce an exaggerated fright, one with no real basis... [48]

In the form of disguise, camouflage and intimidation, he applies mimetic impulses to human instinct and physical response. He ascertains that these responses and their results are nothing more than a "mask" allowing temporary access to a higher order. Although describing these "masks" as separate he does recognise that they are inherently related and often a form of disguise can constitute camouflage, while camouflage can, for example in military terms, allow for intimidation.[49] Similarly the notion of these Janus-type "masks" in human and biological behaviours can be applied to architectural responses in forms and facades set to highlight access to specific experiences or moments of or within a place. However the mark of human application of mimetic camouflage techniques goes beyond presentation. Human camouflage is active; responsive but varied, even within the same context, and has the ability to be altered at will.[50]

Like Caillois, Neil Leach recognises camouflage as result of assimilation to the surroundings. However, for Leach camouflage is described as a "broader sense of representation and self-representation that is always-already at work in culture."[51] As camouflage is not just simply statically representational it allows not only an initial assimilation to the surroundings but an active, physical response and re-interpretation.[52] Thus architectural camouflage is both a mode of representation of self and place as well as actively operates "through the medium of representation itself- through art, dance, music, poetry, architecture, and so on."[53]

For Leach camouflage is directly related to architecture as both a means, by which man can be encouraged to and attempt to connect to place, and as an expression of an awareness of place itself. Camouflage is not only a façade or Caillois's "mask." When applied in architecture it is the realisation of architectures potential as a mediator between man and his surroundings, as well as, a medium through which assimilation to place is promoted.[54] In mimicry and Callois's camouflage theory there is an implication of a literal state of visual similarity, but Leach highlights that, although this is often the realisation of camouflage, its role is not to disguise. Rather, camouflage's role is that of distinction; in providing a medium for temporary symbolization.[55]


Desert Images : Author
Satillite Tracking Base, Salt pan pump



Images : author

1.4.2. Case studies: Camouflage architecture

As Leach identifies architecture as a mode and medium for camouflage, he also identifies and explains key aspects which can be identified within a responsive type of architecture; a type which is not necessarily visually similar or even fully comfortable within its landscape and context. In the following section a few examples of architecture and Namibian desert places will be described through these theoretical aspects and their relation to camouflage.

Privileging the whole: Blending and landscape

"In the very design of buildings, the architect may articulate the relational correspondence with the world... These forms may be interpreted in a similar fashion, by those who experience those buildings, in that the mechanism by which we begin to feel at home in the built environment can also be seen as a mimetic one."[56]

"The background" is the indispensable relation to camouflage. Without an initial assimilation to the surroundings, a separation, re-interpretation and response are impossible. But this response, be it physical, artistic or enactive, not only represents this process, but allows others to similarly experience some form of assimilation.[57] Thus the apparent issue with camouflage in architecture is time.[58] It is dependent on place, user and time all at once in order to gain relevance with people, and Leach therefore recognises that "individually designed "object" buildings should give way to the character of marginal landscapes more readily suited to their eventual role as part of some "background horizon of consciousness."[59] In privileging "the background" in one way or another, architecture recognises its mediatory role within it. Although highlighting "the background" in camouflage, a vital understanding of the dependence on people, place and scale contributing to this identity and "blending" of background space must also be recognised.

This aspect of camouflage can be seen in an extreme form in architectural examples such as in the architecture of the Open City Amereida in Ritoque, Chile. The very nature of this "city" is exploratory, as it was conceived by the architecture school of the Catholic University of Valparaiso as an experimental spatial development linked by place.[60] Some of its buildings literally mimic and express the landscape while others seem to provide a greater connection or awareness to their sites through architectural intervention. Other buildings are "practicing camouflage", in the sense that they are either left to decay or remain in a process of unfinished construction, constantly undergoing change and understanding of the site through unrestricted building.[61] Essentially, through architecture, it expresses camouflage as both a mode of representation of place and medium in which it can allow for multiple interpretations of it.

Wlotzkasbaken-landscape : author

32 Wlotzkas- "baken": author

In the Namib context there is an interesting example of this "both-and" architecture. In terms of landscape and human response the small holiday settlement of Wlotzkasbaken has a unique character of desert dwelling based on the interesting effect of background, object and scale. When viewed from distance the settlement unit appears as cohesive within the desert landscape. As a collective it effectively blends effectively into the horizon. Visually the buildings making up the home units are scattered, with very little relation to one another. Rather, they relate inwardly and to the site conditions of each plot. When viewed closely, each home is an "object" building. Often standing apart, formalistically and materially simple but different, and designed or painted to create a strong sense of individuality in each of these units, while also defining their own unique sense of place. Although privileging the landscape and local site conditions these homes also celebrate a unique character of place within their own individuality. What inevitably links them in common character beyond their scattered landscape response is a functional architecture, an expression of survival in the vertical, the water towers attached to each unit. Similarly the "baken" or beacon that initially defined the human inception of this random piece of desert-space as place, is in itself an alien form. Being a tall beachside tripod this marker has changed relevance in time, but despite being an artificial beacon, alien to the natural landscape, it appears to belong to its background.

Distinction: Sensuous engagement and the surreal

"Camouflage can be read as a productive exchange... here it refers to an engagement with the world. It may operate in three dimensions, and is not limited to the two dimensional realm of the image. It may even be immaterial, as in the case of music. But there is always a visceral engagement..."[62]

Leach portrays the importance of architecture as not only part of the physical but also of the psychological experience. In a sense camouflage is part of the means by which we assimilate ourselves to the environment; the means by and result through which we either adapt to the alien around us or adapt it to us. This idea superficially appears to presuppose that, being adaptable, architecture itself is seemingly unimportant, as man will simply assimilate to anything. Leach counters this argument with an understanding of architecture's purpose as the means through which stimulating, surprising and enchanting experiences allow for meaningful sensuous engagement, with both the physical architecture itself and its context.[63]

This type of sensuous engagement is linked to both the blurring of boundaries between people and landscape and organic and inorganic, and the active distinction with jarring, uncanny moments, that are necessary for identity or in psychological terms "separation of self."[64] This mix of separation and blending and the invoked sensuous response is often present in uncanny moments in interacting with or viewing desert architectural interventions. Some of these moments are present in the experience of Wlotzkasbaken, when highly technical interventions are contrasted against simple low-tech dwelling and materiality. But mostly the distinct, surreal moments or "mythological configurations"[65] of place belong to the contrasts between the experience of landscape and the unapologetically functional technology, infrastructures and abandoned ruins of the entrenched industries of the desert space.

Technology, materiality and place-making

"the boundaries between organic and inorganic were blurred; the body itself, invaded and re-shaped by technology, in turn invades and permeates the space outside, even as this space takes on dimensions that themselves confuse the inner and the outer, visually, mentally, and physically" [66]

Leach recognises architecture as a potential mediator between man and the environment as well as being a means through which a connection is made. He also recognises that we do not naturally connect as singular entities; rather we connect through technology. Thus architecture and technology seem to be linked through the opportunities they provide.[67] As a medium, Leach implies a unity between architecture and technology, as technology and architecture is "forever devising new strategies for dealing with ever-changing material conditions" and allows man to "see ourselves through its use and understanding."[68]

Technology united with architecture becomes a powerful mediator and expression of place. However, care should be taken, as not all technology or technical interventions responds to or is stimulated by the principles that encourage the making of place. With an active search for assimilation or sensuous engagement to place, technology is linked to its own purpose, as well as the function and materiality of the context to which it is engaging.

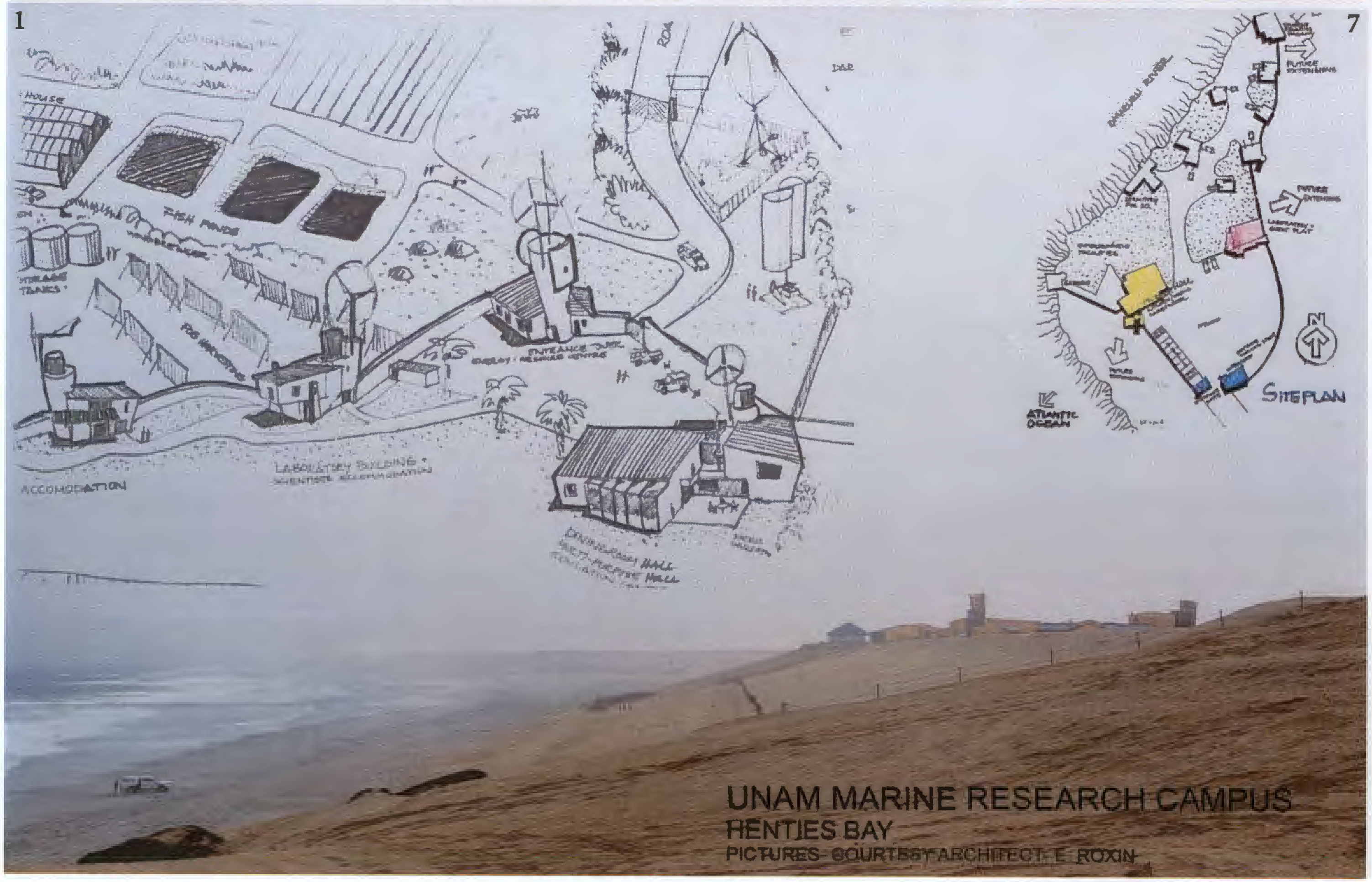
Surreal desert Images : author
Mile 14 camping, Wlotzkasbaken, Salt pans

In a the desert context the juxtaposition between distinct layers; low-tech bases or "fixed" foundations and more "high-tech" skins or secondary structures, as well as the added-on technical machines (that make contemporary desert life easier) can begin to speak to not only the natural conditions but encourage the architectural character of the natural-human- technological interface. The basis of this type of character is seen within some of the Wlotzkasbaken homes, in their additive seemingly ad-hoc natures and solid, service driven cores. Formalistically upgrading and changing technologies are ever present in their forms and expression of occupation or hibernation. For example as spaces are added to accommodate solar technologies, that are wheeled out or clipped onto the structures during times of occupation.

In a more fixed way it is also the language of research bases of the desert, such as the Desert Research Foundation, isolated in Gobabeb, and University Of Namibia's Marine research campus in Henties Bay. These complexes were viewed by their architect as important desert infrastructures[69] and there is an important element of heavy permanence in their abstract forms, and in the case of UNAM station, a light, raised accommodation. These bases are "gathered" points in one way or another, sheltering accommodation in one structure, lines or courtyard spaces, while still recognising the constant movement of researchers to and from it. There is also an understanding of a mix between old and new in the heavy "low" technology and materials that highlights its permanence, and "high" technology, in the highlighting of the services and research equipment required. Both projects contain highly technical aspects that have been added to and changed throughout their lifespan but struggle at the interface between the somewhat infrastructural technologies and the architectural experience.

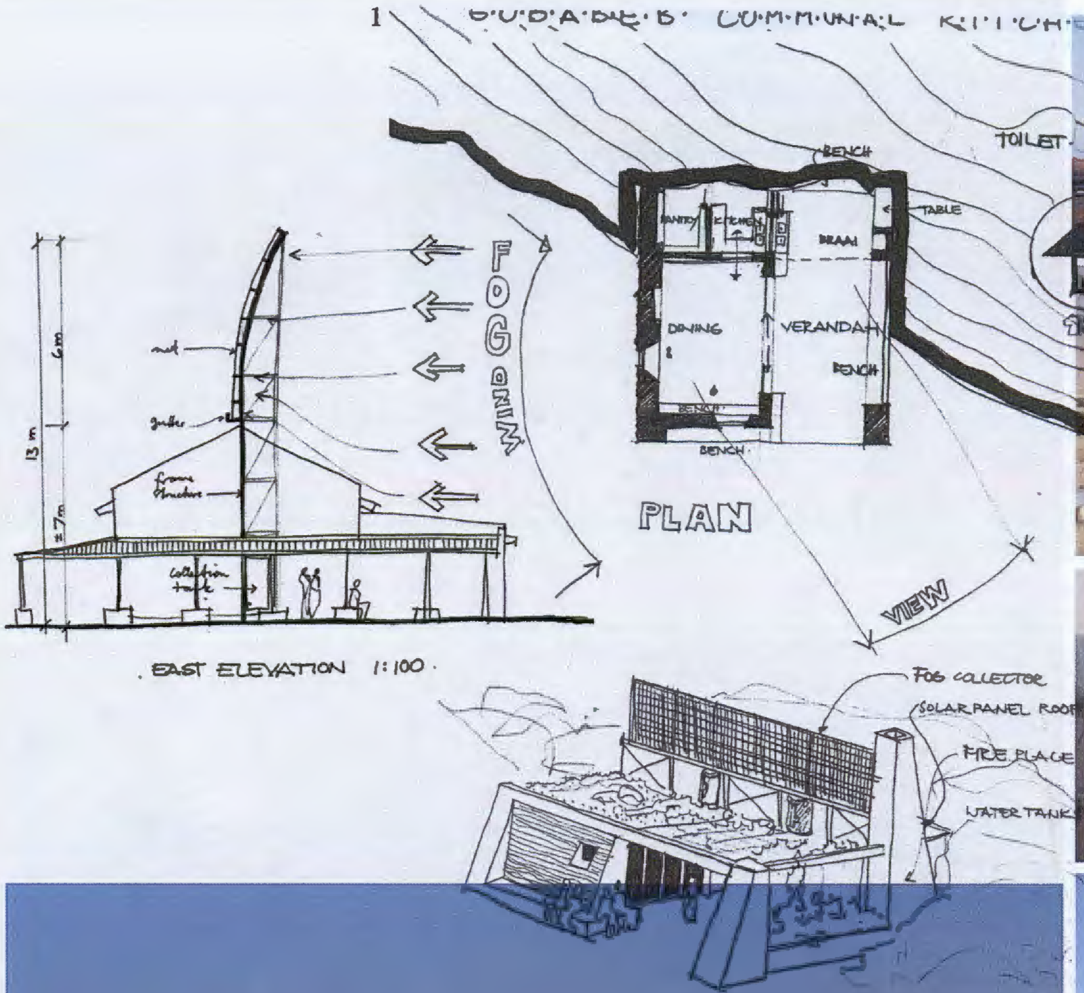
There is opportunity in allowing this type of technical interface into a more integrated architectural experience. The intense infrastructural technologies that service the desert space can, in some ways, become accessible experiences or begin to recognise multifunctional opportunities. In doing so, these surreal machines can start to not only create spatial distinction but begin to have an aspect of blending, with at least the recognition of the sparse human element within the vast landscape.

 Wlotzkasbaken technology: author



1 Drawings by: E. Roxin
2-5 Photographs by E.Roxin
6+7 Author

1


GOBABEB COMMUNAL KITCHEN
TOILET
BENCH
TABLE
PANTRY
KITCHEN
BRAAI
DINING
VERANDAH
BENCH
BENCH
PLAN
1:200
FOG WIND
VIEW
EAST ELEVATION 1:100
FOG COLLECTOR
SOLAR PANEL ROOF
FIRE PLACE
WATER TANKS

2

3

4

5

6


DESERT RESEARCH FOUNDATION
GOBABEB RESEARCH CENTRE
DRAWINGS COURTESY ARCHITECT- E. ROXIN

7

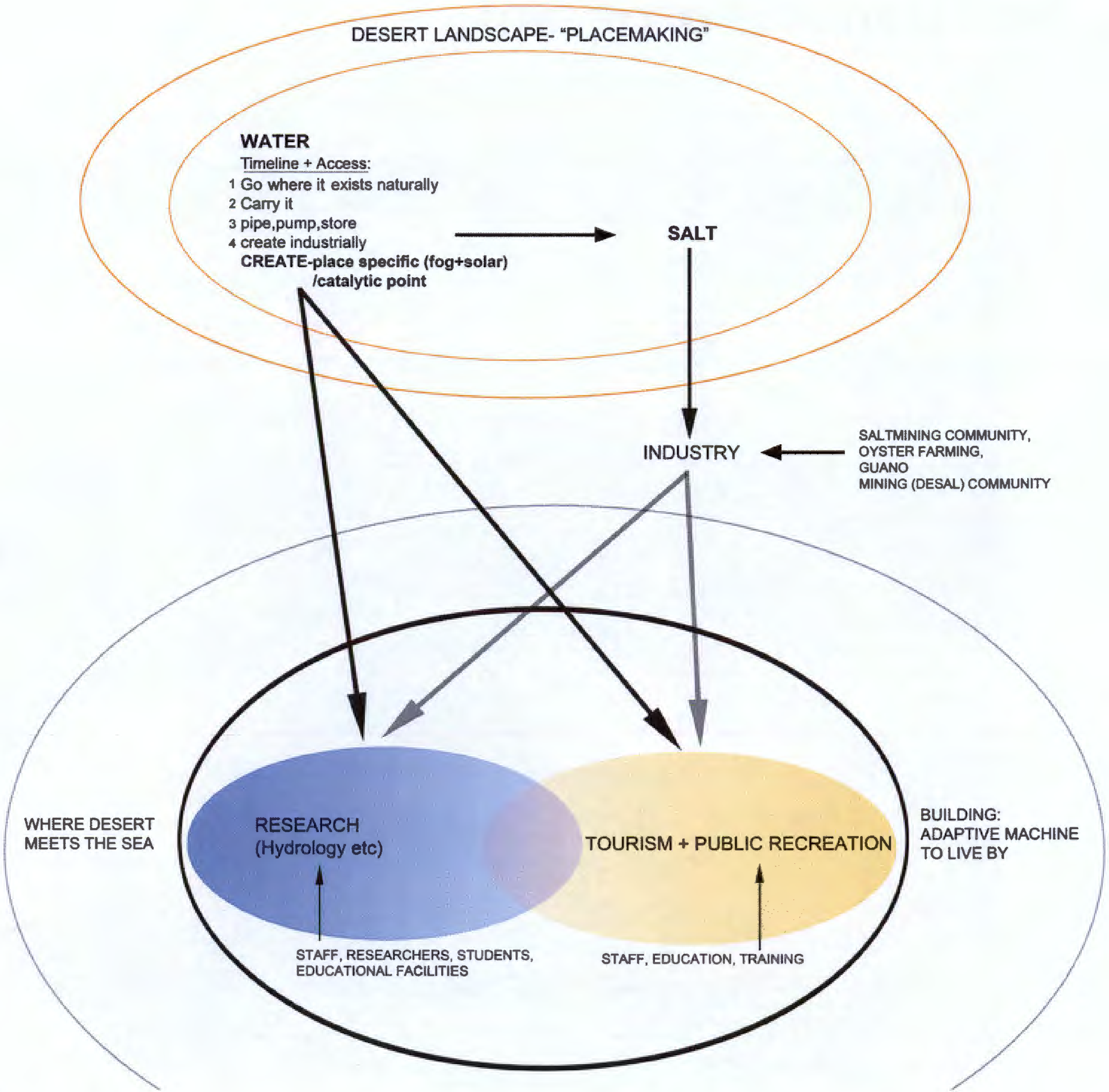
1 Drawings by: E. Roxin
2+3 Seely and Pallett, 2008
4 http://www.gobabebtrc.org/ Accessed:03/09/14
5-7 https://www.facebook.com/pages/Gobabeb-Research-and-Training-Centre/194358393921471?sk=photos_stream Accessed:03/09/14
8 Gobabeb with Kuiseb river in flood Photo: Paul van Skalkwyk in Seely and Pallett, 2008

1.5 Endnotes

1. Norberg-Schultz, 1996, p. 422
2. Wallace and Kinahan, 2011, p. 10
3. Robertson et al, 2012, p. 8
4. Robertson and et al, 2012, p. 39
5. Robertson and et al, 2012, p. 26
6. Robertson and et al, 2012, p. 26,27
7. Seely and Pallett, 2008, p. 33
8. Robertson and et al, 2012, p. 40
9. Robertson and et al, 2012, p. 29
10. Seely and Pallett, 2008, p. 33
11. Schneider, 2008, p. 56
12. Robertson and et al, 2012, p. 40
13. Robertson and et al, 2012, p. 40
14. Knappert, 1981, pp. 10–11
15. Kinahan, 2011, pp. 25, 34
16. Robertson and et al, 2012, p. 113
17. Kinahan, 2011, p. 25
18. Robertson and et al, 2012, pp. 113–114
19. Kinahan, 1990, p. 5
20. Robertson and et al, 2012, pp. 112–113
21. Robertson and et al, 2012, pp. 113–114
22. Wallace and Kinahan, 2011, p. 133
23. Robertson and et al, 2012, p. 118
24. Wallace and Kinahan, 2011, pp. 151, 198
25. Robertson and et al, 2012, p. 26,63,118
26. Robertson and et al, 2012, p. 158
27. Lange, 1998, p. 301
28. water scarcity solutions, n.d.
29. Burger, 2014
30. Robertson and et al, 2012, p. 172
31. Robertson and et al, 2012, p. 144,161
32. Robertson and et al, 2012, p. 145
33. Namwater et al., 2009
34. Namwater et al., 2009
35. Mseyamwa, 2007
36. Hoernlé, 1985, p. 41
37. Robertson and et al, 2012, pp. 124–129
38. Robertson and et al, 2012, p.158,159
39. Leach, 2006, p. 3
40. Leach, 2006, p. 67
41. Mateo, 2008, p. 164
42. Caillois, 1987, p. 67
43. Caillois, 1987, p. 69
44. Leach, 2006, p. 73
45. Caillois, 1987, p. 72
46. Caillois, 1987, p. 59
47. Lacan, 1998, p. 99
48. Caillois, 1960, p. 63
49. Caillois, 1960, p. 77
50. Leach, 2006, p. 75
51. Leach, 2006, p. 240
52. Leach, 2006, p. 9
53. Leach, 2006, p. 240
54. Leach, 2006, p. 10
55. Leach, 2006, p. 242
56. Leach, 2006, p. 45
57. Leach, 2006, p. 243
58. Leach, 2006, p. 46
59. Leach, 2006, p. 8
60. Pendleton-Jullian, 1996, p. 156
61. Pendleton-Jullian, 1996, pp. 20–25
62. Leach, 2006, p. 243
63. Leach, 2006, p. 10
64. Caillois, 1987, p. 63
65. Vidler, 2003, p. 5
66. Vidler, 2003, p. 5
67. Leach, 2006, p. 240
68. Leach, 2006, p. 241
69. Roxin, 1997, p. 1

2. Siting, function and program

View of site- facing the salt pans and desert beyond
Image: Author

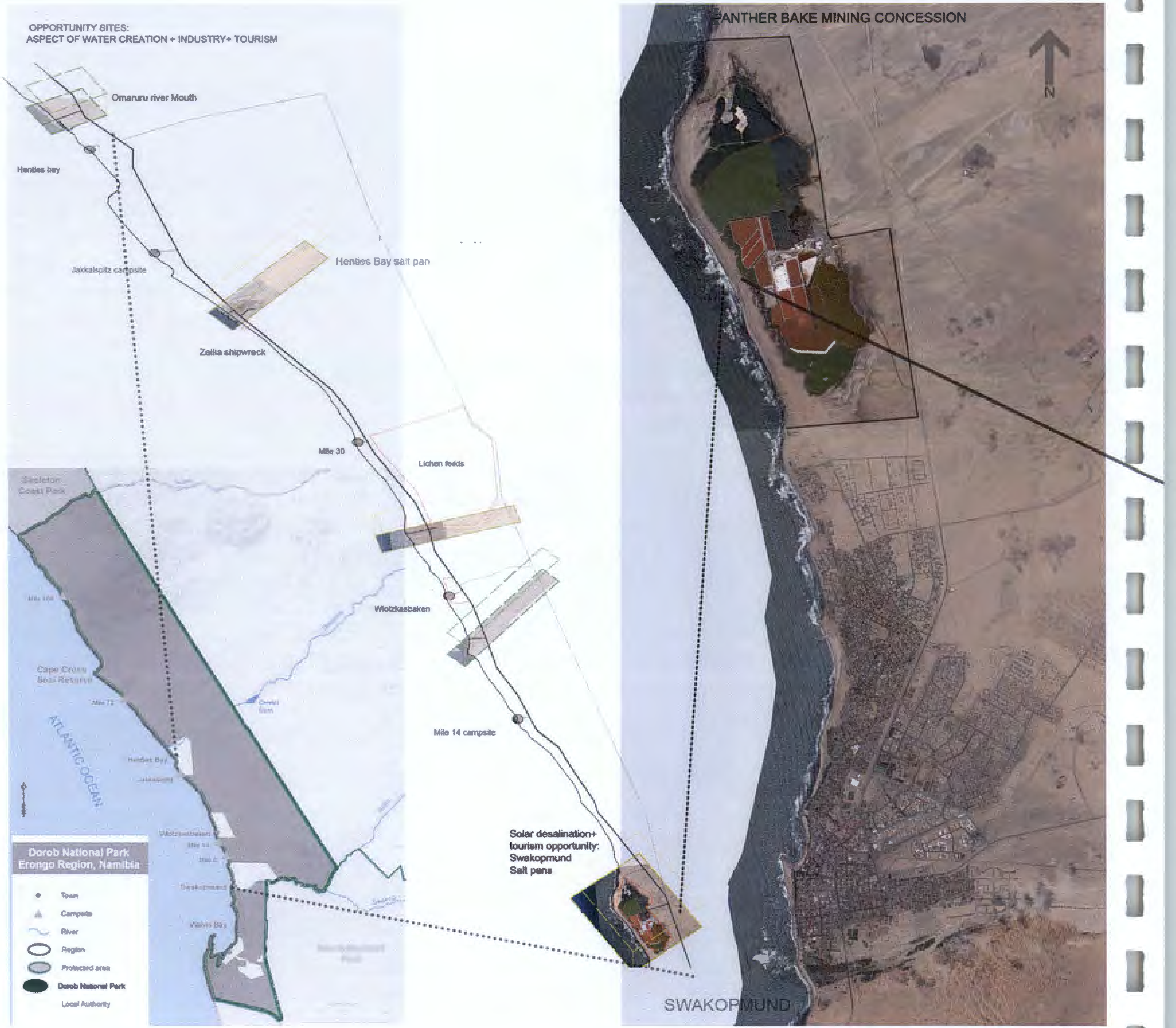

DESERT LANDSCAPE- "PLACEMAKING"
WATER
Timeline + Access:
1 Go where it exists naturally
2 Carry it
3 pipe,pump,store
4 create industrially
CREATE-place specific (fog+solar)
/catalytic point
SALT
INDUSTRY
SALTMINING COMMUNITY,
OYSTER FARMING,
GUANO
MINING (DESAL) COMMUNITY
WHERE DESERT
MEETS THE SEA
RESEARCH
(Hydrology etc)
TOURISM + PUBLIC RECREATION
BUILDING:
ADAPTIVE MACHINE
TO LIVE BY
STAFF, RESEARCHERS, STUDENTS,
EDUCATIONAL FACILITIES
STAFF, EDUCATION, TRAINING

2.1 Introduction

Panther Bake and the Water Line

Through a broad scale investigation into the human, resource and architectural aspects of the gravel desert coastline a few defining clues to the siting, function and program of the project emerged. Firstly the importance of water as a resource, specifically water creation, is and will become a defining feature of its spatiality. Secondly, the prosperity, and to an extent the character, of this place is defined through its link to both industry and tourism. This connection to tourism has only reinforced the strong conservationist attitude towards the coastline. With these factors in mind, there was only one area within the gypsum gravel plains which could meet the criteria of a viable water creation site, has tourist interest, links to an industrial site and is within town boundary lines (outside of the Dorob National Park). This area is the Panther Bake salt mining concession directly north of Swakopmund.

These factors also hint at a functional and programmatic purpose of the building. The area contains the perfect variables for the testing of a solar desalination plant as brine produced could be effectively recycled by the salt industry (this type of water creation system is further described in the technical section). The growing need for the testing of alternative water sources, research into water systems as well as the current monitoring of existing water quality could find form in a hydrology research centre. This centre is envisioned as a coastal-desert base for the Desert Research Foundation which replicates aspects of the intense and transient academic enquiry found in the ephemeral river-desert junction of Gobabeb.[70] Like the Gobabeb base aspects of this centre are more publically based, with a resource centre and flexible accommodation open to researchers and visitors.[71] The salt pans currently are part of a tourist drive-by experience, with the shocking pink waters and birdlife mainly viewed from a car seat. A more public stop-off information point connected to the pans could add to a greater experience of this area.

