

SALT PANS MATTER

**A System of Ecology and Culture Cohabitation
for Cabo de Gata, Andalusia, Spain**

Chenglin Zhu

MLA Landscape Architecture 2019, RISD

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By Chenglin Zhu

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INTRODUCTION

This thesis book seeks new meanings for the concept of “cohabitation”, it is important to understand “cohabitation” as the link to connect cultural inheritance and natural restoration. We need to find a way to coexist with nature and create something beyond - the new relationship for “economy, nature, and culture.”

The salt pans in Cabo de gata of Andalucia, Spain is not just a potential habitat for the migrating birds, especially for flamingos, but also for the cultural heritage of the traditional craft of salt production. Unfortunately, it is the only salt pan still under operation in the region today. Actually, in recent years, the local salt pans have declined because the local traditional salt production has been replaced by industrially produced salt(chemical mined salt) from other countries. While the salt pans are gradually abandoned, the habitat lost, too.

It is important for us to think about ecosystem transformation and cultural protection at this point. Could the traditional salt industry still have value today? What is the potential for the future?

The unique thing about the site is that the salt pan is facing to the sea and right beside the volcano, which creates a shift in scale from the deep topo to a vast flatness. It extracts the water from the sea to create the color palette, which is different from the natural salt pan.

This book brings an idea to guide the salt pan for future development from aesthetic, ecological and experiential viewpoint. The first chapter will talk about the importance of the salt pan, how it works and how the craft of salt production relates to habitat.

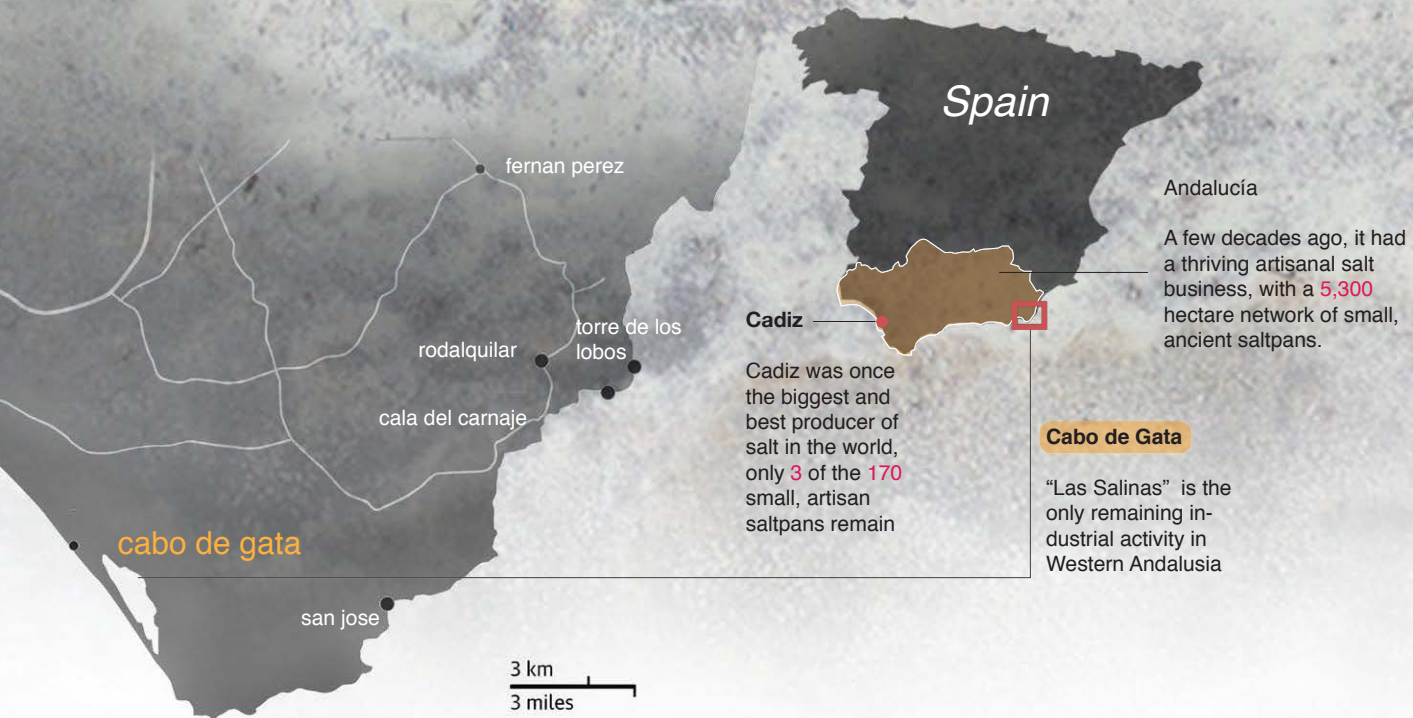
The issue will lead us to think about how could we preserve this special landscape by keeping its natural function and cultural value but also by creating “a unique and valuable experience for visitors”. That could be the reason for it should exist even when the salt production has less economic value for this area in the future.

