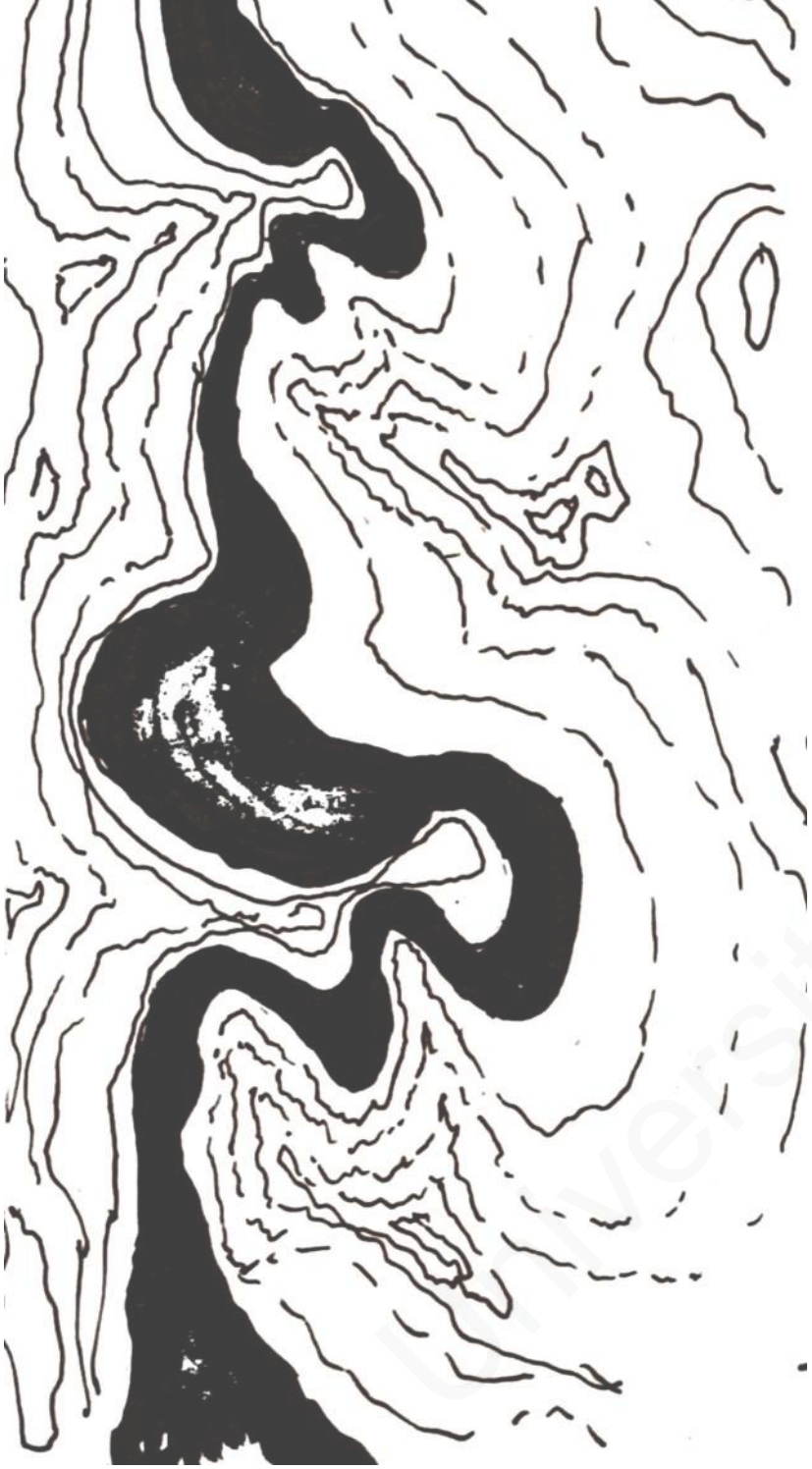

SALT OF THE EARTH

SALT AS A DRIVER FOR SOCIAL-ECOLOGICAL CHANGE IN THE COMMUNITIES OF THE OLIFANTS RIVER ESTUARY

HYLTON GOATLEY
GTLHYL001

NOVEMBER 2022

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SUBMITTED IN PARTIAL FULFILLMENT OF THE MASTER OF LANDSCAPE ARCHITECTURE DEGREE

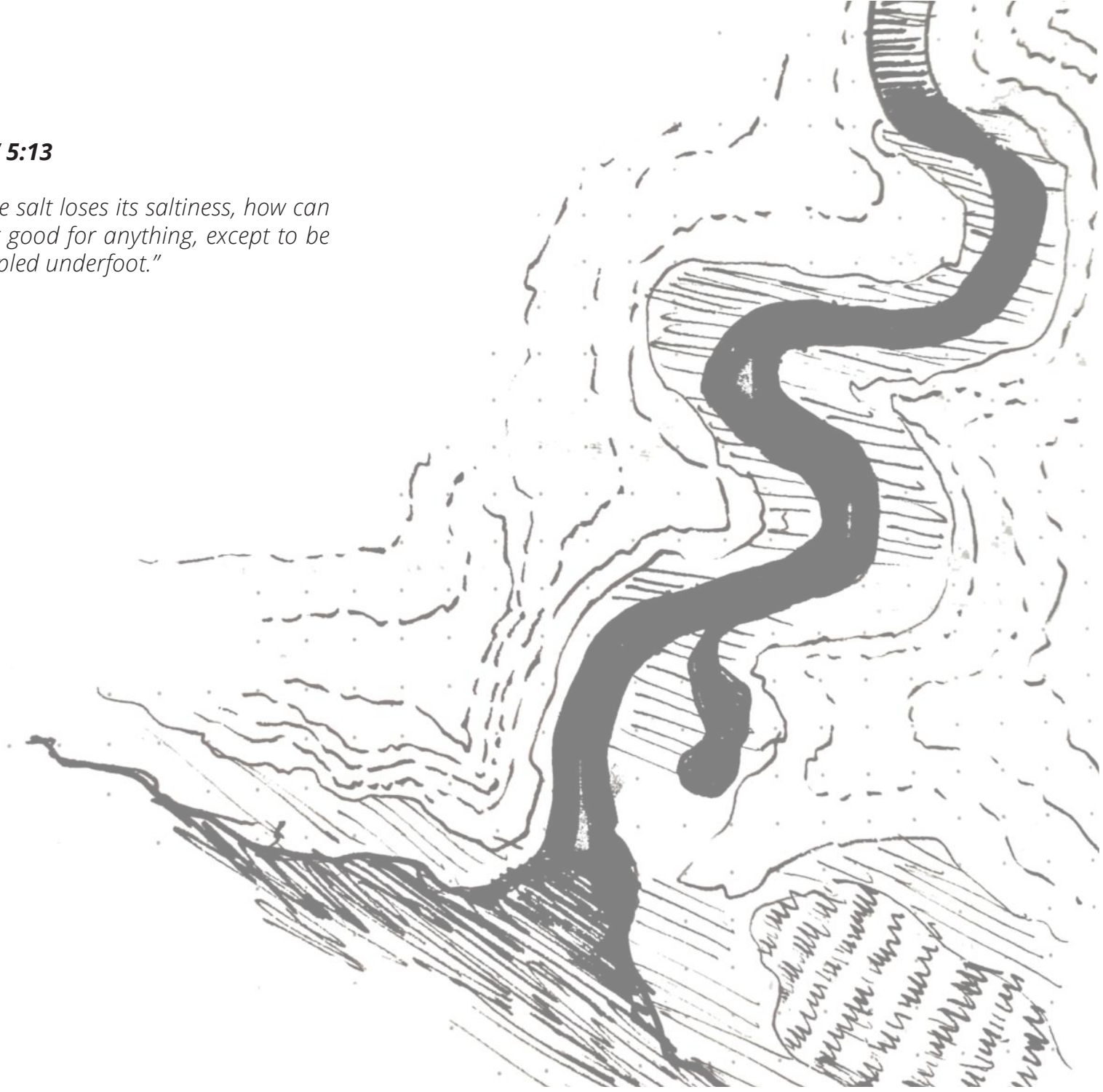
SUPERVISOR - CLINTON HINDES

120 CREDITS

NOVEMBER 2022

MATTHEW 5:13

"You are the salt of the earth. But if the salt loses its saltiness, how can it be made salty again? It is no longer good for anything, except to be thrown out and trampled underfoot."



ABSTRACT

The West Coast of South Africa is a place that one might feel a sense of desolation, however, the harsh environment is one of beauty and richness. This thesis will look at socio-ecological issues linked to the Olifants River Estuary, and the fishing communities of Ebenheaser, more specifically Papendorp, which is situated approximately 350km north of Cape Town .

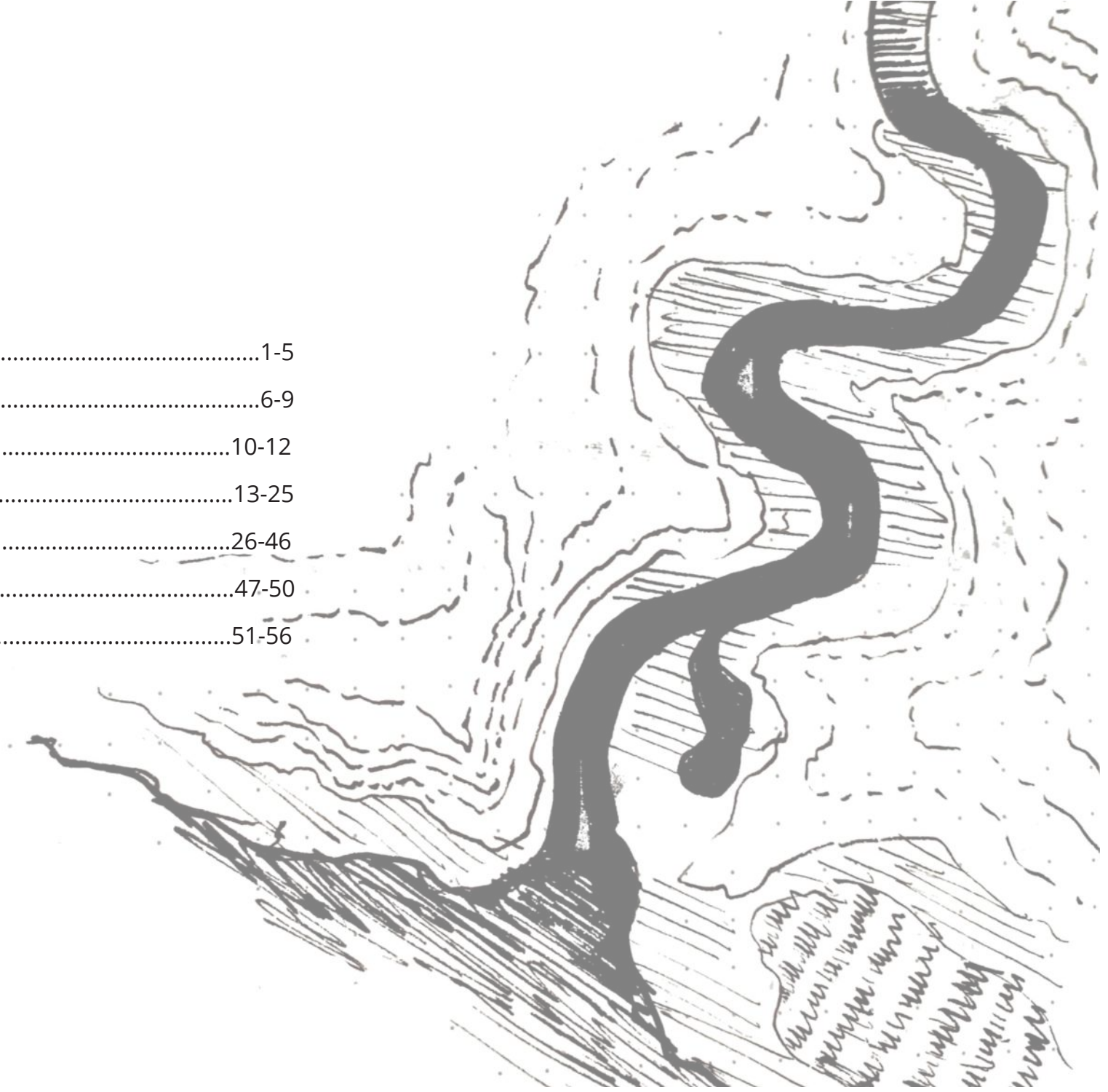
The issues present can be described in two scales: The first, on a broader ecological scale, the ongoing expansion of mines across the West Coast threatens highly biodiverse habitats that support both ecological and human communities. The proposed new mines East and West of the Olifants River Estuary threatens the ecological systems as well as social systems as communities are directly affected by the health of the estuary (Sowman, 2016). The second scale is concerned on a social level as the communities struggle to maintain their livelihoods and ways of life as fish stocks within the estuary have been on the decline (Sowman, 2009). This decline has forced the need for secondary forms of income for the communities (Olifants River Estuarine Management plan (v.7), 2017).

In-order to create a holistic understanding of the issues at hand the thesis will aim to map the patterns and processes of the estuary, its catchment and the landscape which it finds itself in through a lens of extraction. It is proposed that through this method, ecologically activated alternatives to mining might be achieved, ones which harnesses the processes of the natural systems and can provide economic relief and resilience for the community of Papendorp.

This intervention also aims to highlight the translation of natural resource extraction towards one of abstraction. Traditionally, many interventions have failed to fully understand the interwoven nature of ecologies and the Anthropocene, this has led to the marginalization of groups (such as small-scale fishers) and the disregard for their cultural heritage and rights to natural resources. This multi-scalar approach aims to include all aspects of the study area, ecological, cultural, social, and economical to create a layered approach that allows for a detailed understanding of the site, its challenges and its opportunities.

It is hoped that through this approach the outcome will allow for a better integration of ecology and conservation with social and economic aspects and therefore produce an intervention that aids in the improvement of both communities and ecologies.

Contents:



1
PROJECT SUMMARY

Our West Coast is currently under threat from a barrage of mining applications, in search of Diamonds,Heavy Mineral Sands, Gypsum and Salt. The effects of mining on a landscape, especially one as ancient and biodiverse as the West Coast, are often irreversible, even when rehabilitation processes are adhered to.

With this threat towards the landscape comes a threat to the communities that rely upon them, such as the Communities of Ebenhaeser and Papendorp on the Olifants River Estuary. These marginalized communities rely on the sea, the estuaries and the land to sustain their livelihoods and ways of life.

This thesis aims to use the constant pressures of mining on the landscape to challenge the way in which we view and extract our natural resources, as well as to who this abstraction is beneficial or detrimental.

The lens of extraction will be applied in a multi-scalar approach in-order to understand all aspects that effect the Olifants River Estuary and the communities that rely upon it.

Through understanding the systems of the landscape-river-estuary, and the forces of extraction upon these, it is understood that there needs to be shift in the current methods of extraction. A shift towards an abstraction, it is proposed that salt is used as a driver and base in-order to build a resilient system.

The system should be cyclical and layered, creating beneficial feedback loops that enhance the resilience of the ecosystem as a whole. It is the intention of this thesis to use the production of salt from sea water as a cog in the wheel of a resilient system that could exist at the mouth of the Olifants River Estuary. Salt and the processes of crystallization will inform the design process and ultimately become a place-making tool in its own regard. This system aims to benefit the community of Papendorp through a hybridized ecology, being ecology-community-industry.

Figure 1: Centuries old sedimentary cliffs, shaped by years of erosion and weathering are a typical site of the coastline nearby the Olifants River Estuary, some of these cliffs are being destroyed by negligent mining practices.

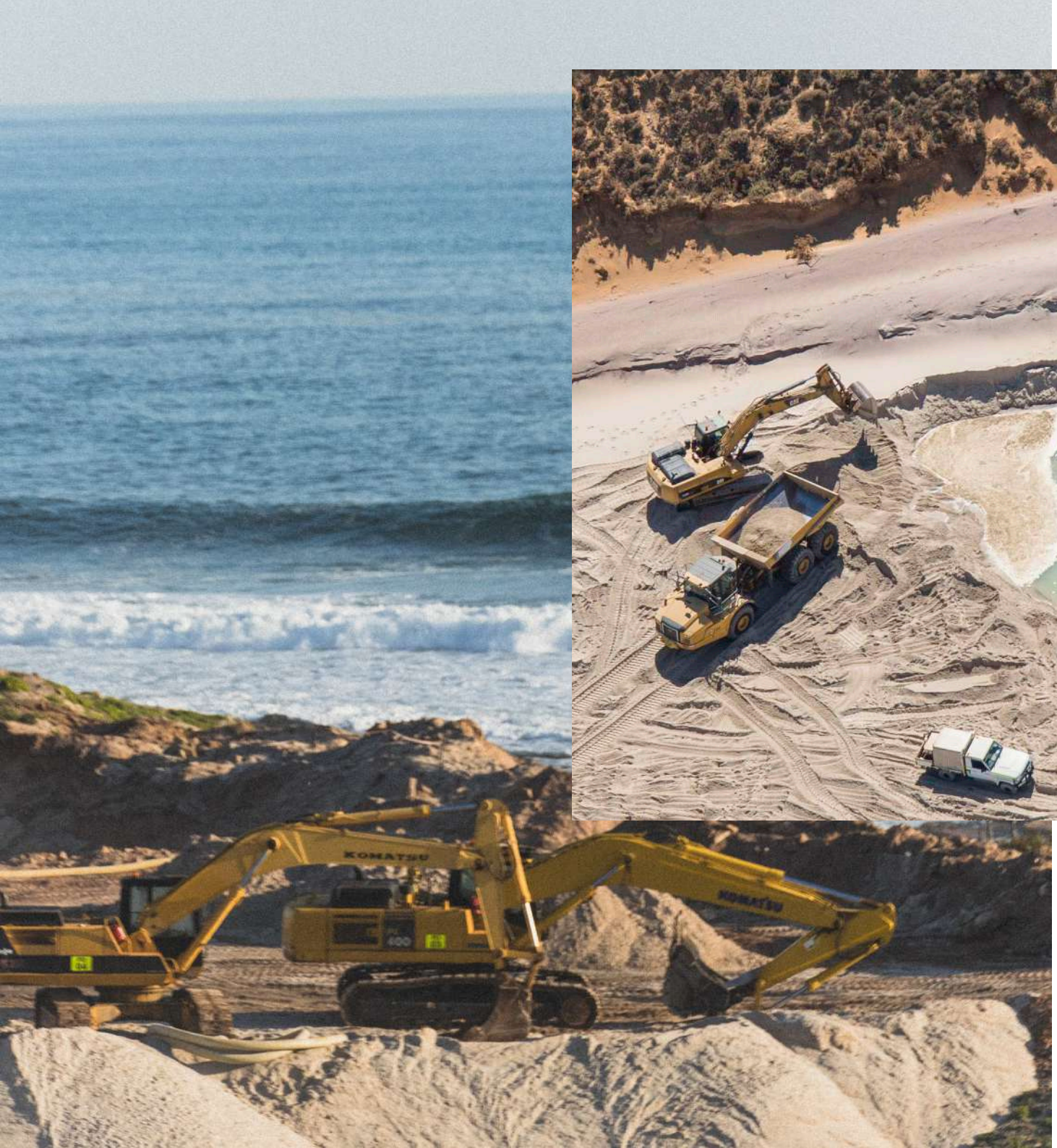


Figure 2 (left) : Diamond mining sluice ponds being dug outside Doringbaai.

Figure 3(top) : MSR Tormin beach mine north of the Olifants River Estuary. Breached EIA's often lead to irreversible damage upon the environments.

WHY SALT ?

- The Salt pan of Papendorp was historically used in an artisanal/ small-scale manner, the channel connecting it to the estuary has already been dug (Figure 5).

- If done correctly the production of salt in an artisanal form has very low impact on the environment, the Salt Pan itself has a very low effect on the Estuarine system. Salt marsh vegetation also provides life for a variety of marine life (Figure 4).

- Salt is made from the crystallization/ evaporation of seawater or brine, this makes it a sustainable resource.

- Salt has the ability to act as a building material, therefore it can be multi-purpose in its use. This can be done through the crystallization of salt onto a structure or material, i.e tensile rope.

- The possibility of growth allows for interesting design outcomes and a system that follows and feeds off of the natural patterns and processes that exist within a system.

- The system designed has the possibility to create a hybrid ecology, mixing tourism-industry-community-ecology.

- This could create a resilient system that addresses poverty/ job creation, resource abstraction, biodiversity, education and conservation.

Figure 4: Supra tidal Salt Marsh Vegetation Near the Salt Pan at the Olifants River Mouth. This vegetation survives in highly saline environments.

Figure 5: Salt Pan, inter tidal and supra-tidal Salt Marshes and Mud flats near the mouth of the Olifants River Estuary.

3
CONTEXTUALIZING
ISSUES AND THREATS TO THE OLIFANTS RIVER ESTUARY

Biodiversity and habitat loss has become a glaring issue the world over. It is widely understood that humans are changing the planet at a rate that we have never seen before (Griggs et al., 2014). The rate of change could undermine current sustainable development goals towards poverty alleviation, equality, education, well-being etc. (Griggs et al., 2014). As humans we have entered a new epoch, the Anthropocene marks the stage in which we constitute the dominant driver of change towards the Earths systems and their functions, the degradation and failure of these systems having detrimental effects on human and ecological well-being (Wynberg & Sowman, 2014). Our natural resources are essential for poverty alleviation, development and food security; however, the exploitation thereof has lasting effects on our environment and has led to the destruction of habitats and loss of ecosystems services (Agardy et al 2005; Ojha et al 2013).

On a broad scale the governance, equity, and sustainability of our natural resources within Sub-Saharan Africa struggles to be resolved through traditional science-based methods or conventional resource management approaches. In redressing these approaches a range of dimensions need to be taken into consideration – social, cultural, economic, ecological, political, institutional, and physical – through a variety of scales, macro to micro (Wynberg & Sowman, 2014). Through the inclusion of the above-mentioned dimensions, we might be able to better understand how we can manage and use these natural systems, with the goal of being able use the approaches to inform spatial design.