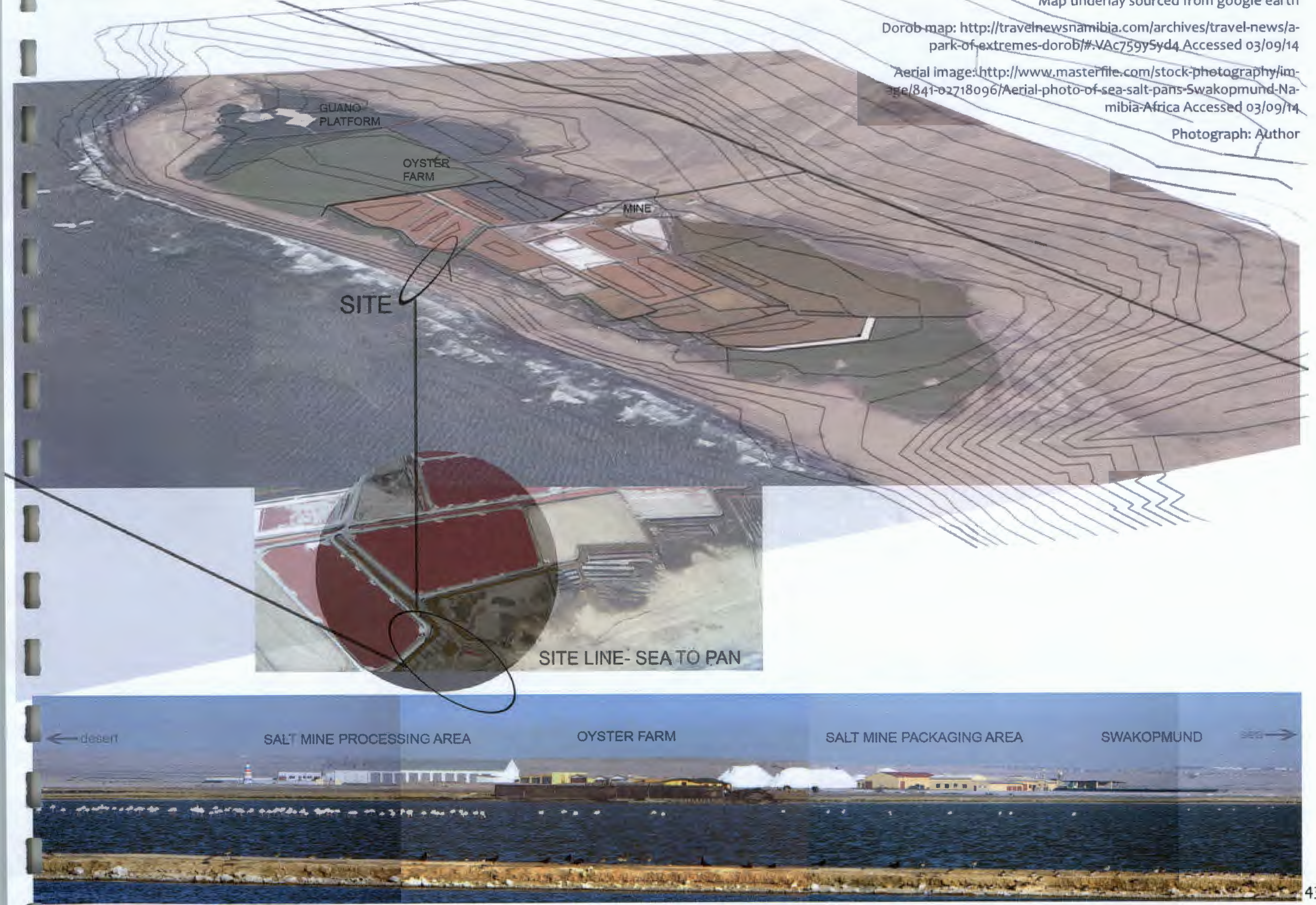

OPPORTUNITY SITES:
ASPECT OF WATER CREATION + INDUSTRY+ TOURISM
Omaruru river Mouth
Henties bay
Jakkalspitz campsite
Henties Bay salt pan
Zeila shipwreck
Mile 30
Lichen fields
Wlotzkasbaken
Mile 14 campsite
Solar desalination+
tourism opportunity:
Swakopmund
Salt pans
Skeleton Coast Park
Cape Cross Seal Reserve
ATLANTIC OCEAN
Dorob National Park
Erongo Region, Namibia
Town
Campsite
River
Region
Protected area
Dorob National Park
Local Authority
PANTHER BAKE MINING CONCESSION
N
SWAKOPMUND

Map underlay sourced from google earth

Dorob map: http://travelnewsnamibia.com/archives/travel-news/a-park-of-extremes-dorob/#.VAc759ySyd4 Accessed 03/09/14

Aerial image: http://www.masterfile.com/stock-photography/image/841-02718096/Aerial-photo-of-sea-salt-pans-Swakopmund-Namibia-Africa Accessed 03/09/14

Photograph: Author



1 ABANDONED INPUT

1 ABANDONED INPUT

2 PAN INPUT PUMP

2

SALT PANS- WATER FLOW
SEA WATER IMPUTS + HARVESTING
1:15000 @ A3

3 SUPPLY CANAL

5 SITE-SMALL OUTPUT PUMP

MOBILE PAN PUMPS

MINE PROCESSING AREA

Images: Auth

2.2 Framing site

Historically, Panther Bake was only considered as a "place" thanks to a 1920's coastal surveying beacon, although it has constantly been defined by its geography as a natural coastal basin.[72] This areas affinity for forming salt pans has provided a base for salt mining since the 1930's.[73] The practices of the mining, associated industries and ecological conditions has physically shaped the pans and character of the area. Currently it contains a huge area of evaporative, concentration and crystallizer pans, which support three industries; a salt mine, oyster farm and guano collection. It is also a registered bird sanctuary as the protected brine waters attract large numbers of sea birds to feed.[74] The entire area thus has an eclectic character, with moments of seemingly natural wetland landscape contrasted by an industrial character with re-molded landscapes and insertions within the salt production pans.

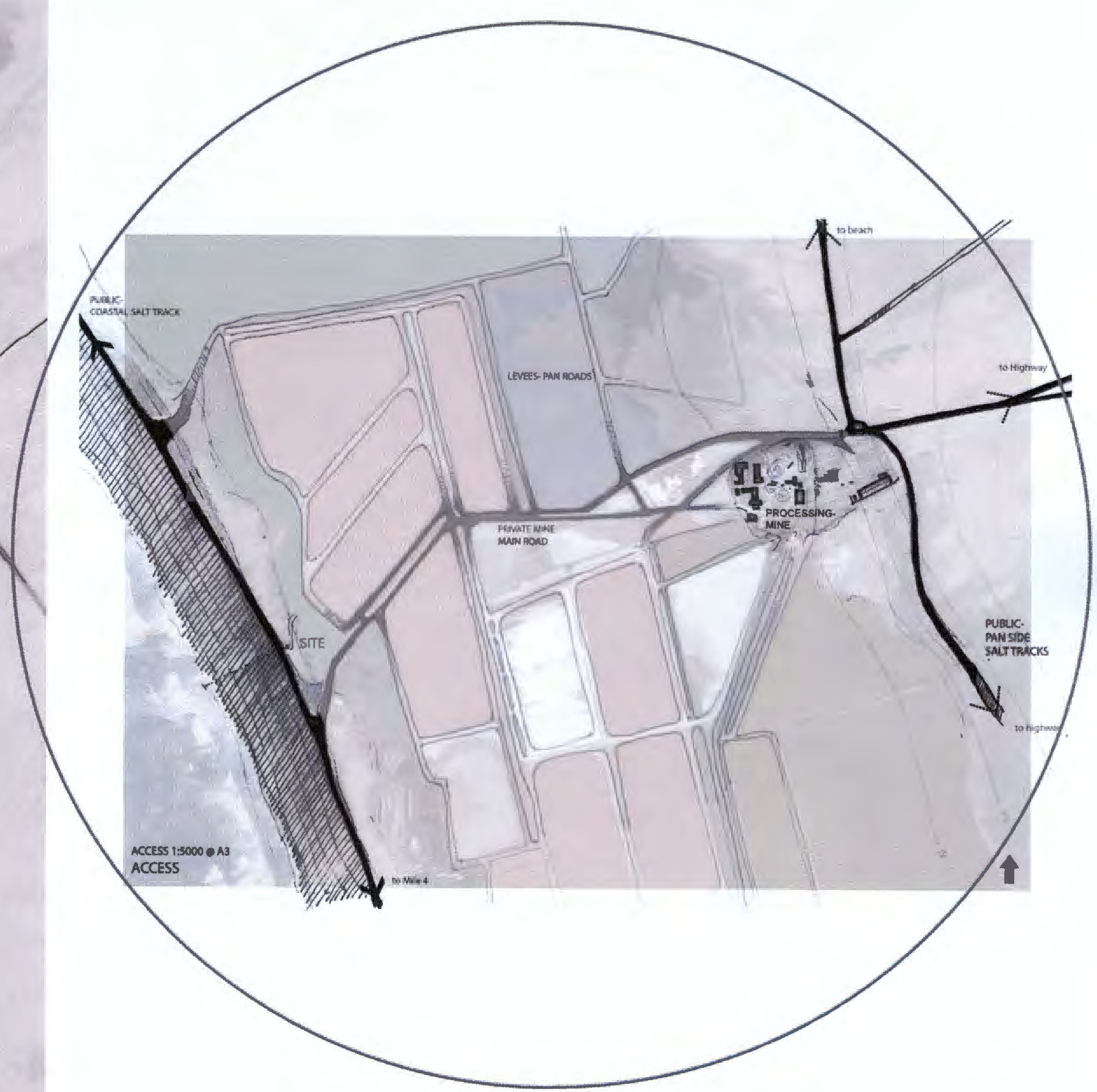
The mine itself continually harvests salt off the pan beds through an evaporative process that can take up to 18 months. At an initial glance this process appears passive with seawater left to evaporate in pans before mechanical harvesting. In reality it is a constant process of the pumping, transfer and mixing of different brine solutions, bittern concentrations and fresh seawater supplies from pan to pan or out of the system completely. In order for salt beds to form in layers, at the correct rate, this crystallization process is carefully monitored and adjusted.[75] The different saline concentration levels create the pans vivid water colors as with changing salinity different algae and halobacteria thrive. When complete a thick salt bed within the crystallizer pans is "harvested", leaving a "salt floor" to support the machinery and prevent soil contamination in the forming crystals. The collected salt is then rinsed with clean brine, stockpiled, treated and packaged. This mine alone has the capacity to produce 120 000 tons of salt a year, as part of a significant Southern African supplier of industrial and edible salt.[76]

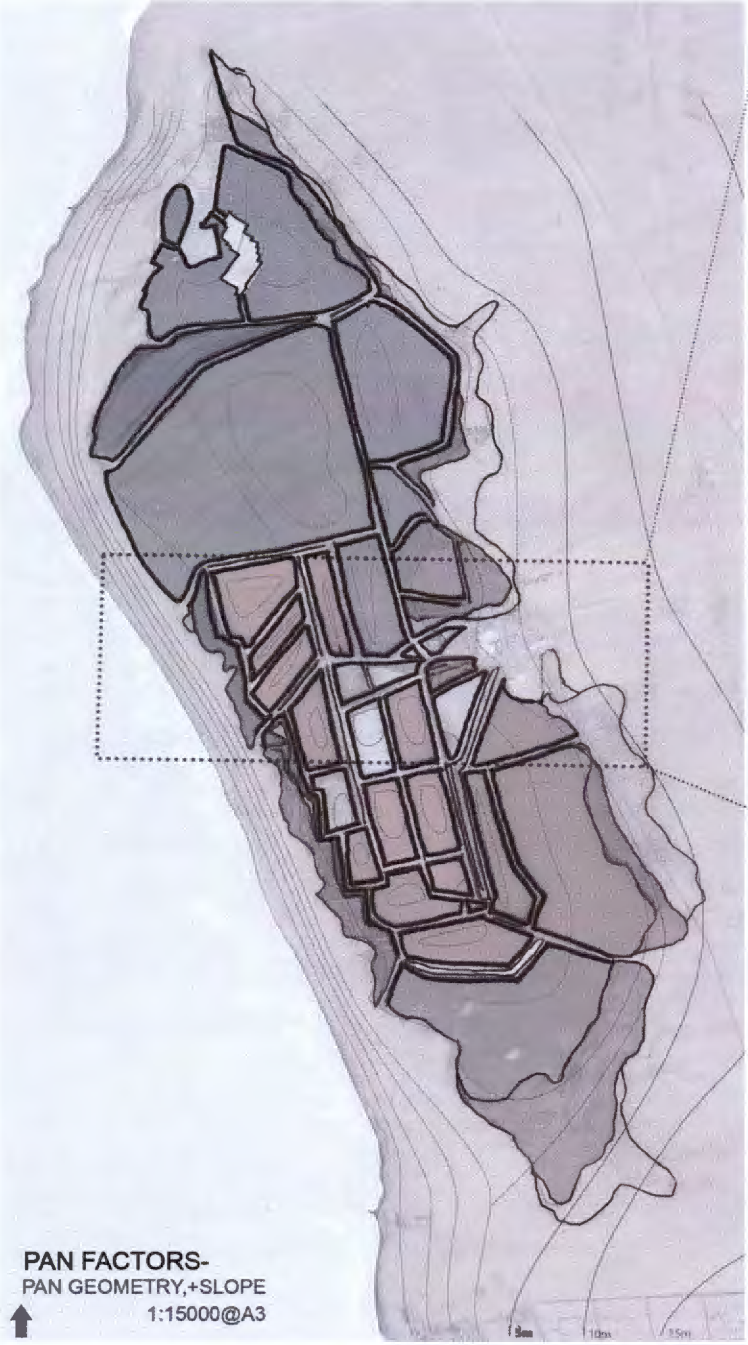
The bordering coastline is relatively unaffected by the process of the pans, with hints of its workings seen in the few input or output pipelines to the beach. Consequently the beach side of the pans is used by the general public for fishing and recreation, as well as for coastline travel to distant fishing locations, to and from the slowly encroaching neighboring suburb of Mile 4. To the East of the pans is the major highway linking Swakopmund to Henties Bay. Access to the beach from this edge requires bypassing or circumventing the pan system, as the levee roads are predominantly limited to the industrial vehicles.

The connection between a public interface with the pans and an introduction to their processes and wildlife is lacking. In a sense it is a drive-by "industrial island" that happens to be scenic and rich in birdlife. The uniqueness of this landscape and its desert-coastal condition can thus be somewhat lost in passing. Accordingly a fixed point or base that may highlight this place as more than an industrial park could help to introduce a shared experience of its uniqueness.

Mining salt : Mobile and fixed pump
Images: author


SALT PANS-
ROAD ACCESS ORDER
1:15000 @ A3
Highway
Hard shoreline track - salt road
MILE 4
Undefined Shore route
Major/ formalized roads
ajor access tracks
w traffic/ informal routeways


to beach
PUBLIC-
COASTAL SALT TRACK
LEVEES- PAN ROADS
to Highway
PROCESSING-
MINE
PRIVATE MINE
MAIN ROAD
SITE
PUBLIC-
PAN SIDE
SALT TRACKS
ACCESS 1:5000 @ A3
ACCESS
to Mile 4



PAN FACTORS-
PAN GEOMETRY,+SLOPE
1:15000@A3

PAN FACTORS
LINEARITY, GEOMETRY, CANALS, SLOPE + SCALE
1:5000@A3

2.3 Site:
Siting factors and design influences

Along the coastal edge of the salt pans are a number of existing and abandoned sea water supply lines. They are seen in exposed broken pipes at the high tide marks, raised protective berms over which cars drive and corroded jetty structures. Presently one major pump inlet line supplies the pans canal system, while a number of small stations can be used to return bitterns to the sea.[77] These smaller stations are rarely used but necessity in times of rapid evaporation.

One of these smaller station lines is re-used as site, as the improvement to a pump line supplying a desalination system can double as the canal pump servicing the pans in returning pan bitterns and desalination filtrate to the sea. A specific pump line with direct access to concentration and crystallization pans was also necessary, as the brine output of the desalination process is sufficiently concentrated to bypass evaporative pan phases.[78] A small solar desalinating system that could produce 9000 liters per day is incorporated into this line as this quantity of water would more than supply the lab but easily cover greater capacities required by visitors and controlled public access. During times of underutilization water produced could also supply the small pan pump tanks of the salt mine, who require fresh water to function.

This site presents a number of opportunities and limitations. It is seemingly at the head of the axis into the salt mine and has a raised berm area along the back of the public shoreline, with relatively easy access along the coastal edge. In order to reach the pans the infrastructural line would cross not only the shore side vehicle access track, water canals and existing edge (on which a lake of sorts has formed), but a levee road used by the industrial salt harvesting vehicles. It also has to contest with a number of differing geometries. The major line responds to desalination, the North to North-Eastern aspect of the site is important for solar orientation while the South Western aspect is important for fog-catching. All of these aspects can be overlaid with the changing landscape character from the ocean to the pans, as well as the programmatic needs of a research facility and its public interface.

Programmatically this base is modelled on other small research bases, such as Gobabeb and UNAM Marine Research base at Henties Bay, in which educational research and monitoring is carried out with general laboratory equipment, sample store, and data capture. Advanced scientific testing is outsourced to specialized laboratories. These bases also have a very small permanent population, with most of the researchers using and living on-base only during on-site research gathering.[79] As such bases like Gobabeb, can hold from ten to thirty to eighty people depending on researcher flow and educational field trips from universities and schools. In the case of Gobabeb, all visitors can be housed in some form or another, as its isolation tends to make overnight stay inevitable. These groups are accommodated but not fed. A communal kitchen services the needs of researchers, while catering for large groups is outsourced all the way from Walvis Bay.[80]

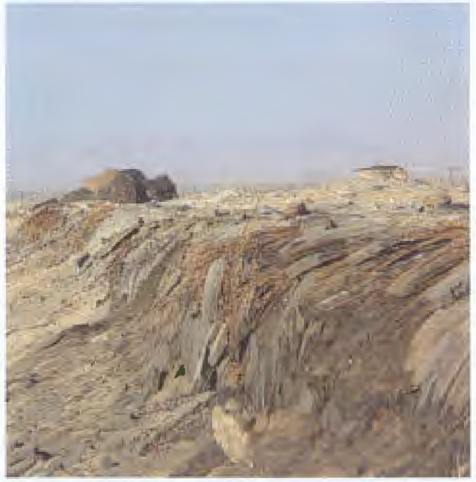
In the UNAM base only a permanent administrator, a few lab assistants and a limited number of temporary researchers (ten) are housed on-site, while remaining students, visitors and tourists are daily visitors, being accommodated in the town.[81] The relation of this site to Swakopmund lends it to more of the UNAM pattern of base inhabitation, but it still has the possibility of doubling unoccupied researcher accommodation as scenic pan-side tourist accommodation or possible camping.

The environmental influences of this site make the materiality of any intervention within the space important. Most materials struggle in this climate as exposure to creeping saltwater in the sands and the moisture and occasional sulfur in condensing fog have corrosive effects on everything from brick to timber. Predominantly heavy concretes or hard-fired bricks are used to form the ground-touching bases of structures. Alternatively they are raised on concrete or timber elements such as hard wearing gum poles. Timber and brick are commonly used for forming skins, but airborne moisture and harsh sun exposure generally requires a skin layer of some sort, at the least paint and plaster and the most a bituminous outer layer. Despite these factors steel is still widely used as there are limited alternatives for industrial developments and infrastructure (such as in the salt mine). Steel that is protected or in contact with dry salty conditions has a relatively slow corrosion rate.[82] With any material or structure in this context, maintenance is vital to its more long-term survival.

The possibilities that arise from the synthesis or separation of all of these environmental, material, programmatic and functional layers to the site and intervention are explored through the design process. This process attempts to find an architectural response which incorporates not only these aspects but also the character of the place.

MATERIALITY

Images: author



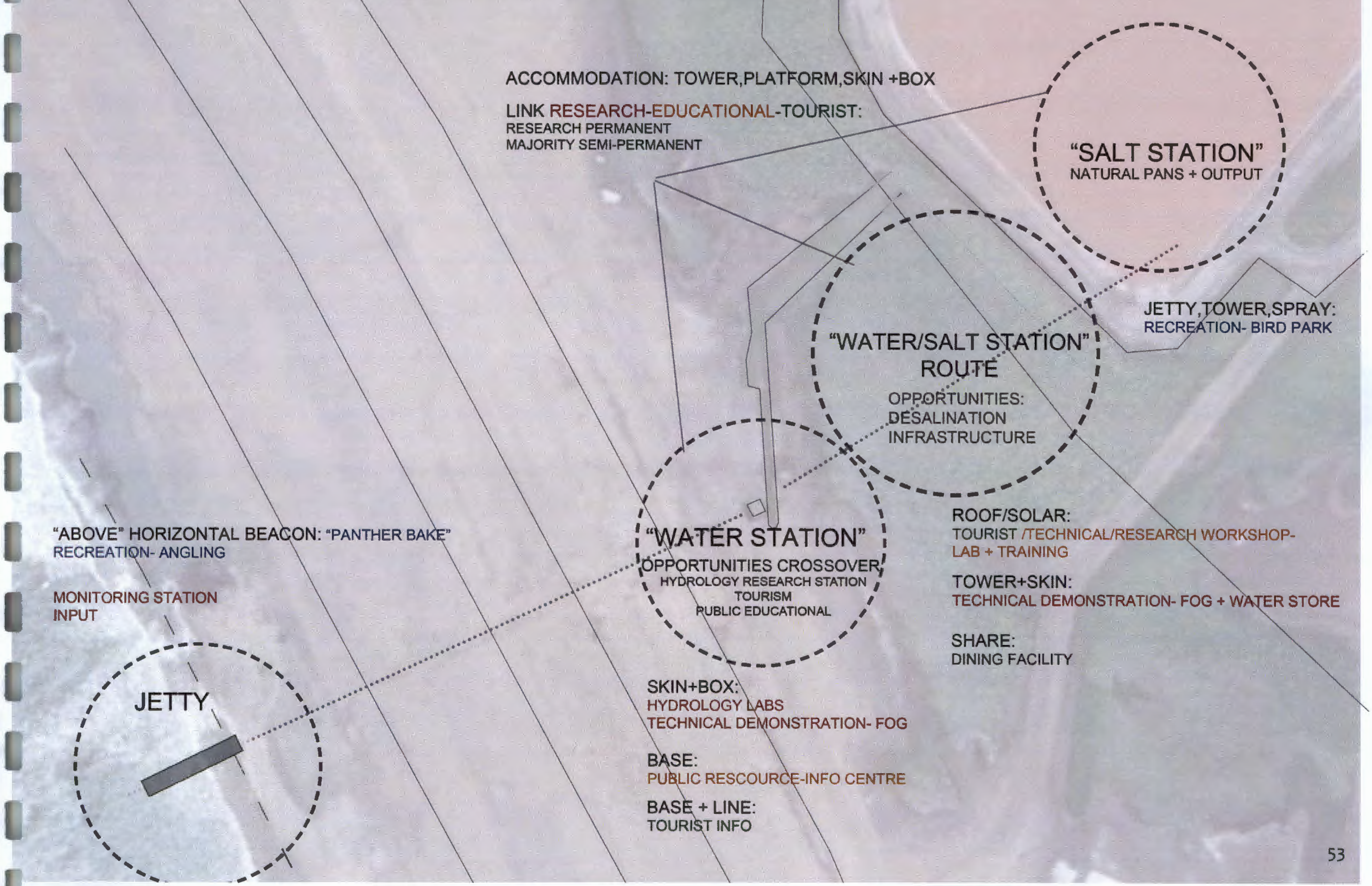
Site: beach view

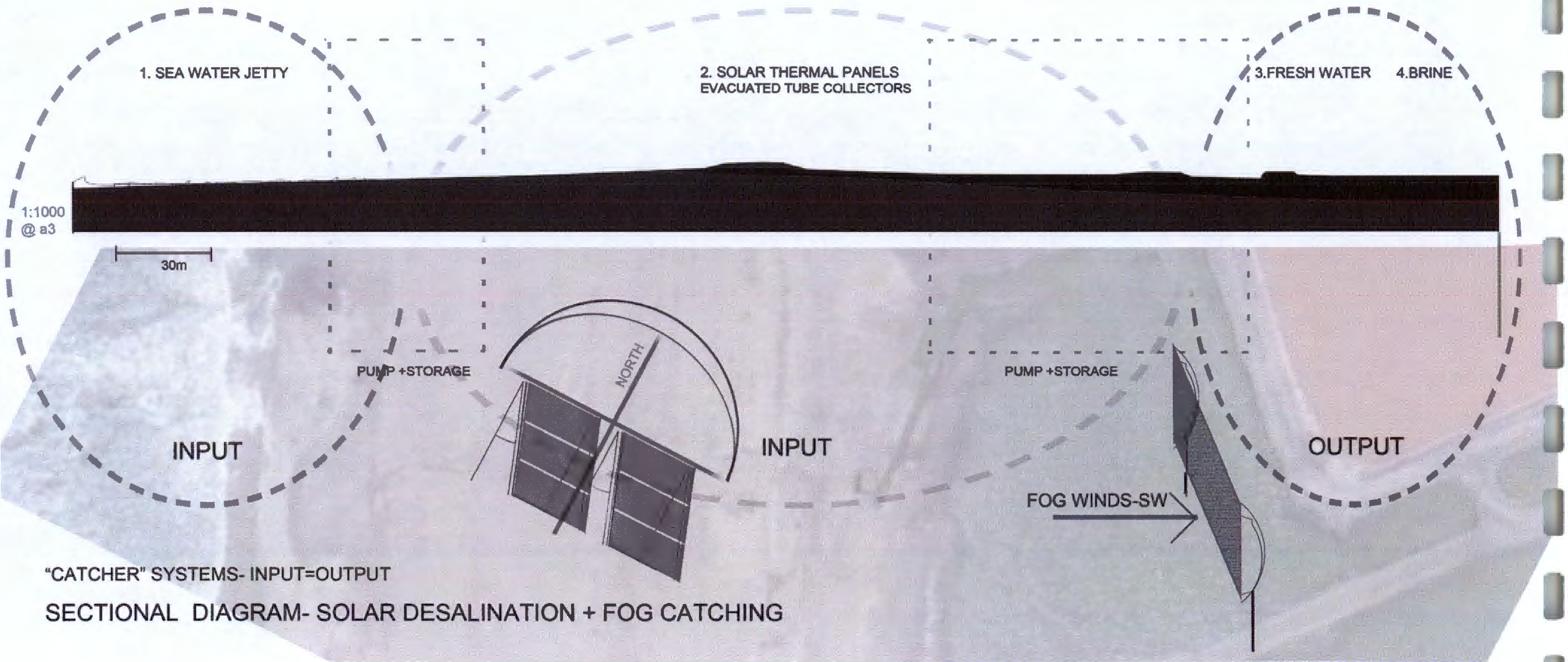
Images: author

Site: view from pump station mound to sea

Site: view of existing pump station- from pans to the sea

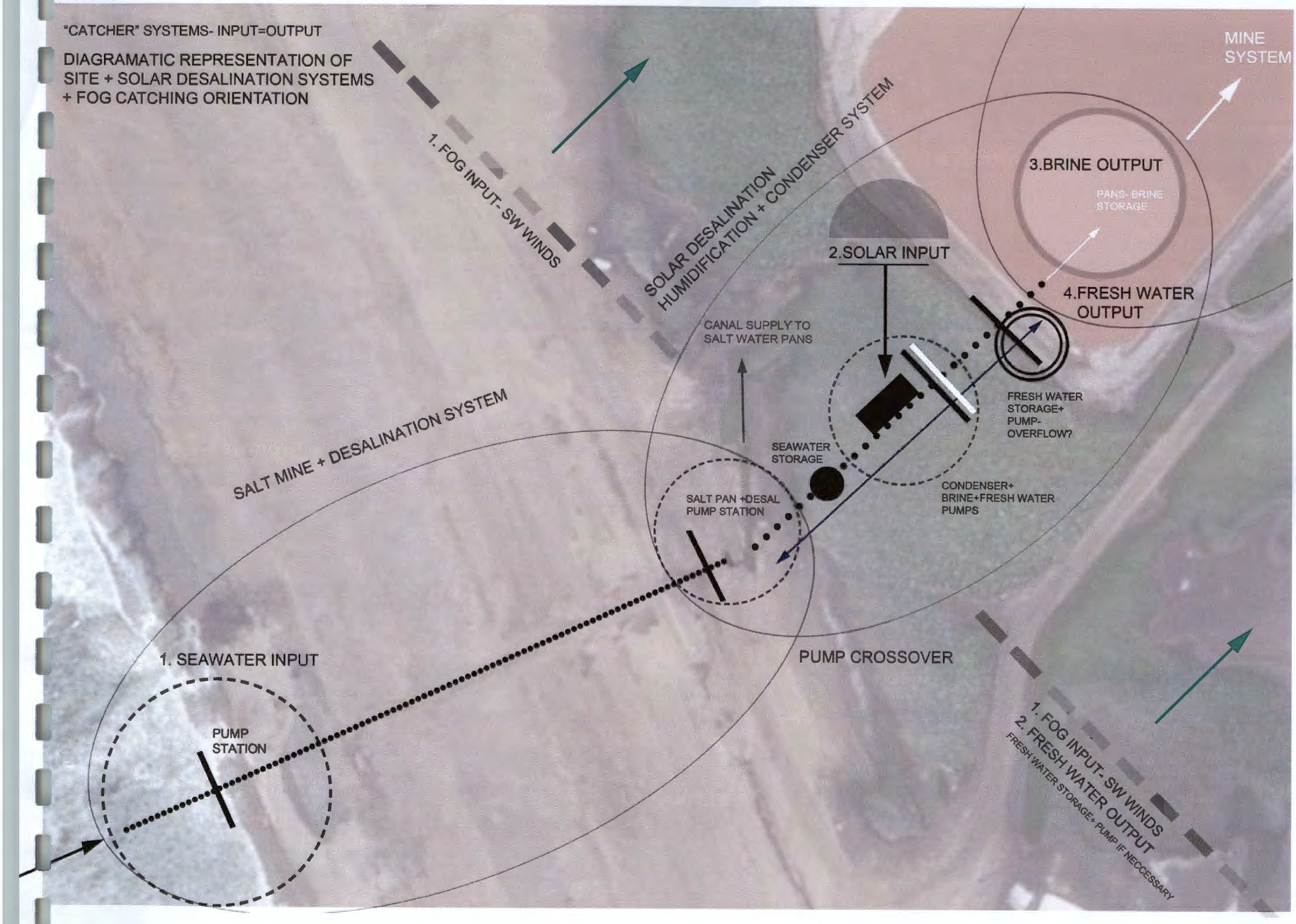
DIAGRAMATIC REPRESENTATION- ROUTE WOVEN INFRASTRUCTURE + HUMAN FUNCTION





"CATCHER" SYSTEMS- INPUT=OUTPUT

SECTIONAL DIAGRAM- SOLAR DESALINATION + FOG CATCHING



"CATCHER" SYSTEMS- INPUT=OUTPUT
DIAGRAMATIC REPRESENTATION OF
SITE + SOLAR DESALINATION SYSTEMS
+ FOG CATCHING ORIENTATION
1. FOG INPUT- SW WINDS
SOLAR DESALINATION
HUMIDIFICATION + CONDENSER SYSTEM
MINE
SYSTEM
3.BRINE OUTPUT
PANS- BRINE
STORAGE
2.SOLAR INPUT
4.FRESH WATER
OUTPUT
CANAL SUPPLY TO
SALT WATER PANS
FRESH WATER
STORAGE+
PUMP-
OVERFLOW?
SALT MINE + DESALINATION SYSTEM
SEAWATER
STORAGE
CONDENSER+
BRINE+FRESH WATER
PUMPS
SALT PAN +DESAL
PUMP STATION
1. SEAWATER INPUT
PUMP CROSSOVER
PUMP
STATION
1. FOG INPUT- SW WINDS
2. FRESH WATER OUTPUT
FRESH WATER STORAGE+ PUMP IF NECESSARY

2.4 Endnotes

70 Seely and Pallett, 2008, p. 79
71. Seely and Pallett, 2008, pp. 79–81
72. Klein, 2014
73. Klein, 2014
74. SaltCo, n.d.
75. Klein, 2014
76. SaltCo, n.d.
77. Klein, 2014
78. "Public Notes on meeting of Council Sci entific and Industrial Research and Salt Co," 2009
79. "Gobabeb Research and training Cen tre-Official Webpage," n.d.
80. "Gobabeb Research and training Cen tre-Official Webpage," n.d.
81. Roxin, 1997
82. Robertson and et al, 2012, p. 119

3. Technical studies

Salt mine- fresh water supply truck
Image: Author

Lino print: "the value of water"or "water is life" by John Muafangejo (1943-1988)
http://www.denverpost.com/art/
accessed:03/09/2014

3.1 "Water is life"

As described earlier, the desert history and current context revolve predominantly around water security. With a growing need for alternative water sources, it is becoming more and more apparent that various viable alternatives begin to be tested.