The design proposal for the “narrative experience”- an experience of knowledge and engagement, and experience about the interaction between the natural process and artificial production.



CHAPTER 1: THE STORY OF SALT

*“The craft of the salt?
Or the craft of the landscape?
What is artificial salt pan?”*



Cadiz
Cadiz was once the biggest and best producer of salt in the world, only 3 of the 170 small, artisan saltpans remain

Cabo de Gata
“Las Salinas” is the only remaining industrial activity in Western Andalusia

Andalucía
A few decades ago, it had a thriving artisanal salt business, with a 5,300 hectare network of small, ancient saltpans.

SITE DESCRIPTION

The salt pan “Salina Cabo de Gata” is located in the south part of Andalusia in Spain. This area used to be one of the most famous salt production spots in the world. But in recent years, the local salt pans have shrunk and collapsed from over one hundred to just a few left. And Salina Cabo de Gata is the only salt pan in the west Andalusia, which still facing a risk a risk of abandonment since the salt production

has declined over the time. The site is famous for the migration birds especially the flamingos, and it’s also popular for the visitors mainly from Europe. As the salt pans become abandoned, people will lose their jobs as well as the birds lose their habitats. If there is no more economic value for the salt production in the future, how could we still preserve this special landscape for its natural functions, cultural value and experience.

SITE FEATURES



PRODUCTION



HISTORY



HABITAT



RESORT

“ We are losing a culture with “long-handled scrapers, and large sun-weathered hands that operate the wooden sluice gates as skillfully as they picking the salt.” - Salt workers in Spain



(<https://www.birdlife.org/worldwide/news/spains-traditional-saltpans-unlikely-bird-haven>)

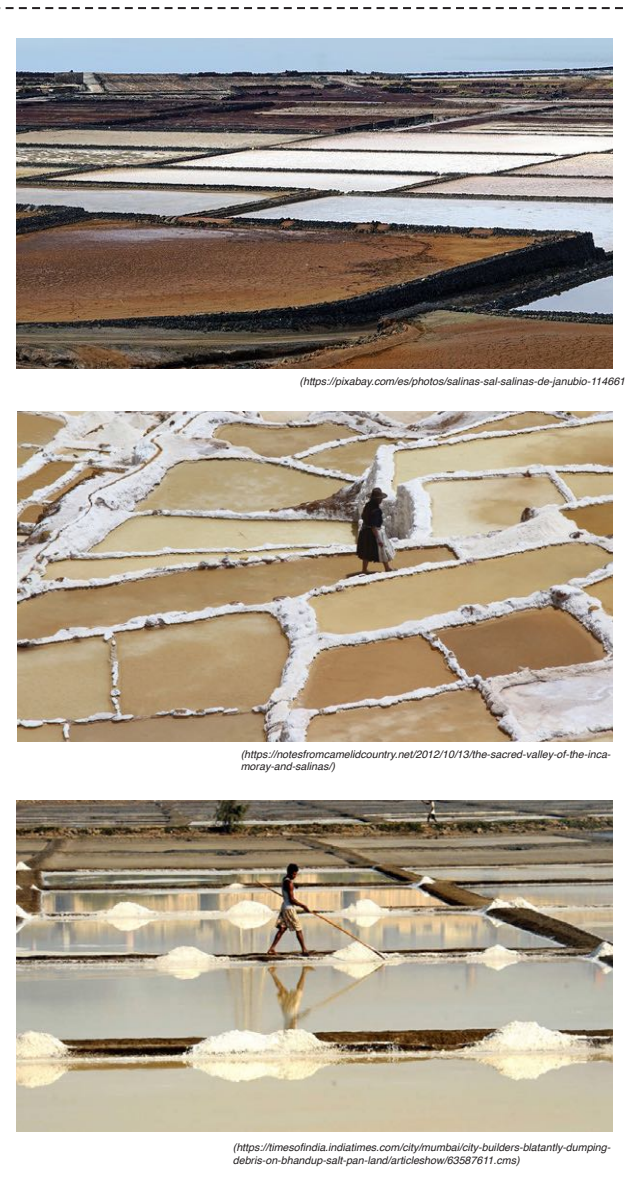
WHAT IS A SALT PAN?