The Olifants River Estuary, one of the largest in the country, is a provider of ecosystem services, giving life to terrestrial and aquatic ecosystems (Sowman, 2009). The ecosystems also provide for the communities of Ebenheaser whom rely on the fishery for their income and way of life. The collection of communities that make up the area known as Ebenheaser, see figure 7, were forcibly removed from fertile farming lands of Lutzville in 1925 due to past policies and laws of the discriminatory apartheid regime (Sowman, 2009). Since their eviction, the descendants of the current communities have had to rely on the estuary as a natural resource, providing food security and economic income (Sowman, 2009), see figure 6. The estuary has a rich past in providing for people as archaeological evidence suggests that First Nations groups, known as the Soaqua, who were part of the broader Khoekhoen group, used the estuary for its resources (Parkington, 1977). More recently an Archaeological study completed in 1999 for a proposed ecotourism project in Papendorp, uncovered the visibility of archaeological remains within the area as extremely high (Archaeological stuyd Viswater/ Papendorop Community Ecotourism Project, 1999). These included widespread scatter of Early, Middle and Later Stone age tools as well as a series of Shell Middens throughout the sites (Archaeological stuyd Viswater/ Papendorop

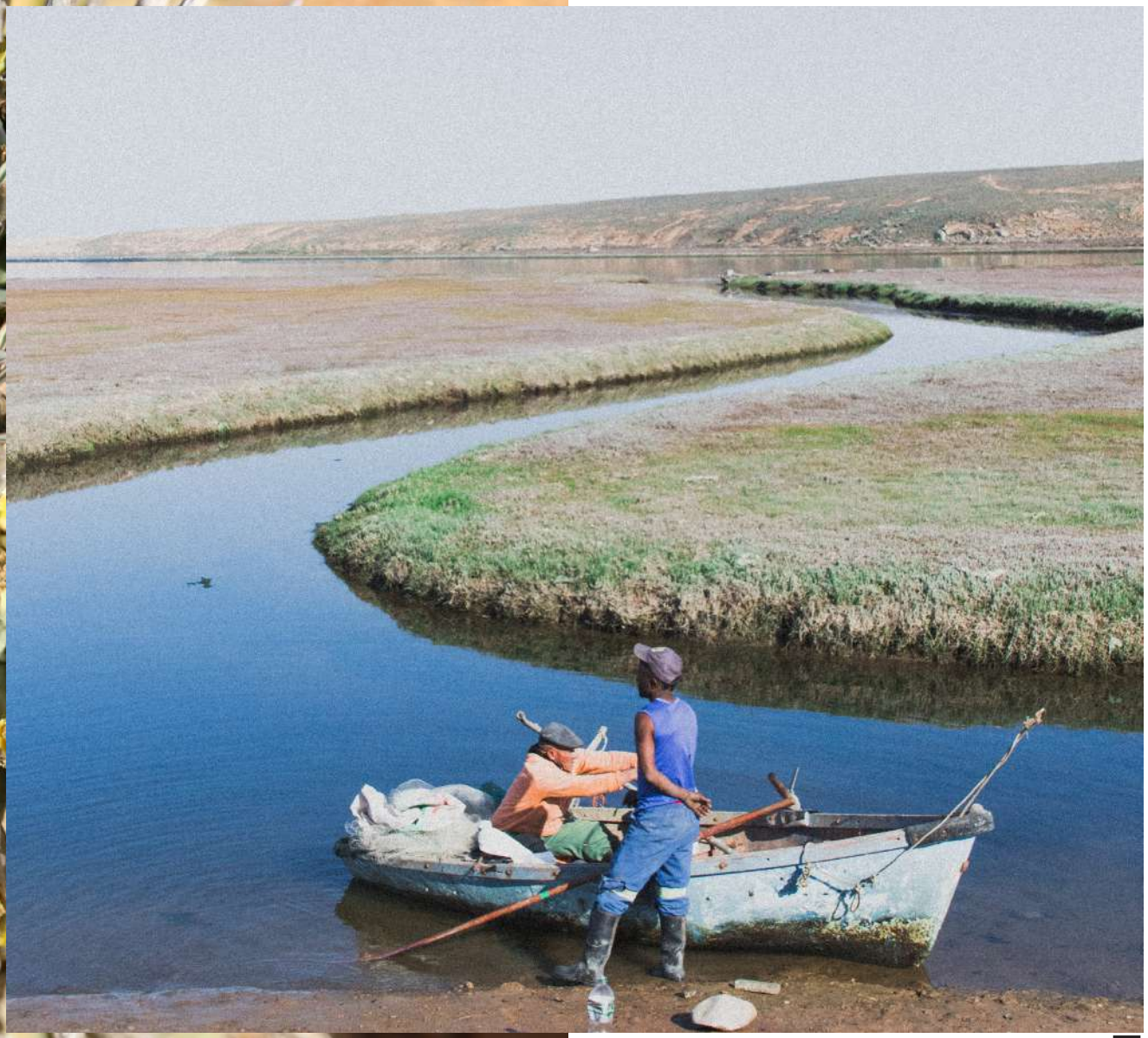


Figure 6: Red List Species *Euphorbia schoenlandii* and *a fisher from Papendorp unloading his catch from a successful night on the estuary.*

Community Ecotourism Project, 1999). These histories begin to create a deeply layered past of the Olifants estuary, and the indigenous and local knowledge that has been ingrained within it.

The beauty of the estuary (figure 8) and its relatively 'untouched' (in the visual sense) nature is currently under threat from several different aspects, the threat of an ecosystem and its value has spurred the investigation into this thesis. The pristine nature of the estuary and its use as a sustainable livelihood for local communities is, and has been, under threat in two ways and it is currently classified as a "C-Class" estuary ("moderately modified") (Olifants River Estuarine Management Plan (v.7), 2017). Firstly, and more recently, Australian Mining Company (MSR) seek to expand their extraction of heavy minerals within the sands towards a stretch of land that borders the Western banks of the estuary (Sowman, 2016), whilst Buchuberg Resources (Pty) Ltd seek to prospect with the intention of mining a farm of 11 453.06ha on the Western flank of the estuary (Gutoona, 2021). With ongoing allegations towards MSR's environmental transgressions and poor treatment of labour on other sites along the coast, the company raise much suspicion within the communities and threatens the value of the estuarine ecosystem (Sowman, 2016). Secondly, the local communities have been battling for several years against government policies that have marginalized peoples such as themselves. These are lower income coastal communities that rely on the ocean and its estuaries to provide income and sustenance. This resource is now under threat due to pressures from mining as well as improper management from governmental authorities.

It is through the possible degradation and defiling of social-ecological structure of the Olifants Estuary that prompts the search to impact the area through understanding the natural systems, therefore ecosystem services, in-order to promote an alternative to heavy minerals mining, which would benefit the community of Papendorp as well as estuary in a sustainable manner. It is my belief that through the integration and use of indigenous and local knowledge, as well as the principles of social-ecological systems theory, the issues that are present will be able to be addressed through social-ecological design.

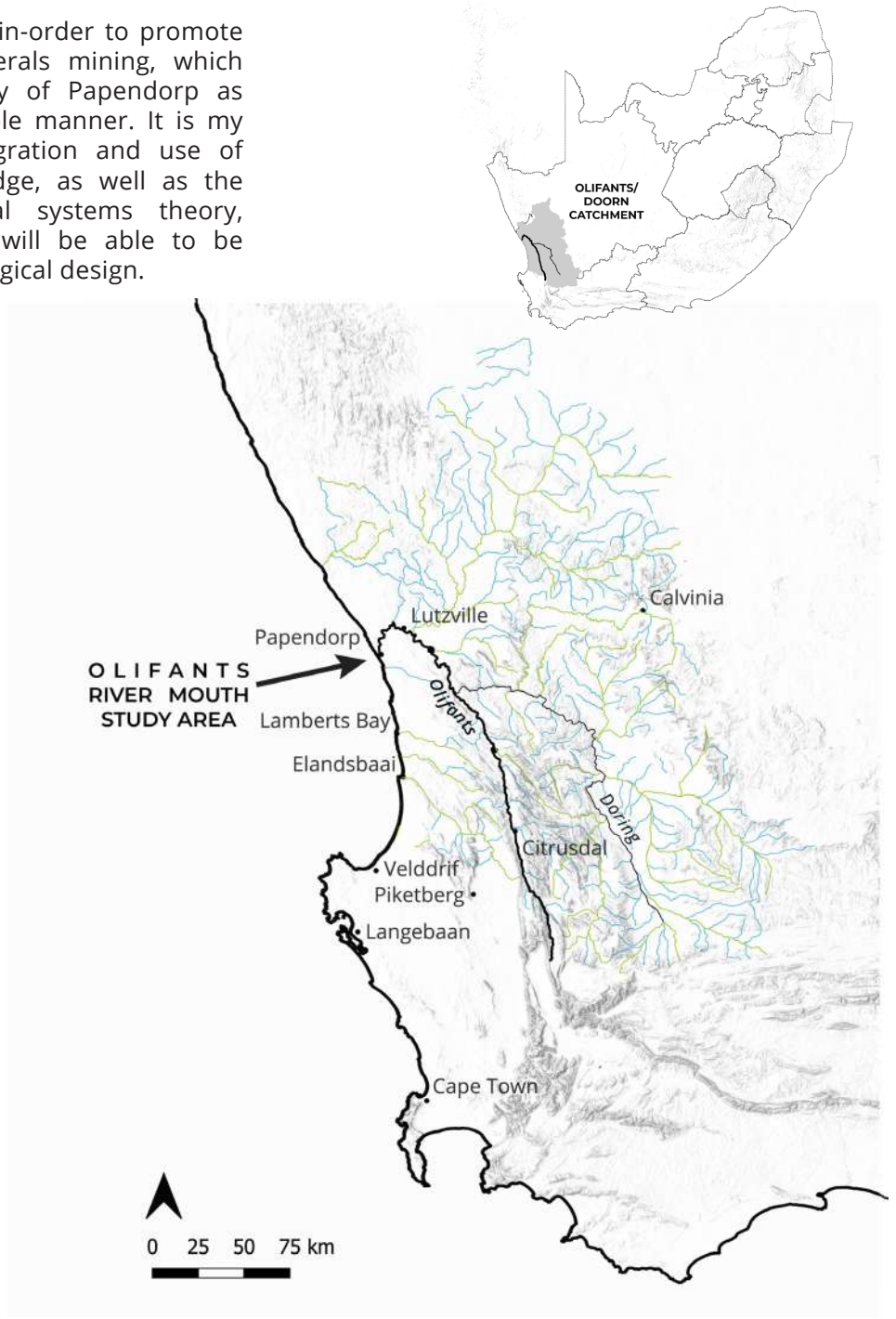


Figure 7: Location of study area and the Olifants River Catchment

Figure 8: Olifants River Estuary mouth is one of the top 3 functioning permanently open estuaries in South Africa

WHAT FUTURE ?

4
METHODOLOGY

Due to the highly layered and complex nature of the study area this thesis draws on social-ecological systems theory. This is done in order to answer the research questions that follow.

Main question / Research Inquiry

In what ways can the creative design of a salt harvesting system meet socio, ecological and economic objectives for the community of Papendorp and the wider estuary?

Secondary Research Questions

How can the use of ecological design principals and systems thinking create a productive salt harvesting system increase the ecological functioning of the estuary?

In what ways can ecosystem services offset the effects of overfishing and improve the health of the estuary whilst providing income for the community?

Will combining salt production and conservation efforts create a space that attracts further income through eco-tourism?

In order to do this, it will take its theoretical framework in systems thinking, looking at ideas of pattern, structure and process, it will then use a social-ecological analysis framework to back this up. It is important to realize the flawed nature of some western theories such as systems thinking and ecological design, and thus through the addition of theories such as social-ecological systems thinking thesis will aim to create this holistic understanding that is spoken of.

What is a system in the confines of this thesis?

A system consists of parts and relationships, and functions between the interrelated parts. It is the landscape and all the tangible and intangible forces that act upon it, either supporting or harming. It can be considered complex and dynamic, and it changes over time.

Social-ecological systems

It is noted that when speaking in the conservation sphere, integrated studies of both human and natural systems are revealing new and complex patterns and processes that were not evident when studied separately (Berkes, 2016). The researchers found that cases often showed patterns and processes of non-linear dynamics with surprises, feedback loops, time lags and other complex behavior (Berkes, 2016), often only revealing themselves when the full social-ecological system was taken into consideration.
Through understanding that a landscape experiences

a vast array of inputs on both a social and ecological scale, we realize the importance of a social-ecological systems approach in Landscape Architectural design. Understanding that these systems are complex and are not linear, allows for the ability to gain access into the complexity so that we can pinpoint the most applicable location and intervention. Emphasis needs to be made on the explicit linking of social (communities, society, economy) and natural systems (ecosystems), as there are interactions that happen between the subsystems. It is in these subsystem interactions where we find the link between people's historical knowledge and the manners in which they interact with the landscape.

It is from this basis understanding of complex intertwined social-ecological systems that we can begin to unpack the Olifants River estuary and its surrounding communities in order to pinpoint the most effective intervention site. To do this we can look at the key concepts that exist within social-ecological systems to formulate the analysis process.

Multiple Scales

Understanding the landscape in scales of both time (temporal) and space (spatial), and how events or actions effect the landscape differently according to the length (temporal) and scale (spatial) that they occur for.

Multiple Levels

Working with scale, levels are specific points along a scale, or a unit of analysis within scale. These help us to analyze the landscape across scales, in-order to determine where and what interventions should occur.

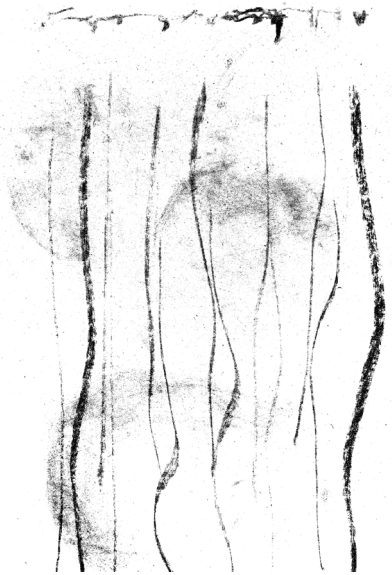
Resilience

To have resilience is to design for a system to maintain overall function and structure, despite unexpected shocks to the system. In the social-ecological system, by analyzing its resilience or lack there of we might gain an understanding of which aspects to learn from or else change.

Throughout this research and design investigation the social-ecological systems analysis will be filtered through a lens of extraction. The landscape of the West Coast and the Olifants River specifically has been under threat to many different kinds of extraction and thus, through understanding the impacts of extraction upon the landscape this thesis aims to adequately address these through social-ecological design.

EXTRACTION; as a material process

‘an act of extracting or the condition of being extracted’



The research is therefore both qualitative and quantitative in nature to understand the complex systems as best as possible. Qualitative data is collected through photography as means of storytelling, non-participatory observation, and desktop analysis (mapping).

Throughout the research process photography has been used as a method of storytelling and place making. Through documenting and representing the space in an artistic way the desire is to achieve a sense of place and community; by layering these images in collage and thick section a deeper understanding of place might be achieved.

The quantitative section of this research will mainly be gathered through a desktop study of scientific case studies. This will be done in order to understand processes of extraction within the study area. Extraction of communities, fauna, flora, minerals and water.

5
SITE ANALYSIS
UNDERSTANDING SOCIAL AND ECOLOGICAL EXTRACTIONS OF THE ORE

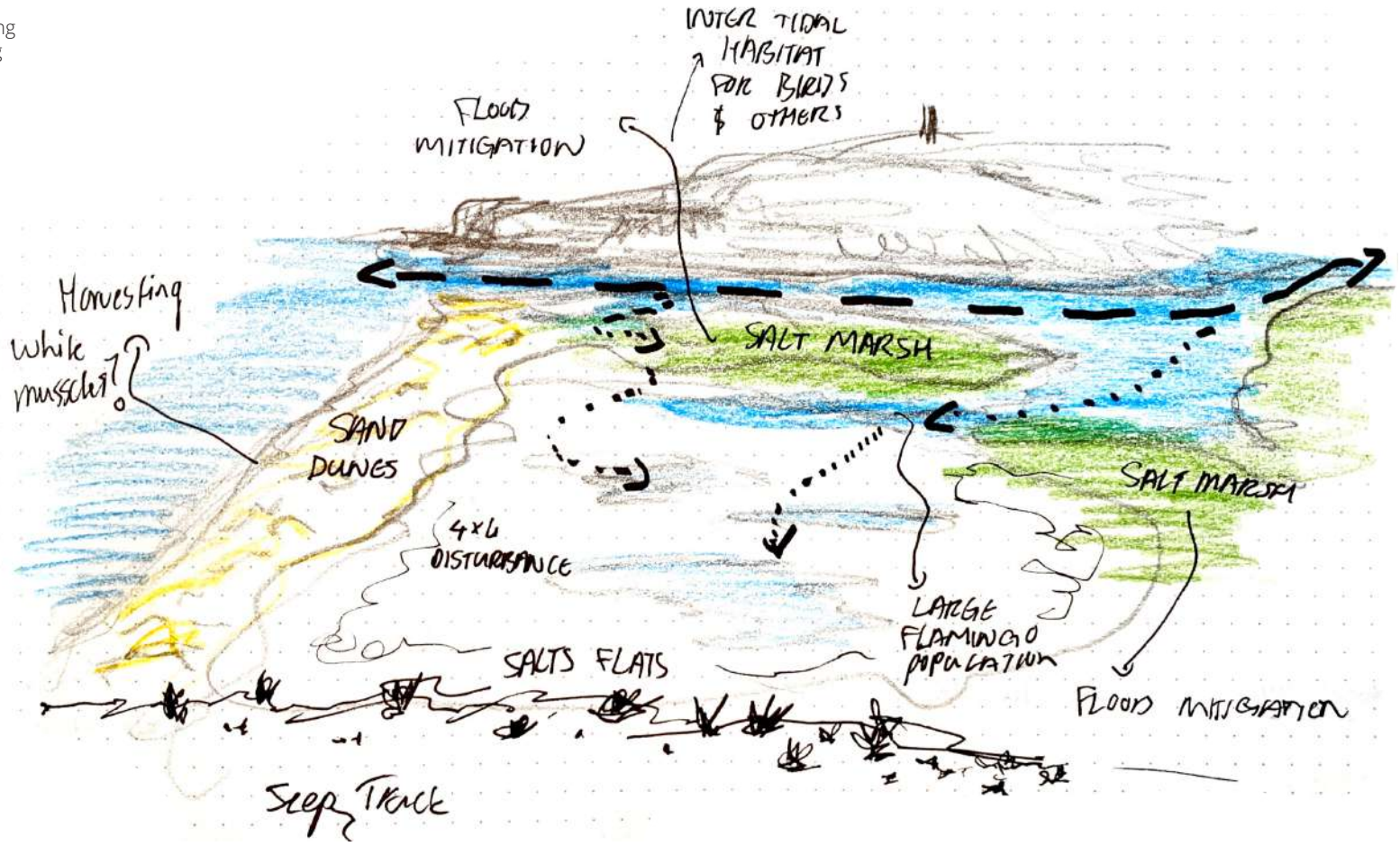


Figure 9: Initial on-site drawing of the estuary and it working systems.

5.1
ECOLOGICAL EXTRACTIONS

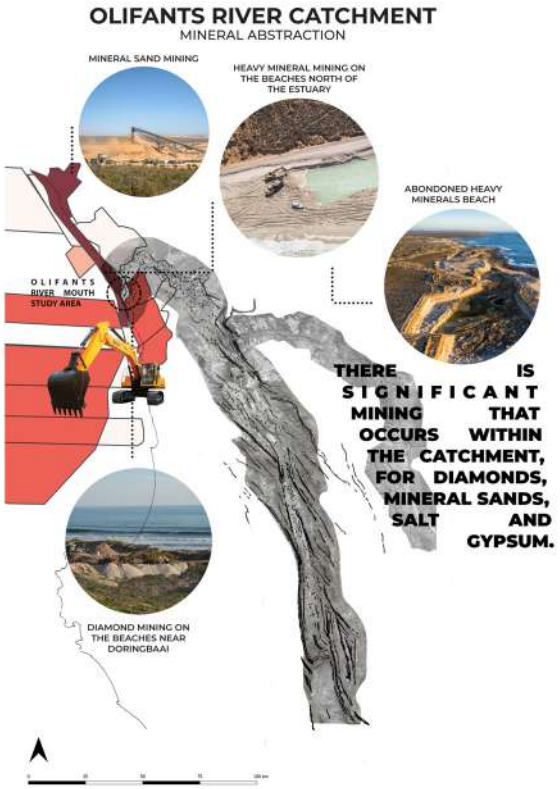
In order to understand the elements of ecological extraction upon the Olifants River Estuary, it is necessary to understand the forms of extraction that exist on a catchment scale. This broader scale analysis highlights the importance of the Olifants Estuary, and the role it plays along the West Coast of South Africa.