Mostly, in the case of the Namibian coast, water security needs can be met through desalination. The first desalination system on Namibia's shore was founded in 1895. In the form of a basic recycled ship seawater condenser this machine attempted to provide the only water supply to the 100 or so miners in the isolated guano and seal industries of Cape Cross.[83] Little is known about the effectiveness of this source as, even then, the weak link in this system was fuel. In its contemporary form desalination is highly effective but often, in industrial application, it is not highly sustainable. With huge energy requirements and draws these projects provide one limited resource at the expense of another.[84] Despite this reality the necessity of water has, in the past, made this cost easy to bear. Although this is generally the current case in desalination schemes, the Namib climate provides another resource that, coupled with technology, can test a viable alternative to energy provision in this system.

Solar driven desalination introduces solar collectors as the energy source, supplying pumps and filtration systems in desalination plants.[85] These systems are still small and new, constantly undergoing a great deal of testing and efficiency improvement. Although still widely experimental they have also successfully applied as functioning systems, in isolated places throughout the world.[86] In Namibia examples such plants exist, specifically one in Mowe Bay, Skeleton Coast, the other in Akutsima as part of the Cuve Waters Integrated Water Resources Management project for the Cuvelai-Etosha basin in central Namibia.[87]

Although desalination appears to be the leading technology in terms of mass volume water creation there are less technical, more mimetic technologies that can, in a smaller scale, contribute to water security. Fog catching identifies with a mimetic technology that begins to relay the idea that our physical and psychological connection to the environment not only incorporates its aesthetic and symbolic properties, but attempts to understand its systems and its actions as well.[88]

What is evident in the implementation of either or both of these technologies is that their full success will lie in their application in context. While this type of infrastructural water technology is generally mechanically successful based on extensive research and testing, its most underutilized potential is its ability to connect users to context. This user-mechanical–context relationship becomes a key aspect in the design and utilization of these technologies.[89] In highlighting this relationship the aim of utilizing resultant technologies is not only to passively affect the environment but to understand its complexities as well as our dependence on it.

Mowe Bay: Elements of the small scale reverse-osmosis desalination plant
Images: G Howard

Areva's RO desalination plant at Wlotzkasbaken

Top 2 images: author
Bottom image: Groenewald, 2010

3.2 Desalination situation, processes and solar integration

There are many methods of desalination. The most common, and highly implemented process, is reverse osmosis, while a number of other thermal distillation methods are also widely employed.[90] In the first method, energy is required to generate enough high pressure to effectively force saltwater through a membrane. In the second methods, water is distilled through a means of actively heating, cooling and catching the water. Reverse-osmosis is currently considered the most practical method in accessible, energy-rich contexts, but desalination is becoming increasingly popular in poorer off-grid locations.[91] This has led to the questioning of both the choice in process and the energy source supplying it.

All of the different desalination processes can be run, to an extent, by solar energy. This coupling is seemingly an obvious answer as most places that experience water shortages have high solar radiation. However, in terms of running these processes, the limitations of solar energy must be understood. For example, on a domestic scale, solar reverse osmosis is effective, but due to the greater water pressure demands on energy supplied by photovoltaics they require greater voltaic areas than thermal distillation processes. In industrial sized reverse-osmosis plants, solar energy yields a relatively low productivity rate, low thermal efficiency and requires a large area of land.[92] In order to be productive on an industrial scale, they do not integrate solar systems and draw an enormous amount of continual investment, not only in initial conception but in constant energy supply.[93]

One example of such a plant, the Wlotzkasbaken desalination plant, belonging to Areva Trekkopje uranium mine, was completed in 2010. This is the largest desalination plant in Southern Africa, with the capacity to produce about 54000 cubic meters of fresh water a day.[94] In theory, this massive investment (with a 20 year lifespan) should benefit both the massive thirst of the mining process and the coastal population, as about 30 percent of the water produced is not required by the mine. However, in practice the large-scale and highly specialized technology creates an expensive water source that although may be useful in the future, has yet to be as the mine, and therefore, plant remains in stand-by hibernation.[95] Similarly a new smaller, desalination plant has been proposed by the Husab Uranium mine (currently in rapid construction and development) North of Swakopmund.[96] Pragmatically, industrial reverse osmosis makes mining in the desert possible and the associated energy cost is accepted as a necessity, but the lack of public access to this resource and technology has limited its potential possibilities.

On the other end of the scale lie the smaller, localized solar driven desalination units. These plants are considered to be successful in providing water as a more communal and sustainable resource. Although they still require a substantial initial investment, they have minimal operation costs and have been shown to be efficient enough for more small scale production.[97]

Many different types of solar desalination units are currently being tested and utilized around the world. These small solar desalination plants differ in terms of their desalinating process. Often the major advantages and disadvantages of each respective process in the context of a specific location, water type, water output and importantly solar collector, are weighed up before a selection is made.[98] With this in mind an understanding of the system and its relationship to the context is vital. In the case of Namibia, the efficacy of different solar driven systems has not been tested at the coast, as currently there is only one independent plant active in the isolated Mowe Bay base of the Skeleton Coast. This plant makes use of solar driven reverse-osmosis. Different systems have been tested in the inland Cuve Waters projects, which makes use of a variety of different processes, in order to test their efficacy and acceptance within this harsh environment, over time.[99] These infrastructural developments recognise the state of this current technology as relatively untried, yet holding a great deal of potential in both providing for current water needs and in research and development of the technology itself.

From these studies, it appears that one of the processes (other than reverse osmosis) that remains reliably efficient, easy to supply, integrate and maintain in isolated communities is the desalination technique of humidification-dehumidification (HD).[100] Simply put this process uses a cyclical vapour system which incorporates a linked humidifier and condenser to heat and evaporate out fresh water, while recycling trapped heat. Solar Energy is used to not only run the pumps but to directly heat and maintain high seawater temperature through heat exchangers. In the latest studies of the HDH technologies it has been found that the so-called Closed-Air-Open-Water HDH arrangement of this system is the most energy efficient.[101] Although there are various other configurations and added steps that can be arranged, this type of configuration will be the only one that is described.

Areva's RO desalination plant at Wlotzkasbaken beachside input pumphouse

Cuve Waters HD solar desalination plant,
Akutsima Namibia

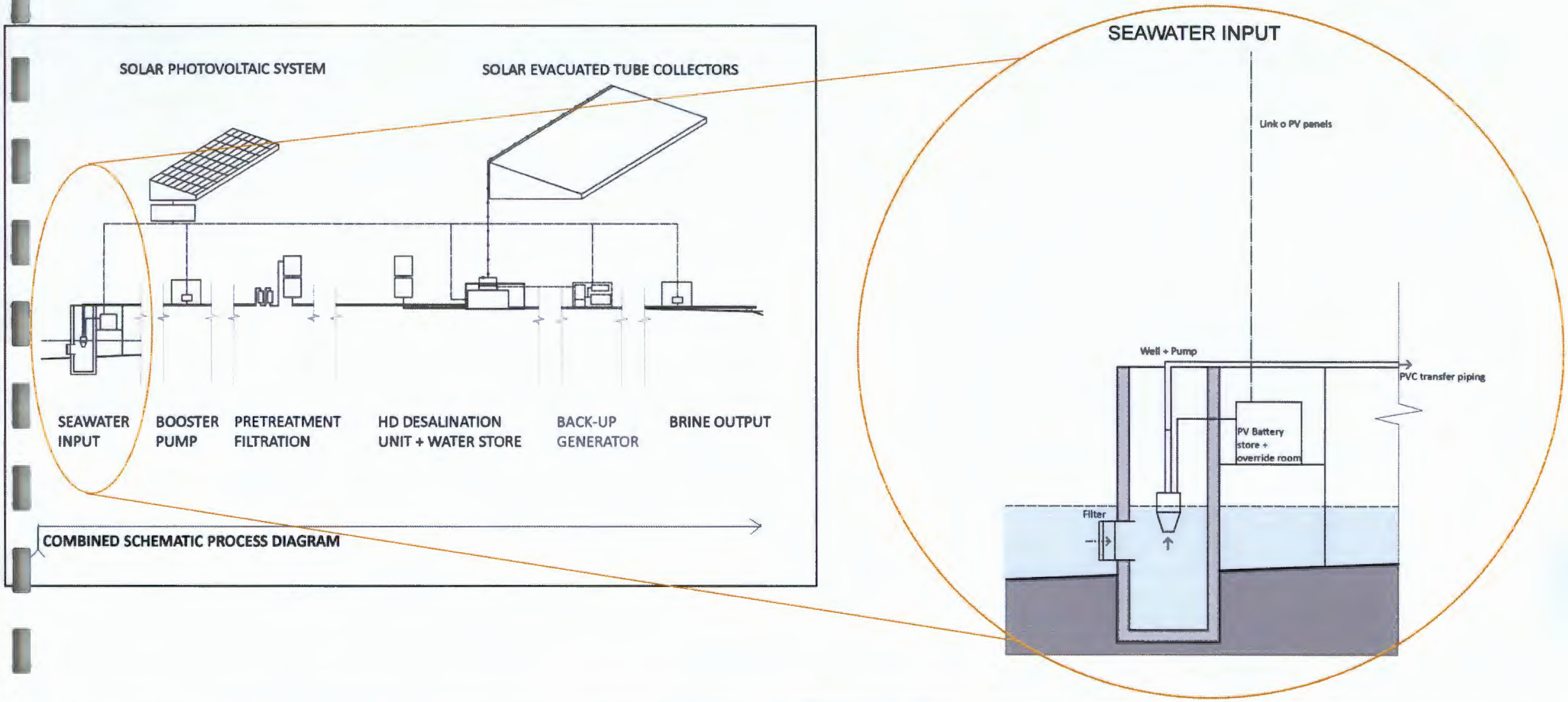
TerraWater.de- Official Webpage accessed:03/09/2014

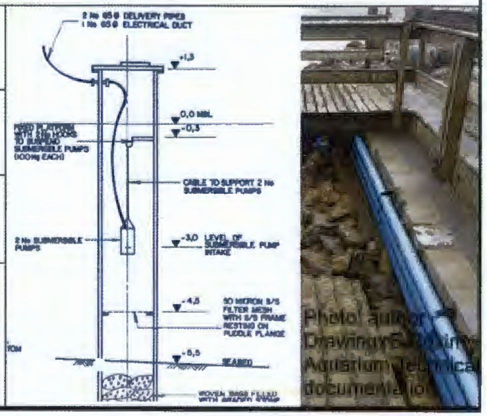
3.3 Desalinating process:

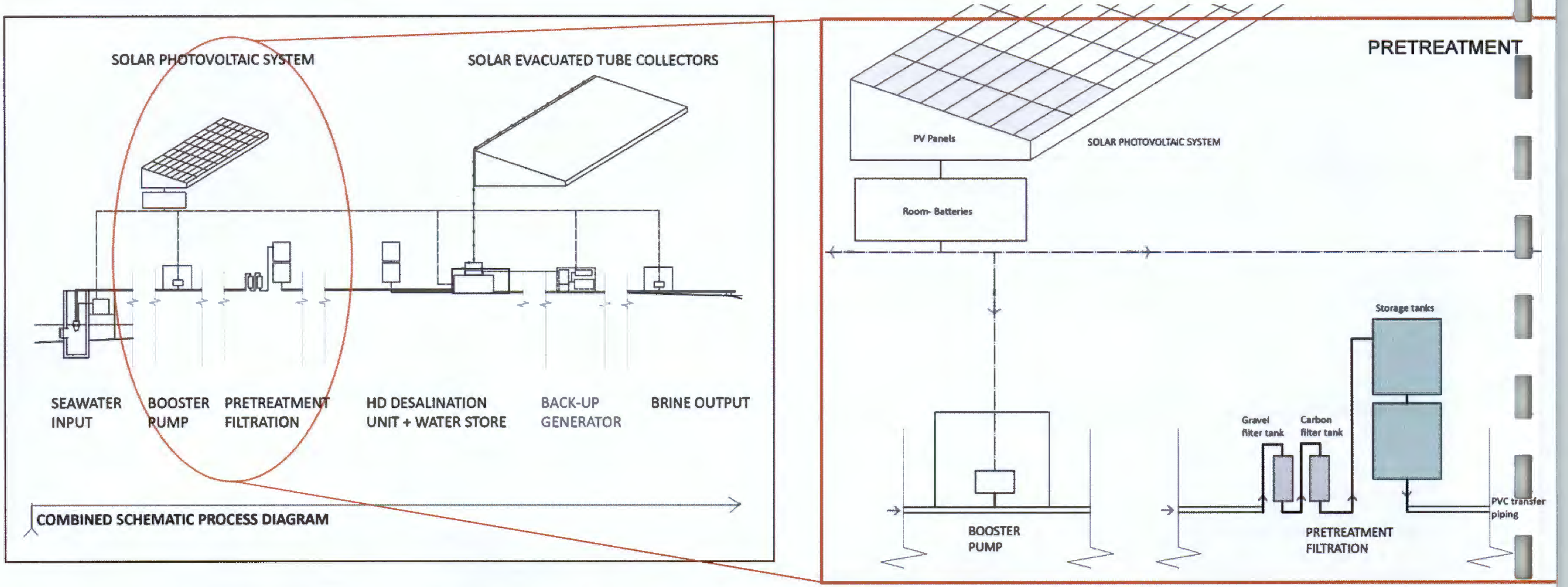
Solar-driven Humidification-Dehumidification desalination (HD)

There are three major parts to any desalination plant, the seawater input system (with any necessary pre-treatment or filtration), the actual desalination system (in this case HD) with water storage tanks, and the transfer or storage of the output of brine. In solar plants there is also the solar collection system in the form of both photovoltaics (electrical energy) and solar thermal evacuated tube collectors (heat energy) that connect to the HD system and pumps.[102] The actual process is better explained through diagram and tables, but what is essential in its technological spatiality is the cyclical nature of the HD process, thus its desalinating elements have to be connected in a compact manner (seen in images on page 62,65 and 66). As this is the case the entire HDH portion of the plant (excluding water storage tanks and solar elements) can generally be fit into and run from a shipping container. This also has a number of added logistical benefits as its transport, upgrade and replacement, as part of the greater system, is fairly simple.

The size of an HDH unit is obviously also dependant on its required output, as this influences the size of HDH elements. In general a plant that can provide an average of 9000 litres a day, with an average additive water usage per person at 75 litres, provides for up to 120 people[103] and can fit into one 40 foot (12x 2.4 x2.6m) shipping container.[104] This type of plant, with its process and elements are better illustrated and explained in the following figures and tables.

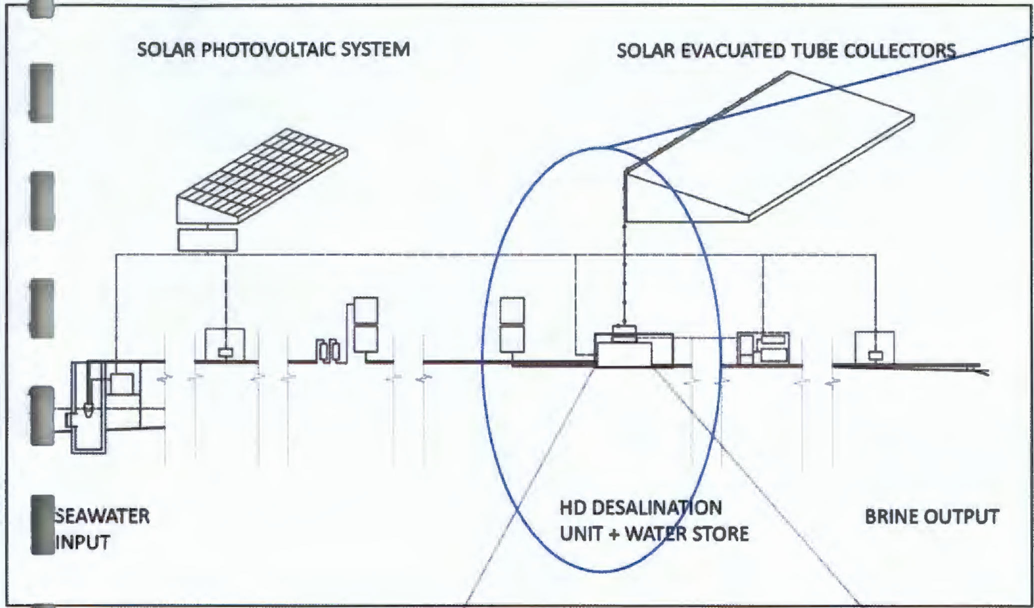


	MECHANICAL/TECHNOLOGICAL PROCESS	SPATIAL MANIFESTATION	SPACE REQUIREMENT Capacity fresh water production 9000 litres/day- max brine output 15000 litres	VISUAL EXAMPLE Seawater intake pump system- Swakopmund Aquarium
Seawater Input Components:				
Mesh and/or stone filter layers	Prevent large sediment uptake	Mesh grids line the entry to well	-	
Water Stilling Well	Wave action calming to prevent excessive suspended sediments in the water supply	Concrete well with footing	Diameter concrete well at least 1.5m with protected opening at footing for sea entry and access to pump through side/top	
Immersable Marine Pump	Sea water uptake using centrifugal pump suction	Suspended pump in well	Pump- diameter 600mm, length 1000mm plus battery + electrical override room	
2x 150mm transfer pipes	Transfer of seawater to HD desalination unit	High strength PvC- protected direct elements or encased high strength steel fibre cement	-	



ELEMENTS: EXPLANATORY TABLE

	MECHANICAL/TECHNOLOGICAL PROCESS	SPATIAL MANIFESTATION	SPACE REQUIREMENT Capacity fresh water production 9000 litres/day- max brine output 15000 litres	VISUAL EXAMPLE Solar collection and fresh water tank store of Cuve Waters Project desalination plants in Amarika and Akutsima.
Pre-treatment Components:				
Booster pump- will be potentially required if transferred long distances	Water transfer pump-maintain water pressure	Marine strength water transfer pump Pump linked to solar voltaic battery system Room 3x3m	500x500x1000mm pump and room for battery store and bypass	
Pre-treatment filters	Gravel Filter + Activated carbon filter to remove light sediments and suspended organic matter	2x specialized filter tube tanks packed with filter substrate	Tube tanks- 500 diameter, 1.2m high	
Pre-desalination storage tank	Stilled water supply + back up for pump servicing	Storage Tanks- either poly plastic, fibreglass or permanent concrete	2x 5000 litre tanks Diameter 1.8, height 2m	
Solar Photovoltaic panels	Providing electrical stored energy for air and water flow pumps	Panels 1x0.6 m- aluminium mounted- N to NE facing at 20 degree slope Battery room	50 m2	



Humidification-Dehumidification Desalination process (Closed-air-open-water):

1. Initially the condenser coil runs seawater incoming seawater through it, preheating it with recycled latent heat.

2. In the external heat exchangerthe water is fully heated to 95 degrees. Heat is exchanged with captured thermal heat from evacuated tube collectors.

3. In the humidifier, hot salt water is precipitated within its plastic layer structure and begins to evaporate.

4. The air movement system activates and in reverse flow the fan pushes colder air from condenser to humidifier, where contact with hot water heats and humidifies the air, now holding evaporated water.

5. The saturated air is thus transferred to the condenser by reverse flow

6. Left over, unevaporated water and salt is collected as brine at the base of the humidifier where it is transferred to collector salt pan.

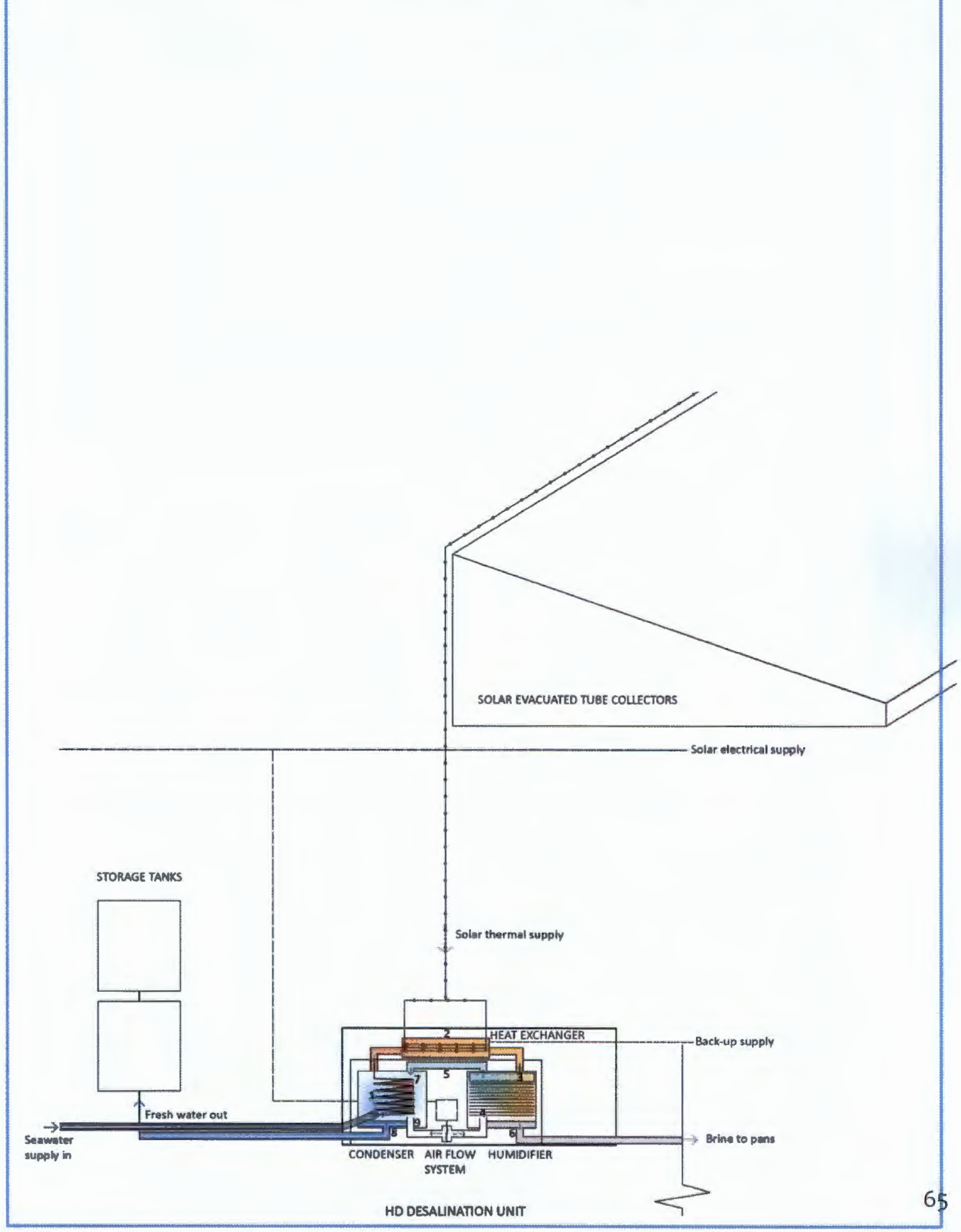
7. In the condenser, saturated hot air from the humidifier enters and cools on initial raw water cooling pipes (in turn this both condenses out freshwater and preheats incoming seawater)

8. Fresh water collects at condenser base and transfers to storage

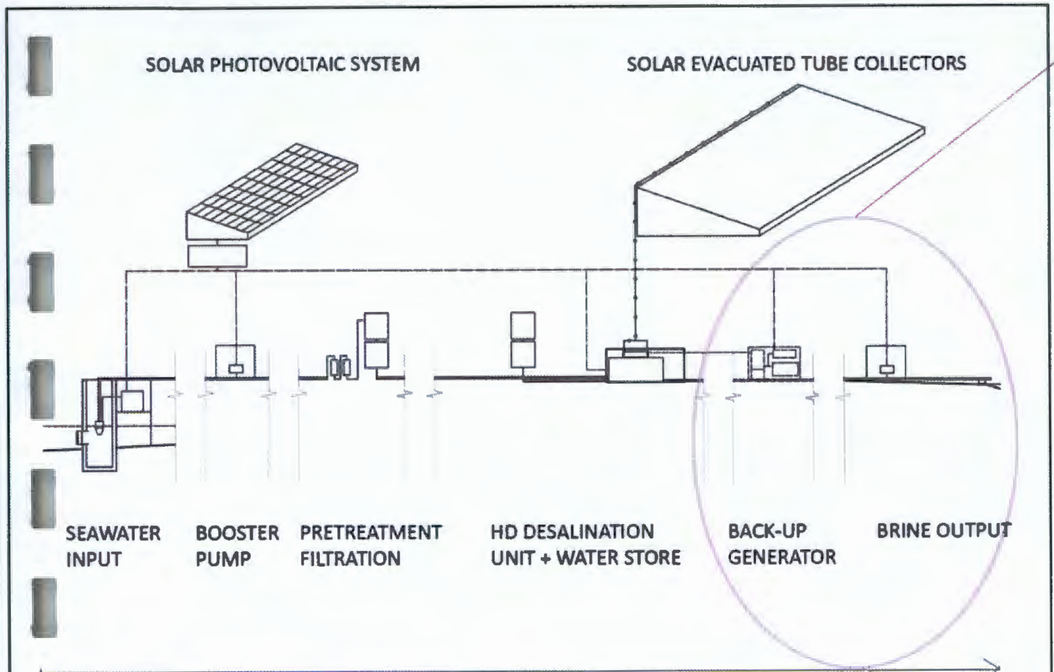
9. As water condenses out it cools the air flow which is, via the fan system, transferred back to the humidifier to restart the cycle.