Natural salt pans - Natural salt pans or salt flats are flat expanses of ground covered with salt and other minerals, usually shining white under the sun.

([https://en.wikipedia.org/wiki/Salt_pan_\(geology\)](https://en.wikipedia.org/wiki/Salt_pan_(geology)))



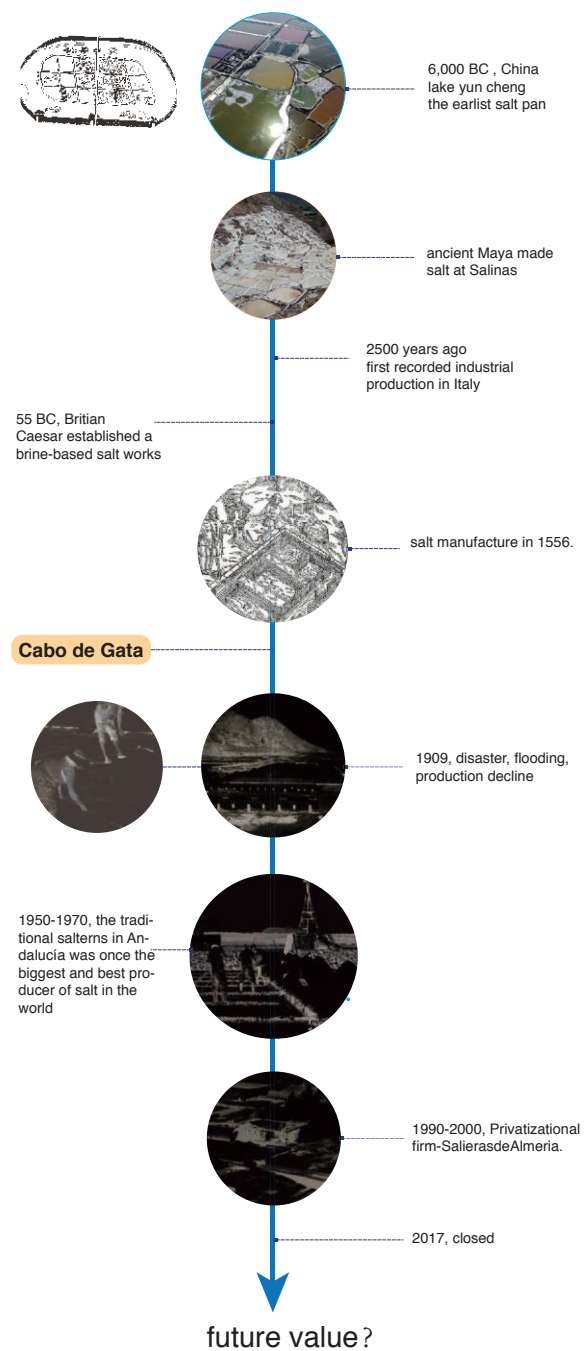
Artificial salt pan-A salt evaporation pond is a shallow artificial salt pan designed to extract salts from sea water or other brines.