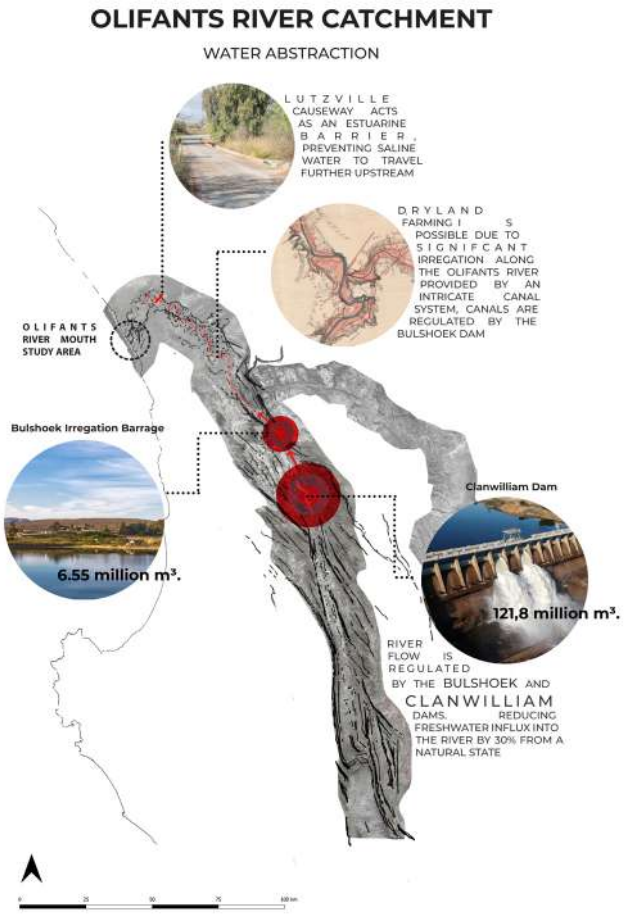
Hydrological Extractions

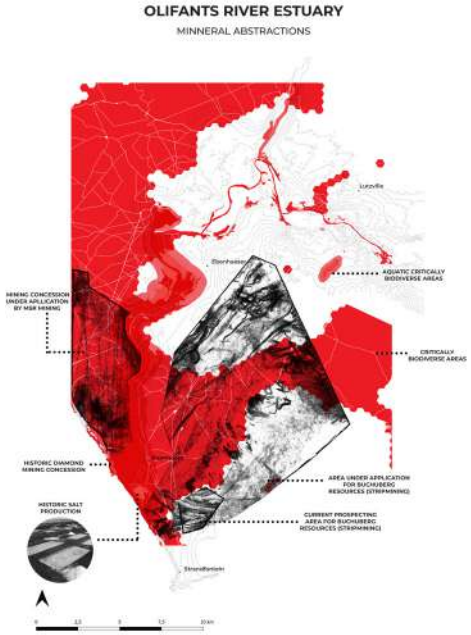
The main river in the catchment is the Olifants River which runs from the Winterhoek Mountains in Ceres to the ocean at Papendorp. Its main tributary is the Doring river which passes through a very arid region bringing with it sedimentation when there are heavy rains. The main forces of hydrological abstraction would be those of the Clanwilliam and Bulshoek dams which provide water through an intricate canal system to the farmers of the region. The Clanwilliam dam regulates the flow of the Olifants River, mitigating effects of flooding during high rainfall. However, the dams and irrigation scheme have resulted in a 33% less than natural state of freshwater inflow into the estuary. The construction of the Lutzville causeway also created an estuarine barrier, preventing saline water from exceeding its boundary.

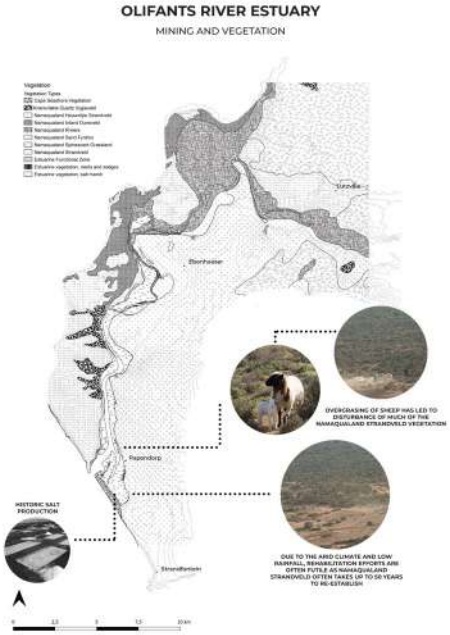
Mineral Extractions

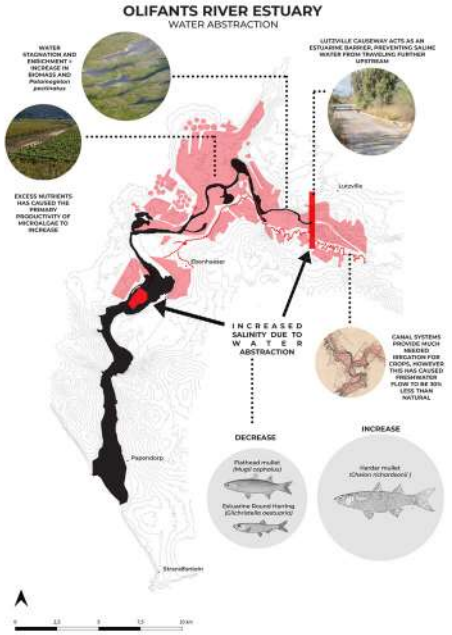
As mentioned earlier, mining has been growing at a rapid rate through the catchment, specifically along its coastline for Mineral Sands and Diamonds. Mining is inevitable and as mention earlier in this thesis, it is essential for the rapid globalization that our planet is experiencing. However, the mining along the West Coast is expanding at such a rapid rate and this expansion is not regulated through an overarching environmental plan. Thus, it is imperative to highlight the ways in which these extractions occur, and why there needs to be a change towards more sustainable, controlled methods.











Mineral Extractions around the Estuary

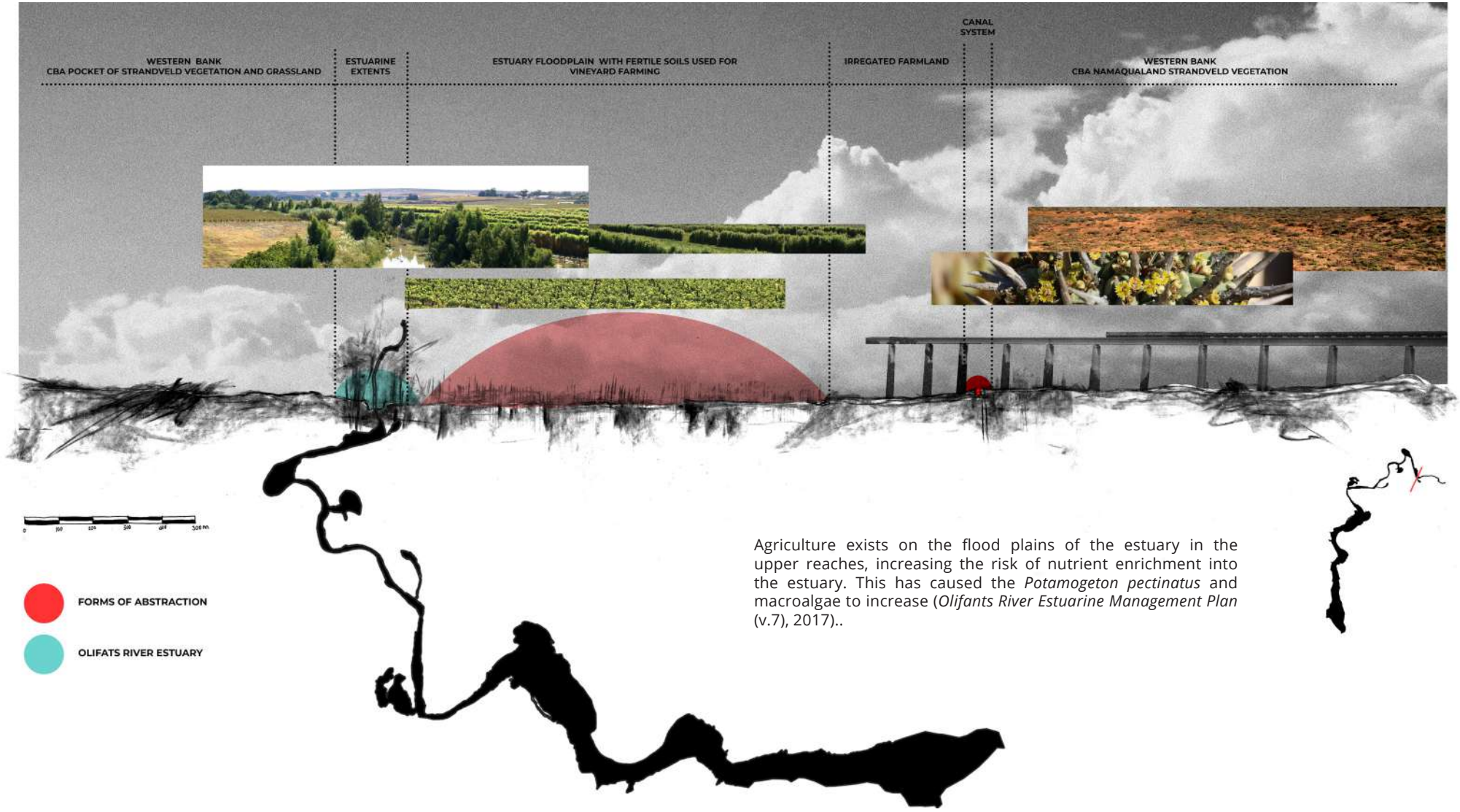
There are currently two mining concessions near the Olifants River Estuary. MSR mining company has had prospecting approved for the exploration of mineral sands on the western banks, and Buchuberg Resources (pty) ltd are in the process of applying for rights to a portion on the eastern bank. It has been proven that these forms of mining can be detrimental towards the landscape (Sowman, 2016), specifically as they fall within Critically Biodiverse Vegetation and buffer zones. The actions of mining go against the will of the community and their plan for their landscape (Sowman, 2016).

Vegetation Extractions

There are a variety of terrestrial and aquatic vegetation types that exist around the estuary, namely: salt marsh vegetation (intertidal, supratidal and floodplain), dune scrub (Cape Seashore Veg), coastal strandveld (Namaqualand Strandveld), and succulent karroid scrub. The latter of which is of high importance as Acocks et al. (1988) indicates the Olifants River Mouth to be the only place where succulent karoo vegetation reaches the sea. Much of this vegetation has been severely modified in some areas as it falls prey to overgrazing, prospective mining pits dug by bulldozers and unregulated camping on the floodplain. The arid nature of the area (rainfall of aprox. 250mm or less) makes the rehabilitation of these modified areas a task that could take up to 50 years due to the lack of rain and harshness of the environment (Theron, 1999) .

Effects of Hydrological Extractions

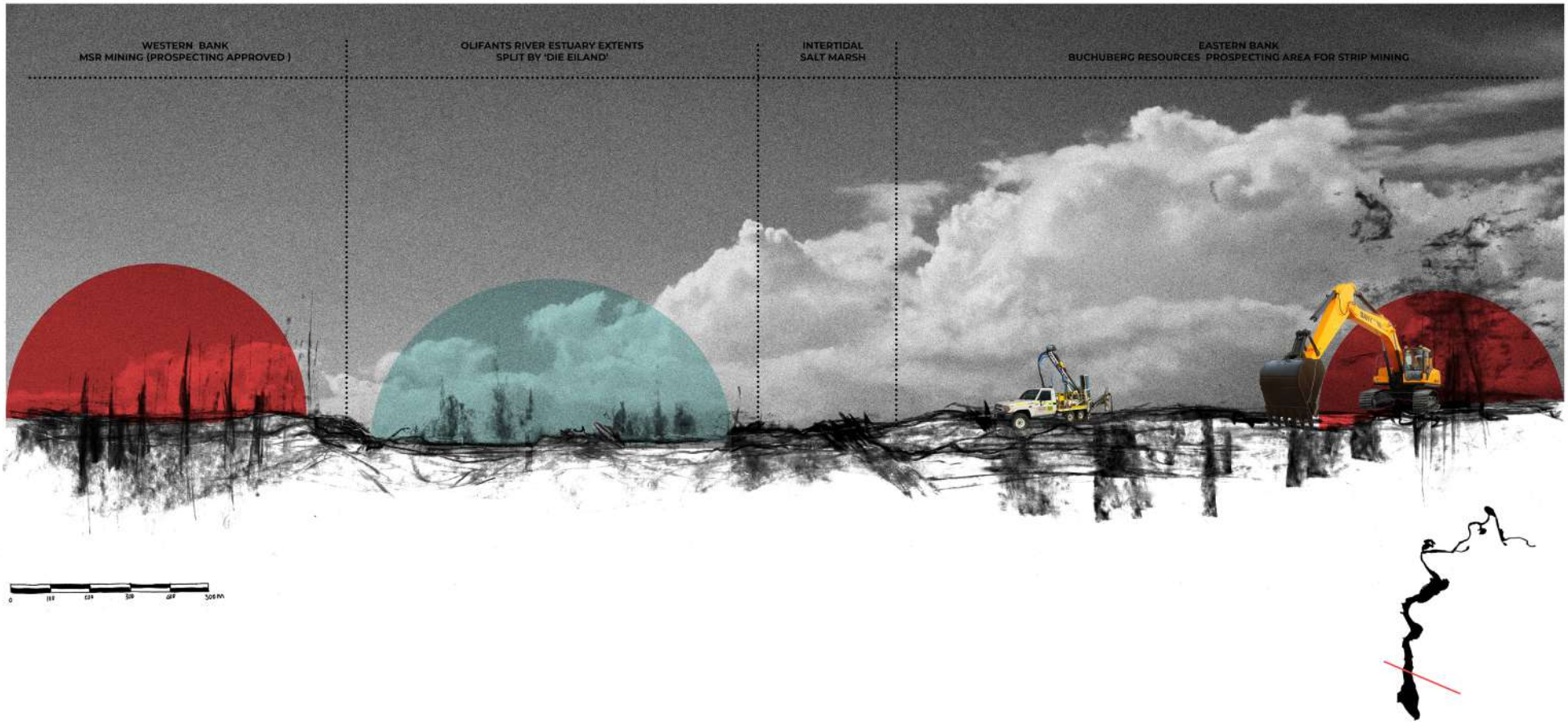
Upstream water abstraction by the Bulshoek Irrigation Barage and the Clanwilliam dam have reduced the natural freshwater flow by 33%. This combined with the Lutzville causeway which creates an estuarine barrier, have increased the salinity within the estuary. This increase in salinity has changed the make-up both fauna and flora, with the decrease in fish such as the estuarine round herring and the flathead mullet and an increase in Harder Mullet (Olifants River Estuarine Management Plan (v.7), 2017). Freshwater reeds and sedges have receded upstream as they do not tolerate the higher levels of salinity (Olifants River Estuarine Management Plan (v.7), 2017).



Agriculture exists on the flood plains of the estuary in the upper reaches, increasing the risk of nutrient enrichment into the estuary. This has caused the *Potamogeton pectinatus* and macroalgae to increase (*Olifants River Estuarine Management Plan* (v.7), 2017)..

What does mean in terms of Salt ?

The ecological extractions that exist within and around the Olifants River Estuary all play a part in its health and functioning. One of the main effects upon the estuary would be the increase in salinity within the estuary due to an extraction of water resources and a regulation of flow. This increase in salinity and change in predominant fish species creates the possibility for aquaculture. Because of the reduction of estuarine round herring and the flathead mullet and an increase in Harder Mullet, the aquaculture of flathead mullet could release pressure on the estuarine fishery whilst still making use of traditional fishing techniques and knowledge. The increased salinity of estuarine water means



that the density of salt within the estuarine water is greater. This makes applications such as salt harvesting a viable option as highly saline water is much preferred. The inclusion of more salt marsh vegetation would also be a possibility as these vegetation types thrive within saline environments. Increased salinity levels within the water allows for the re-purposing of a salt harvesting system that has been around since before the first records date in the 1870's. This salt harvesting system has the ability to work with aquaculture systems in order to build a resilient system that can support the community of Papendorp whilst having positive environmental effects.

5.2
SOCIAL EXTRACTIONS

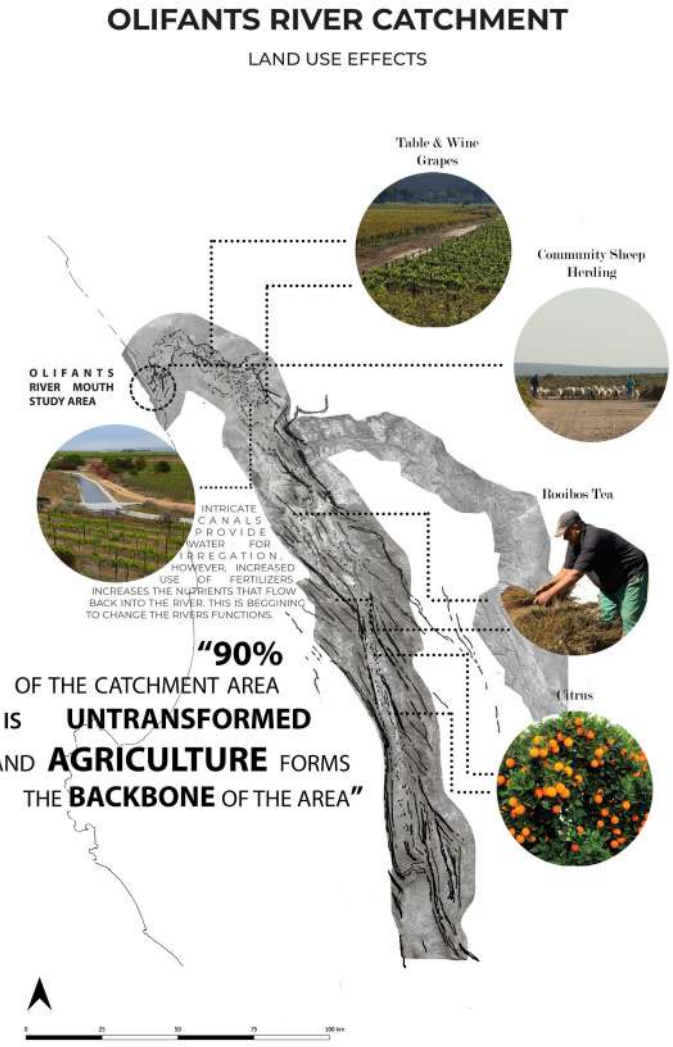
The Olifants River Estuary is at the end of river that is steeped in history. The river provides a lifeline for those who have relied upon it for centuries. The West Coast of South Africa is known for its archaeological richness, showing how both river and sea played a large part in the sustenance and livelihoods of early indigenous groups such as the Soaqua (Parkington, 1977). In the modern age some of these ways of living still live on through ancestors who reside in the Ebenhaeser and Papendorp areas. In order to understand the most appropriate intervention for the people of the Olifants River Estuary it is critical that we understand their histories, and the social extractions that have effected them.

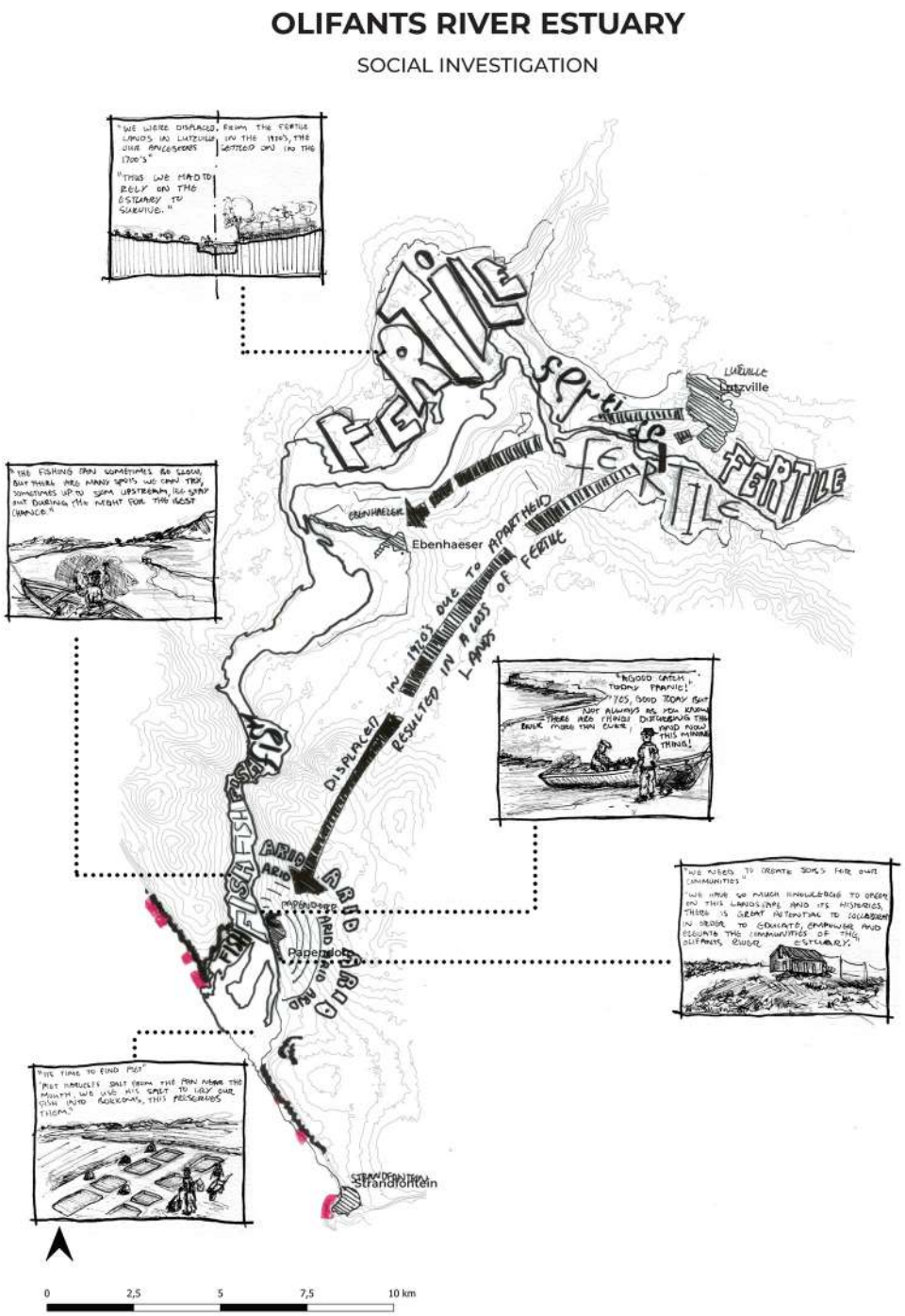
Land Use Extractions

According to Anchor Environment Consultants (2008) who did an assessment on behalf of [Cape Nature], the catchment area is the most sparsely populated in the country and around 90% of the land is considered untransformed with most of the land used as nature reserves or for livestock farming. The population is predominantly Coloured (70%) and White (20%) with more than 90% of the people Afrikaans speaking. Agriculture forms the backbone of the catchment, the majority of irrigated crops flank the Olifants River in-order to gain access to water, these include citrus, grapes, some stone fruit and rooibos tea in the arid regions. This is possible due to an intricate canal system that receives its water from the Bulshoek Irregation barrage. The canal system runs from the Bulshoek to Ludzville/ Ebenhaeser, allowing the adjacent farmland to flourish, however the town of Papendorp struggles with access to water, thus they have had to rely upon the estuary for their survival. The region has very low rainfall with 1500mm of annual rain in the south and 300mm in the North, the average rainfall for Papendorp is around 250mm.