Table- pto

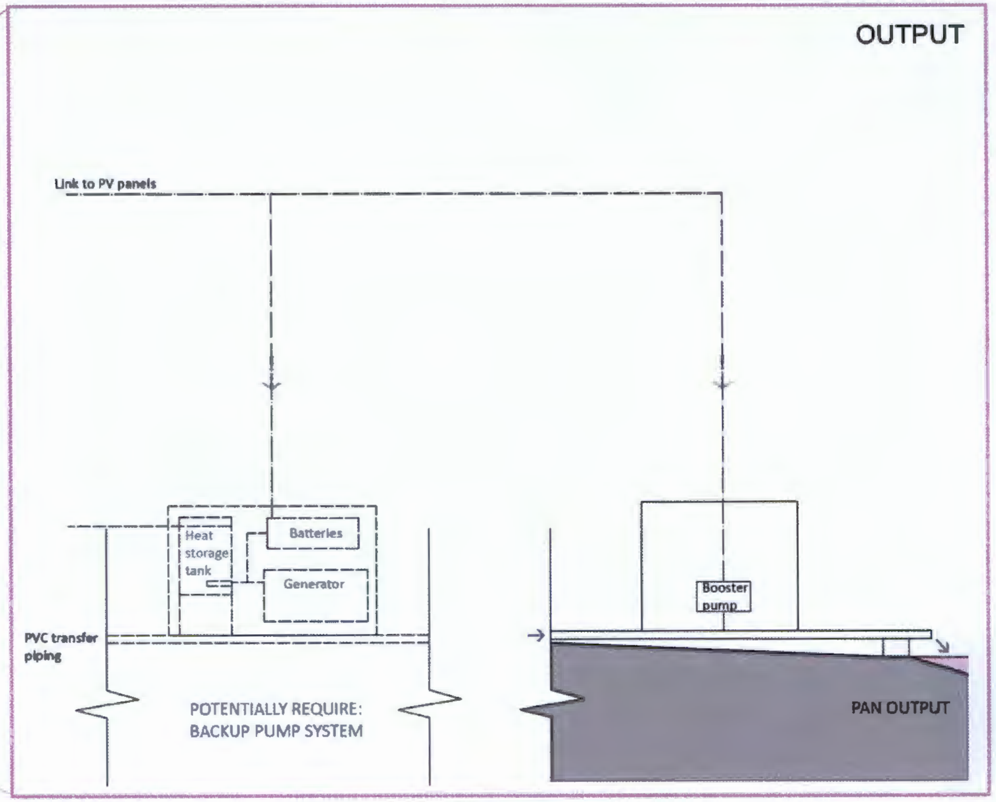
HD DESALINATION UNIT +WATER STORE



	MECHANICAL/TECHNOLOGICAL PROCESS- Process numbered sequentially:	SPATIAL MANIFESTATION	SPACE REQUIREMENT Capacity fresh water production 9000 litres/day- max brine output 15000 litres	VISUAL EXAMPLE A- Inland TerraWater HD plant system in Amarika,Namibia B- Larger scale testing plant- Chinese Acadamy Sciences
Closed-air-open-water HDH unit Subsystems: **(chemical free Terra Water/Solar units)**				
Solar- Evacuated tube collectors	Provides the heat energy for the heating of seawater as it transfers collected solar heat in its own circulating liquid to the heat exchanger in HDH unit. Tube collectors allow solar absorption even under grey sky conditions and high wind chill factors.	Panels- 900x2000mm (for 10 tube panels) Mounted- N to NE facing at 20 degree slope	150m2 Panels	
Dehumidifier/condenser	1. Initially preheats incoming seawater with recycled latent heat 7 Saturated hot airflow from humidifier enters in reverse flow, and cools on initial raw water cooling pipes (both condenses out freshwater and preheats incoming seawater) 8 Fresh water collects at condenser base and transfers to storage	Sealed Condenser unit	1500x diameter 1200mm	
External heat exchanger	2 Transfer heat collected in circulating air system of solar thermal tubes to fully heat preheated seawater to 95 degrees	Plastic heat exchanger- linked to heated circulating fluid from solar thermal collectors and separated from HD unit	2000x1000x500mm	
Air flow fan	Controls flow and reverse flow of air to fully vaporize water and transfer it to dehumidifier: 4 in reverse flow sucks colder air from condenser to humidifier where contact with hot water heats and humidifies the air with evaporated water 5 Saturated air transferred to condenser by reverse flow 9. As water condenses out in condenser, cool the air flow, which transferred back to humidifier to restart cycle	Linked vapour fan-piping system with motor linked to PV panels	Inbuilt system	
Humidifier	3 Hot salt water precipitated in plastic layer structure- water begins evaporate 6 Left over, unevaporated water and salt collected as brine in base of humidifier where it is transferred to solar salt pan	Sealed humidifier unit	1500x diameter 1200mm	
Storage tanks	Store and maintain fresh water	Storage Tanks- either poly plastic, fibreglass or permanent concrete	2x 5000 litre tanks Diameter 1.8, height 2m	
Post-treatment long-term sterilization Chlorination	Sterilization in minute doses set per tank but only necessary for long term storage	Small injection chemical tank- tubing to tanks- caretaker pH monitoring essential	Small chemical wall mounted tank	



COMBINED SCHEMATIC PROCESS DIAGRAM



	MECHANICAL/TECHNOLOGICAL PROCESS	SPATIAL MANIFESTATION	SPACE REQUIREMENT Capacity fresh water production 9000 litres/day- max brine output 15000 litres	VISUAL EXAMPLE Pumping inlets into salt pans of Swakopmund
Back up electrical system Both added Photovoltaic battery and petrol generator	Back up transfer to electrical heating system	Generator- room – back up insulated water heating tank with element to heat the heat exchanger 4x4m room	1000x2000mm generator Heat storage tank-1000 litre Room for battery and petrol store and bypass.	Images: Author 
Brine output: Components:				
Potentially require: Marine strength water transfer pump	Pump brine from HDH system to salt pans	Pump linked to solar voltaic battery system room 3x3m	500x1000mm pump- room for battery store and bypass	
PVC output pipe with flexible spout- initial hard surface flow into pans	Transfer into pans	Secured pipe and solid surface	-	

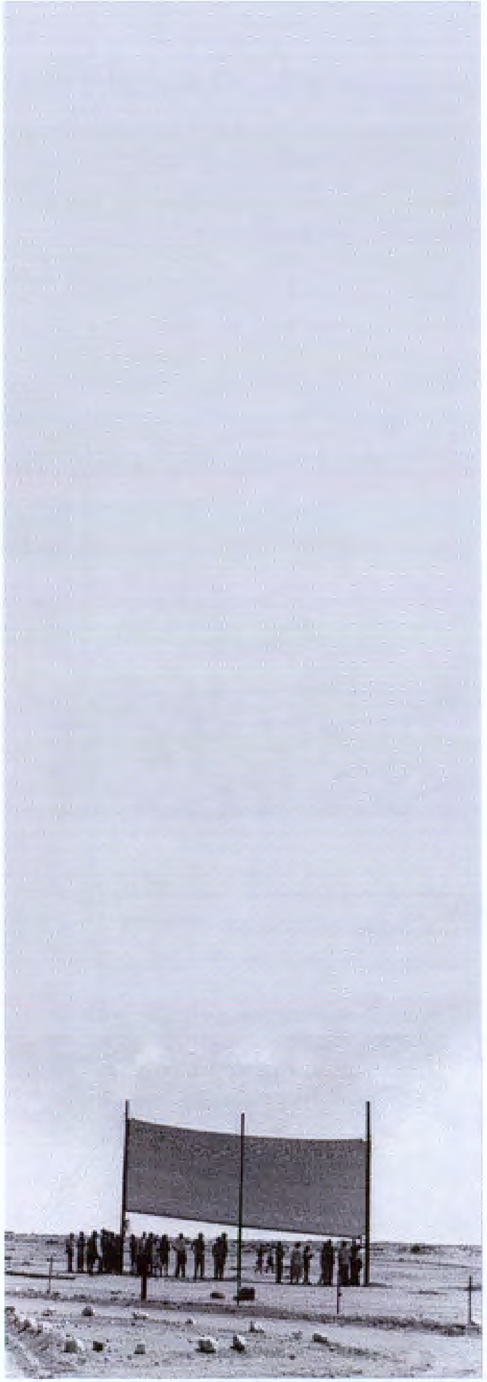


Image: Shanyengana, E. 2002

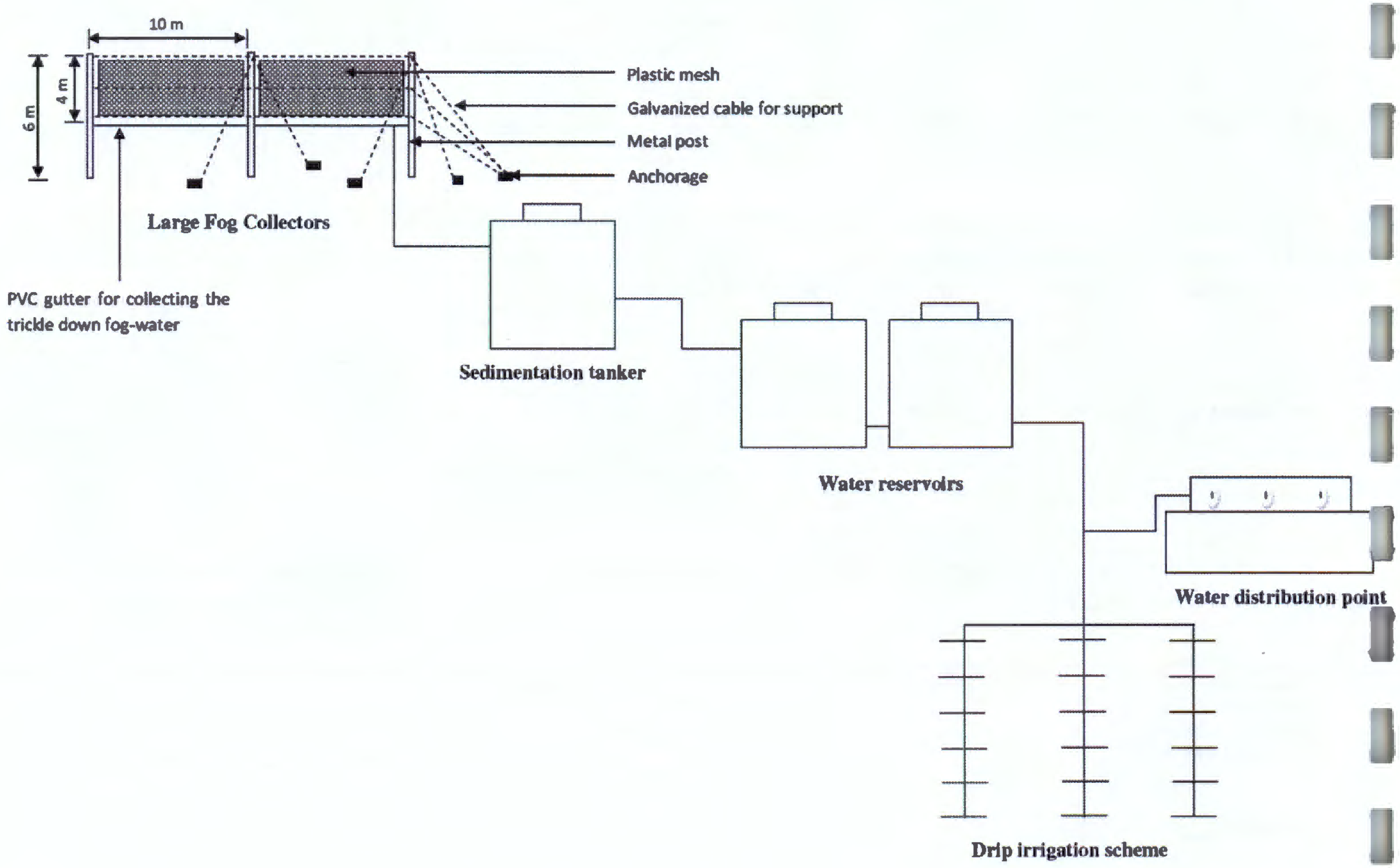


Diagram: Fessehaye et al. 201

3.4 Mimetic Technology: Fog-catchers

The action of solar desalination is modelled on the natural evaporative processes that occur within the atmospheric rain cycle. This mimetic potential is similarly realized in fog catching technologies. Fog catchers attempt to mimic the fog-basking action of Namib dune beetles, which condense and drink airborne water off their own bodies.[105] This technology is significantly more low-tech to implement but is also much less reliably water productive and efficient.

Similarly to small scale desalination, fog catching holds the potential to, at the very least, add to the water security of isolated communities. In Namibia they have been effectively tested at a number of research bases and effectively used by a few isolated Topnaar communities. Due to the availability of on-grid water sources their permanent testing and use along the coast itself has not been widely attempted. This technology is described below, with the understanding that their relationship to their users and landscape is part of their fundamental attributes.

"Fog catchers" refer to devices used to condense minute airborne water particles and collect or re-direct the water condensed by a surface into storage or towards human purpose.[106] Fundamentally this condensing system is passive. It relies not only on a constant high humidity but a wind borne fog to transfer the minute water particles to the surface.[107] Often used in remote locations or in a low resource economy these structures commonly rely on a simple vertical net form, supported by vertical poles and tension bracing to suit the size of the catching net.[108] The net must remain in tension and stable under wind pressure in order to maintain an uninterrupted flow of water to the water transfer system at its base. This transfer system can be any form of gutter or linked to a pipe network and storage system. The movement of water is thus passively guided throughout this system, into storage, by way of gravity.[109] The key to the catchment system is to exploit the hydrophilic properties of the net, while the transfer system becomes highly efficient when it is hydrophobic and quickly forms and transfers streams of water.[110] The efficacy of the unit thus becomes about a number of factors; its size, location, quality of its materials and, more recently hypothesised, its form.

Fog catchers are only useful in fairly predictable, fog abundant environments. In these locations the catchers are placed perpendicular to the prevailing fog-bearing winds. In order to catch uninterrupted wind flow these structures often stand high above the ground surface, generally between 1 and 3 meters.[111] As contact with a large surface area is vital to the functioning of these machines, their size is an important factor in their design. The nets are generally no more than 2 meters high but generally range in length, from modules of 1 meter to 8 meters. Although there is technically no limit to the size of fog catchers, and the larger nets bring in substantially more yields, they are also harder to maintain, build and stabilize against wind pressure.[112]

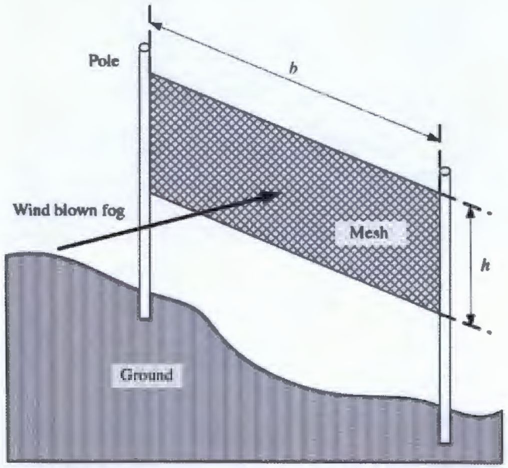
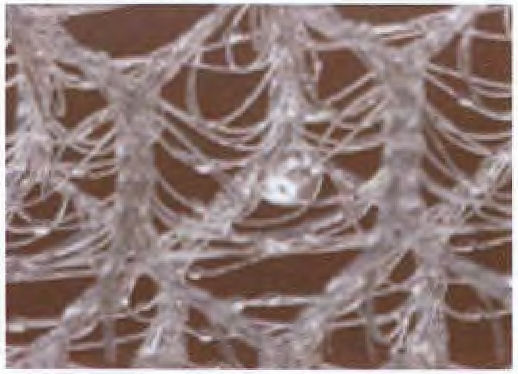


Image :Fessehaye et al. 2014


http://www.fastcompany.com/1749098/can-harvesting-fog-bring-water-thirsty Accessed 13/04/14


http://www.fastcompany.com/1749098/can-harvesting-fog-bring-water-thirsty Accessed 13/04/14

http://www.expatica.com/de/news/news_focus/Peru-slum-goes-cutting-edge-with-German-_fog-catcher_-_15111.html Accessed 13/04/14

Image: Shanyengana, E. 2002

Image: Suau, C. 2010

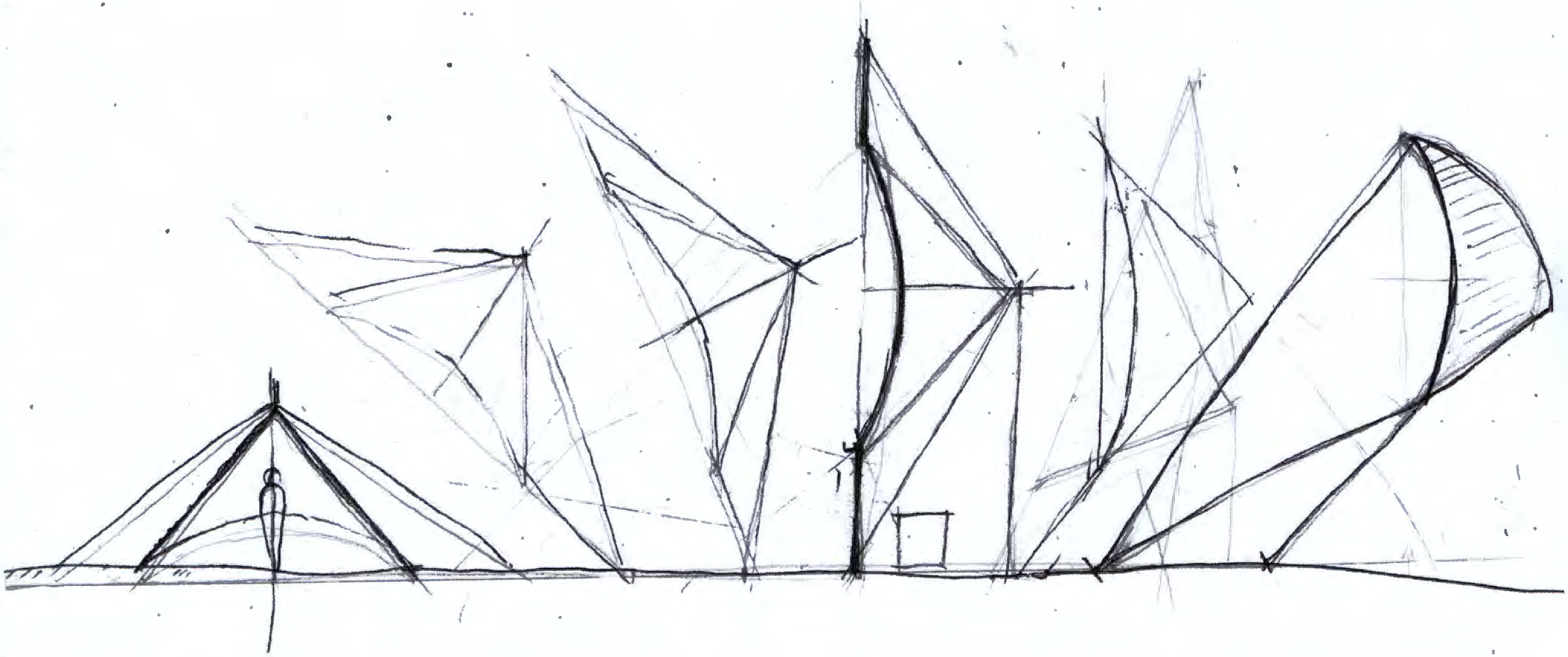
One of the major factors influencing the efficiency of these machines is the mesh material and weave used for catchment.[113] The majority of nets are made with the most readily available material, a 35% shade coefficient polypropylene mesh (standard shade netting). Although not optimal, a single layer net on average makes contact with around 30% of the passing wind. Most fog nets are double layered to help improve this factor but the threshold for this layered material is still around a 35% catching capability.[114] It is with this low contact figure in mind that new mesh materials are starting to be developed. Specially designed stainless steel meshes coated in super-hydrophilic engineered solutions have been shown to increase yields up to five times that of their standard mesh counterparts.[115]

Along with material developments, the flat forms of fog catchers are being questioned, by way of more robust and potentially more efficient three dimensional structures. These structures range from curving the netting surface to increase fog contact and maintain collection points, funnelling nets that channel fog wind more purposely towards their own surfaces[116] and three dimensional structures than encourage self-shading.[117]

The yields on fog catchers vary; for example in the Namib, a study determined that with a standard double layer polypropylene mesh the water yield could average anywhere between 1 to 15 litres per day, per square meter.[118] The storage and use of fog-water is dependent on the water quality. A hydro-chemical analysis of the desert fog-water in Namibia found it to be safe for human consumption[119], while in Chile it is commonly used for agriculture, due to its high nitrate concentration.[120] The storage of water is generally in tanks, as part of the catcher system, but precautions to chlorinate and keep the water contaminant free involves the constant care of users. Although catchment is small scale, it is good enough to substantially supply or supplement low consumption families, in rural environments. It seems that the yields generally warrant the initial cost and maintenance of this technology, but it is the user interest and correct maintenance that realises the full potential of this mimetic technology.

3.5 Dual Systems

There are advantages and disadvantages to using these technologies as separate entities but in the context of the Namib Desert the possibility that they can be combined as suppliers to the same system is also relevant. While solar desalination can function during grey sky conditions, it may require the use of back up generator systems during heavy fogs, with minimal thermal exposure. At these times fog catchers are especially useful. Although fog catching has variable or low yields, it can be a valuable contributor to water supplies. It is also a technology that has development potential in the testing of new materials and forms that could increase the water catching yields. Fog catching is also inevitably linked with access to another water supply which, in this case, could be a supplementary supply to solar desalinated water. Approaching water security with the notion of dual systems, combining more advanced machines with simpler technologies could not only lend itself to the environmental conditions of this coastline but test the effectiveness of their technical capability.

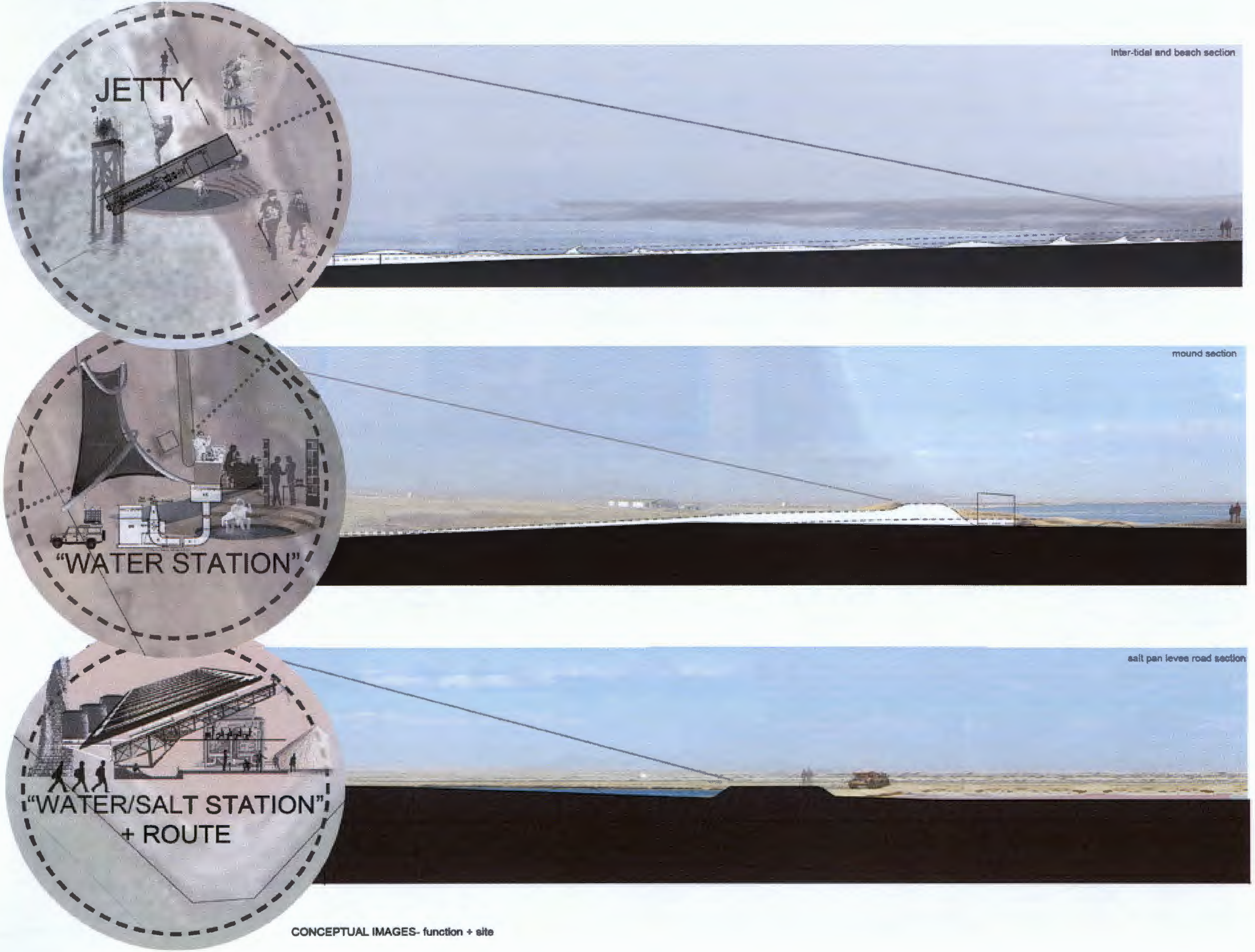


Li[illegible]t coastal materials- transformation

3.6 Endnotes

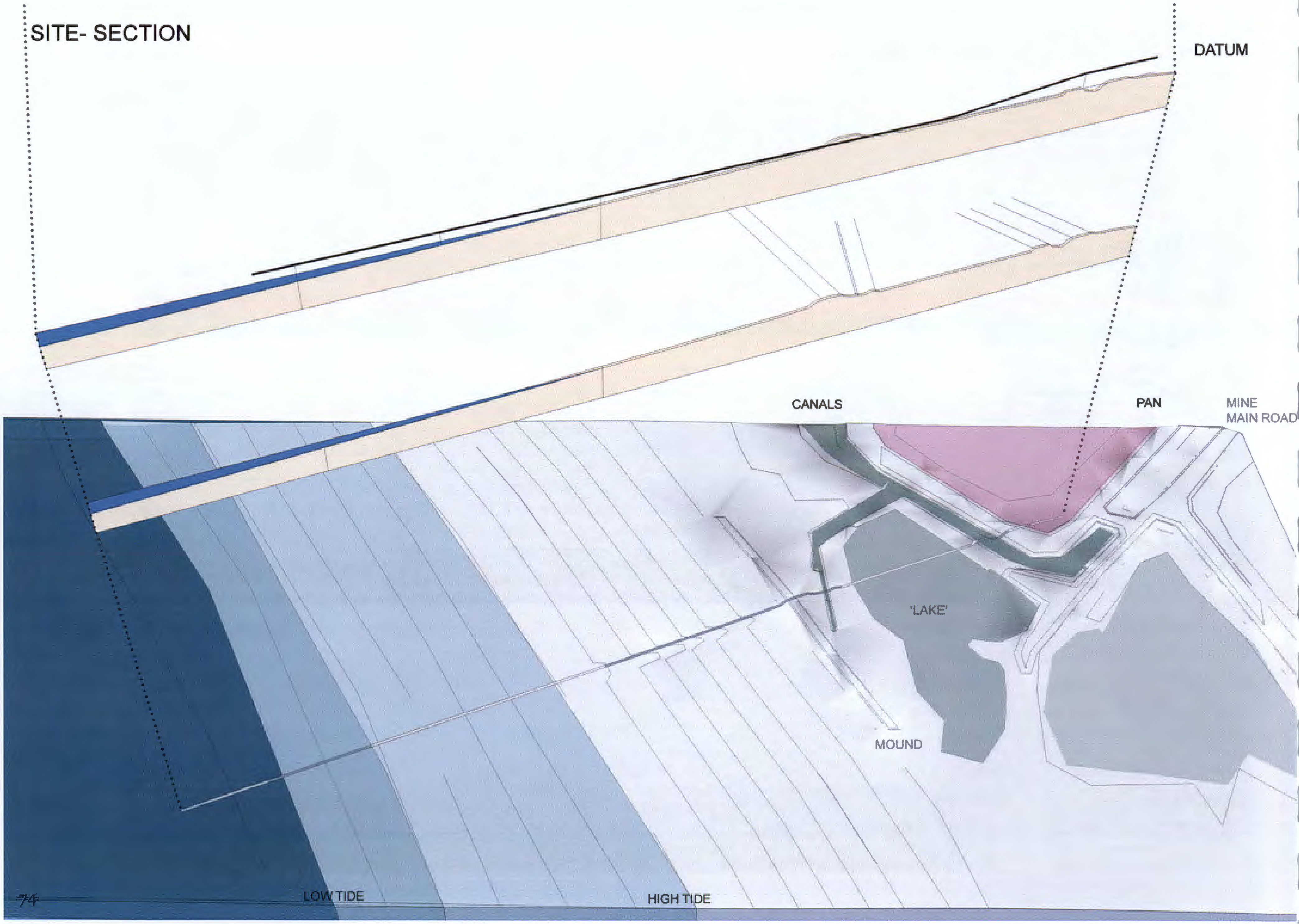
83. Downing, 2013
84. Qiblawey and Banat, 2008, p. 634
85. Qiblawey and Banat, 2008, p. 635
86. Von Oertzen and Schultz, 2008, pp. 1–3
87. Von Oertzen and Schultz, 2008, p. 10
88. Benyus, 2002, pp. 2, 60
89. M Fessehaye et al., 2014, p. 55
90. Bourouni et al., 2001, p. 167
91. Qiblawey and Banat, 2008, p. 634
92. Qiblawey and Banat, 2008, p. 634
93. Parekh et al., 2004, p. 168
94. Groenewald, 2010
95. Langley, 2012
96. Hartman, 2014
97. Von Oertzen and Schultz, 2008, p. 13
98. Von Oertzen and Schultz, 2008, p. 10
99. Marian, 2008
100. Parekh et al., 2004, pp. 172–173
101. Bourouni et al., 2001, p. 171
102. TerraWater, n.d.
103. Banat and Jwaied, 2008, p. 567
104. "TerraWater.de- Official Webpage," n.d.
105. Shanyengana et al., 2002, p. 251
106. Mussie Fessehaye et al., 2014, p. 53
107. Mussie Fessehaye et al., 2014, p. 54
108. UNEP- web published by the organisation for American States, n.d.
109. Mussie Fessehaye et al., 2014, p. 55
110. Rivera, 2011, p. 336
111. UNEP- web published by the organisation for American States, n.d.
112. Shanyengana et al., 2002, p. 252
113. Rivera, 2011, pp. 338–339
114. Rivera, 2011, p. 340
115. Park et al., 2013, p. 269
116. Hoehler, n.d.
117. Rivera, 2011, p. 341
118. Shanyengana et al., 2002, p. 257
119. Eckardt and Schemenauer, 1998, p. 298
120. Suau, 2010

4. Design development



CONCEPTUAL IMAGES- function + site

SITE- SECTION



4.1 Introduction

The synthesis of a number of conceptual ideas has come to the fore through the design development of the Water Line. Although these ideas are still finding form, the basic design is described in the following points and images.