(<https://pixabay.com/es/photos/salinas-sal-salinas-de-janubio-1146613/>)

(<https://notesfromcamelcountry.net/2012/10/13/the-sacred-valley-of-the-inca-moray-and-salinas/>)

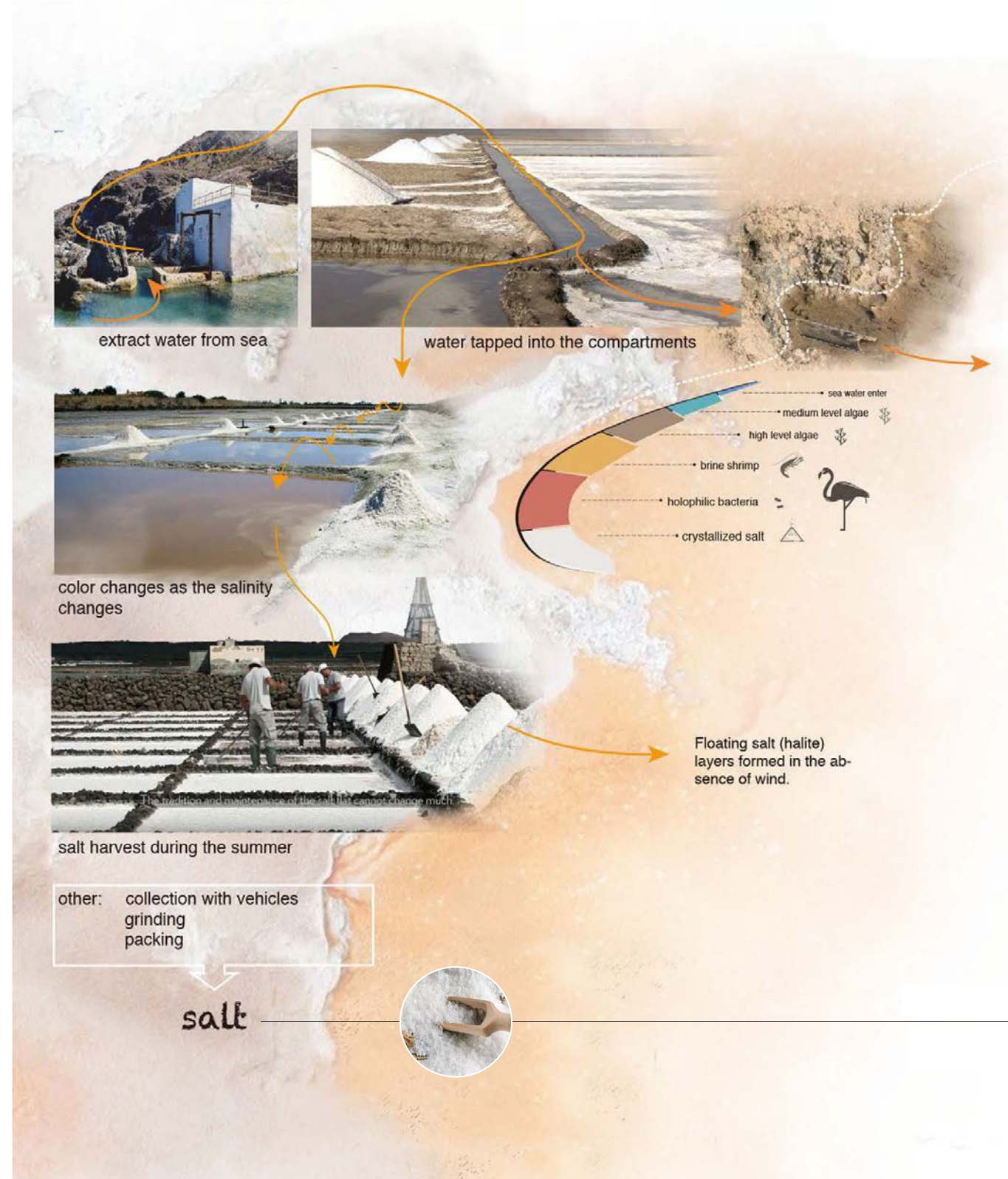
(<https://timesofindia.indiatimes.com/city/mumbai/city-builders-blatantly-dumping-debris-on-bhandup-salt-pan-land/articleshow/63587611.cms>)



THE HISTORY OF SALT EXTRACTION?