Social Investigations on the Olifants River Estuary

The community of Papendorp and Ebenhaeser have deep historical ties to the site, being descendants of the Khoekoen people who settled in the area in the 1800's when the colonial British government allocated the old "Ebenezer" land to the Khoi Chief, Kees Andries Louis but to be held by and formally granted to the Rhenish Missionary Society to be held in trust for the Community (EcoAfrica, 2013). They were then forcibly removed from the land in the 1920's when the Government was making provisions for poor white people (EcoAfrica, 2013). The government provided alternative land to the Ebenhaeser Community, some of which became Papendorp. The communities have struggled with the arid landscape and water access, thus have had





A STRUGGLING COMMUNITY, EXTRACTED THROUGH RE-SETTLEMENT, RELIANT ON THE ECOSYSTEM SERVICES OF THE ESTUARY, THREATENED BY THE PROSPECTS OF MINING

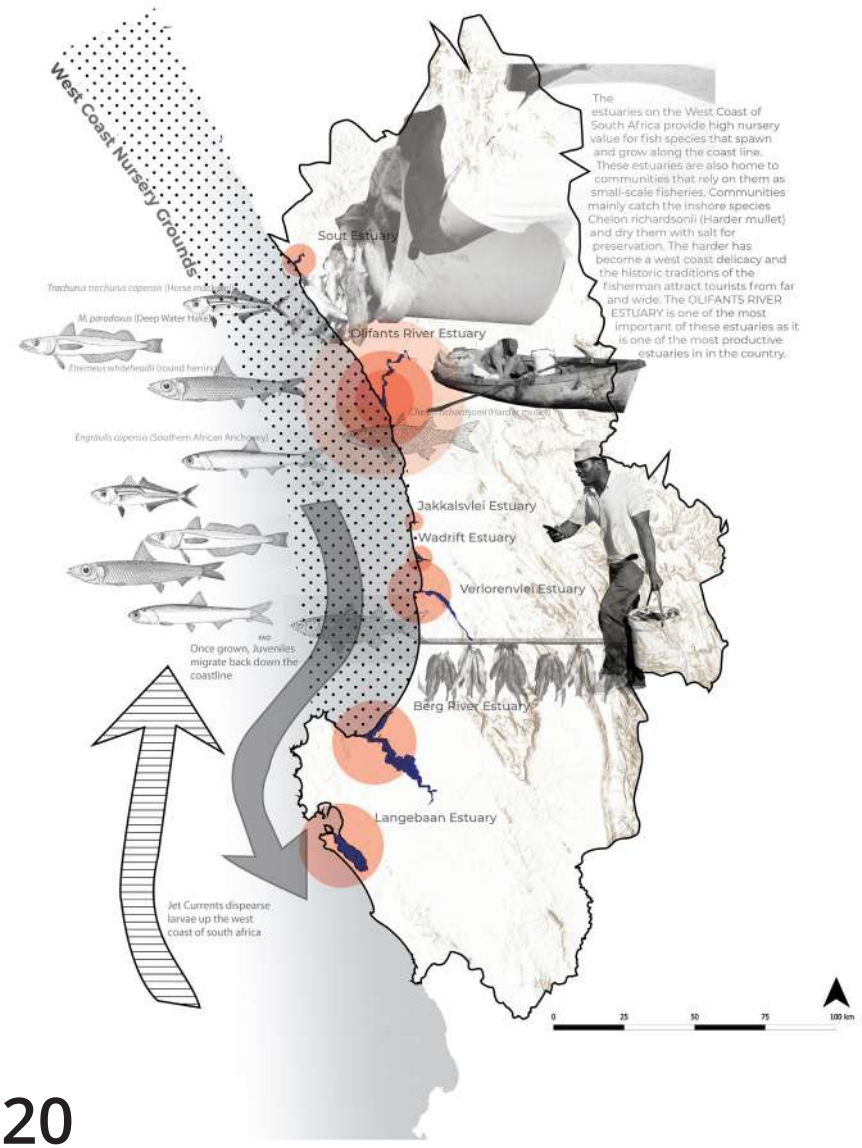
to rely on the estuary as a small-scale fishery for their livelihoods and ways of life. This has led to an extraction and an over-extraction in some cases of estuarine resources as it is often the communities only form of income and sustenance. This practice of fishing is under threat as fish stocks begin to dwindle and older generations pass on, with their knowledge going with them.

Why is the Olifants River Estuary Important along the West Coast ?

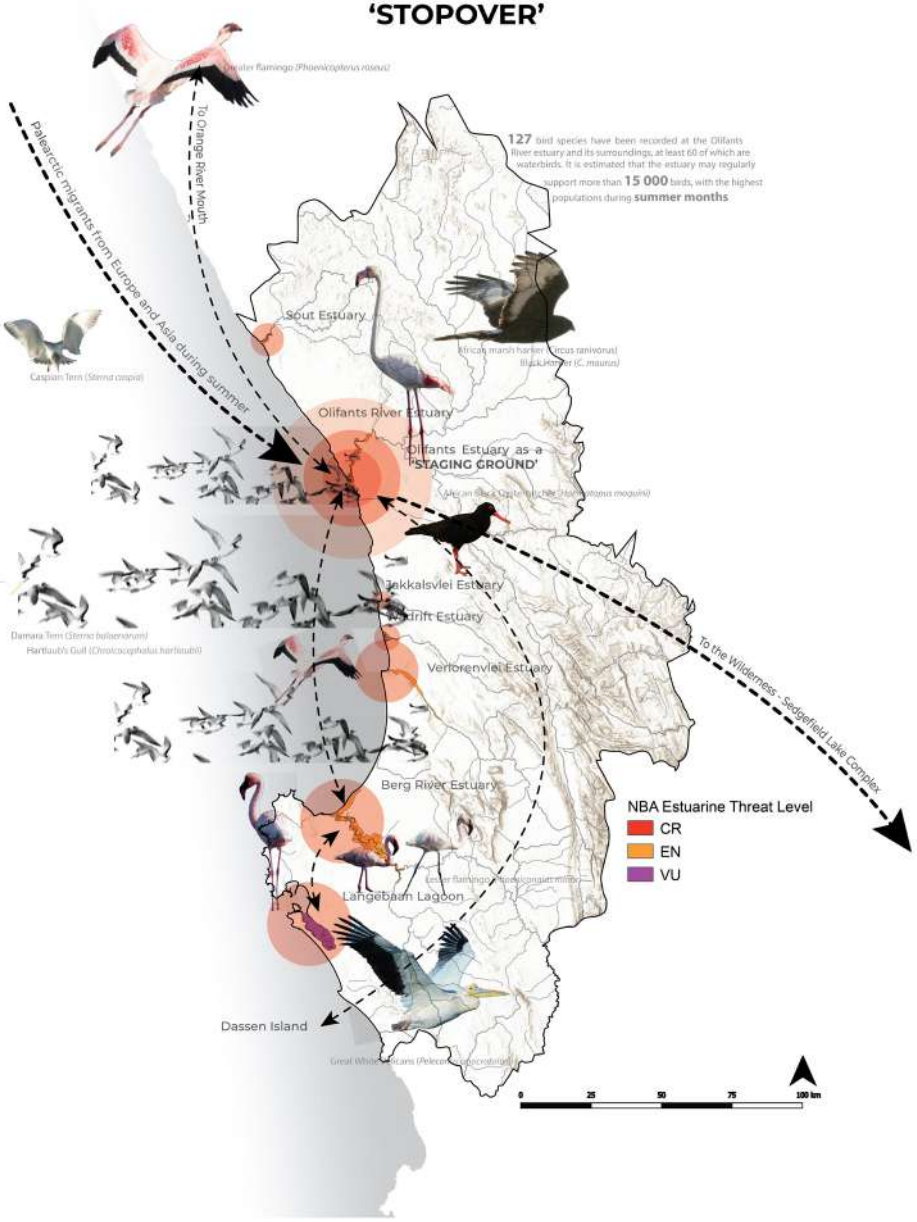
The West Coast of South Africa is supported by the cold Benguela current that carries nutrients up the coastline. These cold currents bring with it fish larvae that move up with the currents from the Agulhas Banks. The larvae rely upon the coastline and estuarine waters as nursery grounds for their survival. In turn, coastal communities have relied upon the small-scale fisheries that exist within the West Coast to sustain their livelihoods and ways of life. The communities of Papendorp and Ebenhaeser on the Olifants River Estuary are no exception and have been relying upon the estuary since they were forcibly extracted from their fertile irrigated lands in the 1920's. The estuary is then even more important as it is one of the top 3 functioning permanently open estuaries in South Africa, making its conservation of utmost importance.

According to the NBA Estuarine threat level, the Olifants River Estuary is rated as endangered, this is the predominant rating along the West Coast, with Jakkalsvlei being an exception at Critically Endangered. The estuary also acts as an incredibly important space for avifauna, supporting up to 15000 birds during the summer months when palearctic migratory birds come down from Europe and Asia. It becomes a staging ground for endangered Greater and Lesser flamingoes that move between the estuaries in the south and the Orange River in the North. Great White Pelicans who breed on Dassen Island to the south, come to forage here after the breeding period. What this means is that the Olifants River Estuary is an incredibly important knuckle for fauna and flora as well as for communities, and the opportunity for upliftment through tourism, especial through

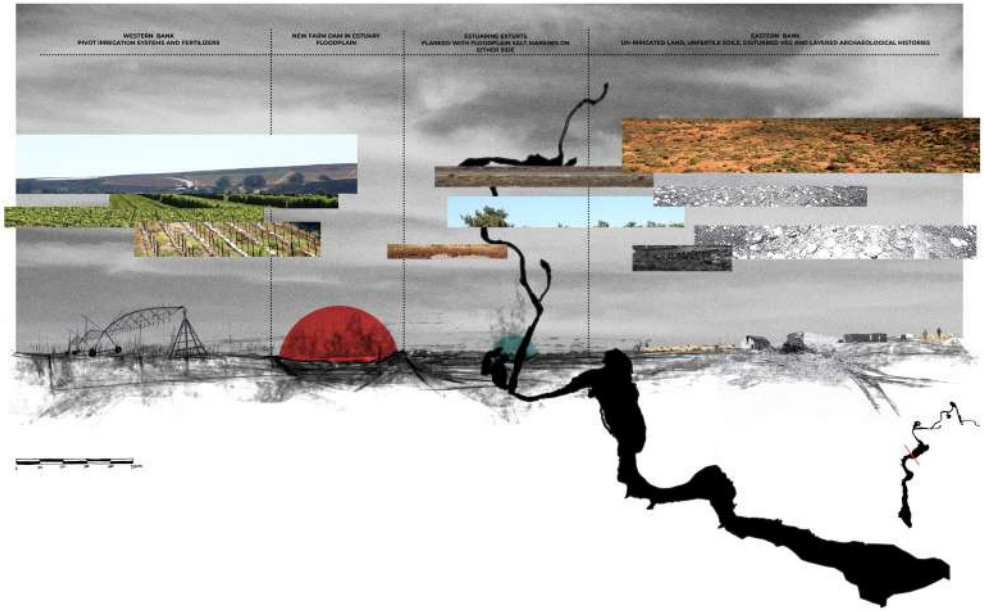
CAPE WEST COAST ESTUARIES PRODUCTIVITY



OLIFANTS ESTUARY MIGRATION 'STOPOVER'



IRRIGATED VS NON-IRRIGATED LAND



ESTUARY MOUTH DYNAMICS

Irrigation schemes play a big role in the success of crops due to the aridity of the region. The community of Papendorp thus has to rely on the grazing of their sheep and goats in natural vegetation, as the water is too brackish to grow anything.

The area encompassing the mouth of the Estuary and the town of Papendorp is rich in life. Both east and west banks have been modified to some extent, the west through historical diamond mining and the east through prospective mining trenches, historical salt production, overgrazing of sheep and holiday makers camping on the floodplain salt marsh. The community of Papendorp rely on this section of the estuary as a small-scale fishery. There are a large number of bird species that swell to the area during summer months.

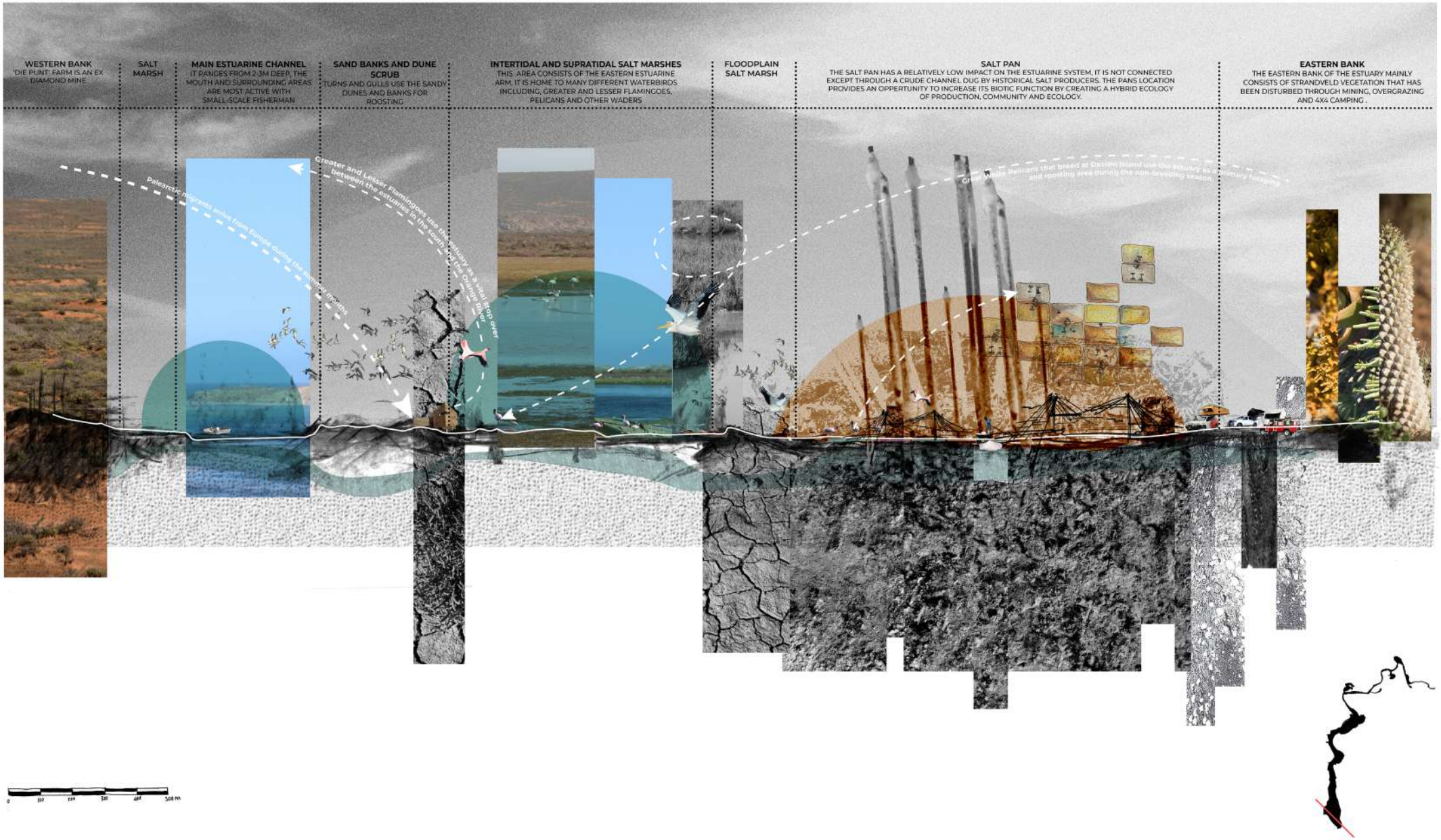
What does this mean for salt?

The communities that make up Ebenhaeser, and more specifically the town of Papendorp have been historically marginalized through government regulations and laws on the use of natural resources. We have highlighted the past atrocities and extractions that have occurred within the estuary's communities, mainly being; an extraction of people, an extraction of resources (mining) which goes against the rights of the people and an extraction of water which benefits some and not others.

What this means is that any intervention that exists must be one that puts the community first and ultimately builds a resilient system that will provide the best possible working conditions/ outcome for the communities.

The salt pan of Papendorp, at the mouth of the estuary is a space that has historically been used to produce salt. Therefore, it is an existing system that has been used for over 100 years. Salt is a sustainable resource that requires seawater, sun, and wind to be produced. The production thereof is also labour intensive and thus there would be between 30-40 Job opportunities available for local residents of Papendorp (EcoAfrica, 2013). The Community Development and Land Acquisition Plan for Ebenhaeser and Papendorp (2013), also states it is a viable option for development in the future, as well as the aquaculture of Flathead Grey Mullet. These interventions make use of existing traditional knowledge within communities and combine it into a new type of hybrid ecology that could exist.

A LAYERED FUTURE OF SALT



OLIFANTS RIVER MOUTH SITE ANALYSIS

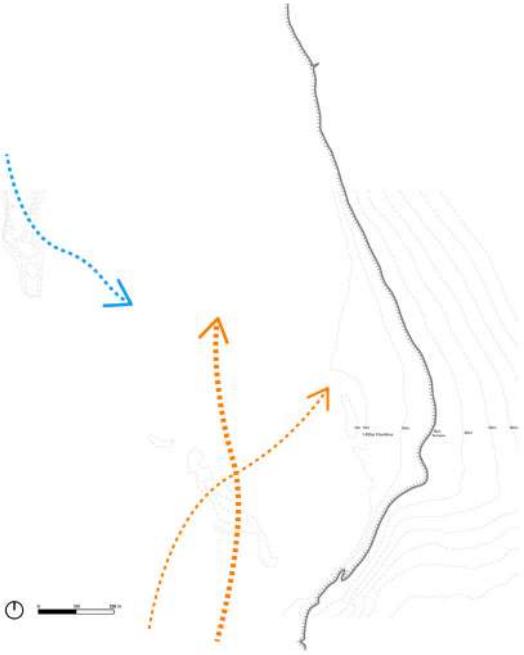
ESTUARY AND SALT PAN

The estuary is one of the top 3 permanently open estuary's in South Africa. This allows for the constant interaction between river and sea, highlighting the nursery value of the estuary and bringing essential nutrients. Historically the estuary consisted of three estuarine arms; the western arm (Main Channel), Central arm (secondary channel) and the Eastern arm (now dried up and sometimes tidal). The central and eastern arms are believed to have connected to the salt pan many years ago. Today, there is a man made channel that connects the central arm and the salt pan, this is believed to exist since before memory of the local communities.

VEGETATION

The estuary is home to some of the highest populations of intertidal, supratidal and floodplain salt marshes in South Africa. The intertidal and supratidal habitats are home to the highest number of bird species. The floodplain salt marsh vegetation is largely disturbed due to overgrazing as well as camping during peak summer periods. Dune vegetation exists along the dune belt to the south west of the salt pan which separates it from the sea. The salt pan itself offers a relatively low biodiversity input towards the estuary as a whole.

WIND DIRECTIONS

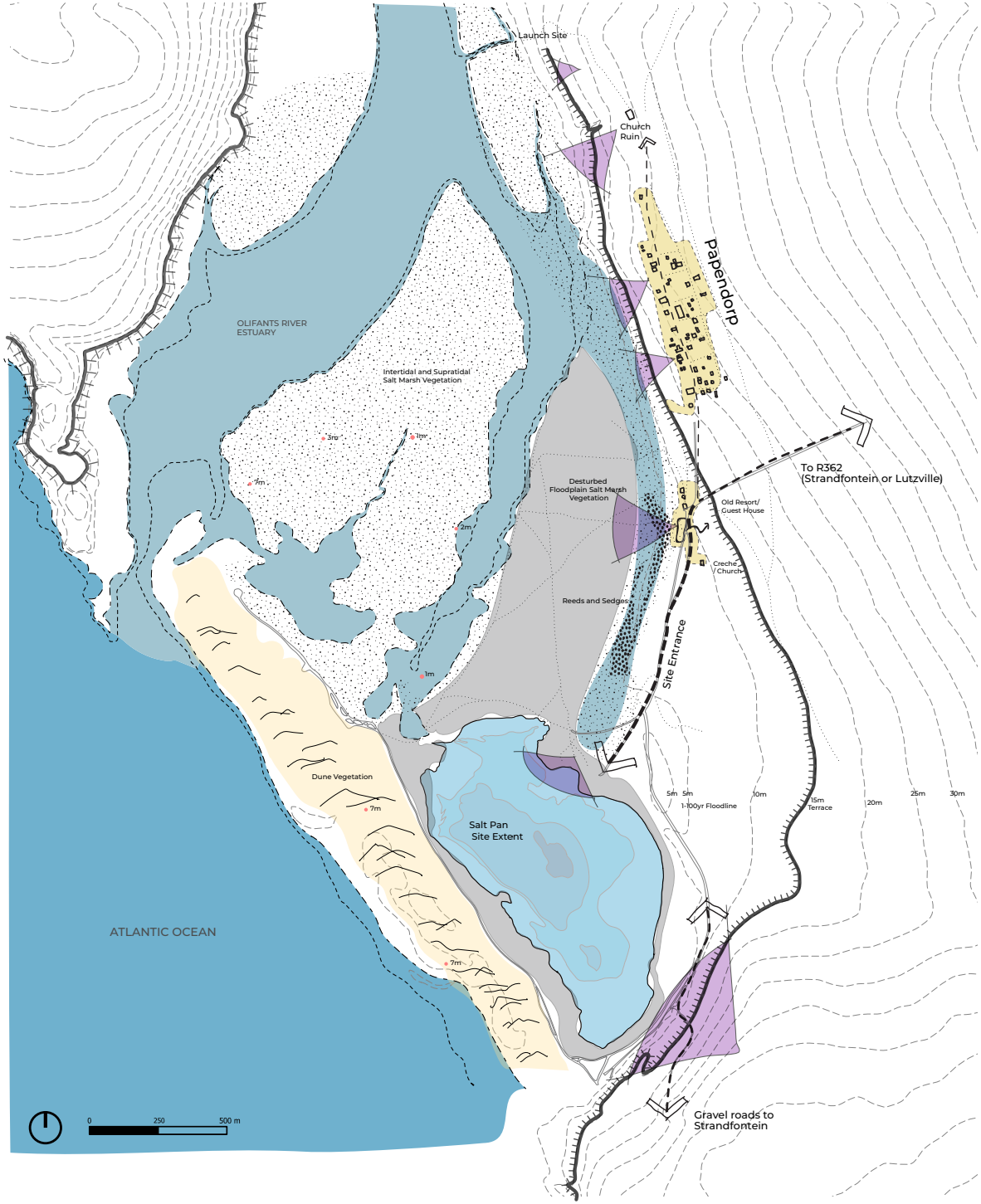


The estuarine landscape is relatively flat and offers minimal protection towards windy conditions. Summer winds are commonly strongest, ranging between 20-40kph for most of the time. Coming predominantly from the south and swinging between south west and south east. Winter winds swing towards the northwest and range between 10-30kph for the most part. The constant winds and high temperatures during summer (25-35 degrees C) provide the perfect conditions for the natural process of salt crystallization.