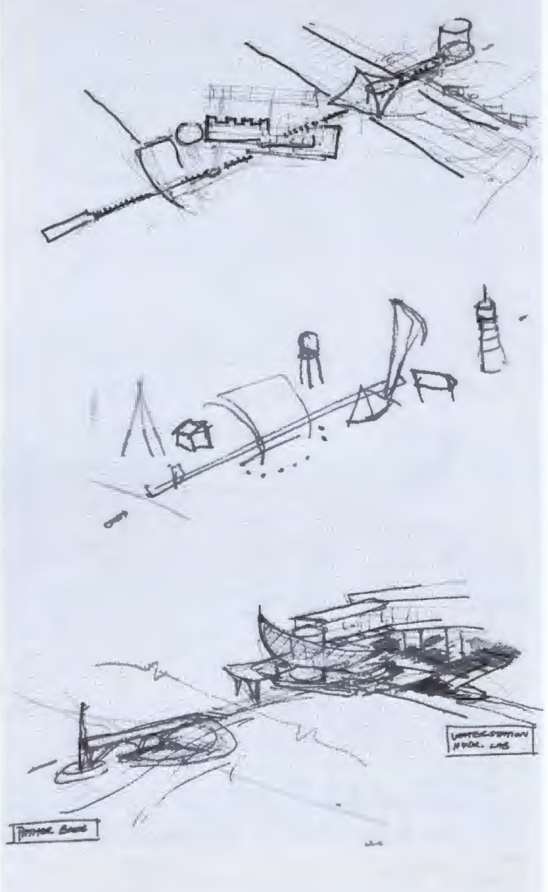
4.2 Blending and landscape: Line and scale

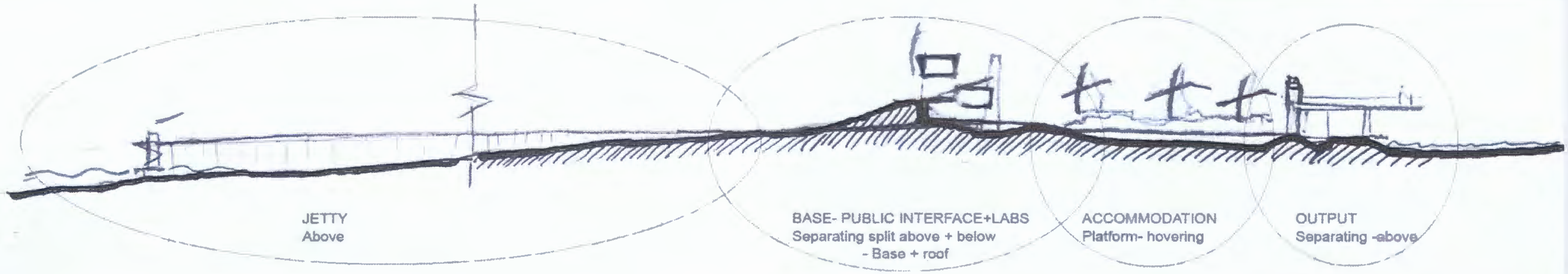
An understanding of scale and designed spaces as a manifestation of a whole element, a line and as its parts or points was attempted by engagement with the landscape. The use of the horizontal in such vast horizons allows for juxtaposed impression of the blended whole and expressive object. The elements that define the line thus attempt to unite the intervention together, in its horizontality, while highlighting the uniqueness of its elements as singular points through unique forms or in vertical elements.

The part and whole aspect, as well as the datum line of the project, was tested in a number of different configurations. The changing condition of the landscape-line interface hence became part of this investigation; with the line's earthing, raising or separating forming the base or platform for the buildings. The shifting site condition, as well as the line itself, speaks to responsive moments of nestling or grounding and un-grounding in raised interventions.

This changing cross section begins to identify with a layered building with two qualities; the "fixed" heavy base-like quality that speaks to the permanence and hard wearing capabilities required, and the gathering of space under lighter roofs and sheltered skins, which highlights the general temporality of the spatial experience. Both the ground-scape and roof-scape of the project are thus formalistically highlighted.

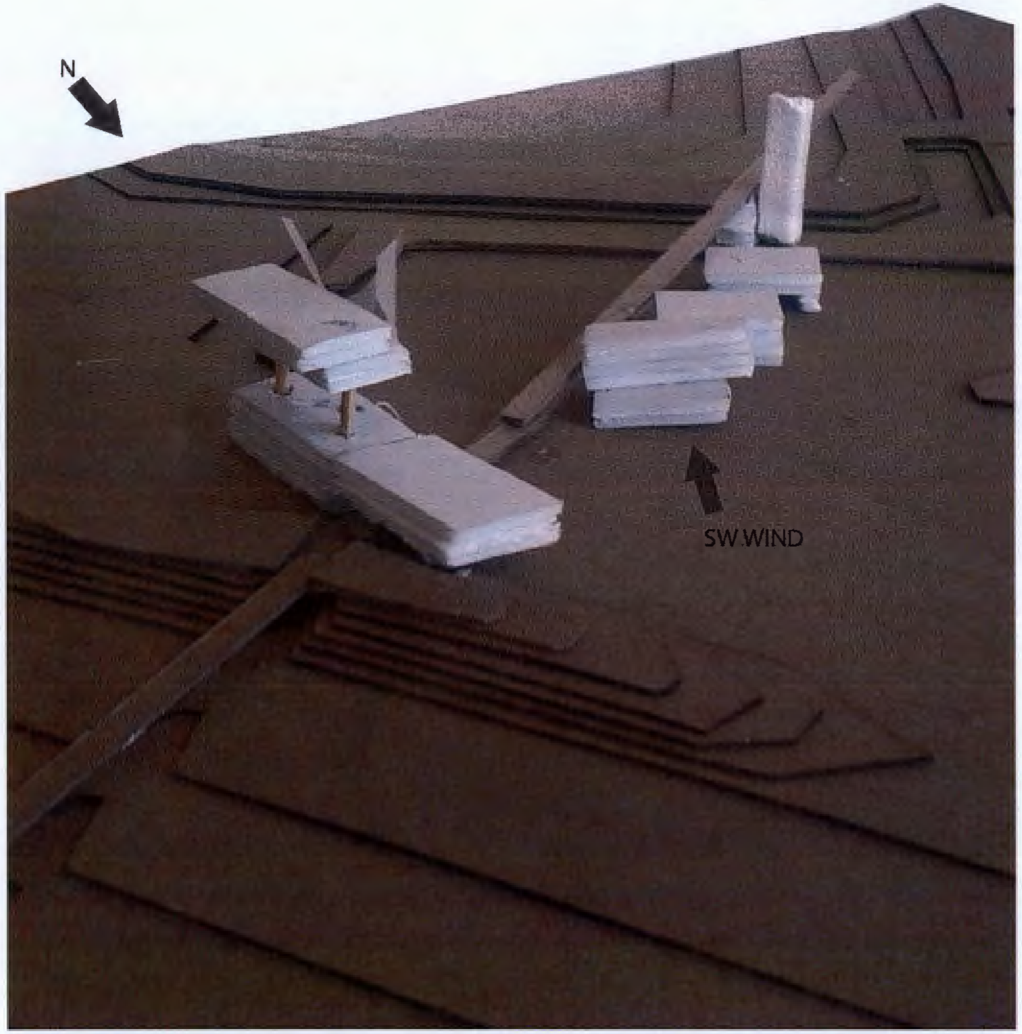
Conceptual sketches

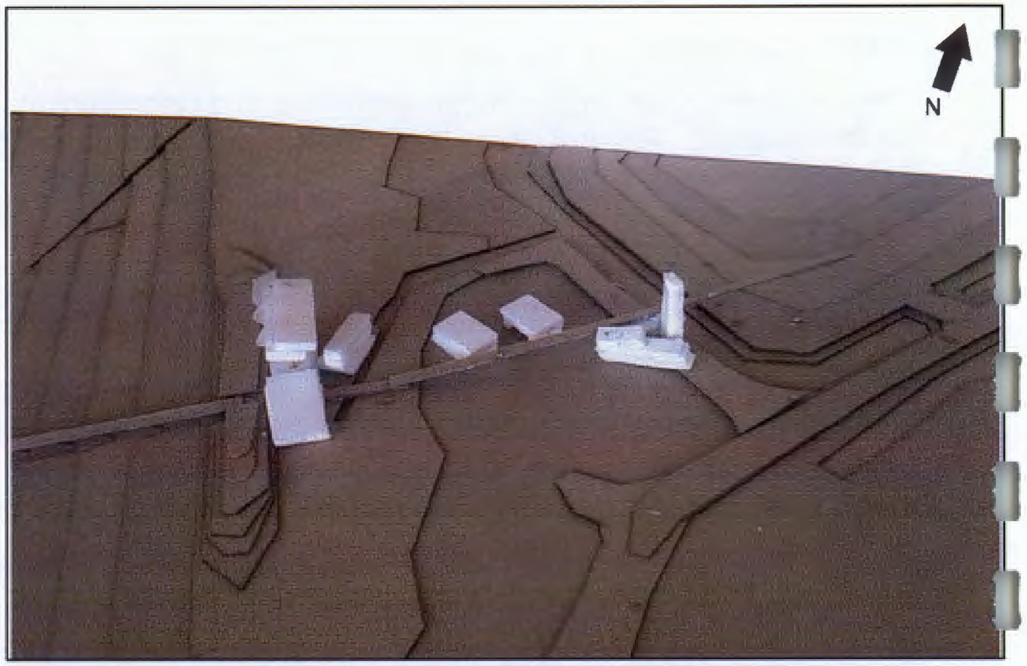


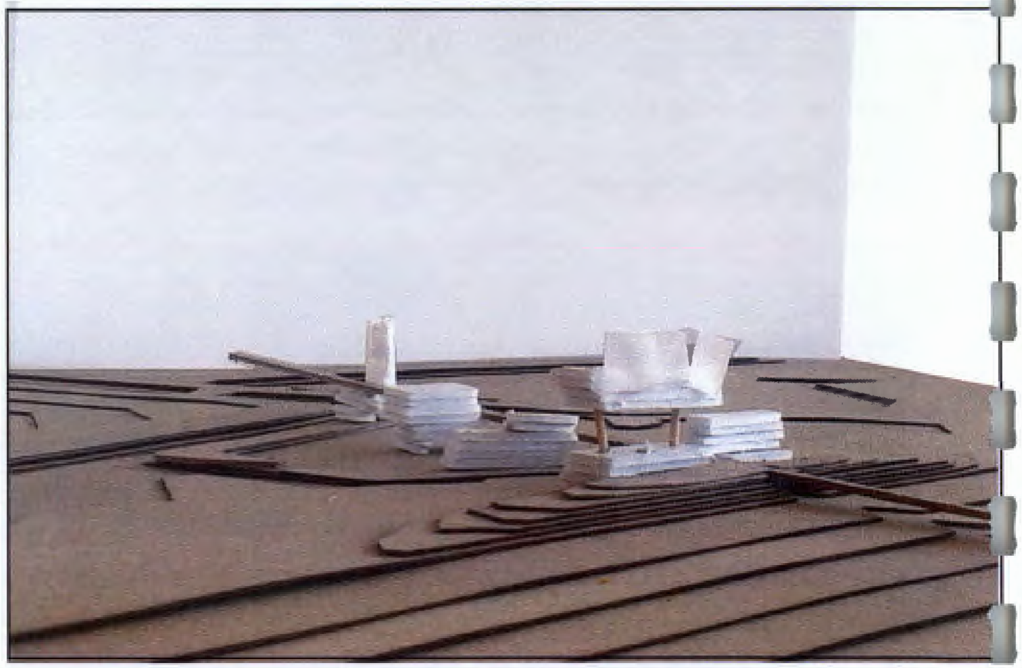


Horizontality: Part + whole

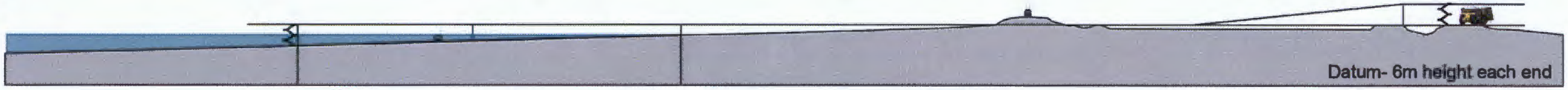
Examples of building configuration options
model 1:500

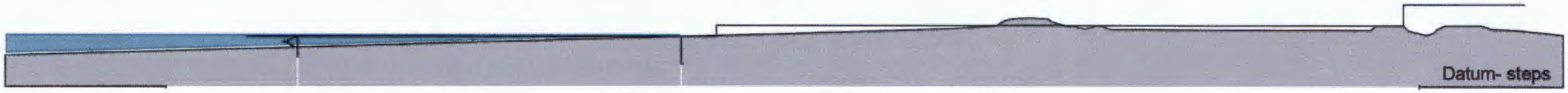


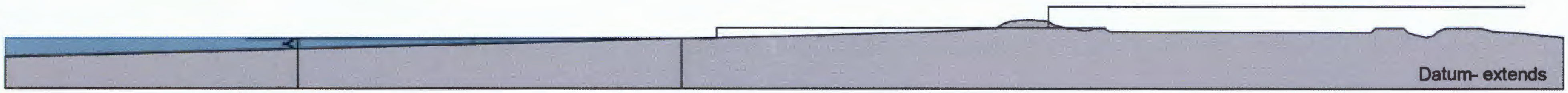


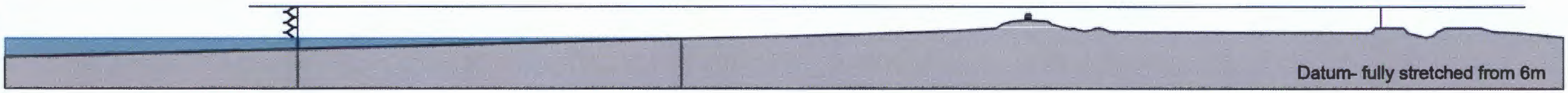


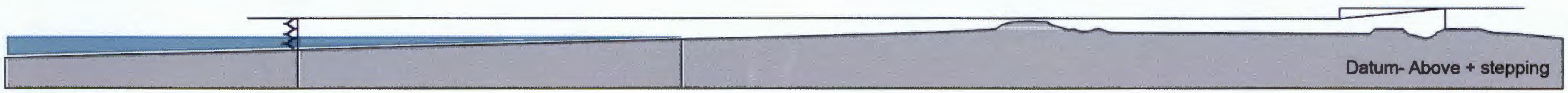
‘Aquaduct’: Landscape- line options

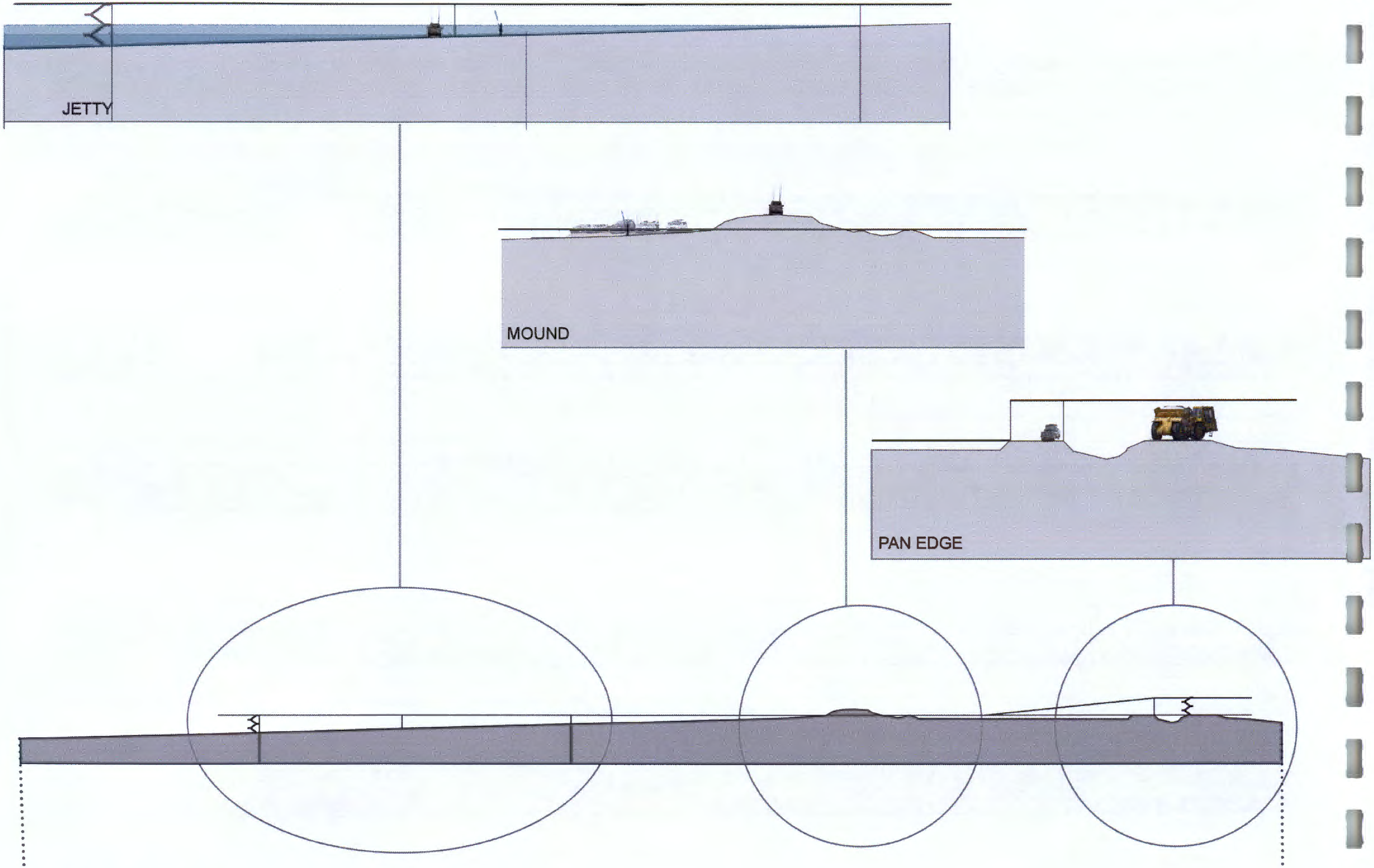












Route line datum: Through mound and 6m above each end

4.3 Distinction

The points or elements composing the Water Line are singular entities that express their own uniqueness in the functions they house, responses to site and in their materiality. Just as their relation to the whole or line is important, the unique characters of points begin to create distinction, with a greater variety of experiences of the landscape and architecture.

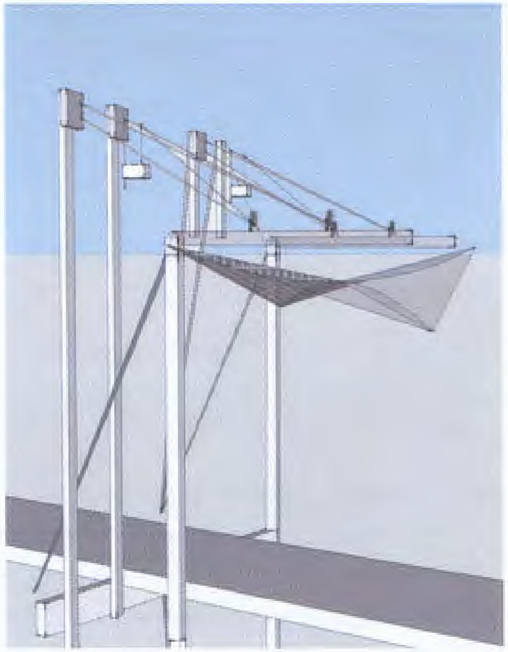
The unapologetically functional architecture of the desert and pans is carried through into the industrial character of the Water Line. Expressing and emphasising forms related to water production processes adds contrasting verticality to the line and its points.

Surreal experiential moments of distinction is an important aspect of the desert space. This changeability and the mobile human experience are expressed as features within the base. Undefined "roofed" space can be temporarily and flexible inhabited, while moving fog catchers serve the dual purposes of water catching and shading, as well as expressing the changing moments and experiences of the climate. Human interactions with these elements allow, at different times, both the effected space and technology to be experienced differently.

4.4 Technology: "A machine to live by"

Functionally the Water Line is interpreted as infrastructure on which buildings and capturing technologies clip and cluster. These technologies and elements have their own specific requirements and, as such, conflicting geometries as well as their gathering and separation are constantly present. This being said, these technologies also create unique architectural and experiential opportunities. These opportunities are taken advantage of to define aspects of the Water Line's architectural realization.

The architecture of survival and sustainability in the desert necessitates an eclectic mixture of both high and low technology and materiality. Utilizing the opportunities that high tech infrastructure and materials can provide, while integrating locality in simple forms and materiality, is an important aspect of the design of both the line as a whole, and the building points along it.



Testing of fog catcher structure: transforming to shade net roof

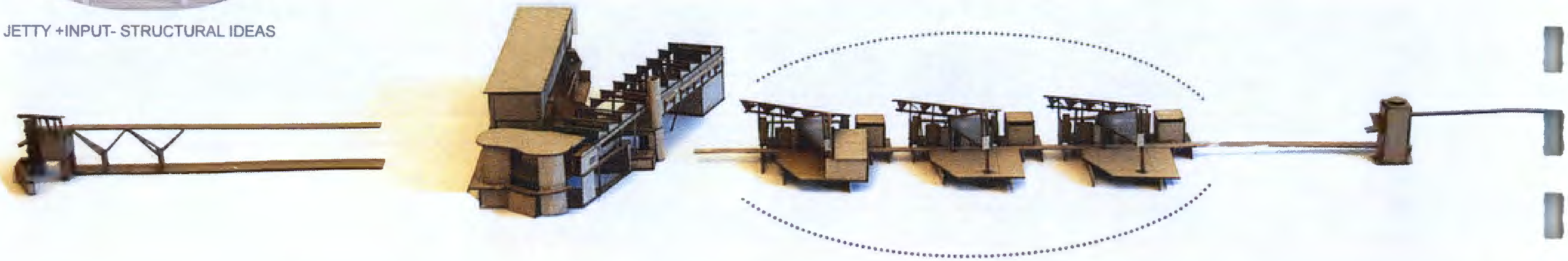
Initial testing of line datum, industrial character and split points

Author images: salt mine, Swakopmund water pump, mobile pan pump

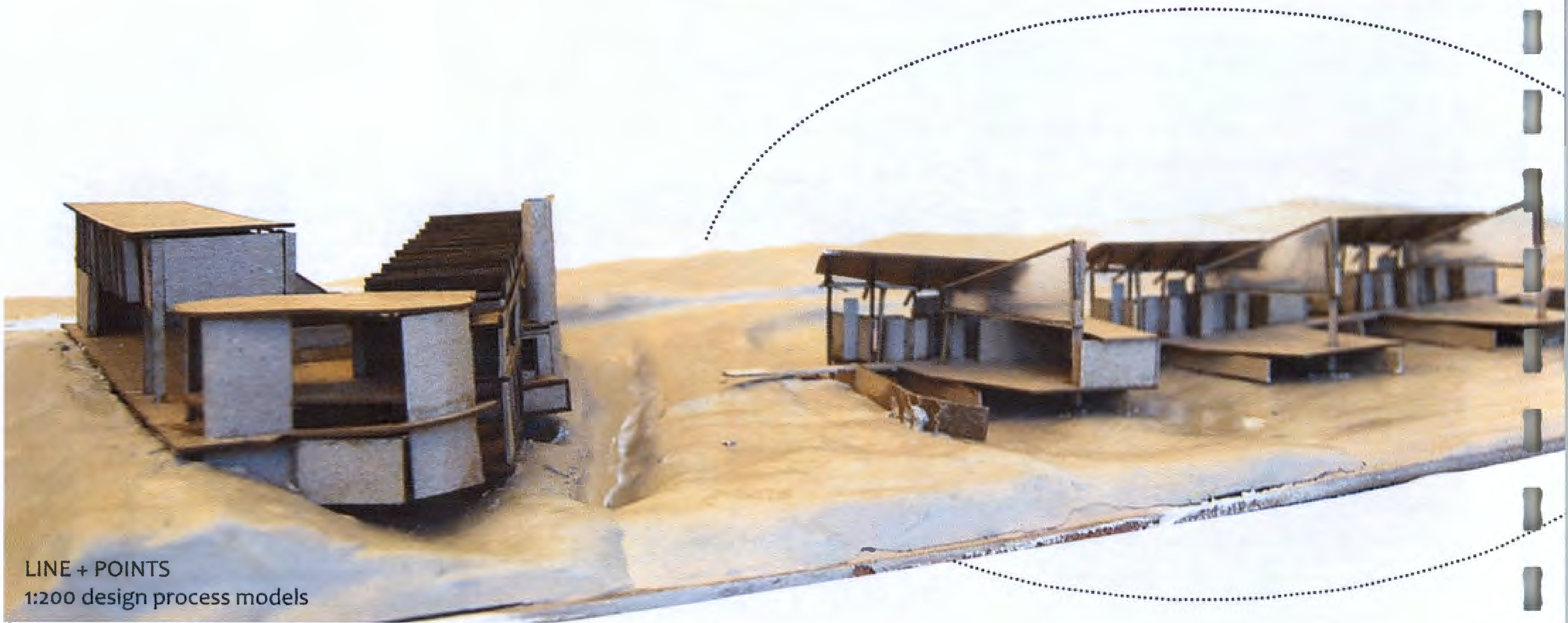
Initial testing of the 'water point' public functions, lab buildings and landscape interface both embedded and above the mound with strong linear frontage and roof-scape

Initial testing of the line aspect, with scattered accommodation points and raised output over the pan road

JETTY +INPUT- STRUCTURAL IDEAS



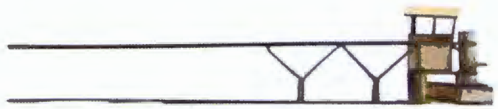
RESEARCHER/TOURIST ACCOMMODATION



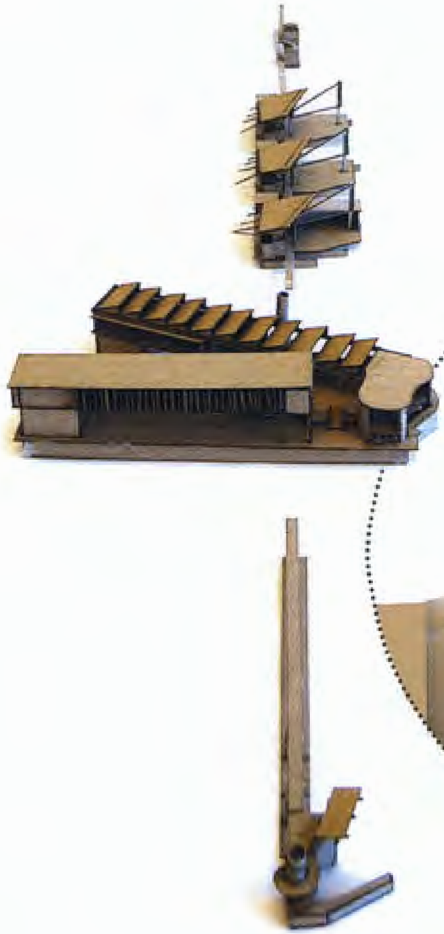
LINE + POINTS
1:200 design process models

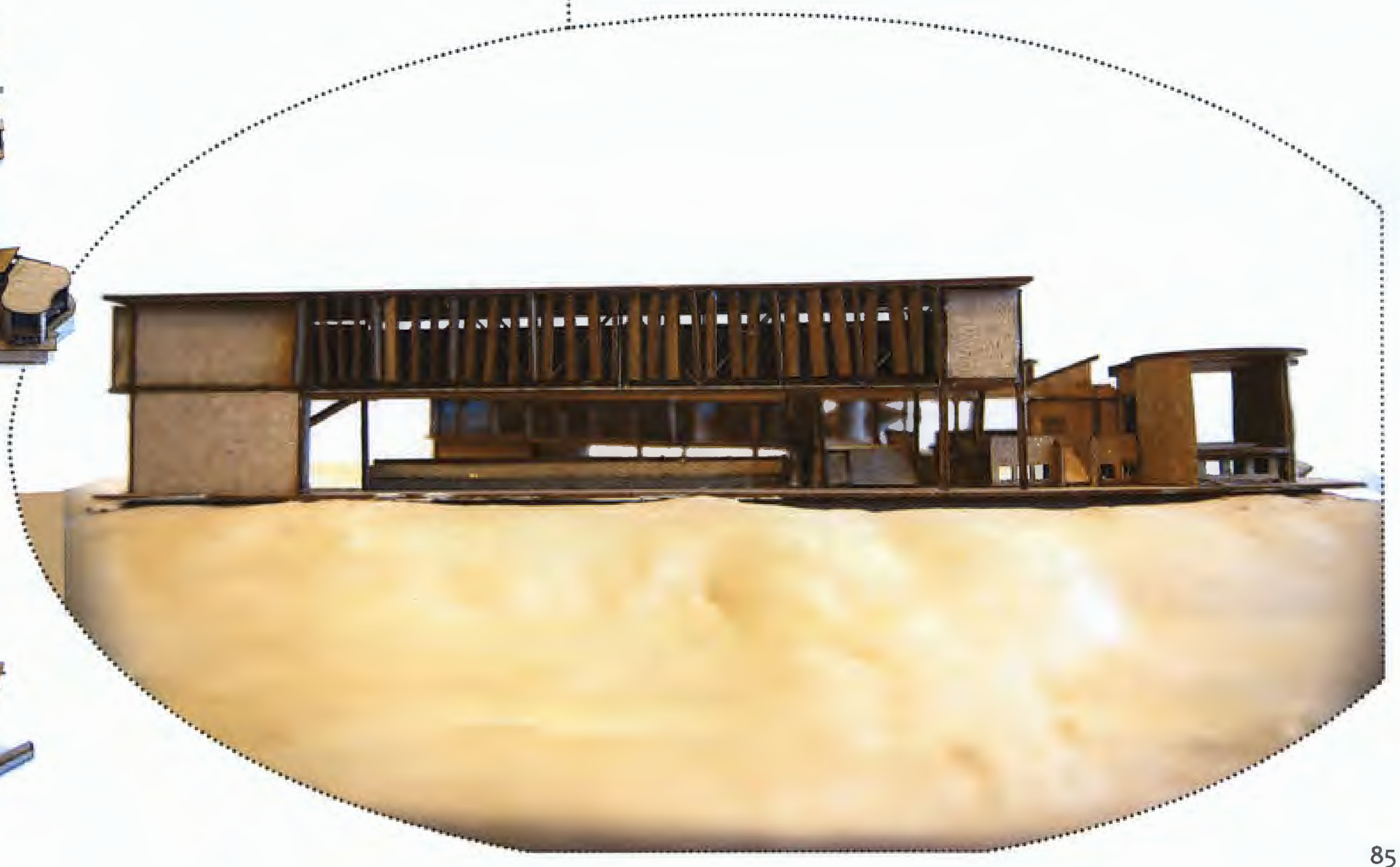
LINE + POINTS
1:200 design process models

OUTPUT BRIDGE

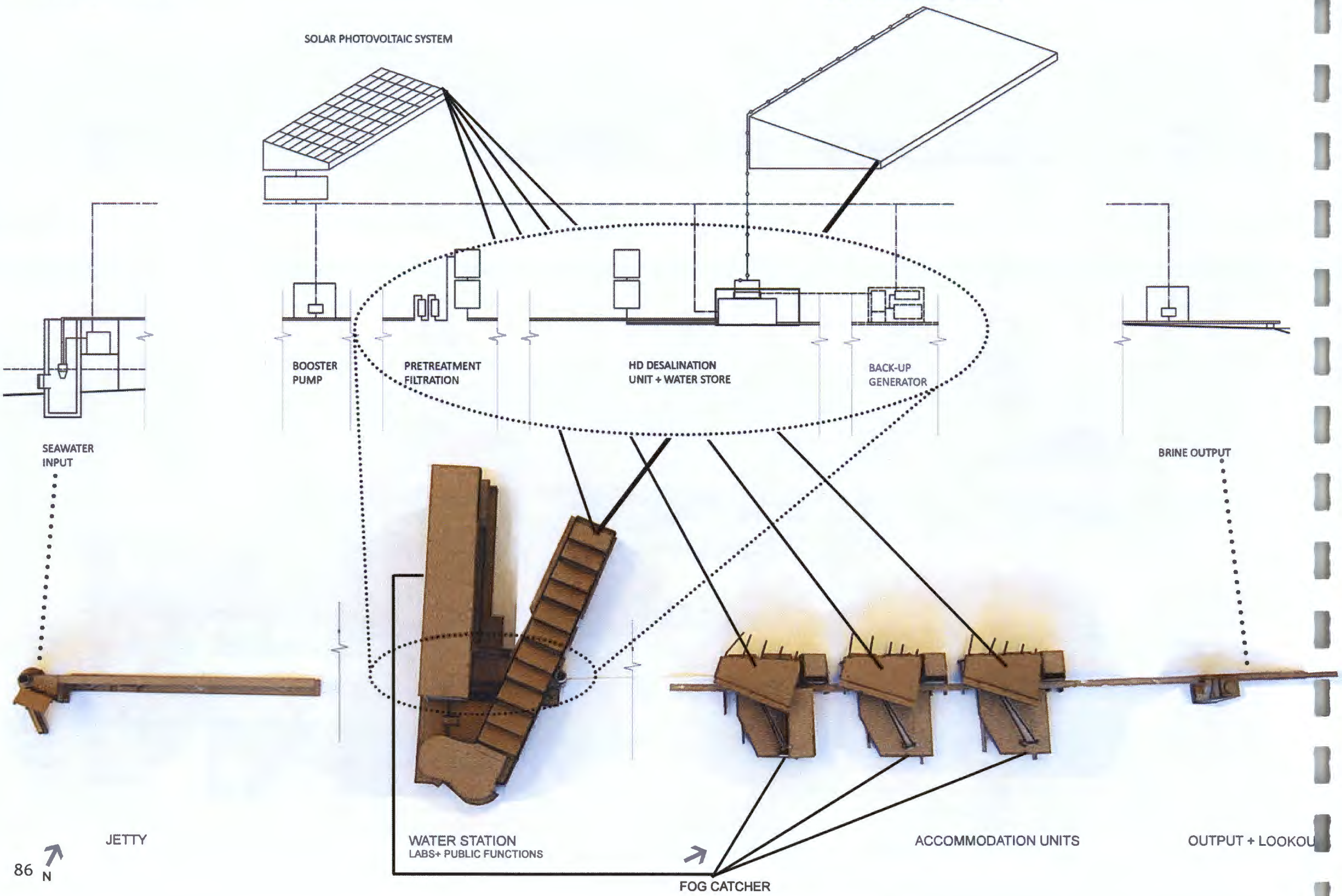


WATER STATION- LABS + PUBLIC INTERFACE

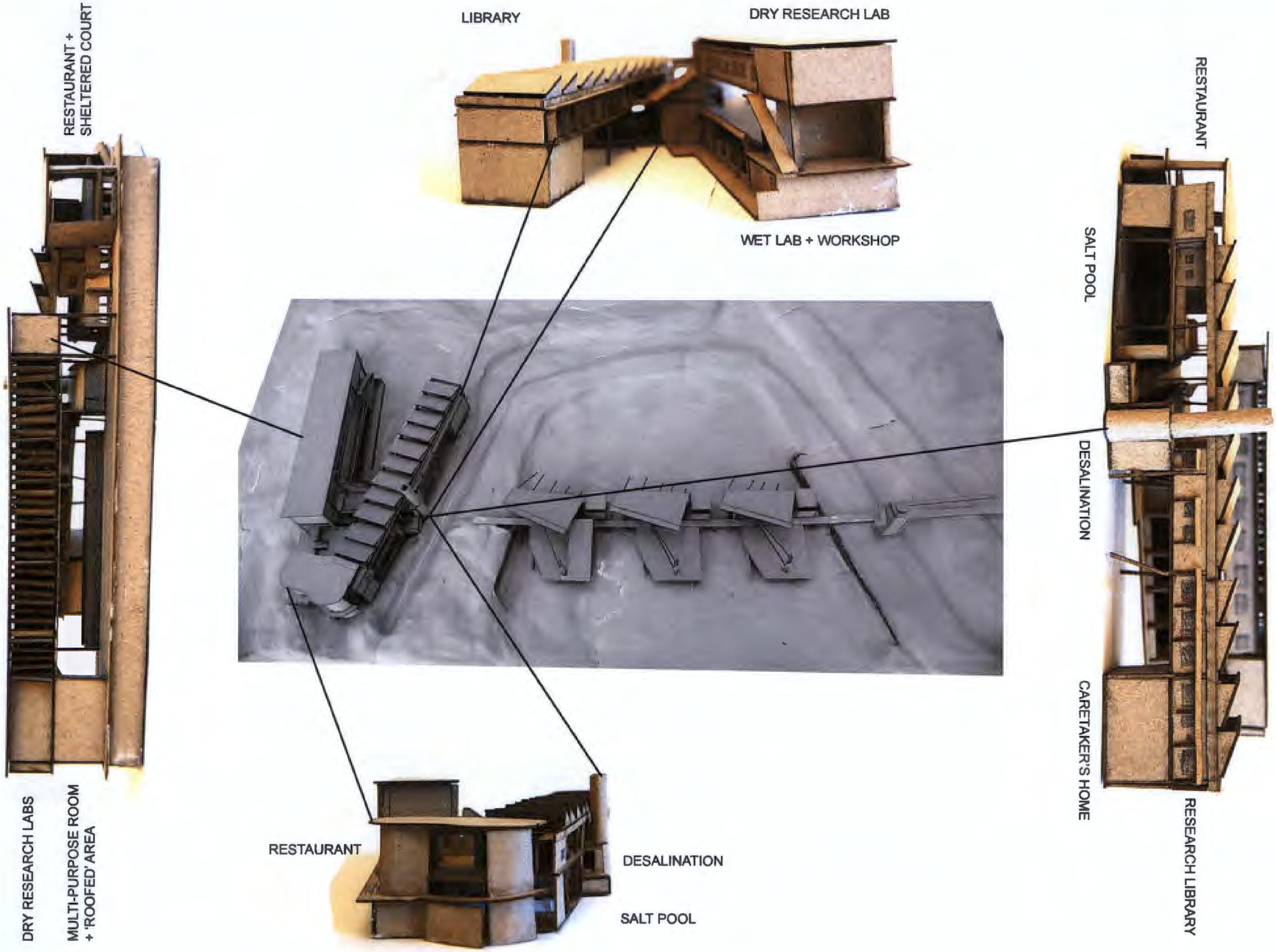




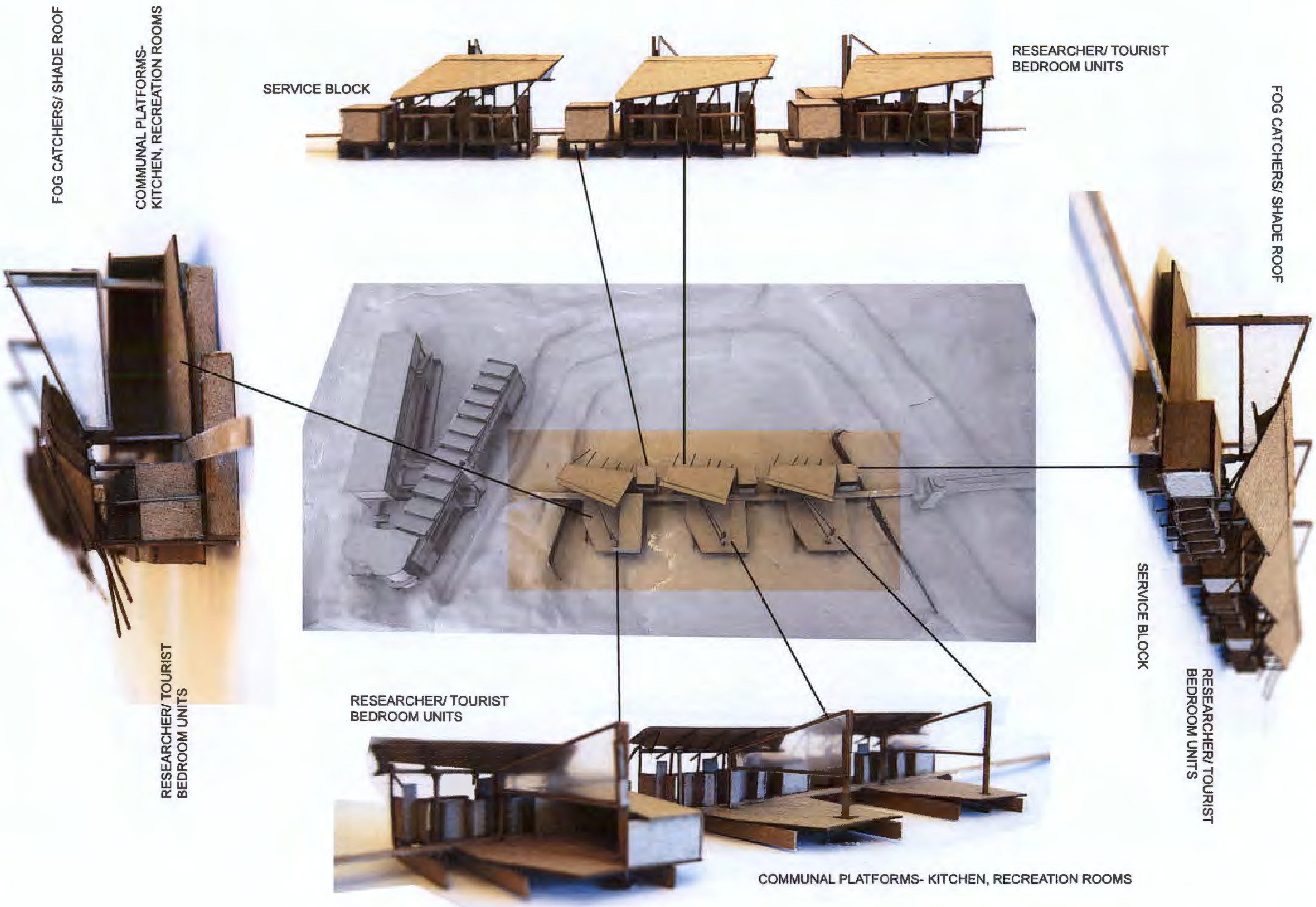
TECHNOLOGY-integration
1:200 design models



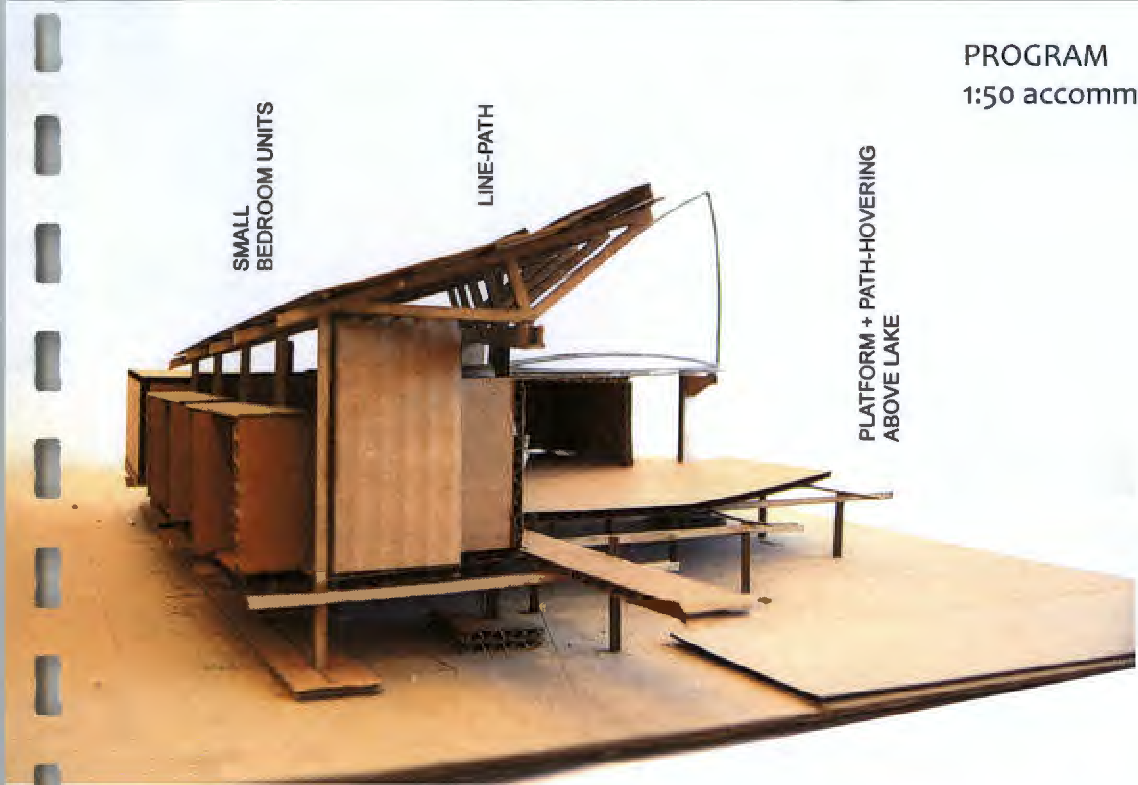
PROGRAM
1:200 water station design model

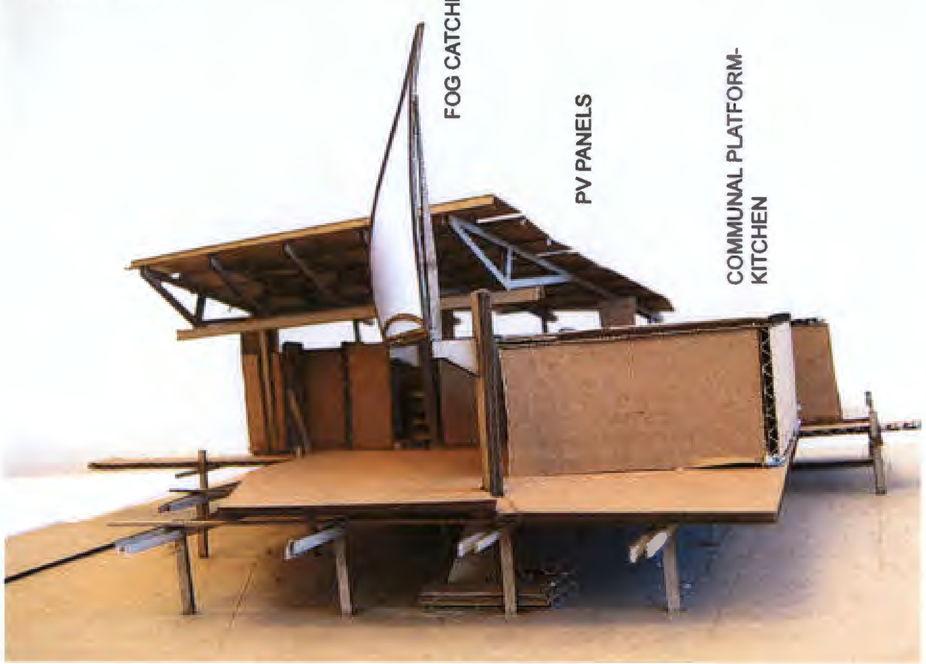


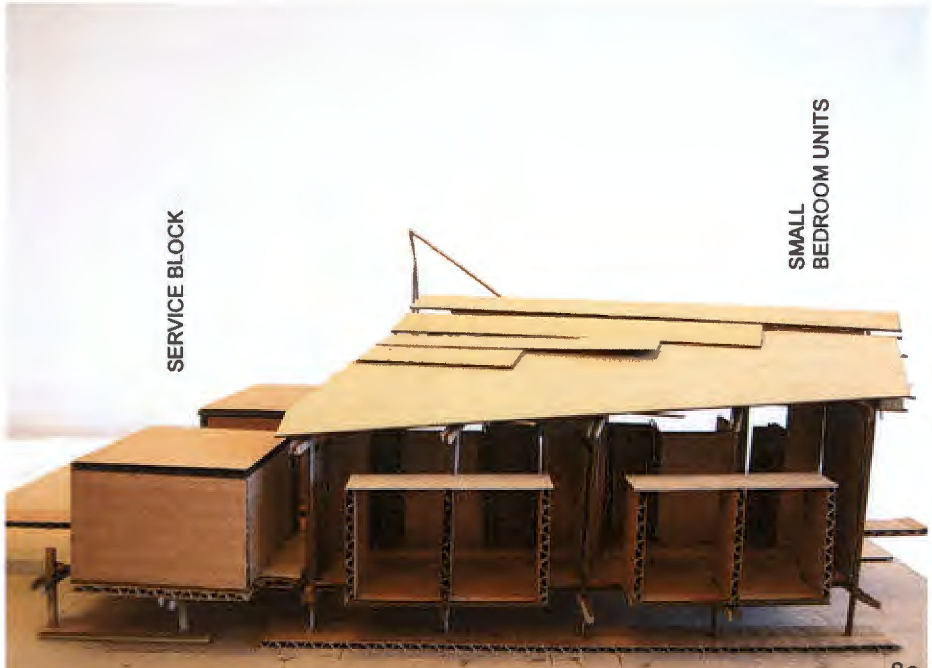
PROGRAM
1:200 accommodation units design model



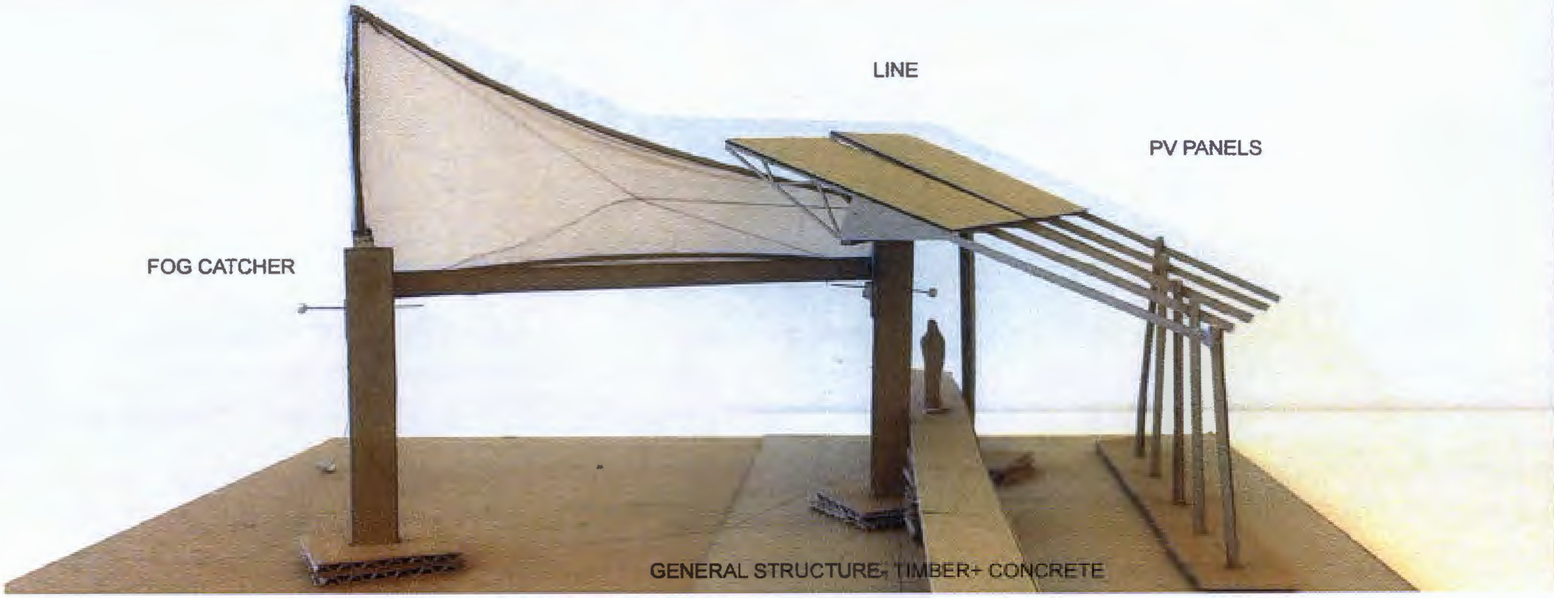
PROGRAM
1:50 accommodation units model







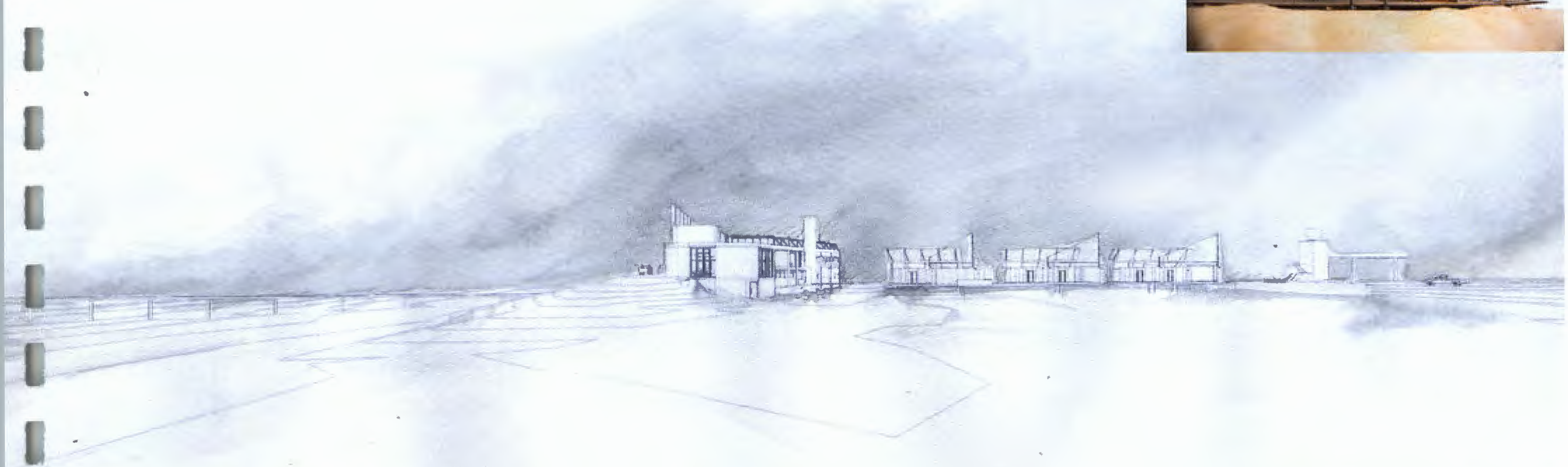
STRUCTURE
1:50 accomodation units and pivoting fog catcher model



4.5. Conclusion

"It is through mimetic impulse that human beings absorb external forms, incorporate them symbolically into their self-expression and then re-articulate them in the objects they produce."[121]

The understanding of this peculiar place and site has inevitably drawn design responses correlating to the functional, programmatic, aesthetic and formalistic character of the place itself. Through this narrative, and the narrative of the Water Line as a base point within it, this dissertation has attempted to incorporate place, with its opportunities and idiosyncrasies, as the fundamental driver of a design.



121. Quote by Adorno in Leach, 2006, p. 52

5. Bibliography

Banat, F., Jwaied, N., 2008. Economic evaluation of desalination by small-scale autonomous solar-powered membrane distillation units. Desalination 220, 566–573. doi:10.1016/j.desal.2007.01.057

Benyus, J.., 2002. Biomimicry. Harper Perennial, New York.

Bourouni, K., Chaibi, M.T., Tadrist, L., 2001. Water desalination by humidification and dehumidification of air: State of the art. Desalination 137, 167–176. doi:10.1016/S0011-9164(01)00215-6

Burger, P., 2014. Improving the bulk water supply to the town of Walvis Bay, Namibia. Presented at the Resilient Cities 2013-4th Global Forum on Urban Resilience & Adaption, Bonn, Germany.

Caillois, R., 1960. The Mask of Medusa. Victor Gollancz, London.

Caillois, R., 1987. Mimicry and Legendary Psychasthenia, in: Michelson, A. (Ed.), October: The First Decade, 1976-1986. MIT Press, Cambridge, Mass.

Downing, N., 2013. Historical display of the History of Cape Cross at the Cape Cross Museum.

Eckardt, F.D., Schemenauer, R.S., 1998. Fog water chemistry in the Namib desert, Namibia. Atmos. Environ. 32, 2595–2599. doi:10.1016/S1352-2310(97)00498-6

Fessehaye, M., Abdul-Wahab, S.A., Savage, M.J., Kohler, T., Gherezghiher, T., Hurni, H., 2014. Fog-water collection for community use. Renew. Sustain. Energy Rev. 29, 52–62. doi:10.1016/j.rser.2013.08.063

Fessehaye, M., Sabah, A., et al, 2014. Fog-water collection for community use. Renew. Sustain. Energy Rev. 01, 52–62.

Gobabeb Research and training Centre-Official Webpage [WWW Document], n.d. URL http://www.gobabebtrc.org/ (accessed 3.9.14).

Groenewald, Y., 2010. Tapping the sea. Mail Gaurdian.

Hartman, A., 2014. Rössing plans N$200m desalination plant. The Namibian.

Hoehler, I., n.d. Dropnet [WWW Document]. URL Available at: http://www.designboom.com/design/imke-hoehler-dropnet/

Hoernlé, W., 1985. The social organization of the Nama and other essays. Witwatersrand University Press, Johannesburg.

Kinahan, J., 1990. The impenetrable shield: HMS Nautilus and the Namib coast in the late eighteenth century. Cimbebasia.

Kinahan, J., 2011. From The Beginning: The Archeological Evidence, in: A History of Namibia: From the Beginning to 1990. Jacana Media, Auckland Park, South Africa.

Klein, J., 2014. Research Questions- Salt Pans and Mining.

Knappert, J., 1981. Namibia, land and peoples, myths and fables, Nisaba. Brill, Leiden.

Lacan, J., 1998. The four fundamental concepts of psycho-analysis. W.W. Norton, New York; London.

Lange, G.-M., 1998. An approach to sustainable water management in Southern Africa using natural resource accounts: the experience in Namibia. Ecol. Econ. 26, 299–311. doi:10.1016/S0921-8009(97)00119-5

Langley, P., 2012. . Nucl. Hist. URL http://nuclearhistory.wordpress.com/2012/08/23/areva-suspends-trekkopje-uranium-mine-project/ (accessed 3.9.14).

Leach, N., 2006. Camouflage. MIT Press, Cambridge, Mass.

Marian, B., 2008. Factsheet for Cuve Waters- Solar□driven Desalination,An Environmentally Sound Technology.

Mateo, J., 2008. Darwin on our Desk, in: Abalos, I., Mateo, J.L., Eidgenössische Technische Hochschule Zürich (Eds.), Natural Metaphor: An Anthology of Essays on Architecture and Nature. ETH ; Actar-D, Zürich; Barcelona; New York.

Mseyamwa, N., 2007. DEVELOPMENT-NAMIBIA: Interest in Uranium Powers Desalination Plans. Inter Press Serv. News Agency.

Namwater, Dippenaar, S., et al, 2009. Environmental Impact Assessment for Proposed Desalination Project at Mile 6, Swakopmund, Namibia. Namwater.

Norberg-Schultz, C., 1996. , in: Nesbitt, K. (Ed.), Theorizing a New Agenda for Architecture: An Anthology of Architectural Theory, 1965-1995. Princeton Architectural Press, New York, p. 422.

Ott, R., 2004. Salt Chapel. J. Archit. Educ. 57, 11–17. doi:10.1162/104648804772745201

Parekh, S., Farid, M., Selman, J., Alhallaj, S., 2004. Solar desalination with a humidification-dehumidification technique — a comprehensive technical review. Desalination 160, 167–186. doi:10.1016/S0011-9164(04)90007-0

Park, K.-C., Chhatre, S.S., Srinivasan, S., Cohen, R.E., McKinley, G.H., 2013. Optimal Design of Permeable Fiber Network Structures for Fog Harvesting. Langmuir 29, 13269–13277. doi:10.1021/la402409f

Pendleton-Jullian, A.M., 1996. The road that is not a road and the Open City, Ritoque, Chile, Graham Foundation/MIT Press series in contemporary architectural discourse. Graham Foundation for Advanced Study in the Fine Arts ; MIT Press, Chicago : Cambridge, Mass.