INFRASTRUCTURE AND ACCESS

The urban infrastructure of Papendorp exists between the Old Church building to the North and the old resort buildings to the south. The urban footprint is generally small with opportunity for development. The town centre offers exceptional views over the estuary as it is situated upon the 15m contour terrace. Access is available through the R362 and a tar road that runs to the town of Papendorp. Between the Papendorp and the salt pan are several well established dirt roads. There are various footpaths and semi-permanent jeep tracks that exist throughout the study area.

OLIFANTS RIVER MOUTH SITE ANALYSIS



CREATING A HYBRID ECOLOGY THAT CAN SUPPORT:

- SALT PRODUCTION
- AQUACULTURE HARVESTING
- ENVIRONMENTAL EDUCATION
- ECO TOURISM

5.3
FROM EXTRACTION TO ABSTRACTION

The social-ecological analysis done on the Olifants River Estuary has highlighted the predominant forces of extraction upon the estuary. The outcome of this analysis is the need for a resilient system of hybrid ecologies that can exist on and around the Papendorp Salt Pan. A system that converts the current practices of extraction to those of abstraction.

The terms ***extraction*** and ***abstraction*** both refer to material processes of removing or taking away of something. However, the difference and shift comes from the manner in which these processes occur.

In this thesis the term ***extraction*** refers to the action or condition of something being extracted (often with effort or force), to take something away or to remove it from its location. It is therefore referring to the material extraction of resources, to be taken away and used elsewhere.

The term ***abstraction*** refers to the act of abstracting, separating or taking away, i.e. the state of taking away. This starts to speak about the process in which something is being taken away, i.e. water being abstracted from a river through a pump system.

It is in the difference of process that this design research can begin its exploration. Moving away from an extraction of materials from one place to another, towards the abstraction thereof, the process that which these materials go through. This shift allows us to focus on the manner and not just the action. In this manner of abstraction we can pay more attention to social-ecological structures that are influenced through its act. Aiming to design using existing systems that might complement the process as well as the ecosystem services that exist on site.

It is noted that the most suitable forms of intervention for the area as well as the community are those of salt production, aquaculture and community run ecotoursim with aspects of environmental education.

In order to design for this hybrid ecology of systems that aims to use forms of abstraction (seawater, salt, fish), we need to understand how the production of these systems work. Specifically, their seasonality as this will allow for an integration of the separate systems (aquaculture and salt production) so that they might create a cyclical loop that would sustain .

Figure 10 is a diagram depicting the seasons and processes of Aquaculture and Salt harvesting. This shows us how the integrated system can be productive year round, if designed correctly. Allowing the aquaculture system to feed the salt harvesting, and the salt harvesting system to feed the ecotourism/ environmental education center by increasing the ecological value of the site (through salt marsh vegetation and bird life).

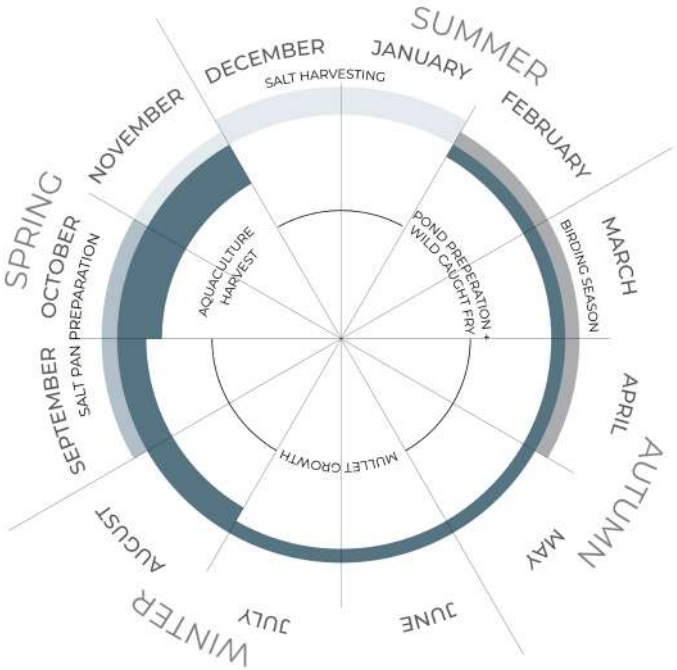


Figure 10: A Seasonal diagram for the processes of aquaculture and salt harvesting.

6
A SHIFT TOWARDS SALT
EXTRACTION TO ABSTRACTION

Figure 11: Forgotten brine pits that were used for artisanal salt production.

Figure 12: The Papendorp Salt Pan with patterns from traditional salt harvesting.

6.1
DESIGN APPROACH

The previous chapter ended with a shift from current forms of extraction towards one of abstraction. That shift is manifested in the design research aspect of this dissertation. The driver for this shift is the production of salt as a sustainable mineral as well as the inclusion of beneficiary interventions that may feed or be fed by the system of salt production. These systems include aquaculture, ecotourism and environmental education.

The existing salt pan of Papendorp, which is situated nearby the Olifants River Estuary mouth, has been historically productive since the 1870's, when the first written rights were put in place to harvest salt from the pan (EcoAfrica, 2013). The salt pan has been harvested using traditional methods that are similar to those used for thousands of years all over the world. In the case of the Papendorp salt pan (see figure 11 & 12) a cruder, yet effective, method was used. This entailed digging a channel between the eastern estuarine arm and the salt pan, which allowed seawater to flow into the pan during high tide. A crude barrier was created using clay and timber to stop the flow when the desired amount of seawater was achieved. The seawater then flowed into the pan through a series of trenches, eventually to end up in rectangular brine pits. The seawater brine was then left to the elements (sun and wind) to increase the concentration of salt and eventually allow the process of crystallization to occur. This process is only viable during summer months as the dry hot climate with warm southerly winds allow for the perfect conditions.

In other areas such as the Île de Ré region in France (see figure 13), use a slightly more developed method, which includes a series of ponds that are connected through sluices and channels. However, the concepts of holding (seawater), heating, densifying (salt concentration), and harvesting remain the same.

Thus, by learning from these systems (figure 14) we can start to inform the way in which we approach design, as a combination of systems/functional design (traditional salt harvesting methods) with spatial design that is influenced by patterns that are formed through the consequences and interactions of this process. These existing systems will form the structuring armature of the design inquiry.

Figure 13: Salt Works ponds on the coastline of Île de Ré

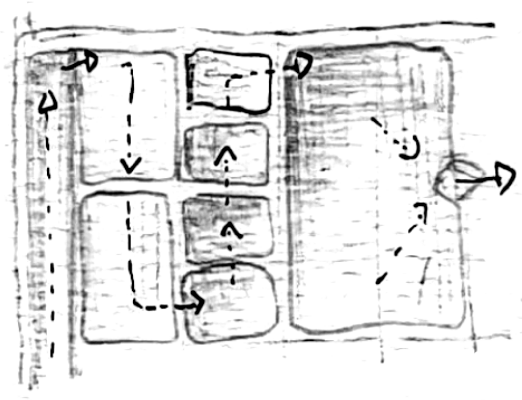
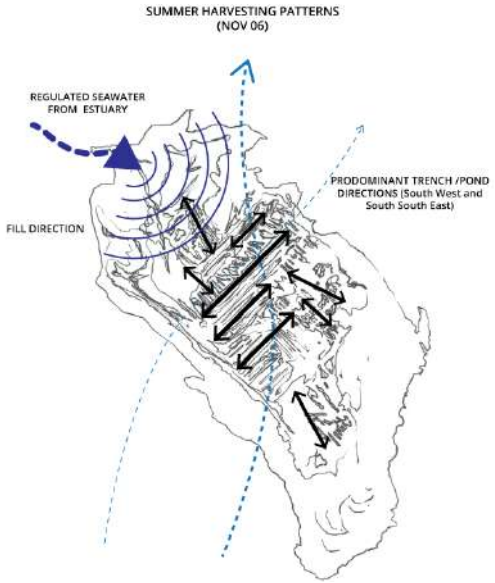
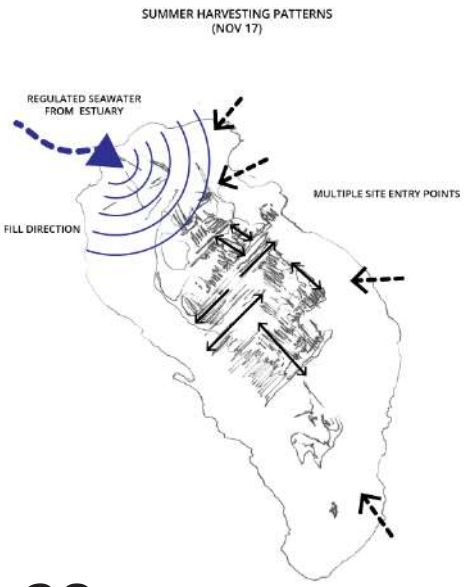
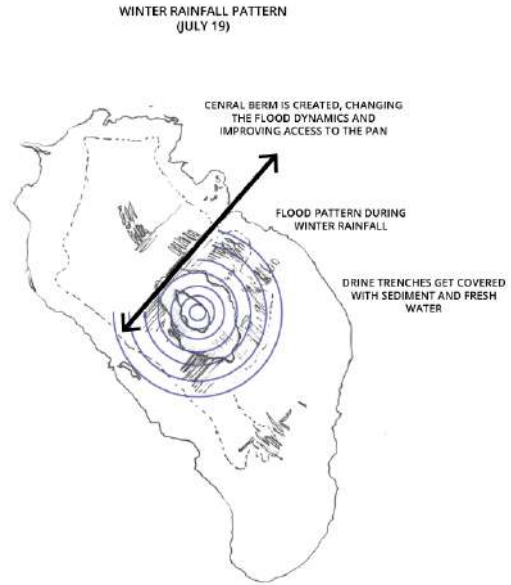


Figure 14: A common diagram of traditional salt works in countries like France.







The diagrams to the left are depicting the salt pan under summer and winter conditions. Through tracing historical imagery and comparing the seasons that the pan experiences, we are able to identify some of the primary interactions between harvesters and the pan.

Summer Patterns (November 06)

- A constant throughout the summer patterns is the inflow of seawater from the estuary, due to the channel dug on the North West corner of the pan.
- Crude crystallization ponds are dug and are highly visible, possibly due to ideal weather conditions, increasing salt crystallization.
- Ponds are dug with a spade and are thus scaled to that of human capabilities
- Ponds start to form strong linear textures
- Ponds are angled either perpendicular or parallel to summer south and south west winds.

Winter Patterns (July 13)

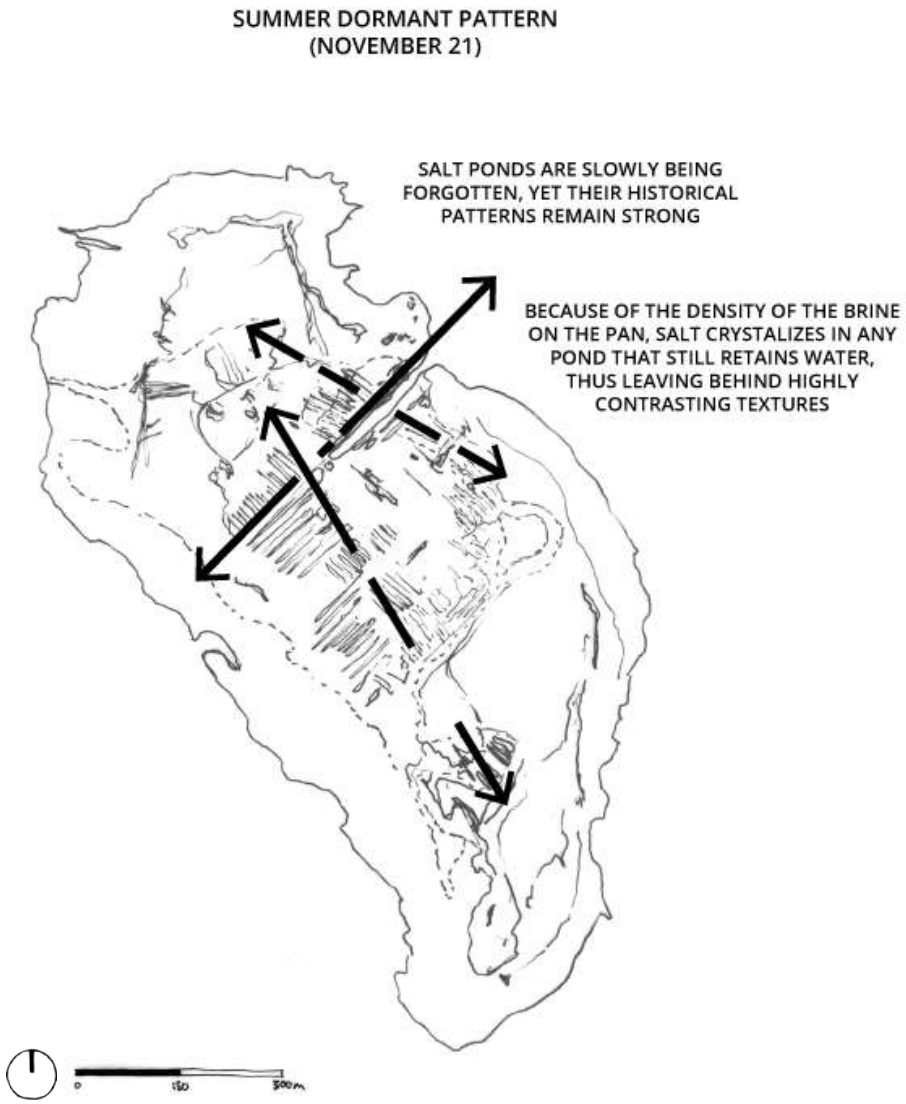
- Winter rain falls during the June/July months and often floods the salt pan.
- The flood pattern starts at the center of the pan and fans outwards.
- Rain brings sediments often obscuring past crystallization ponds.

Summer Patterns (November 17)

- A constant throughout the summer patterns is the inflow of seawater from the estuary, due to the channel dug on the North West corner of the pan.
- Crystallization pond are staggered, possibly due to a disinterest in the production of salt
- Several different entry points to the pan exist, diluting the intensity of the ponds.

Winter Patterns (July 19)

- Winter rain falls during the June/July months and floods the salt pan.
- A central berm is created to control flood dynamics and sea water flow into ponds, this also improves access into the pan and formulates a strong central axis as well as main access route.
- Ponds are filled with sediment, rendering some forgotten



Since roughly 2019, the salt pan has gone through an inactive stage in terms of salt production. This however, does not mean that the natural processes on site of water flow and crystallization failed to continue.

Summer Patterns (November 21)

- Erratic crystallization throughout the pond due to a stop in intentional harvesting.
- Sediment build up in ponds leave some areas unable to hold water, thereby unable to crystallize.
- Water flow from the estuary is stopped, leaving only groundwater (brine) and rainwater on site. This interaction of fresh water on site slows down crystallization processes.
- Central berm begins to erode away from inadequate construction and continuous use.

Summary of Interactions

It is noted that a series of interactions occurred on site which led to the change or repetition of patterns. The introduction or subtraction of interactions also created a change in patterns. Below is a summarized list of what was observed from the systematic elaboration.

-**Filling** with seawater
-**Digging** away the earth with intentional directionality
-Sun (**heating** and **densifying**) & Wind on water (crystallization through **time**)
-**Flooding** (natural fresh water)
-Filling with Sediment
-**Berming** - creating a central axis and creating a main access point
-**Letting go** - staggered flooding/ crystallization

Why is this appropriate for design ?

Through a systematic understanding of past interactions and consequences we are able draw upon the main forming systems. We can do this as these systems are tried and tested over centuries of use, and allowing them to inform us will create a richer design. These forming systems start to formulate and influence the main design inquiry as well as the design language.

Therefore, it is proposed that through the combination of the above formulated design language/ system, and the beneficiary systems (aquaculture/ecotourism/ environmental education), that this design inquiry will successfully address the social-ecological issues that the community of Papendorp face.

6.2
LEARNING FROM SALT

Understanding the processes

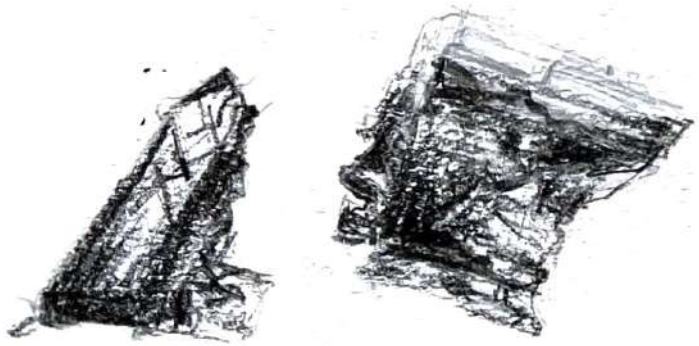
The historical process of salt abstraction requires relatively little input, making it the most sustainable and environmentally friendly way to produce salt. All that it requires is seawater, sun, wind, and a surface on which to evaporate (salt pan). The crystallization of salt occurs when the salinity levels are around 250ml of salt per liter of water, salt crystals (Figure 15) are then produced when evaporation occurs. Ecologically, coastal salt works are known to increase the biological function of salt pans as they support a variety of marine life, much like coastal salt marsh systems. The varying levels of salinities support different types of organism which in turn, attract a large amount of bird life. It is even noted that the optimal operation of Solar Salt works is impossible without maintaining their ponds as healthy and functioning ecosystems (Korovessis & Lekkas, 2009).

In the growth of salt, crystals can also form upon tensile structures, this occurs because of capillary action (Figure 16) (Pungercar & Musso, 2021). The growth of salt crystals and their dynamic properties are what help to inform this design process, they are cubic in form (figure 15) and their growth is dependent on the natural cycles of the location.

Salt crystallization upon structures can increase a structures density, as long as it remains upon the structure. This ability to allow structures to be dynamic in their function, use and thermal properties allows us to explore the hybridization of programme both over time and functions. Through using a combination of both traditional methods (salt ponds) and new methods (crystallization structures) a new typology might be able to form. One that is flexible in its use and can form a baseline for future modulation.

There are therefore 2 different processes that will be explored: 1) Salt crystallization upon structures 2) Traditional salt harvesting methods

Figure 15 : A sea salt crystal is a complex structure, predominantly forming cubes. However the structures often branch out creating angular connected shapes.



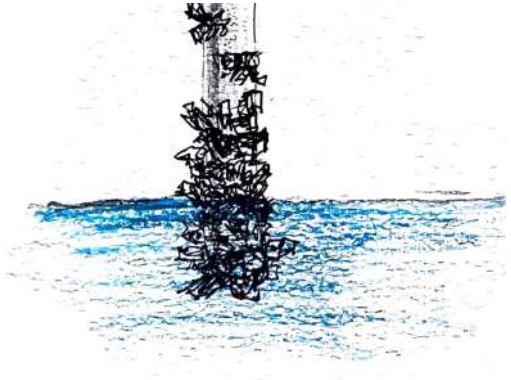


Figure 16: A sketch of salt crystallizing up a tensile structure through capillary processes, the more tensile the structure the better the crystallization process.

SALT EXPERIMENT AS AN INVESTIGATION OF CRYSTALLIZATION PROCESS

The salt experiment:

The aim of the salt experiment was to test the process of salt crystallization upon different materials under tensile force.

The salt solution was created through dissolving sea salt in water at a ratio of 250ml per 1 liter of water. This is the ideal density for the process of evaporation and salt harvesting.

Three types of materials were used.
1. Cotton string
2. Hemp rope
3. GP-12 synthetic rope

Ultimately all the ropes provided adequate surfaces for crystallization processes as salt crystals grow best on tensile objects, however the GP-12 synthetic rope performed best as it did not absorb any water and purely allowed the salt to crystallize on its periphery. This rope is also incredibly strong (3mm diameter has a tensile strength of 1.3 ton), therefore could be usefully in the design application.

In conclusion, the salt experiment highlighted the dynamic and explorative properties of salt and the possibilities that the crystallization process offers towards design. The variability and reliance on the climatic conditions are aspects that could be controlled and directed towards an extent, informing the design process and outcome. The idea being that the system created is fluid and can fluctuate with the natural environment or be more controlled where necessary. It is important to note that in a recent study about the properties of salt as a building material by Pungercar and Musso (2021), it was identified that salt growth and crystallization

3

1

3

is a viable option for temporary structures, providing good thermal and shade properties. It is further noted that when treated correctly, salt bricks are similar to rammed earth in construction, yet perform slightly better (Pungercar & Musso, 2021).