Public Notes on meeting of Council Scientific and Industrial Research and SaltCo, 2009.

Qiblawey, H.M., Banat, F., 2008. Solar thermal desalination technologies. Desalination 220, 633–644. doi:10.1016/j.desal.2007.01.059

Rivera, J. de D., 2011. Aerodynamic collection efficiency of fog water collectors. Atmospheric Res. 102, 335–342. doi:10.1016/j.atmosres.2011.08.005

Robertson, T., et al, 2012. Namibia's coast: ocean riches and desert treasures. Directorate of Environmental Affairs, Ministry of Environment and Tourism, Windhoek.

Roxin, E., 1997. Client design Report -Unam Henties Bay Campus.

SaltCo, n.d. Salt Company Information Pamphlet.

Sauter, F., 2008. The Sun Also Shines Today, in: Abalos, I., Mateo, J.L., Eidgenössische Technische Hochschule Zürich (Eds.), Natural Metaphor: An Anthology of Essays on Architecture and Nature. ETH ; Actar-D, Zürich; Barcelona; New York.

Schneider, G., Becker, Thomas, 2008. The roadside geology of Namibia. Borntraeger, Berlin; Stuttgart.

Seely, M., Pallett, J., 2008. Namib Secrets of the Desert Uncovered. Venture Publications, Windhoek, Namibia.

Shanyengana, E.., Henschel, J.., Seely, M.., Sanderson, R.., 2002. Exploring fog as a supplementary water source in Namibia. Atmospheric Res. 64, 251–259. doi:10.1016/S0169-8095(02)00096-0

Suau, C., 2010. Fog Collection and Sustainable Architecture in Atacama Coast.

TerraWater, n.d. Terrawater technologies: Humidification / Dehumidification- animation [WWW Document]. URL https://www.youtube.com/watch?v=KSVxJefUUik&feature=player_detailpage (accessed 3.9.14).

TerraWater.de- Official Webpage [WWW Document], n.d. URL http://www.terrawater.de/index.php?option=com_content&view=article&id=15&Itemid=5&lang=en (accessed 3.9.14).

UNEP- web published by the organisation for American States, n.d. “Fog Harvesting” based on book- Alternative Technologies for Freshwater Augmentation in Latin America and the Caribbean [WWW Document]. URL http://www.oas.org/dsd/publications/unit/oea59e/ch12.htm (accessed 9.4.14).

Vidler, A., 2003. Fantasy, the Uncanny and Surrealist Theories of Architecture. Pap. Surrealism.

Von Oertzen, D., Schultz, R., 2008. Village-scale and Solar Desalination Technology Experience in Namibia (No. Cuve Waters paper 4). Frankfurt.

Wallace, M., Kinahan, J., 2011. A history of Namibia: from the beginning to 1990. Jacana Media, Auckland Park, South Africa.

water scarcity solutions, n.d. Water scarcity solutions- Case study of groundwater recharge at the Omdel Dam Namibia [WWW Document]. URL http://www.waterscarcitysolutions.org/assets/2030WRG_case_study_omdel_dam.pdf (accessed 9.30.14).

Image reference list:

Smith, A.B., Kinahan, J., 1984. The invisible whale. World Archaeol. 16, 89–97. doi:10.1080/00438243.1984.9979918

Gobabeb Research and training Centre-Official Webpage [WWW Document], n.d. URL http://www.gobabebtrc.org/ (accessed 3.9.14).

https://www.facebook.com/pages/Gobabeb-Research-and-Training-Centre/194358393921471?sk=photos_stream Accessed:03/09/14

E. Roxin- Sketch design drawings

Dorob map: http://travelnewsnamibia.com/archives/travel-news/a-park-of-extremes-dorob/#.VAc759y-Syd4 Accessed 03/09/14

Aerial image: http://www.masterfile.com/stock-photography/image/841-02718096/Aerial-photo-of-sea-salt-pans-Swakopmund-Namibia-Africa Accessed 03/09/14

Image : Abandoned mine in Sperrgebiet
http://stories.namibiatourism.com.na/blog/bid/307846/Pomona-Namibia-s-Forgotten-Ghost-Town accessed:03/09/2014

Image : Oil Rig Skeleton Coast
http://www.getaway.co.za/travel-ideas/abondoned-sites-southern-africa/ accessed:03/09/2014

Images: Glenn Howard Emcon Engineers

http://en.wikipedia.org/wiki/Chaplin's_Patent_Distilling_Apparatus_with_Steam_Pump

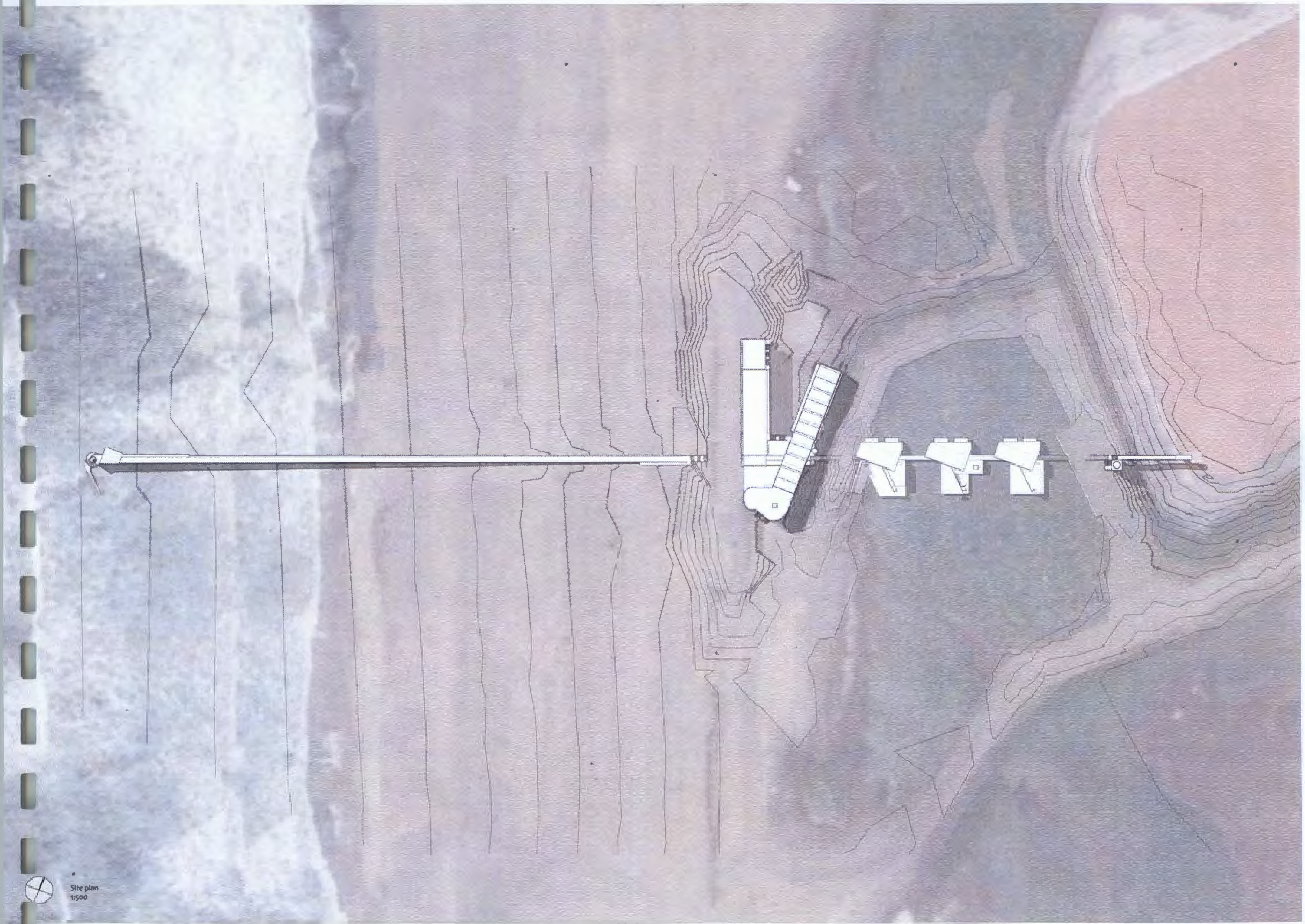
Drawing: E Roxin, Aquarium Technical documentation

Yuan, G., Wang, Z., Li, H., Li, X., 2011. Experimental study of a solar desalination system based on humidification–dehumidification process. Desalination 277, 92–98. doi:10.1016/j.desal.2011.04.002

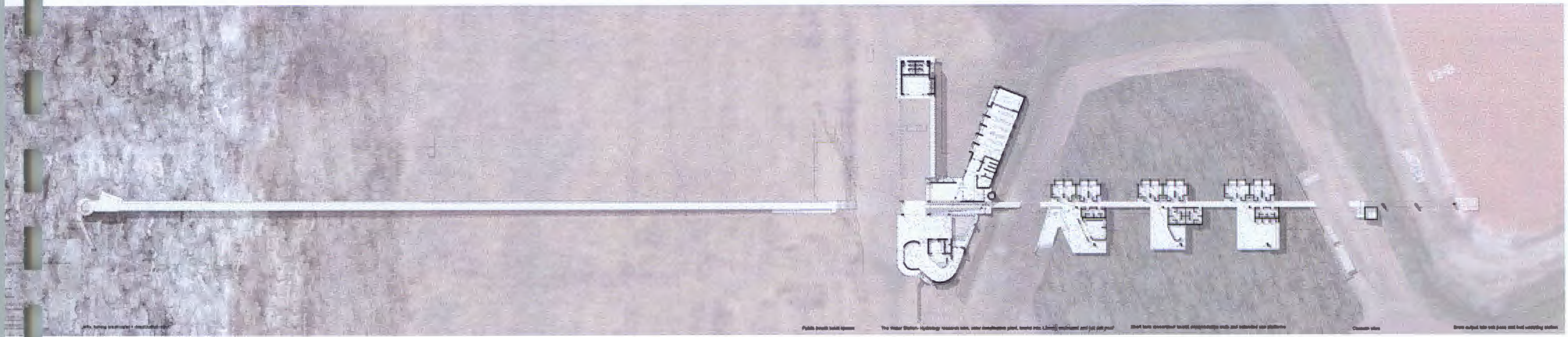
http://www.fastcompany.com/1749098/can-harvesting-fog-bring-water-thirsty Accessed 13/04/14

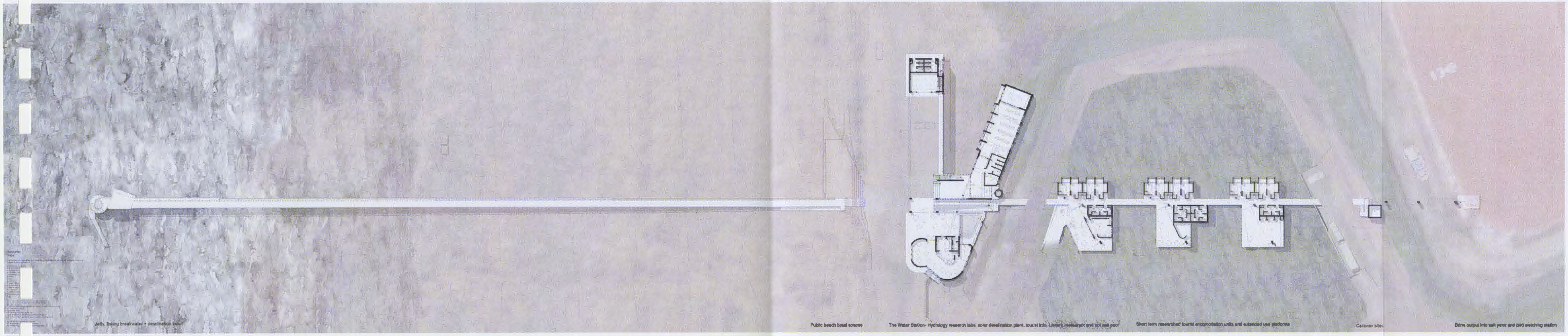
http://www.expatica.com/de/news/news_focus/Peru-slum-goes-cutting-edge-with-German-_fog-catcher_-_15111.html Accessed 13/04/14

http://www.denverpost.com/art/ accessed:03/09/2014

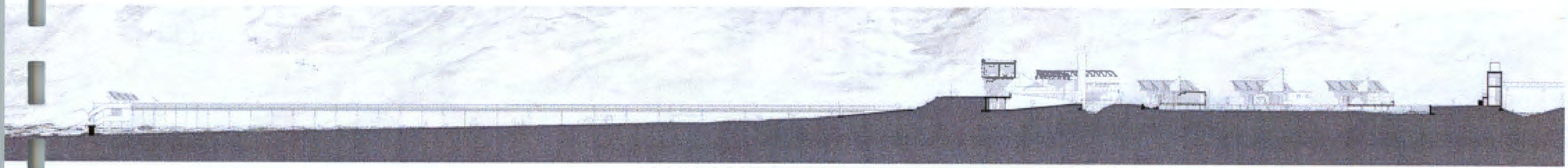


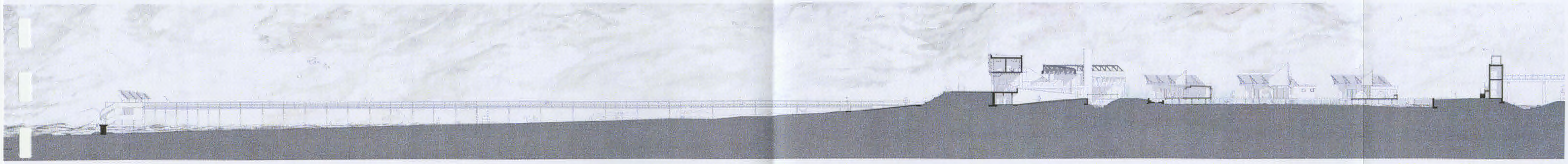
Site plan
1:500

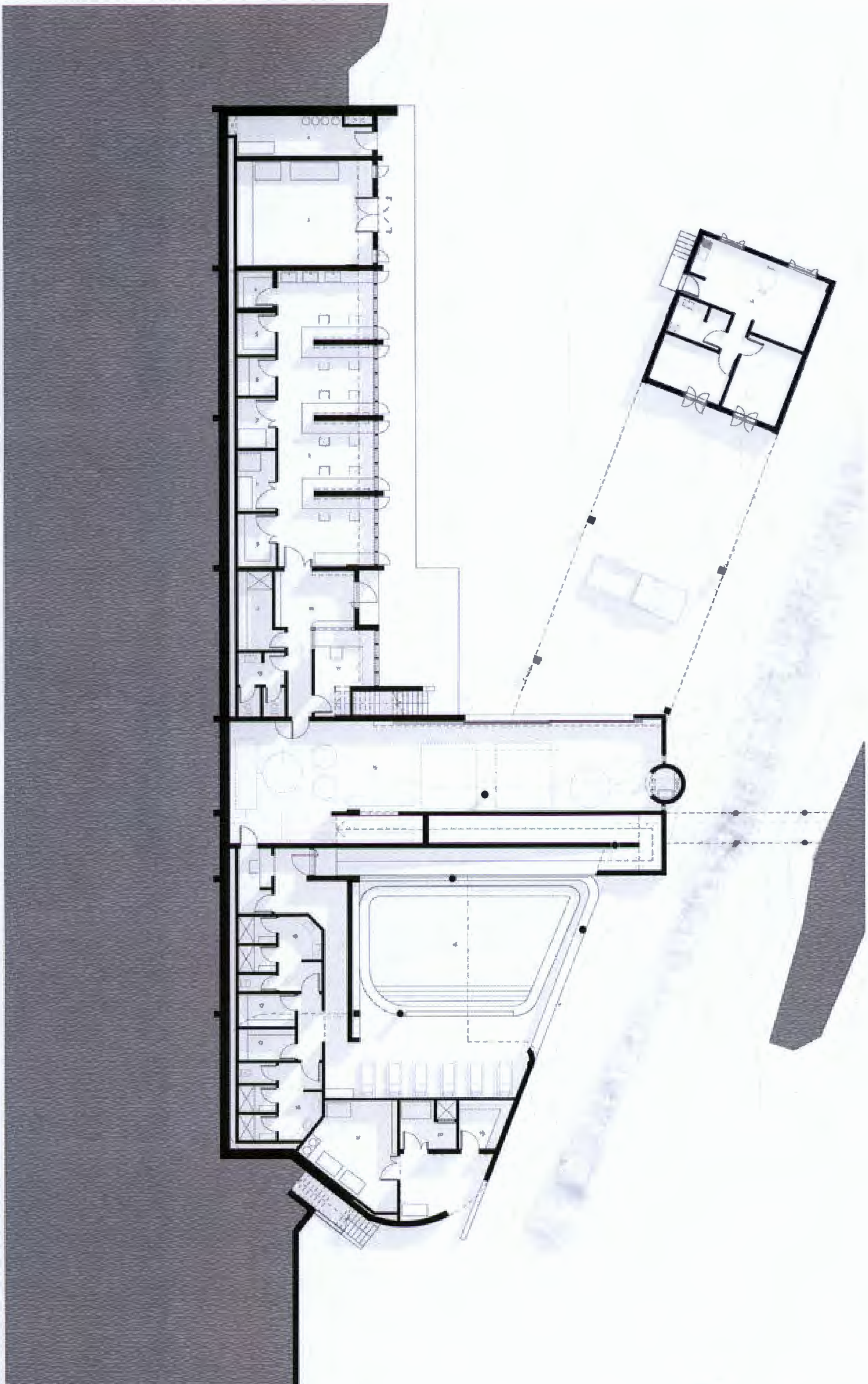




Public beach local spaces
The Water Station- Hydrology research labs, solar desalination plant, tourist info, Library, restaurant and hot salt pool
Short term researcher/ tourist accommodation units and extended use platforms
Caravan sites
Brine output into salt pans and bird watching station



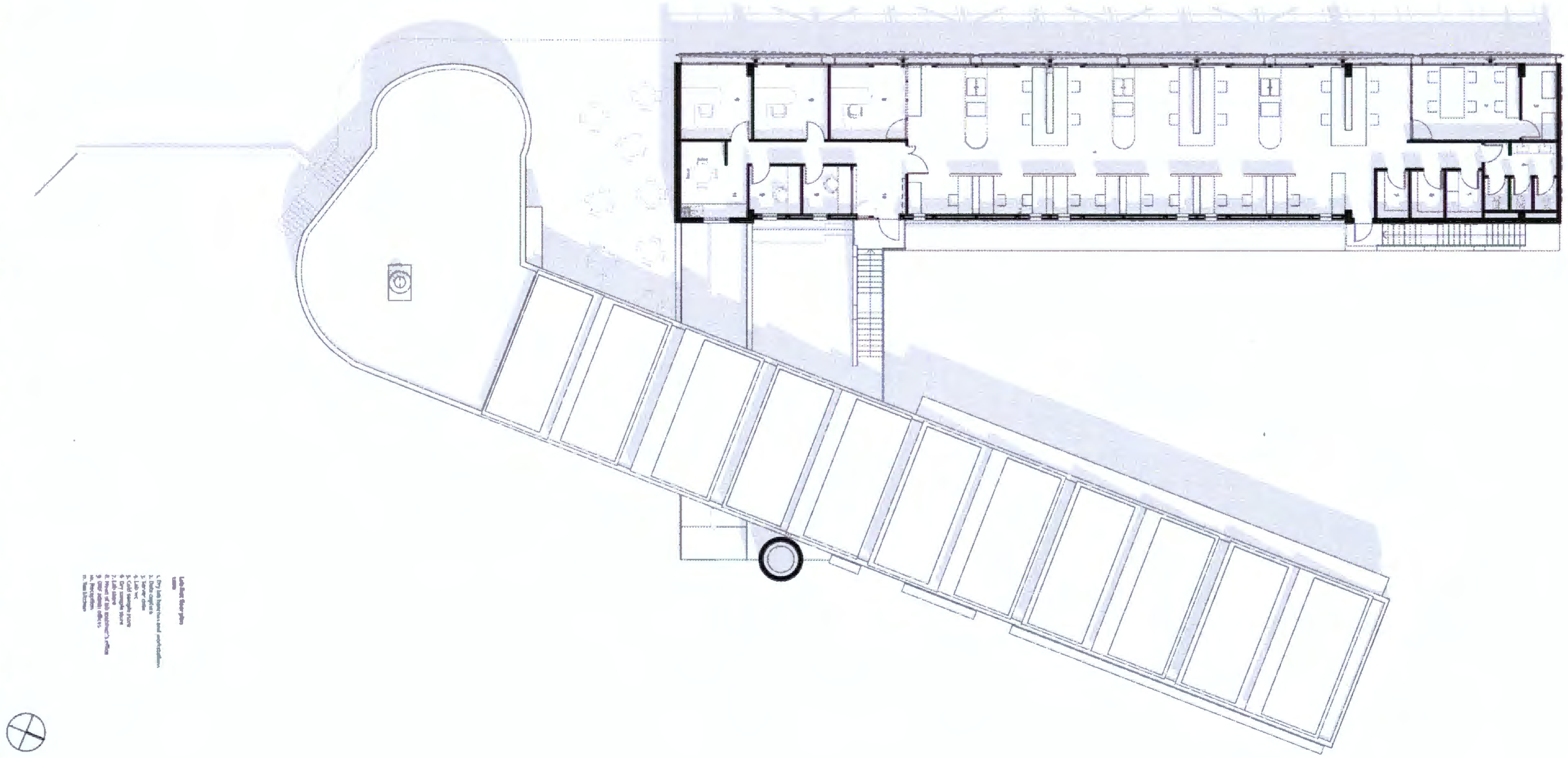


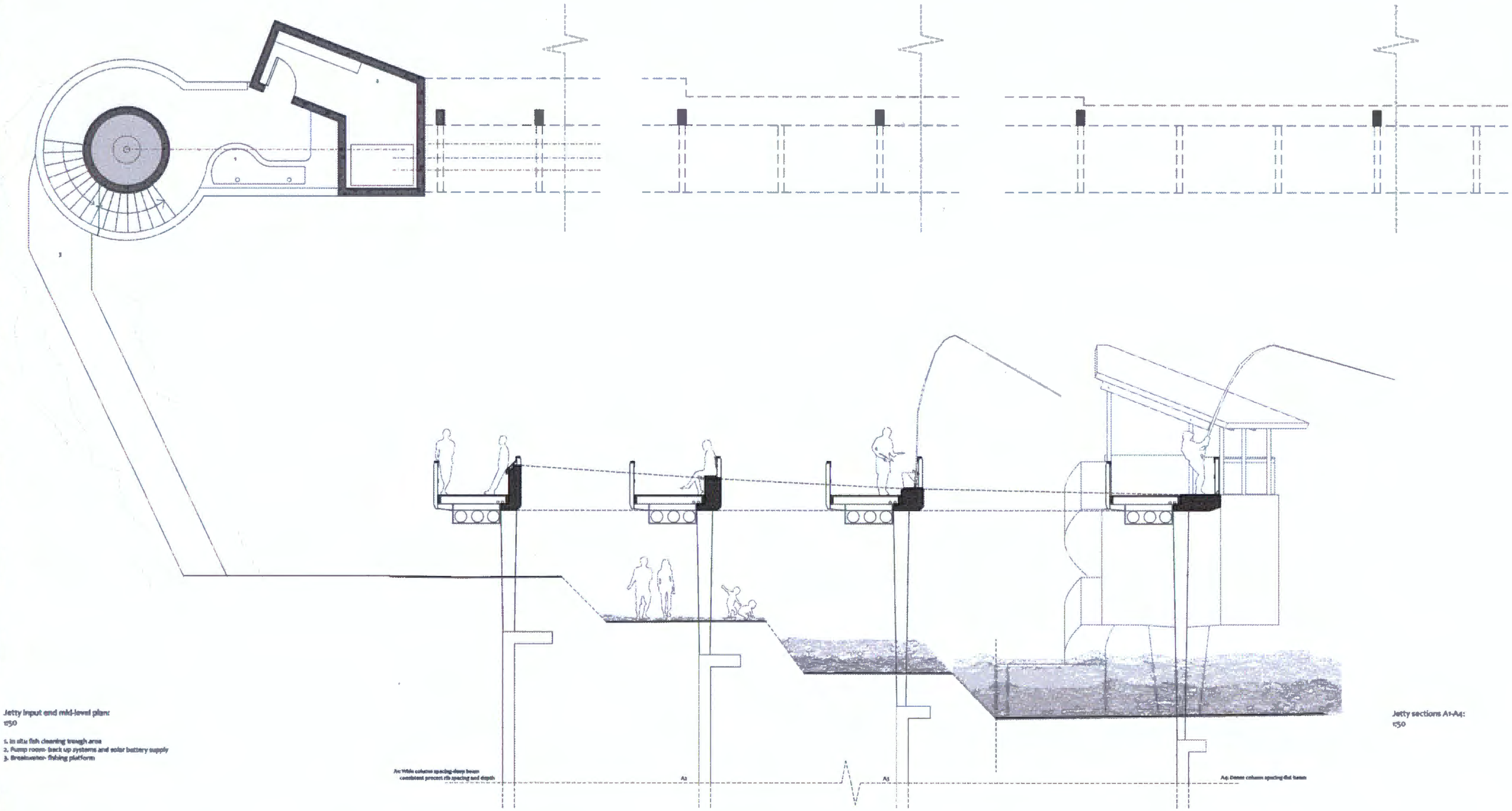


Base plan

1:100

1. Store room: back up generator and flammable liquid store
2. Workshop
3. Wet research lab-lab benches
4. Cold sample store
5. Dry sample store
6. Gas chromatography [illegible] room
7. Autoclave
8. Centrifuges
9. Lab equipment store
10. Reception
11. Head of habitat assistant office space
12. Emergency measures room
13. Lab wc
14. Caretakers [illegible]
15. Desalinatio[illegible] housing
16. Warm cell [illegible]
17. Changing rooms and lockers
18. wc
19. [illegible]