What does this mean for design?

The nature of salt and the abundance of sea water, specifically in the Olifants River Estuary, highlights the sustainability of the mineral and not only its ability to be sold as an artisanal product but also as a design tool and informant. This starts to speak to the change we seek to achieve, that from a concept of extraction to one of abstraction. Ultimately, the characteristics of the salt creates a basis that we can design from in order to achieve a hybridized ecology within the site. Moving away from traditional methods and maximizing the use of the ecosystem services that exist, through understanding the systems that they find themselves within.

3

Figure 17: Historical harvesting patterns that exist upon site. Note the difference between wet and dry months, as rain fills the pan from the center outwards. During the rainy months, sediment often covers up previous ponds.

TRADITIONAL SALT HARVESTING METHODS

Figure 18: Historical imagery of salt crystallization ponds.

Using the patterns of site as an informant

The salt pan itself is layered with information, from past and present users. The pan has been historically productive since the 1870's, when the first written rights to mine salt were put in place (EcoAfrica, 2013). However, the use of the pan predates these written agreements. Its relationship to the surround ecosystem can be viewed as both connected and disconnected at the same time as it fluctuates according to the availability of water. When the salt pan was functioning, workers used a crude trench dug in connection with the eastern arm of the estuary, this trench had a sluice which regulated the saltwater flow during high tides. In-order to produce the salt, workers dug shallow ponds that increased the salinity levels by harvesting the power of the sun and the wind. Once salinity levels were high enough salt started to crystallize within the ponds and the workers would rake or spade the crystals next to the ponds (see figure 18). These ponds were regulated by the inflow trench.

Ultimately, we can start to look at the patterns of digging, regulating, filling, harvesting, to inform the way we view and design on site. This combined with the patterns of crystallization informing space-making could ultimately create the shift from extraction to abstraction (Figure 17).

According to M'Closkey and VanDerSys (2017), "Patterns are a consequence of interactions", this refers to Lawrence Halprin's work of notational drawings which he develops in partnership with his wife. Highlighting that time and movement, which are generally unseen aspects of a design, are best described through notational diagrams that celebrate pattern of processes and performance (M'Closkey & VanDerSys, 2017). The authors go on to speak about how one can achieve high degrees of change from slight modifications to very few elements within a system. They argue that through the orchestration of a sequence of events that form over time, one can form orderly arrays based on simple rules and interactions (M'Closkey & VanDerSys, 2017).

HISTORICAL FLOOD DYNAMICS DIAGRAM

Figure 19: Historical imagery also allows us to understand the manner in which the pan floods, thus informing the design.

Now, although salt isn't part of an overly complex system, it is the interest in a set of sequences or rules that force one to wonder how these could be created/formed/altered in a system that has existed since the beginning of civilization. A system that societies have relied upon, that works. Can it and should it be done?

Through understanding these 'orchestrating' systems we can begin to bend/modify/adapt these systems to achieve a desired outcome. In the case of this thesis, the desired outcome is a Hybridized system, one that is cyclical and can feed off itself, providing a resilience to the community of Papendorp. Learning from the identified interactions on site in section 6.1, we can begin to explore how those orchestrating systems begin to look as diagrams. Through feeding off of those orchestrating systems; seawater, sun, wind, tides etc. we can extract valuable informants for the design.

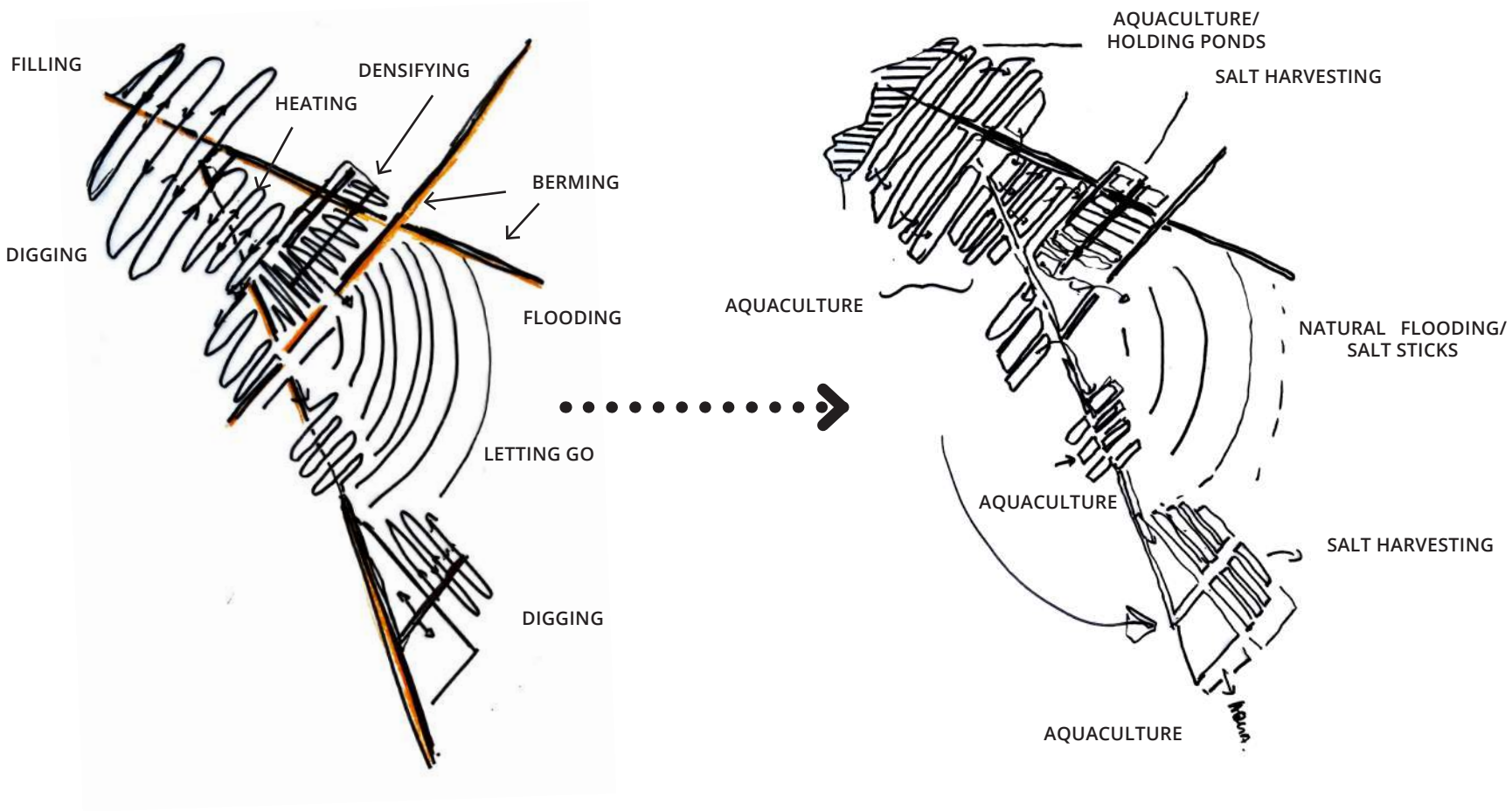
Figure 20: Salt pan in flood after winter rainfall. (July 2022)

EXTRACTING PATTERNS FROM SITE, EXTRAPOLATING AND USING THEM AS FORMULATING SYSTEMS

USING THE HISTORICAL SALTWATER FLOOD DIRECTION OF SITE, COMBINED WITH THE EXISTING DIRECTIONALITY OF FORM.

EXPANDING ON THE DIRECTIONALITY OF EXISTING FORM, HIGHLIGHTING MAIN ARTERY'S AND INTRODUCING SECONDARY AND TERTIARY ARTERY'S. STARTING TO IDENTIFY SPACES OF NEW FORM AS WELL AS OLD 'EXISTING' FORM.

EXTRAPOLATING SPACES BETWEEN ARTERY'S, HIERARCHY OF WATER MOVEMENT ACROSS SITE AND THE INCLUSION OF NEW ABSTRACTING SYSTEMS (SALT STICKS AND CRYSTALLIZATION STRUCTURES).

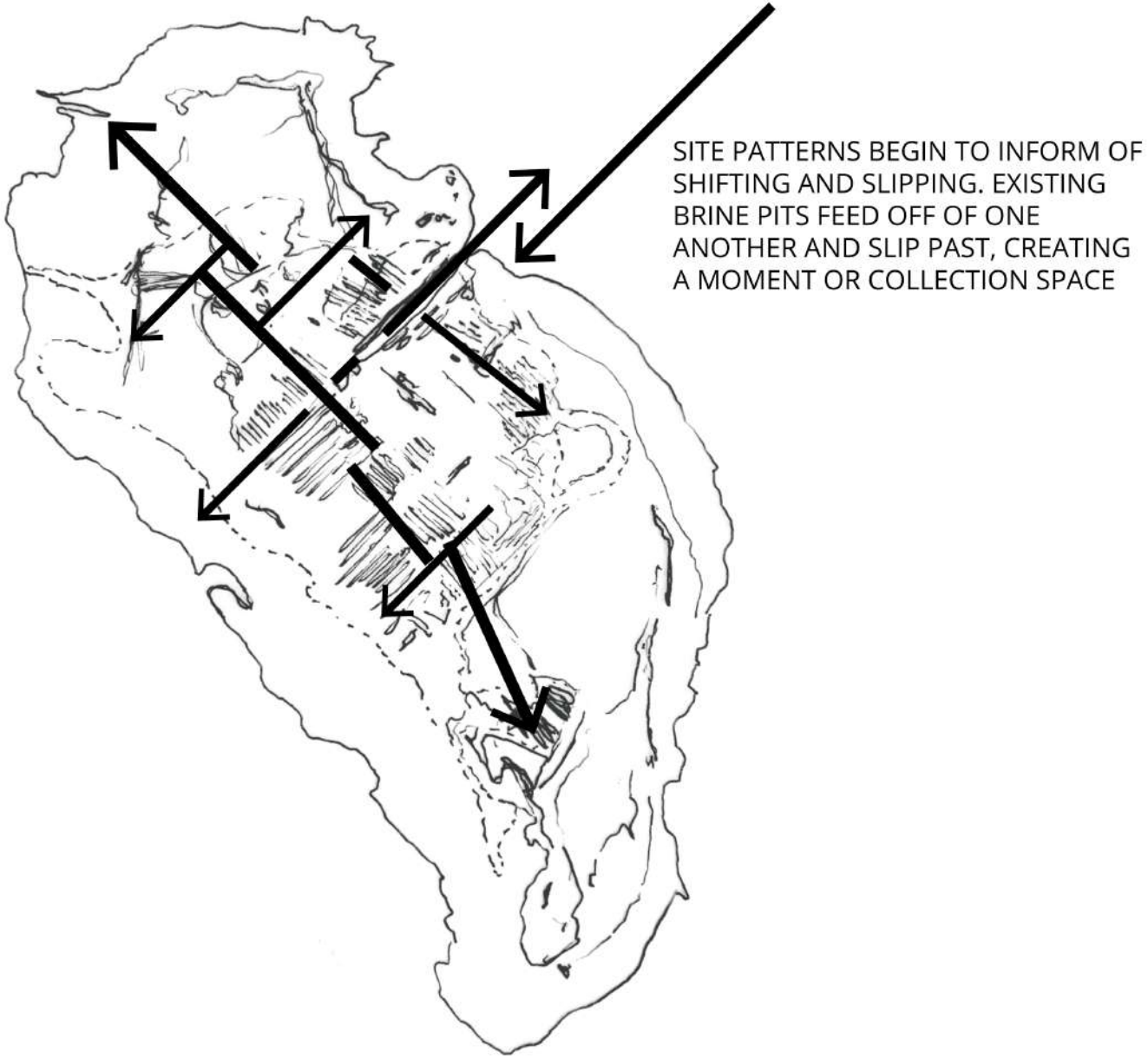


CONCEPT DEVELOPMENT: JOINING TWO SYSTEMS TO BECOME MUTUALLY BENEFICIAL, WHILST REMEMBERING THE PATTERNS OF PAST.

Through the earlier exploration into the orchestrating interactions upon site we are able to identify elements that we could draw into design.

-**Filling** with seawater
-**Digging** away the earth with intentional directionality
-Sun (**heating** and **densifying**) & Wind on water (crystallization through **time**)
-**Flooding** (natural fresh water)
-Filling with Sediment
-**Berming** - creating a central axis and creating a main access point
-**Letting go** - staggered flooding/ crystallization

These elements can now be seen being brought into design through the diagrams above and are combined to create the hybridized system desired. Where there is a combination of Salt Harvesting, aquaculture, ecotoursim and environmental education.


SITE PATTERNS BEGIN TO INFORM OF SHIFTING AND SLIPPING. EXISTING BRINE PITS FEED OFF OF ONE ANOTHER AND SLIP PAST, CREATING A MOMENT OR COLLECTION SPACE

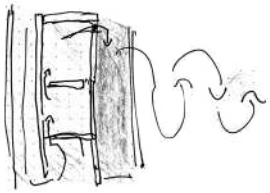
SALT PRODUCTION PROCESS

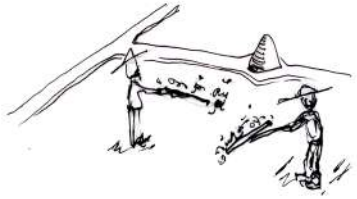
SALT PAN PREPPING

ONCE THE PANS HAVE SUFFICIENTLY DRIED AFTER WINTER RAINS, WORKERS STOMP THE SURFACE OF THE PAN INTO AN IMPERMEABLE LAYER. THEY ALSO RECONSTRUCT ANY DAMAGED BERMS FROM THE RAIN.

SEAWATER HOLDING AND HEATING

ONCE THE PANS ARE READY AND SUMMER IS AT ITS PEAK, SEAWATER CAN BE FILTERED THROUGH A SERIES OF CONTROLLED TIDAL CANALS THAT HEAT THE WATER IN ORDER TO INCREASE THE DENSITY OF SALT



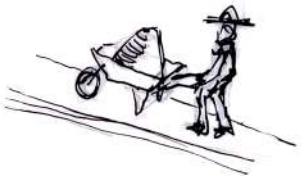


SALT HARVESTING

SEAWATER REACHES ITS IDEAL HARVESTING SALINITY, 300G OF SALT PER LITER OF WATER. IT IS NOW READY TO BE HARVESTED WITH RAKES AND SPADES. SALT IS PUSHED TO THE CENTRE OF DIVIDING BERMS.

SALT COLLECTION

DURING THE HARVESTING PROCESS SALT MUST BE CONTINUALLY COLLECTED AND TRANSFERED TO THE CENTRAL COLLECTION AREA.



BRINE WASHING

ONCE COLLECTED AND PILED, SALT CAN BE WASHED WITH BRINE IN ORDER TO RID IT OF ANY IMPURITIES.

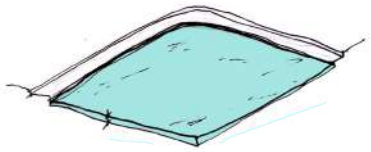
PACKAGING

CLEAN, THE SALT IS THEN PILED, SORTED AND PACKAGED. READY TO BE COLLECTED FOR DISTRIBUTION.

AQUACULTURE PROCESS

NURSERY POND PREP

PONDS ARE PLOUGHED WITH 2.5-5 TONNES OF COW DUNG/ HECTARE. THIS ACTS AS A NATURAL FOOD SOURCES.

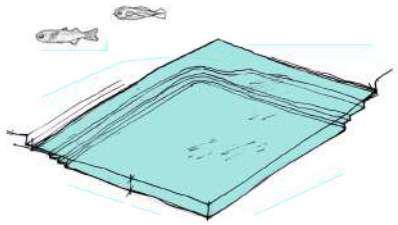


NURSERY POND PREP

NURSERY PONDS IS FILLED WITH 30CM OF WATER FOR 7 DAYS FOR THE NUTRIENTS TO DISSOLVE INTO THE WATER.

WILD FRY CAUGHT

LOCAL FISHERMAN CATCH WILD FRY (16-20MM) FROM THE ESTUARY. FRY ARE PUT INTO ACCLIMATIZATIONPONDS.

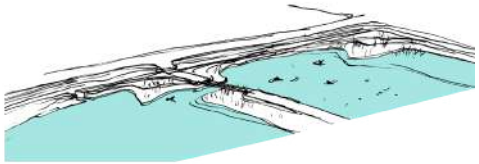


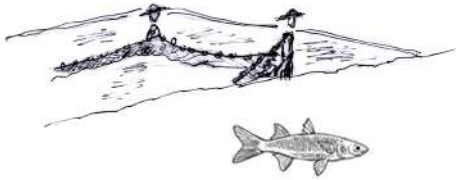
NURSERY POND FILLING

PONDS ARE THEN FILLED TO 1.5M DEEP AND FRY ARE GROWN FOR 4-7 MONTHS.

GROWING PONDS

FINGERLINGS ARE GROWN OUT IN INTERTIDAL GROWING PONDS FOR ANOTHER 7-8 MONTHS. THESE PONDS ARE TIDAL TO ALLOW FOR THE GROWTH OF SALT MARSH VEG AND ZOSTERA SPECIES. THIS WILL INCREASE THE FOOD SOURCE AS WELL AS BIODIVERSITY OF THE PONDS. TIDAL ENTRANCES ARE COVERED WITH FISH BARRIERS TO PREVENT ESCAPE

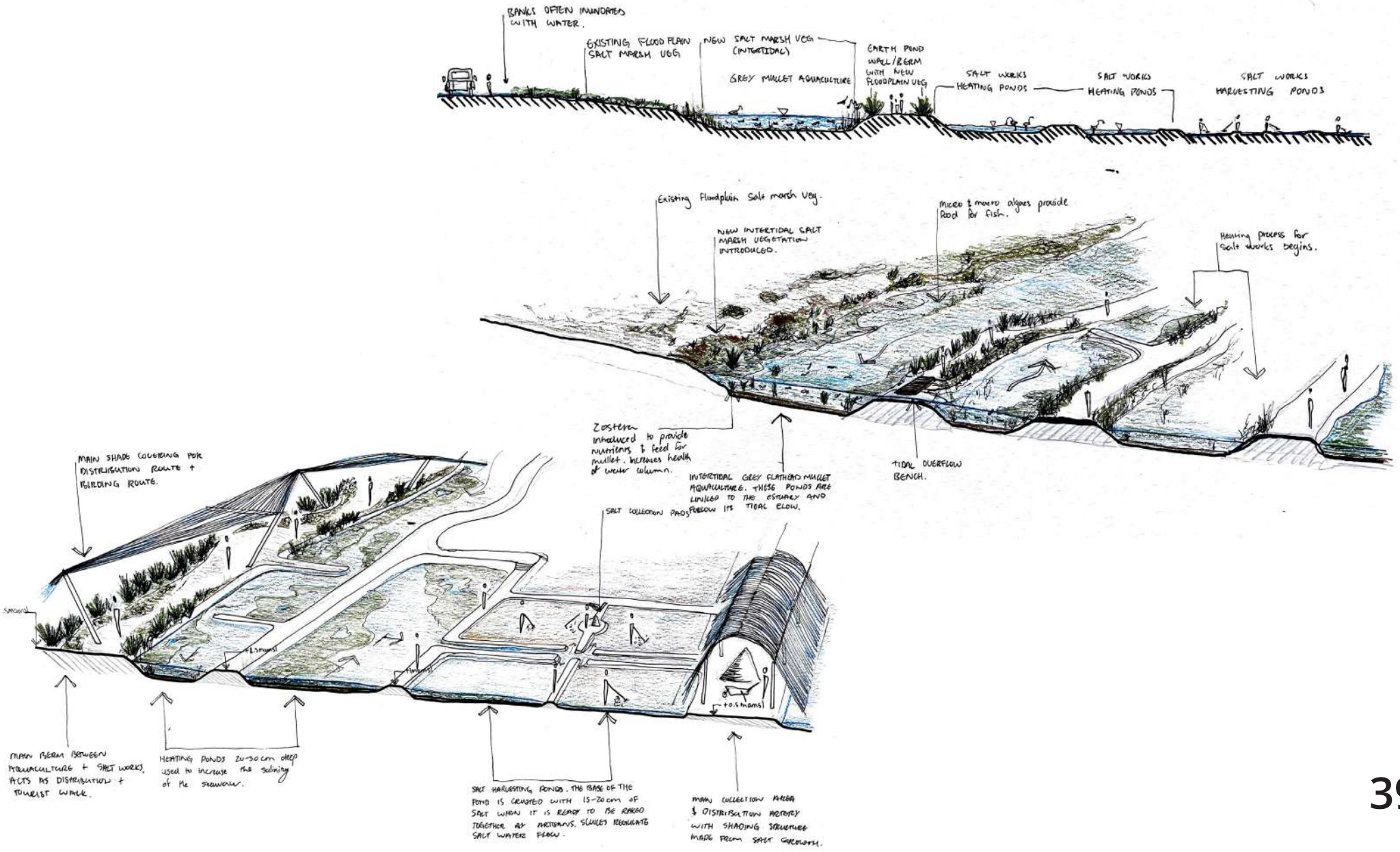




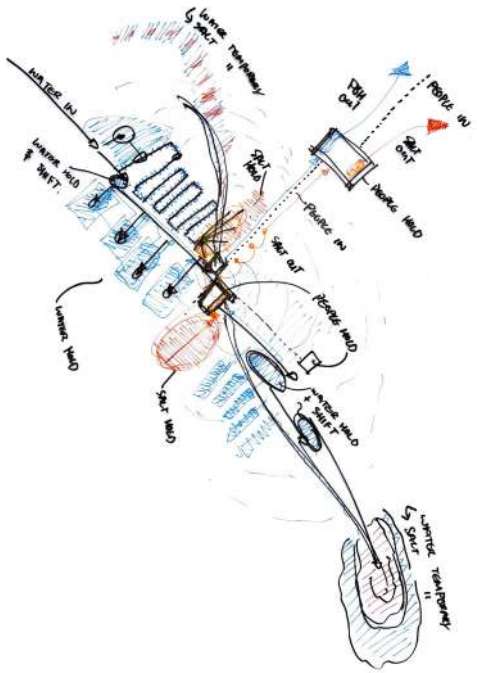
HARVESTING

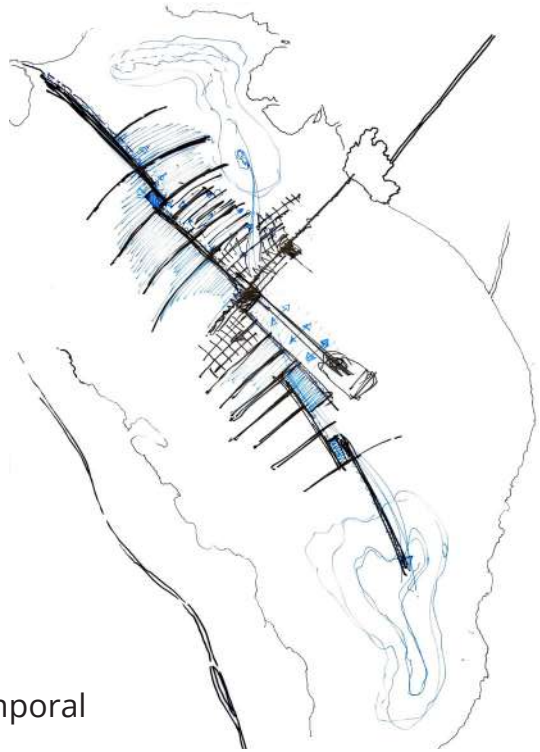
FLATHEAD GREY MULLET ARE THEN CAUGHT WITH GILL NETS WHEN THEY AR 0.75-1KG. THE FISH ARE THEN TRANSPORTED TO THE NEAREST MARKET OR DRIED AS BOKKOMS AND SOLD.