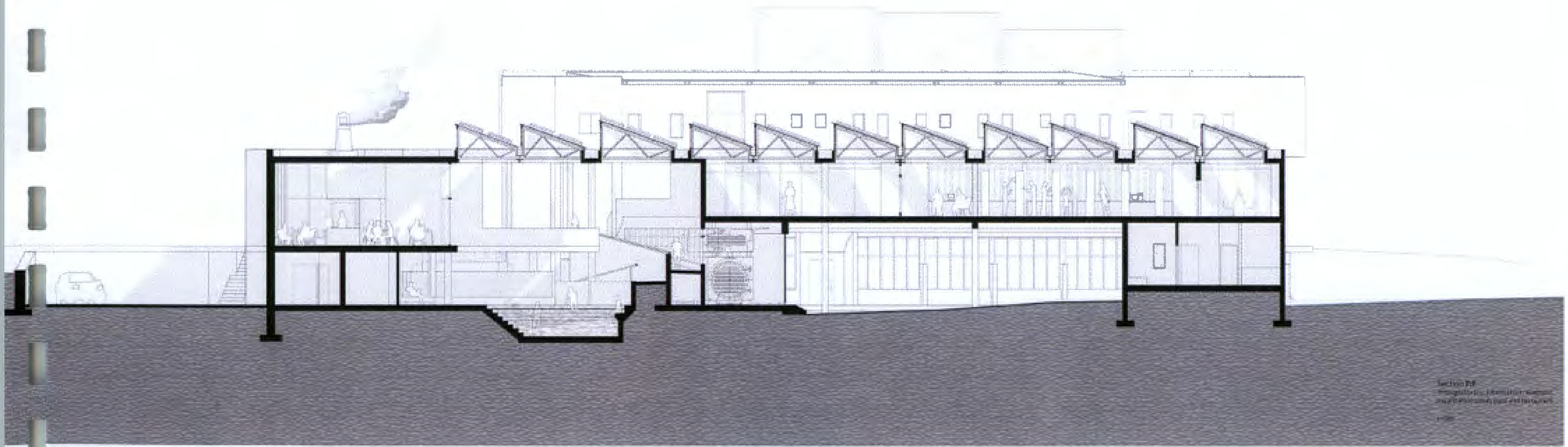


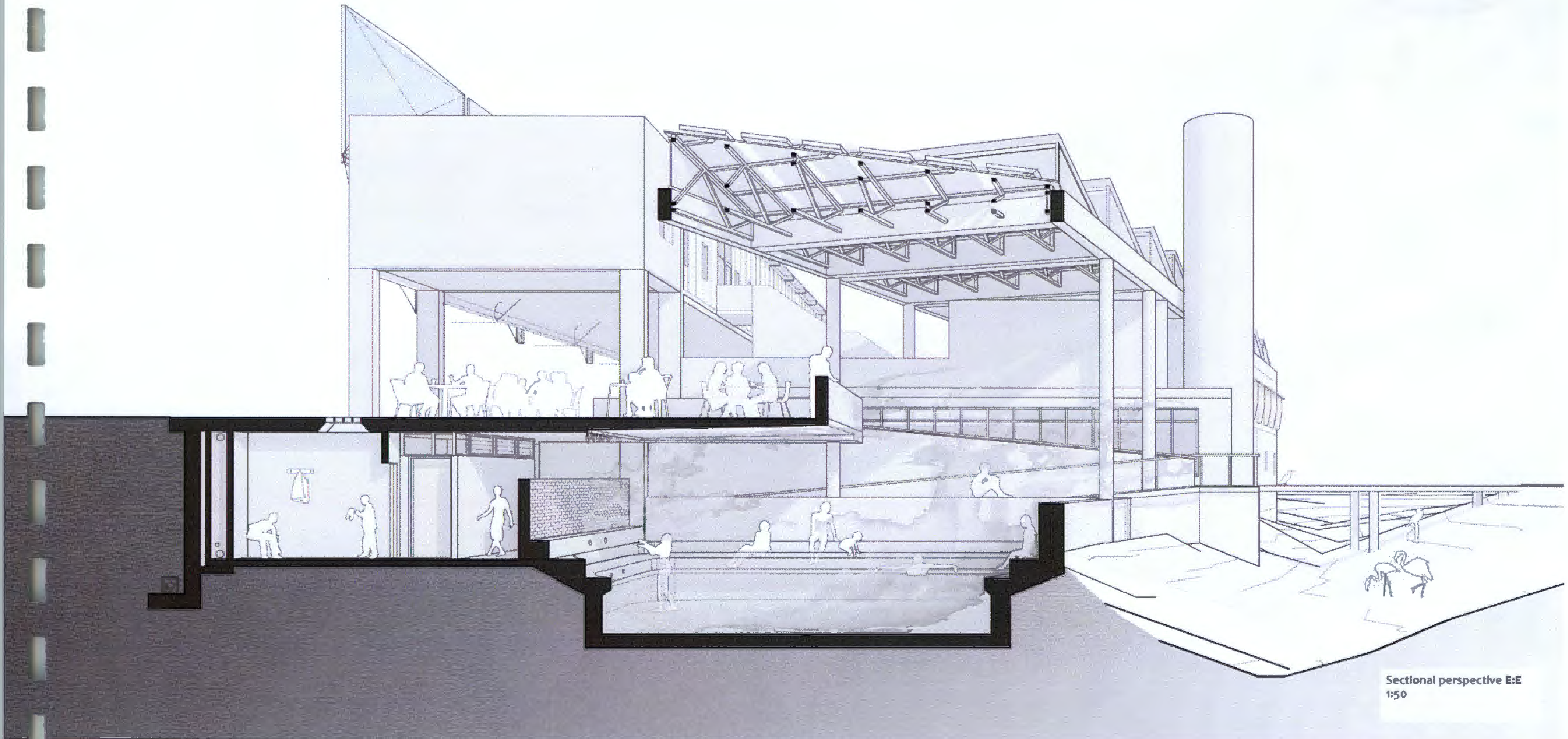


Jetty input and mid-level plan:
1:50

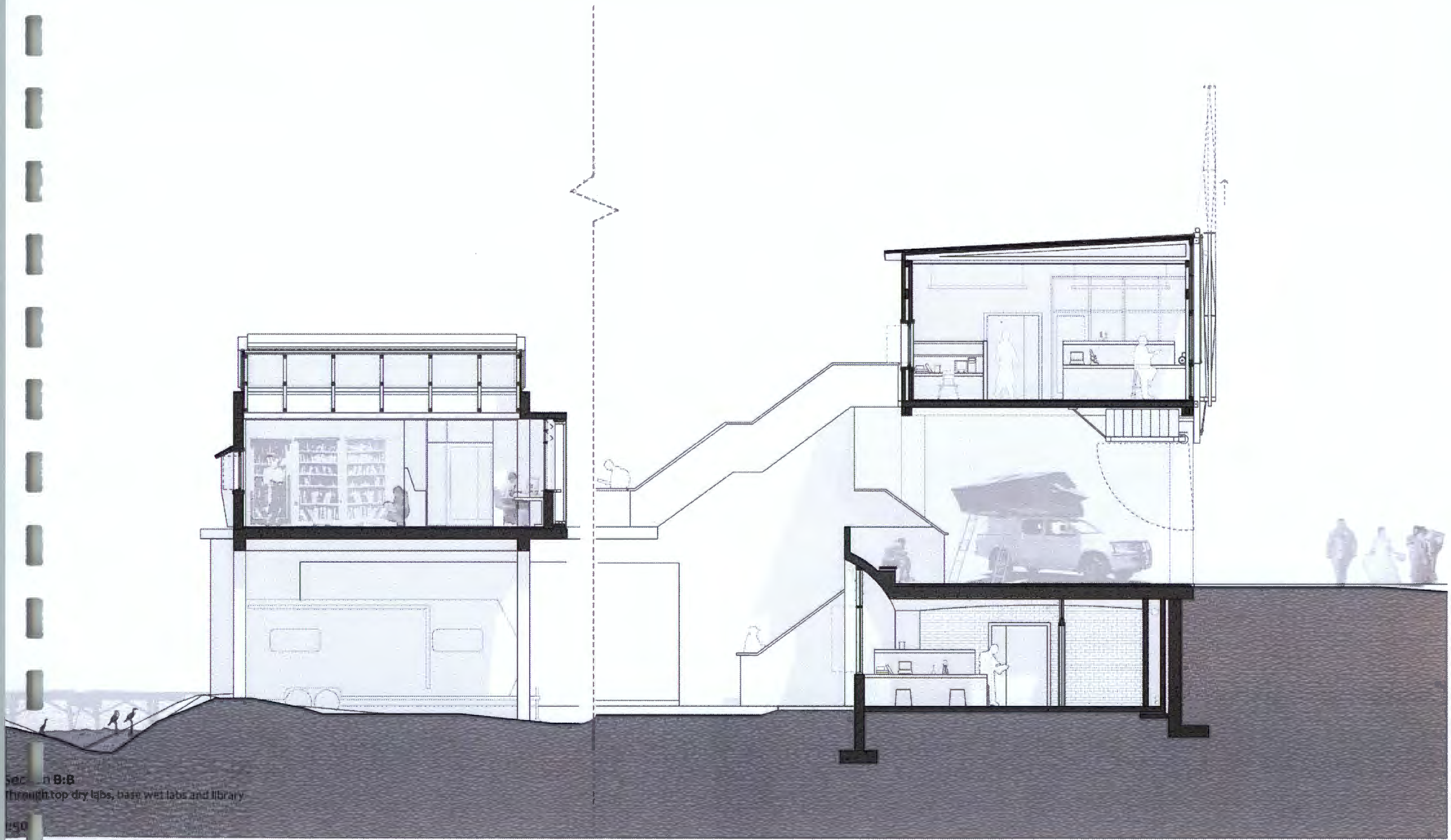
1. In situ fish cleaning trough area
2. Pump room- back up systems and solar battery supply
3. Breakwater- fishing platform

Jetty sections A1-A4:
1:50

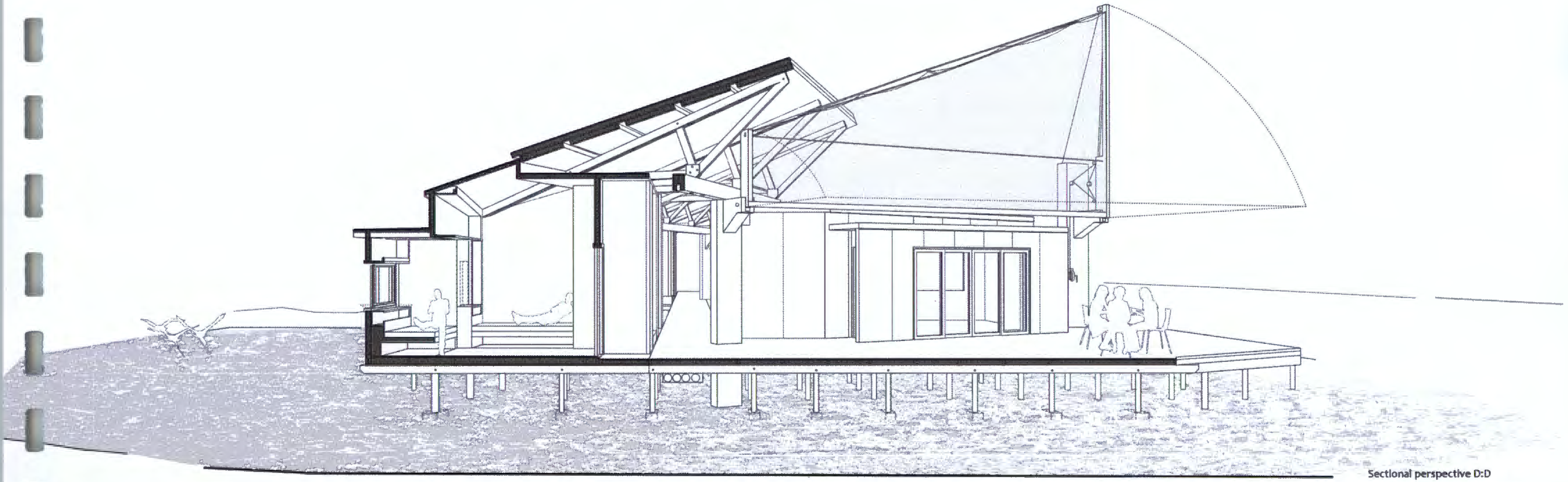




Sectional perspective E:E
1:50



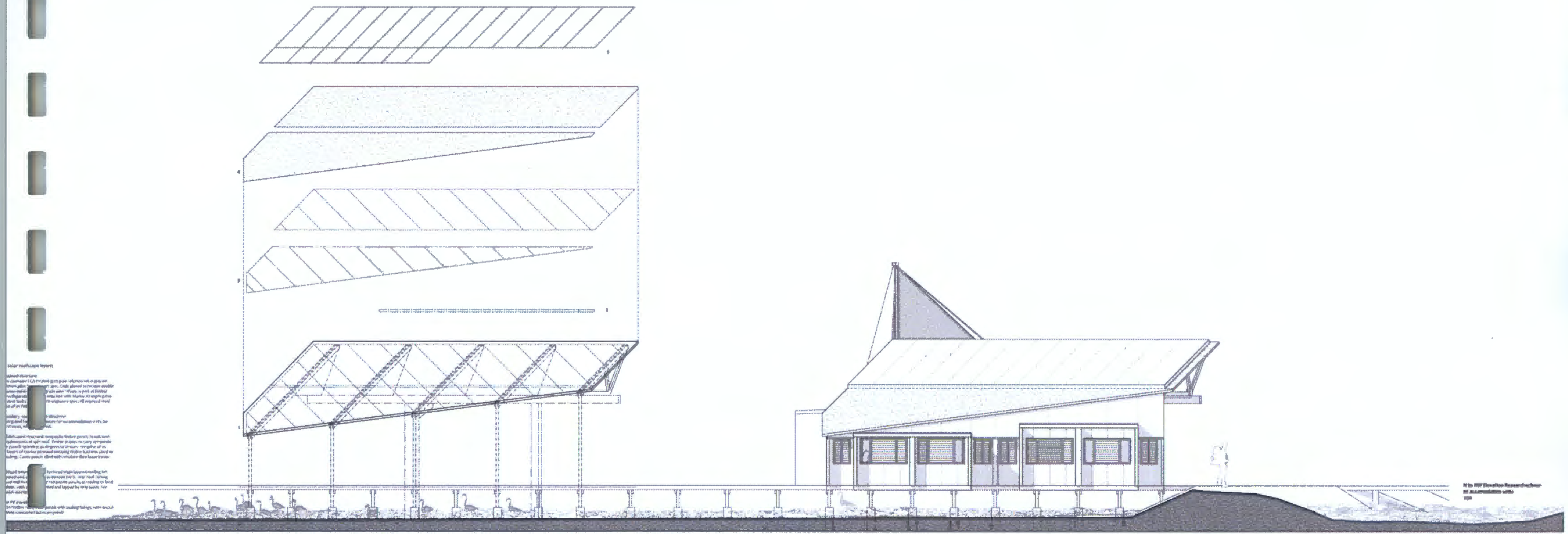
Section B:B
Through top dry labs, base wet labs and library
1:50

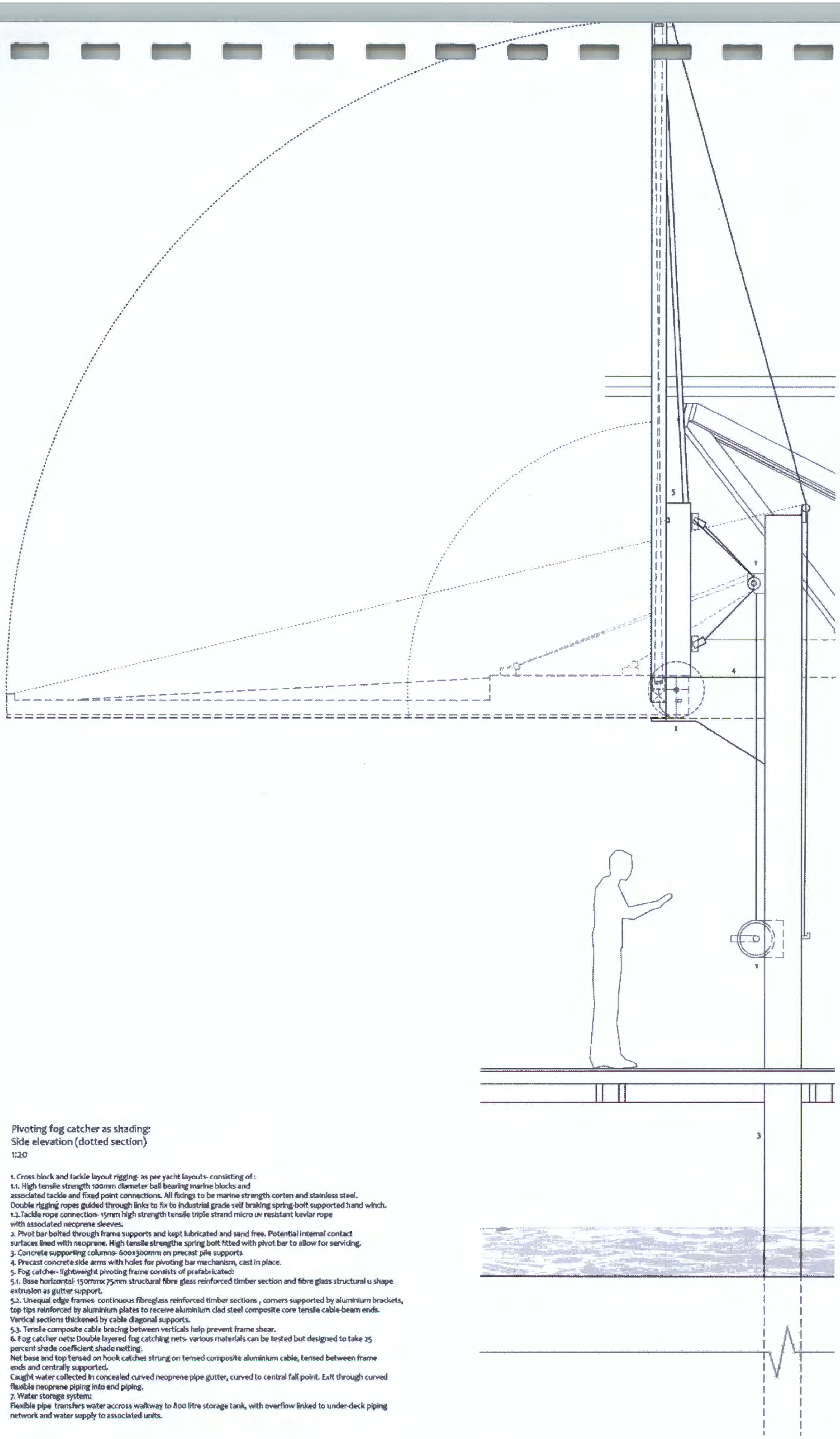


Sectional perspective D:D

Researcher/tourist accomodation units and rec room

1:50

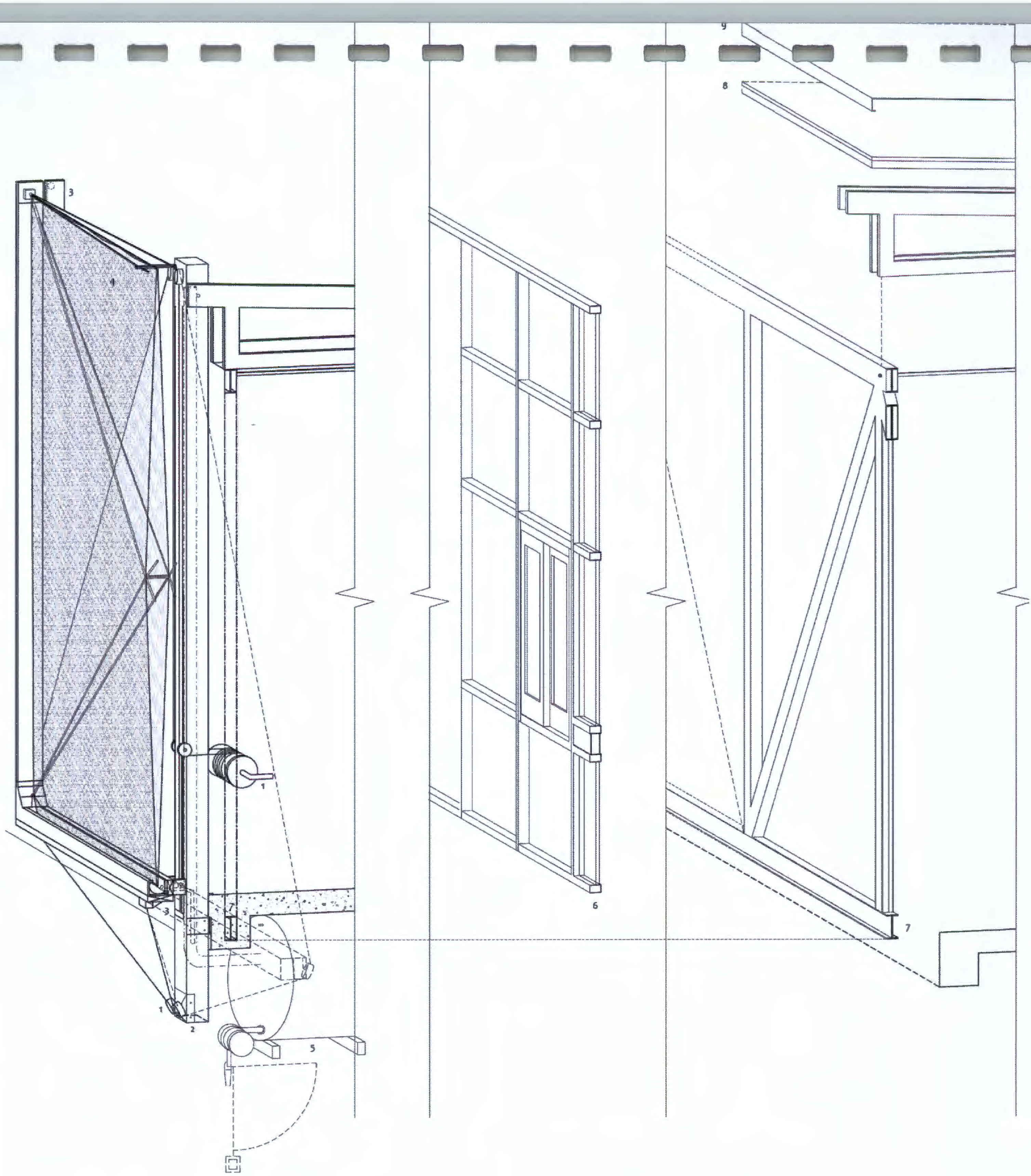




Pivoting fog catcher as shading:
Side elevation (dotted section)

1:20

1. Cross block and tackle layout rigging- as per yacht layouts- consisting of :
1.1. High tensile strength 100mm diameter ball bearing marine blocks and
associated tackle and fixed point connections. All fixings to be marine strength corten and stainless steel.
Double rigging ropes guided through links to fix to industrial grade self braking spring-bolt supported hand winch.
1.2.Tackle rope connection- 15mm high strength tensile triple strand micro uv resistant kevlar rope
with associated neoprene sleeves.
2. Pivot bar bolted through frame supports and kept lubricated and sand free. Potential internal contact
surfaces lined with neoprene. High tensile strengthe spring bolt fitted with pivot bar to allow for servicing.
3. Concrete supporting columns- 600x300mm on precast pile supports
4. Precast concrete side arms with holes for pivoting bar mechanism, cast in place.
5. Fog catcher- lightweight pivoting frame consists of prefabricated:
5.1. Base horizontal- 150mmx 75mm structural fibre glass reinforced timber section and fibre glass structural u shape
extrusion as gutter support.
5.2. Unequal edge frames- continuous fibreglass reinforced timber sections , corners supported by aluminium brackets,
top tips reinforced by aluminium plates to receive aluminium clad steel composite core tensile cable-beam ends.
Vertical sections thickened by cable diagonal supports.
5.3. Tensile composite cable bracing between verticals help prevent frame shear.
6. Fog catcher nets: Double layered fog catching nets- various materials can be tested but designed to take 25
percent shade coefficient shade netting.
Net base and top tensed on hook catches strung on tensed composite aluminium cable, tensed between frame
ends and centrally supported.
Caught water collected in concealed curved neoprene pipe gutter, curved to central fall point. Exit through curved
flexible neoprene piping into end piping.
7. Water storage system:
Flexible pipe transfers water accross walkway to 800 litre storage tank, with overflow linked to under-deck piping
network and water supply to associated units.



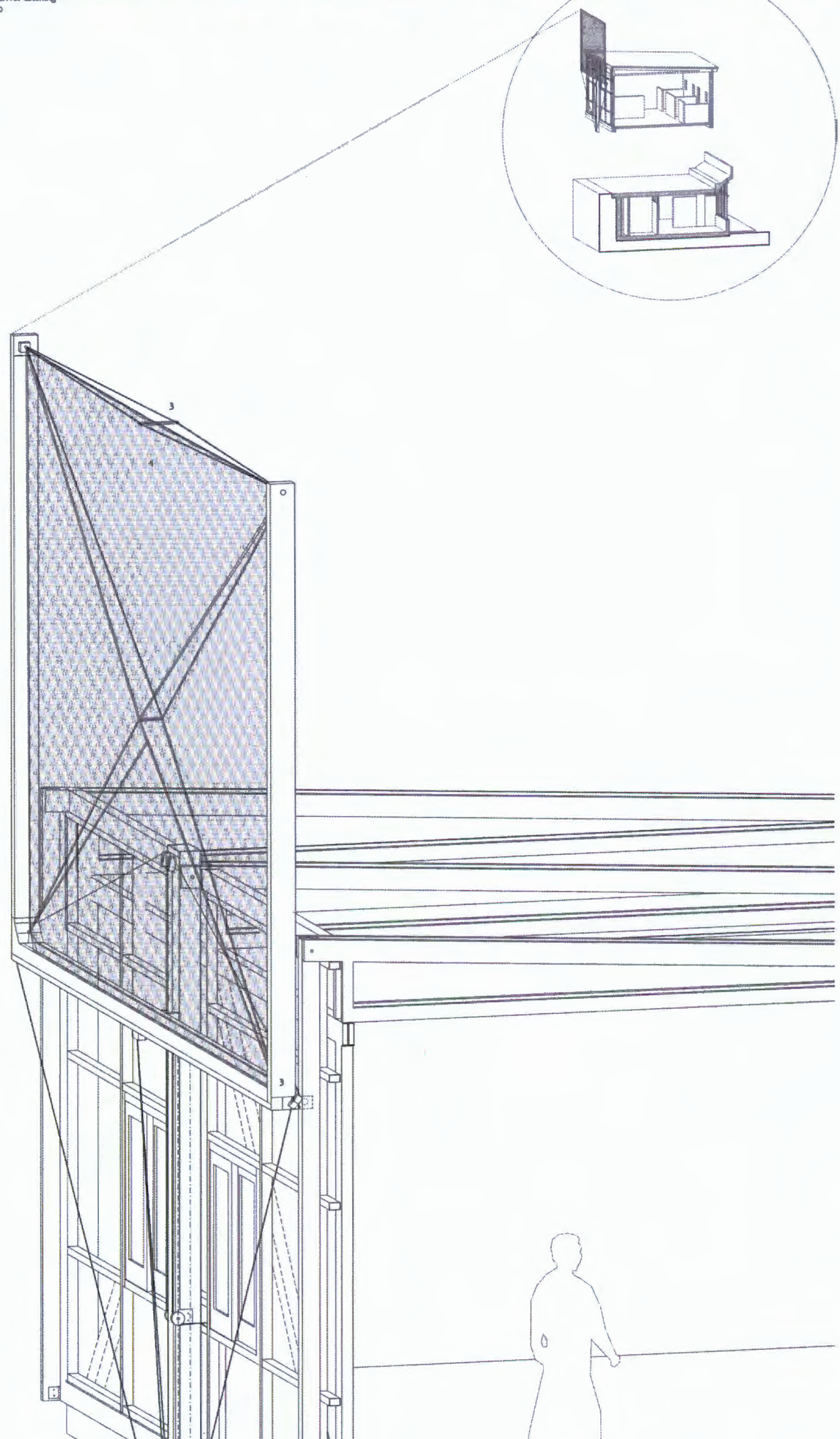
Fog catcher facade bay units structure:
closed for sun shading

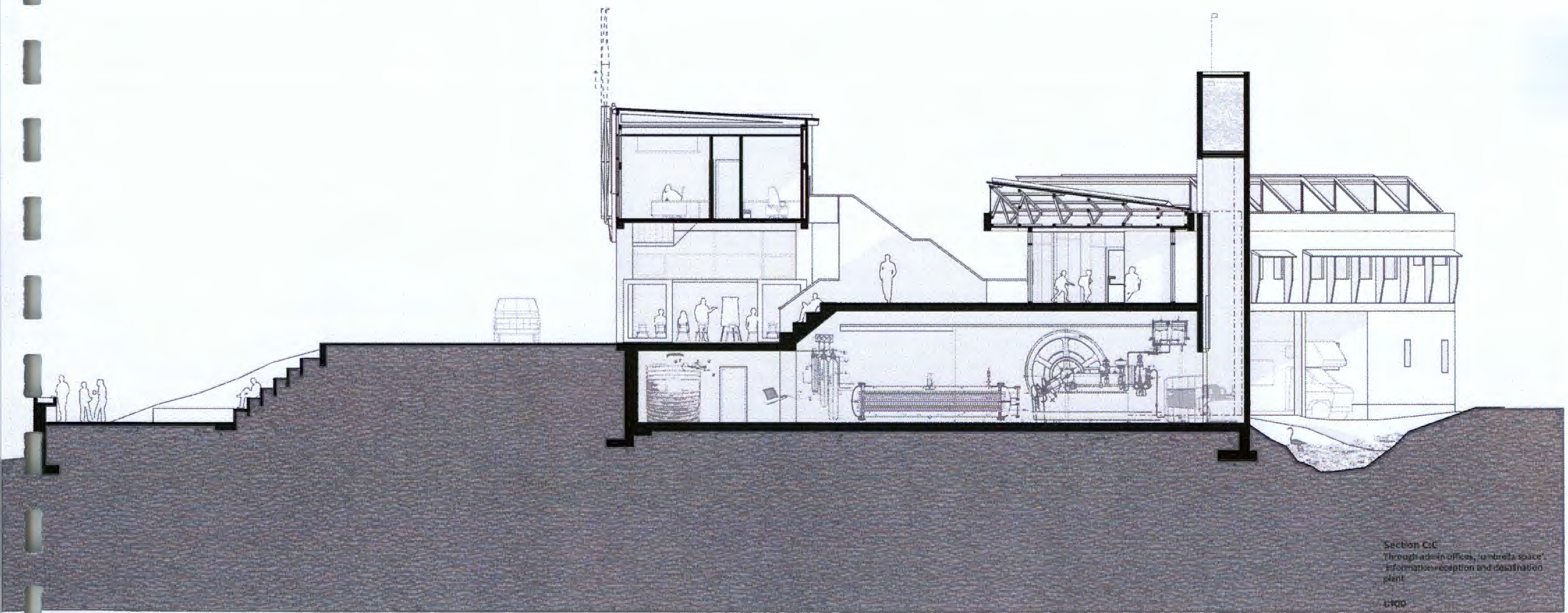
1:20

1. Square block and tackle layout rigging- as per yacht layouts- consisting of :
1.1. High tensile strength 100mm diameter ball bearing marine blocks and associated tackle and fixed point connections. All fixings to be marine strength corten steel. Double rigging ropes guided through links to fix to industrial grade self braking spring-bolt supported hand winch.
1.2.Tackle rope connection- 15mm high strength tensile triple strand micro uv resistant kevlar rope with associated neoprene sleeves.
2. Fixed rigging column- 200x100mm prefabricated composite column comprised of Proform structural shape fibreglass reinforced timber section and composite extrusion, with 70mm upvc strip channel downpipe concealed within extrusion.
Base of timber to be plate fixed to in situ stel bars, linked to steel truss. top of timber to be bolted to double timber trusses and steel tie bar.
3. Fog catcher- moving frame consists of prefabricated:
3.1. Base horizontal- 150mm L shaped structural fibre glass reinforced timber section and fibre glass structural u shape extrusion as gutter support.
3.2. Base horizontal of frame plate fixed to 3 guides- wheel guide and track on central column and 2 T-guides on outer frame edges, linked to shared unit secondary frame guiding columns
3.3. Edge frame- continuous fibreglas reinforced timber section , corners supported by aluminium brackets, top tips reinforced by aluminium plates to receive aluminium clad steel composite core tensile cable-beam ends
3.4. Tensile composite cable cross bracing beams between double layer fog catching nets prevent frame shear.

4. Fog catcher nets: Double layered fog catching nets- various materials can be tested but designed to take 25 percent shade coefficient shade netting.
Net base and top tensed on hook catches strung on tensed composite aluminium cable, threaded between frame ends and centrally supported.
Caught water collected in concealed curved neoprene pipe gutter, curved to central fall point. exit through curved flexible neoprene piping into central downpipe.
5. Water storage system:
Fixed downpipe curves into pipe connection to suspended under soffit 400 litre storage tanks.tank fitted with overflow and industrial grade pull spring flexible retractable hose reels and pull ropes.
6. Aluminium curtain wall with double glazing glare reducing glass and specialized fixed panel to allow for rope rigging holes.
7. Primary structure- room depth corten steel truss to engineers specs. Enclosed by curtain wall and cast in situ concrete slab and downstands. Two edge trusses stabalized by room spanning steel tie bars. Top truss member as supporting plate for double timber trusses.
8. Roof structure- 50mm ridged insulation board adheared to prefabricated double 25mm composite marine plywood roofing panels.
9. Triple layered malthoid sand textured bitumin infused roofing felt lapped and laid to local specialists nail fixing specializations.

Fog catcher facade bay units structure
open for catching
1:20





Section C:C
Through admin offices, 'umbrella space', information-reception and desalination plant

1:100