DESIGN DEVELOPMENT - COMBINING PROCESS THROUGH EXPLORATORY SECTIONS

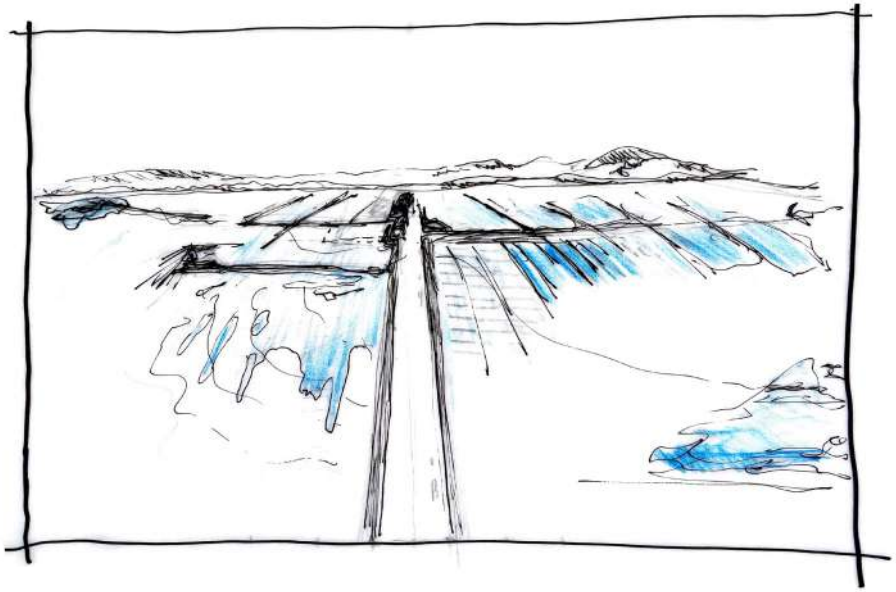


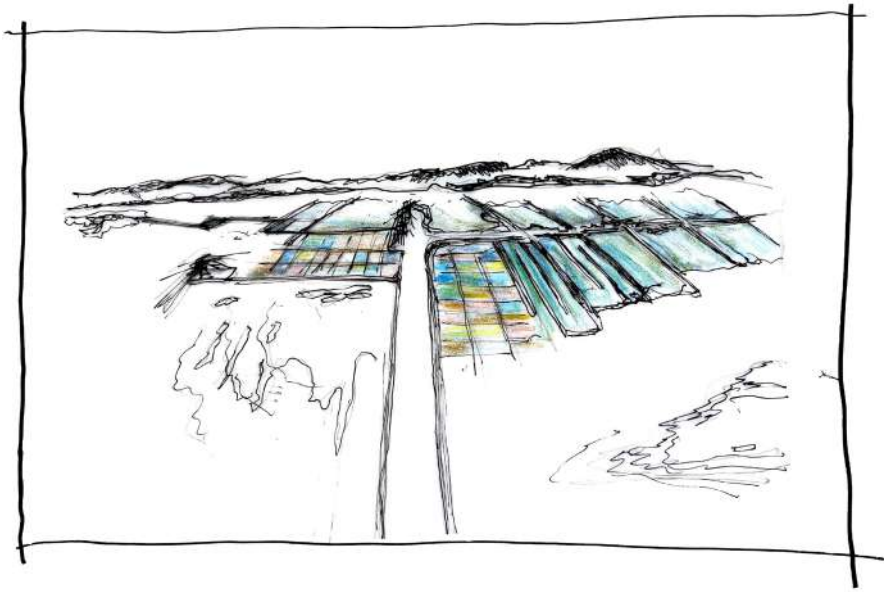
DESIGN DEVELOPMENT - IDENTIFYING THE SPINE AND COMBINING PROGRAMME TO CREATE RESILIENCE



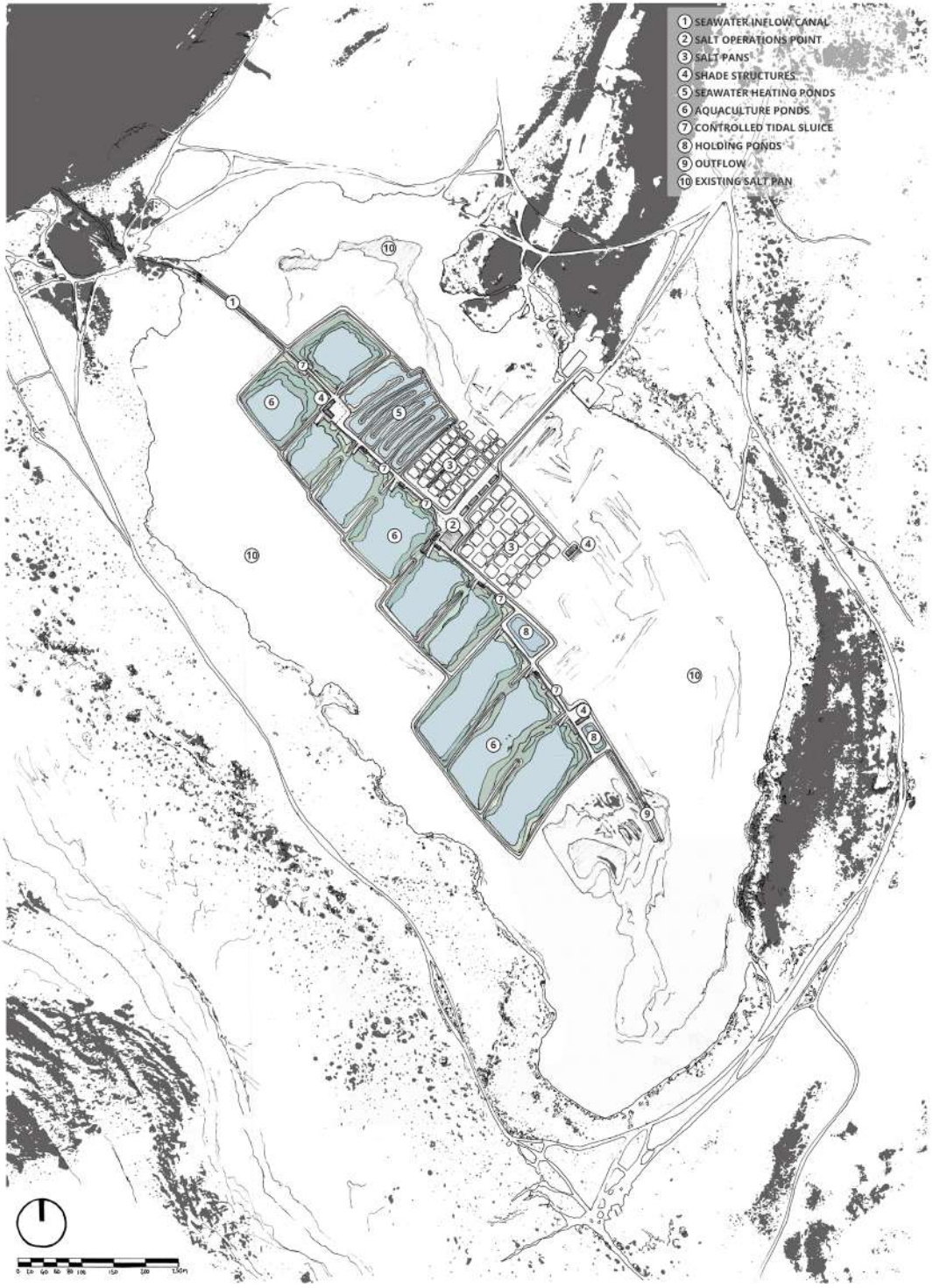


TEMPORALITY AND SEASONAL CHANGE | permanent and temporal infrastructure





DESIGN PLAN | scale 1:2500



DESIGN COMPONENTS EXPLODED AXO

MAIN SEAWATER CANAL

MAIN CANAL SYSTEM THAT FEEDS THE ENTIRE SYSTEM WITH SEAWATER THROUGH TIDAL PUSHES.

INTRODUCED SALT MARSH

SALT MARSH VEGETATION CREATING A VEGETATED SPINE, NUTRIENTS AND FLOOD PROTECTION

- SUPRA-TIDAL SALT MARSH VEG
- INTER-TIDAL SALT MARSH VEG
- ZOSTERA

SALT WATER FLOW

DIRECTION OF FLOW THROUGH SALT HARVESTING SYSTEM

SALT PONDS

- HEATING PONDS
- HARVESTING PONDS

POND ACCESS

ACCESS TO AQUACULTURE PONDS VIA TRACTORS FOR PEPERATION AND HARVESTING

AQUACULTURE

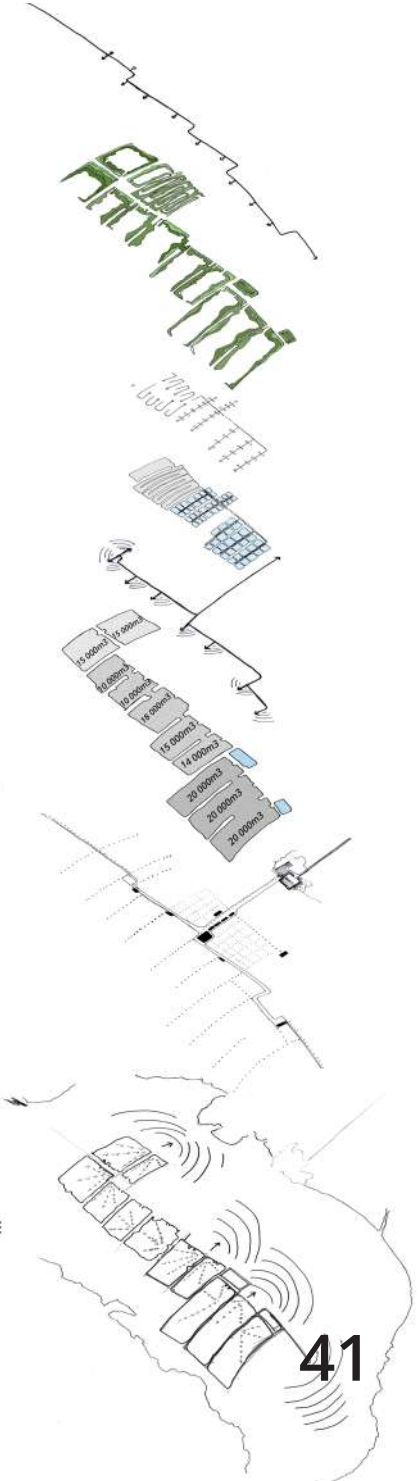
- NURSERY PONDS
- GROWING PONDS
- ON-GROWING PONDS
- DETENTION/FEEDER PONDS

INFRASTRUCTURE

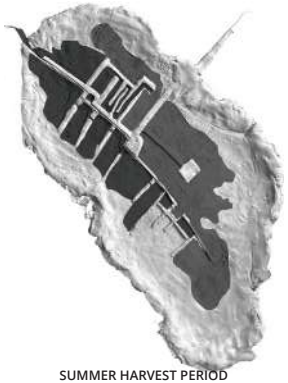
- MAIN TRANSPORT ARTERYS
- PLACE OF SHADE/REST/COLLECTION
- PEDESTRIAN ONLY MOVEMENT
- SALT HARVESTORS MOVEMENT

SALT PAN BASE WITH DRAINAGE

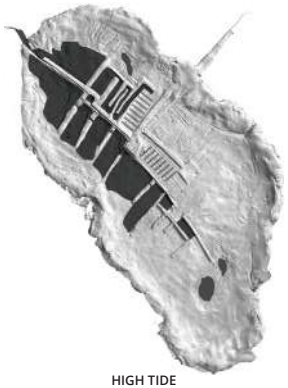
PONDS ARE GRADED AT A 2% GRADIENT TOWARDS THE DRAINAGE EXIT, THEN DRAINED ONTO THE EXISTING SALT PAN



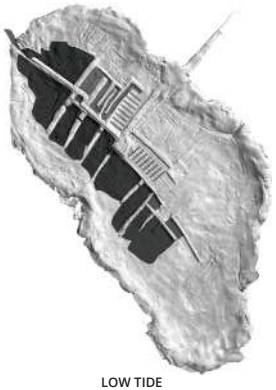
WINTER FLOOD PERIOD



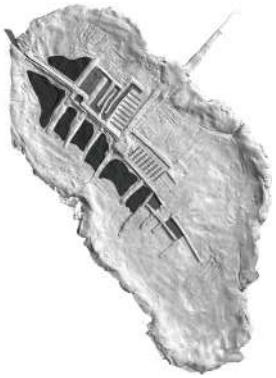
SUMMER HARVEST PERIOD



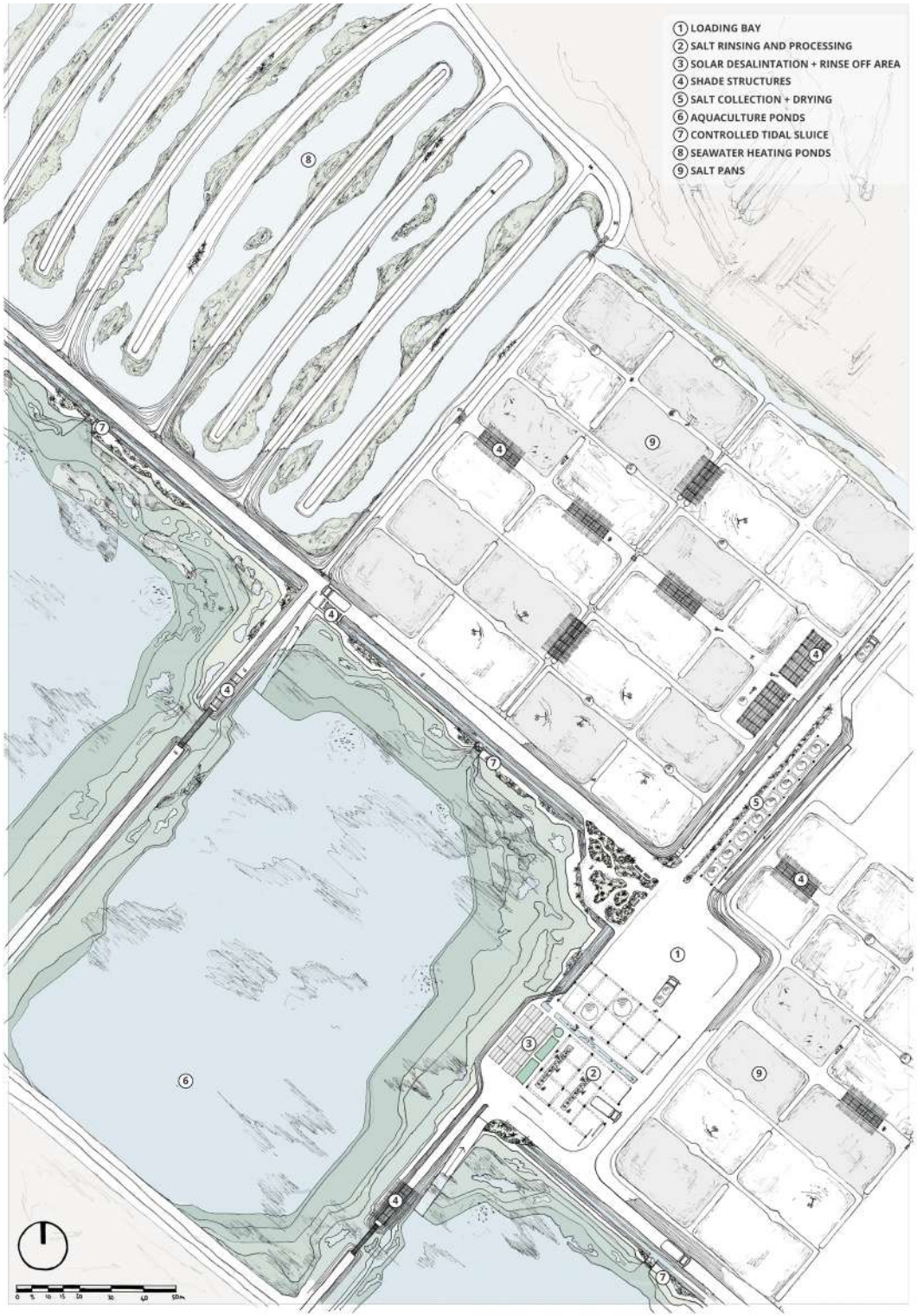
HIGH TIDE



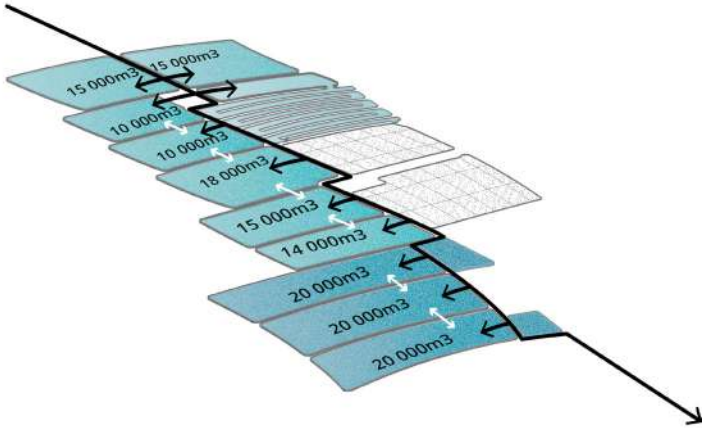
LOW TIDE



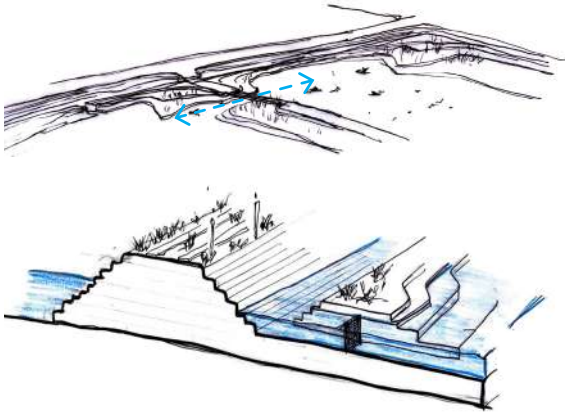
DESIGN PLAN | scale 1:500



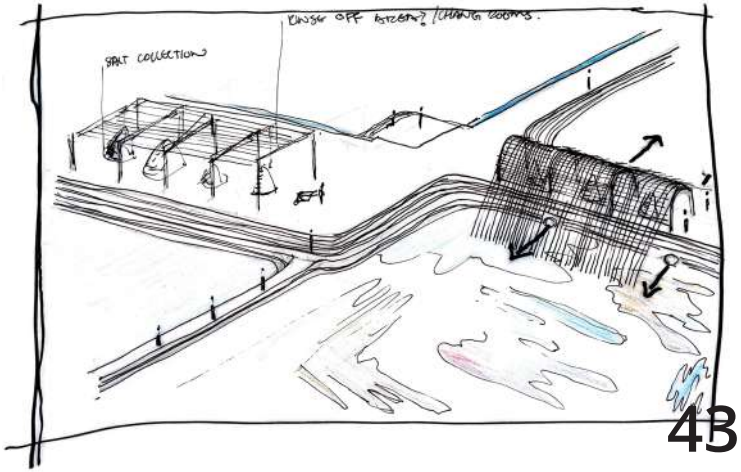
VOLUME AND FLOW DIAGRAM



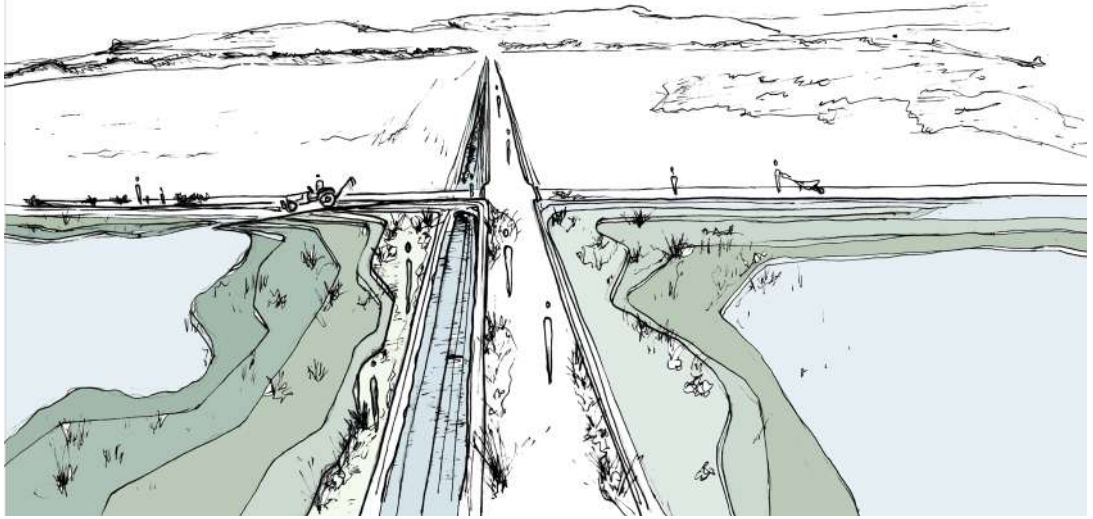
TIDAL CONTROL AND CROSS POND TIDAL INTERACTIONS



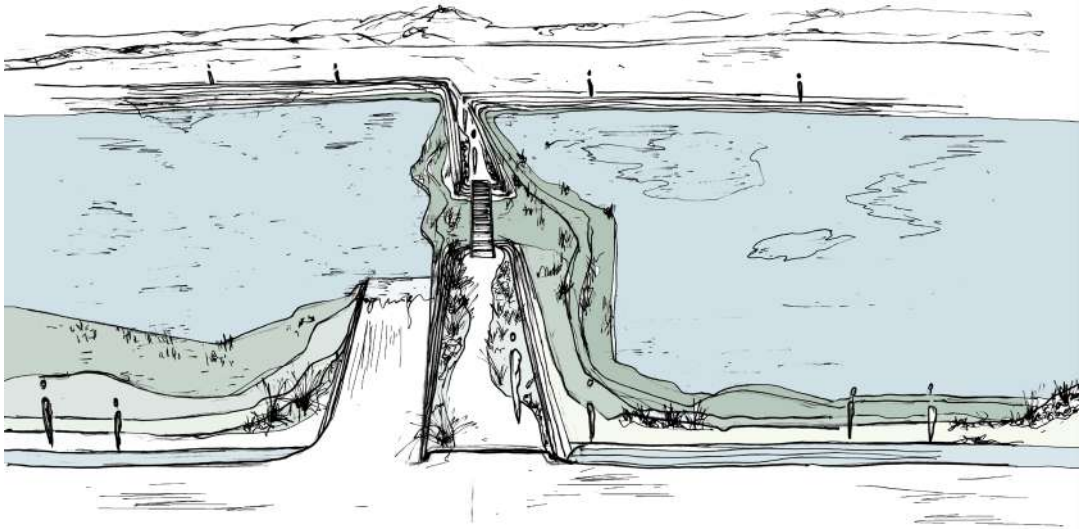
SALT GROWING STRUCTURES AND CROSS POND INTERACTIONS



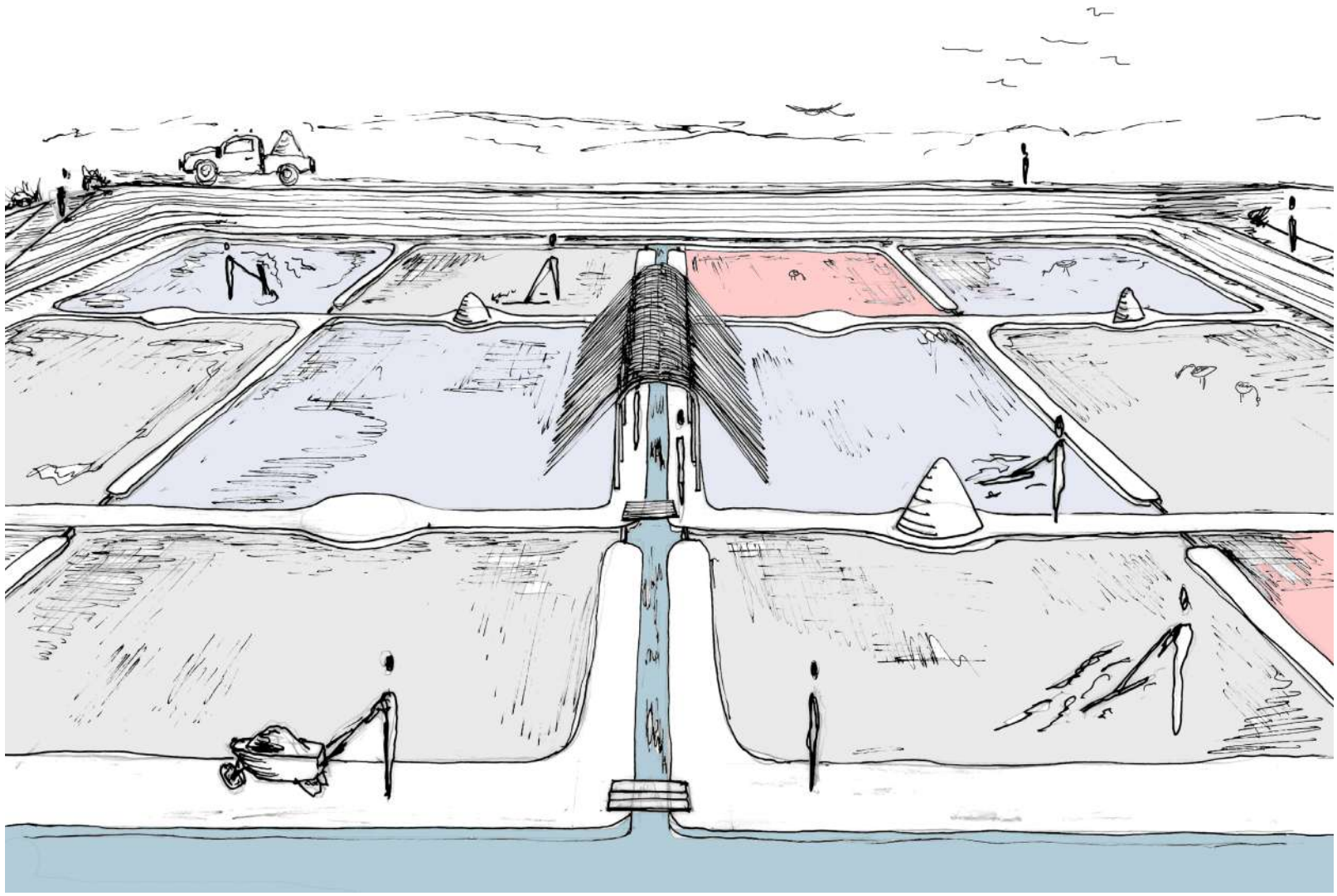
TIDAL CANAL FROM ESTUARY



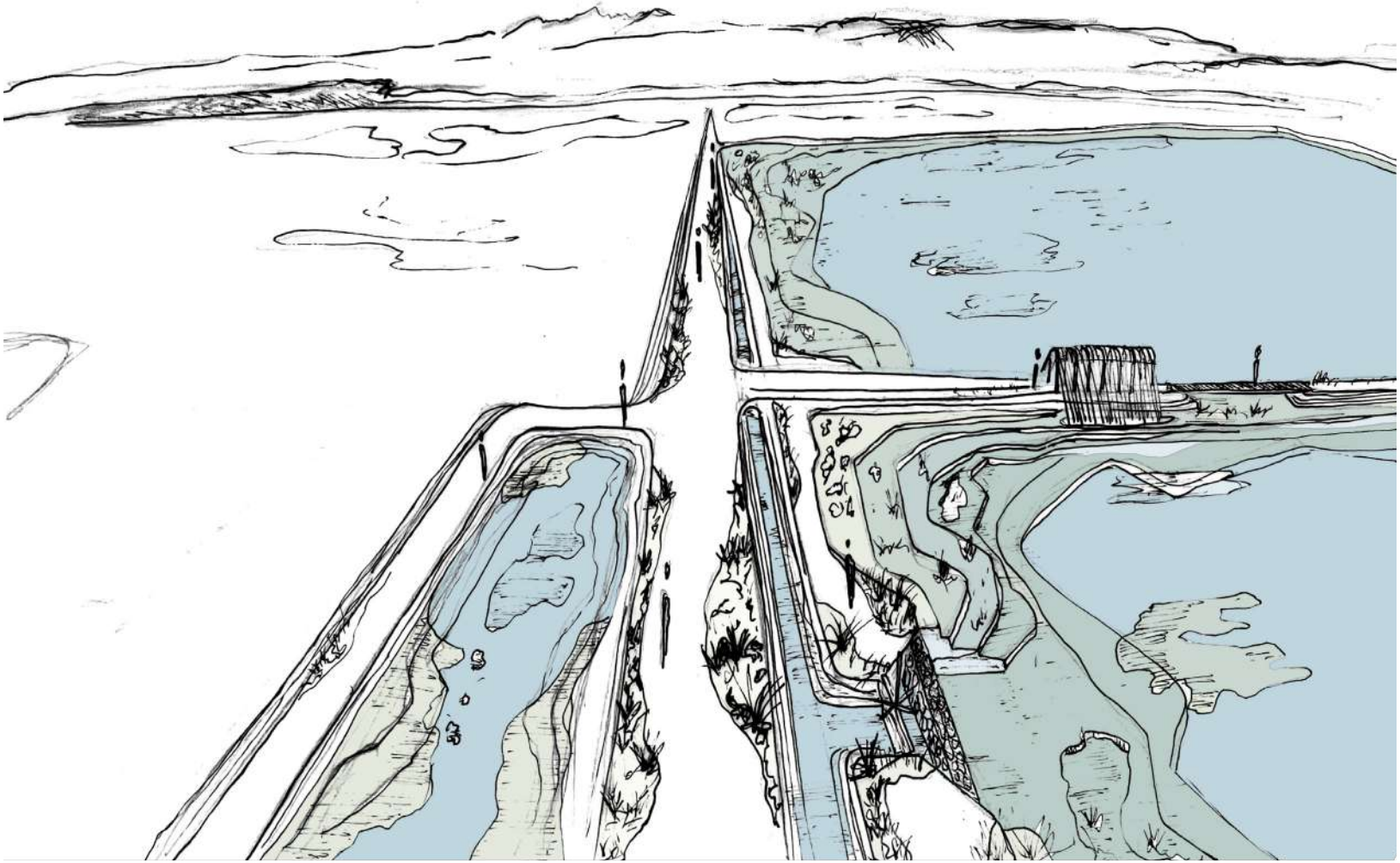
TIDAL BENCH AND ACCESS IN AQUACULTURE PONDS



SHADE STRUCTURE AND WORKING SALT PANS



TIDAL SLUICE GATE, FISH BARRIER AND HOLDING POND



6.3
CONCLUSION

In conclusion, this thesis involved several different types of exploration into the way in which our natural resources can be harvested, how the public interacts with this process and how local communities benefit from it. Through the exploration and understanding of the natural systems, processes and patterns that exist within the Olifants River Estuary, a greater understanding and therefore richer intervention was hopefully achieved.

Ultimately this thesis took a layered and multi-scalar approach at addressing an issue that has become absolutely necessary to address. Using salt as a driver to inform a social-ecological intervention that is designed through the informants of past, present and future site and its people.

Ultimately the intervention was systems driven, as the systems functioning was integral in the success of the resilience of the intervention as a whole. This may have created a rigid structure, however, the effect of time will play a huge role on the outcome of the intervention, its flux allowing the system to change and mold itself into the landscape.

Ultimately, it is a moral dilemma whether to intervene within a natural landscape that is already functioning very well. Do we just introduce conservation methods or do we drastically intervene ? Adopting existing systems and creating hybridized ecologies that can function both for the needs of humans and nature. This is a question that will keep me pondering for some time I believe as it is difficult to give an answer. However, I do believe that humans have touched all natural systems in one way or another, so how is that we rectify this ?

7
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LIST OF FIGURES:

floods,
thus informing the design. [Diagram]. Cape Town.

Figure 20: *Salt pan in flood after winter rainfall. (July 2022) [Photography]. Cape Town.*

8
APPENDIX

Name: Hylton Goatley

Student Number: GTLHYL001

Course: APG5087F

Declaration

I know that plagiarism is wrong. Plagiarism is to use another's work and pretend that it is one's own.

I have used the APA 7th Edition convention for citation and referencing. Each contribution to, and quotation in, this Research Proposal from the work(s) of other people has been attributed and has been cited and referenced.

This thesis is my own work.

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.

Signature Signed by candidate

Date 24/11/2022

ETHICS APPLICATION FORM

Please Note:
Any person planning to undertake research in the Faculty of Engineering and the Built Environment (EBE) at the University of Cape Town is required to complete this form **before** collecting or analysing data. The objective of submitting this application *prior* to embarking on research is to ensure that the highest ethical standards in research, conducted under the auspices of the EBE Faculty, are met. Please ensure that you have read, and understood the **EBE Ethics in Research Handbook** (available from the UCT EBE, Research Ethics website) prior to completing this application form: http://www.ebe.uct.ac.za/ebe/research/ethics1

APPLICANT'S DETAILS		
Name of principal researcher, student or external applicant		HYLTON GOATLEY
Department		LANDSCAPE ARCHITECTURE
Preferred email address of applicant:		GTLHYL001@myuct.ac.za
If Student	Your Degree: e.g., MSc, PhD, etc.	MLA
	Credit Value of Research: e.g., 60/120/180/360 etc.	120
	Name of Supervisor (if supervised):	CLINTON HINDES
If this is a researchcontract, indicate the source of funding/sponsorship		
Project Title		SALT OF THE EARTH

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.

APPLICATION BY	Full name	Signature	Date
Principal Researcher/ Student/External applicant	HYLTON THOMAS MACLEOD GOATLEY		20/05/2022
SUPPORTED BY	Full name	Signature	Date
Supervisor (where applicable)	CLINTON HINDES		23/05/2022

APPROVED BY	Full name	Signature	Date
HOD (or delegated nominee) Final authority for all applicants who have answered NO to all questions in Section 1; and for all Undergraduate research (Including Honours).			
Chair: Faculty EIR Committee For applicants other than undergraduate students who have answered YES to any of the questions in Section 1.	Prof. H. von Blottnitz		28/06/2022

Title **SALT OF THE EARTH** 05/23/2022

by **Hylton Goatley** in **EBE EiRC Submissions** id. 25673319

Average score: **3**

Reviewed by: Michael Louw (Score: 3) 06/13/2022

SUBMISSION	**Cover letter providing a summary of the application** **A copy of the research proposal** **Questionnaire to be used in the research (if needed)** **Consent form where (where applicable see Addendum 2)** **Application signed by relevant authority**
Is the application complete?	**Yes**
Comments on the Submission	n/a
Explanation of Ethics issues	**Adequately covered in the proposal**
Comments on Explanation of Ethics Issues	n/a
Risk	**Low risk data unlikely to cause harm**
Data security	**Doesn't require special handling**
Comments on the Use of Data	**Please make a note about data storage in the consent form so the interviewee understand how/where the data will be stored securely (preferably in a password-protected cloud storage folder) and for how long.**
Consent	**Consent required but not obtained**
Comments on Informed Consent	**Please prepare a separate consent form for obtaining consent from community members when taking photos (this should include a space for signature for taking a photo and for anonymity if requested).**
Is any participant in the research a UCT staff or student?	**Yes**
Comment on UCT Permissions	**The informed consent form should be sufficient for interviewing Prof Merle Sowman.**

Title **SALT OF THE EARTH** 05/23/2022

by **Hylton Goatley** in **EBE EiRC Submissions** id. 25673319

Average score: **3**

Reviewed by: Harro von Blottnitz (Score: 3) 06/28/2022

SUBMISSION	**Cover letter providing a summary of the application A copy of the research proposal Questionnaire to be used in the research (if needed) Consent form where (where applicable see Addendum 2) Application signed by relevant authority**
Is the application complete?	**Yes**
Comments on the Submission	**Well-prepared.**
Explanation of Ethics issues	**Adequately covered in the proposal**
Comments on Explanation of Ethics Issues	**Well considered, but I would like to raise one additional one: in relation to the stated objective to inform an alternative design of a salt mine, it seems to me that neither the researcher nor the single interviewee is skilled in the art of mining. As such, reputations (incl. that of UCT) could be harmed if claims are made that are not based on suitable knowledge. It may be safer to limit the objectives of the study to a description and analysis of the likely impacts of the proposed activity?**
Risk	**Confidential data likely to cause harm to reputations**
Data security	**Data stored securely and disposed of after use**
Comments on the Use of Data	**Agreed with reviewer 1, any documentation resulting from interaction with community members resulting in documentation should be stored securely.**
Consent	**Consent required and obtained**
Comments on Informed Consent	**good for the main interviewee agree with reviewer 1, a separate form is needed for community members**
Is any participant in the research a UCT staff or student?	**Yes**

HR194a	**ACCESS TO UCT STAFF FOR RESEARCH PURPOSES (Fulfilment of a Degree)**	UNIVERSITY OF CAPE TOWN IYUNIVESITHI YASEKAPA • UNIVERSITEIT VAN KAAPSTAD

NOTES

- Forms must be downloaded from the UCT Administrative Forms website: http://forms.uct.ac.za/forms.htm .
- This form must be completed by applicants who are requesting to access UCT staff for the purpose of research for the fulfilment of a degree.
- A copy of the research proposal as well as the Ethics Committee approval must be attached.
- It is the **responsibility of the researcher/s to apply for ethical clearance** from the relevant Faculty's Research in Ethics Committee (RiEC).
- If you are requesting staff information, you are required to complete the HR Information Request Form (HR190) and submit it together with all the required documentation.
- The turnaround time for a reply is **approximately 10 working days unless specified as urgent.**
- Please submit your application including the completed application form and all the above documentation directly to Zoe Cosmopoulos via email (zoe.cosmopoulos@uct.ac.za) for the attention of the Director: Analytics, Risk, System, Payroll & Admin. Please do not submit these to the Director directly.

SECTION A: APPLICANT DETAILS

Title	Mr	Name	Hylton Goatley
Telephone number	079 649 1166	Email address	gtlhyl001@myuct.ac.za
Student number	GTLHYL001	Staff number	
Visiting researcher ID / passport number			
University or institution at which employed or a registered student	UCT		
Faculty or department in which you are registered or work	EBE		
Address (if not UCT)			

SECTION B: SUPERVISOR DETAILS

	Title and name	Telephone number	Email address
Supervisor	Clinton Hindes	0216505153	clinton.hindes@uct.ac.za
Co-Supervisor			

SECTION C: APPLICANT'S FIELD OF STUDY / TITLE OF RESEARCH PROJECT / STUDY

Degree	Masters of Landscape Architecture		
Research project or title	Salt of the Earth		
Research proposal attached	☒ Yes	☐ No	
Target population	Professor		
Number of UCT staff required	1		
Research method	☒ Interviews	☐ Questionnaire	
Amount of time required for the above	+- 2hours		
Lead Researcher details	Hylton Goatley - GTLHYL001 - 0796491166		

SECTION D: FOR OFFICE USE (Approval status to be completed by the Executive Director, Human Resources or Nominee)

UCT Proof of ethical clearance status attached		☐ Yes	☐ No	
Proof of ethical clearance status from the University/Institution, if registered outside of UCT		☐ Yes	☐ No	☐ Not Applicable
Support or approval		Role	Signature	Date
Supported?	☐ Yes ☐ No	Zoe Cosmopoulos (Specialist: HR Analytics)		
Approved?	☐ Yes ☐ No	Naeema Brey (Director: Analytics, Risk, System, Payroll & Admin)		

INFORMATION SHEET & CONSENT FORM – Prof Merle Sowman

Salt of the Earth

Hello, my name is Hylton Goatley, and I am conducting research towards a master's degree in Landscape Architecture at the University of Cape Town. I am researching towards an alternative to mining nearby the Olifants River estuary whilst trying to solve social-ecological issues that exist within the communities that rely on the estuary and would like to invite you to participate in the project.

The project is about proposing an alternative to prospective mining, through designing an ecologically and socially beneficial salt mine for the community of Papendorp.

I am interested in finding out about the social-ecological systems that exist in and around the Olifants River estuary. As a student of landscape architecture, I would like to understand the complexities of these systems, how they function, the relationship between the communities and the fisheries/estuary, the relationship between the community and conservation, the history of mining etc., and eventually be able to design a system that functions for the benefit of both ecologies and communities. I want to understand how I can do this for a community with so much history and connection to the landscape and the sea, so that I may respect this relationship and design with it at the forefront of my mind. I would like to interview people who have knowledge about the Olifants River Estuary and its people, as well as knowledge of their struggles for environmental and social justice.

Please understand that you do not have to participate, i.e. your participation is voluntary. The choice to participate is yours alone. If you choose not to participate, there will be no negative consequence. If you choose to participate, but wish to withdraw at any time, you will be free to do so without negative consequence. However, I would be grateful if you would assist me by allowing me to interview you.

I would like to interview you through a list of questions related to the above issues in-order to gain an understanding the Estuary and its people. I would be happy to meet you in your office, or wherever suits you best. I would also like to request if this interview could be recorded for research purposes.

There will be no direct benefits from this research. Only an opportunity for you to share your knowledge and expertise on the issue. If you agree to participate, the interview will not cause any pain or discomfort. The intention of the interview is to understand the complex issues at hand.

The conducted interview will not be published publicly, however the information collected will instead be used to inform my design and research.

If it is your wish, anonymity will be maintained through the changing of your name and the creation of an alias, confidentiality in your statements will also be maintained fully.

The data that will be captured will form towards the argument and understanding of my research topic. In some cases, it may even be used to map and identify elements within the project. If you would like, this and the progress of the project will be relayed with you through email or other electronic means.

Name of participant ……Date ……..

Signature of participant ……..