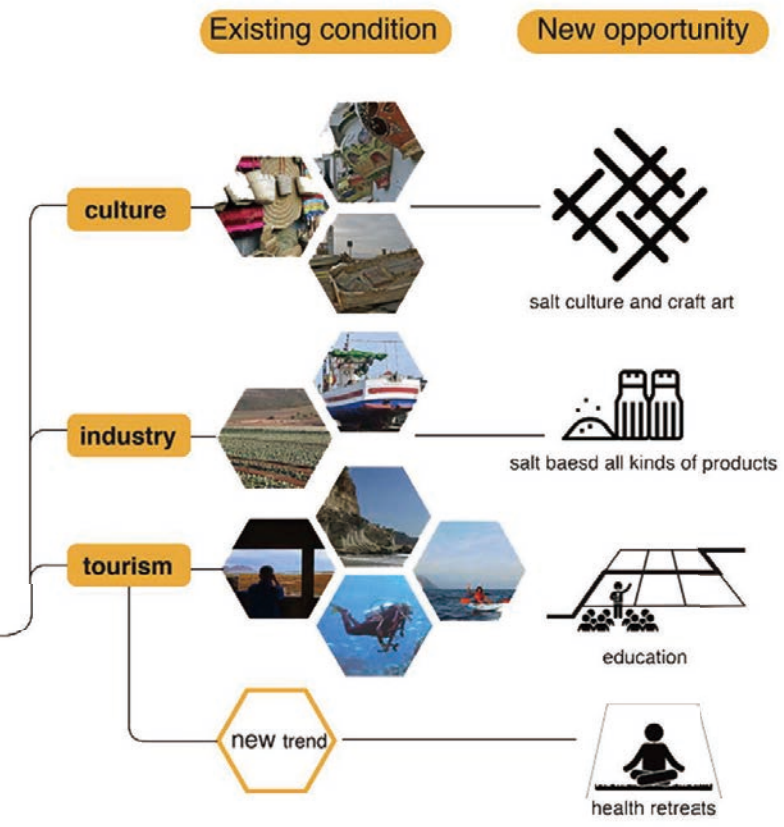
Some of the artificial salt pans extract salts from sea water, and the techonology of water extraction has a long history. This thesis is mainly about the salt pans made by sea water.

SALT PRODUCTION PROCESS



SALT PAN CONSTRUCTION AND COLOR

1. Construction:
Salt pans are shallow open, often use metal or stone. Salt pans are used to evaporate brine.
2. Algae and colour:
Due to variable algal concentrations, vivid colors (from pale green to bright red) are created in the evaporation ponds. The color in the salt pans indicate the salinity of the ponds as well as different organisms in the water.



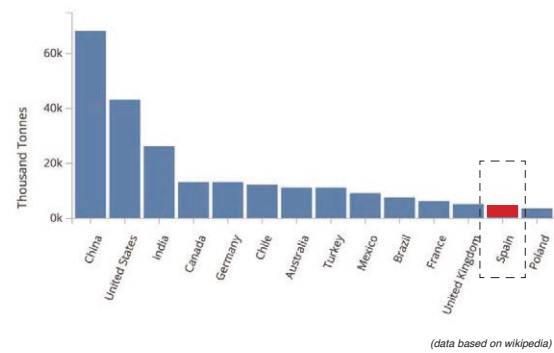
WHY THE SALT PANS COLLAPSED?

1. **Economy:** the competition from the industry produced salt/ traditional salt replaced by the chemical salt (underground mining) imported from China, US, India.

2. **Policy:** protect Spain's coastline/ keep salt marshes.

3. **Others:** mismanaged or simply abandoned/human activities (water abstraction, unsustainable tourism)/ climate changes impacts such as sea level rise and coastal erosion

	Traditional	Industry produced
process	no chemical	chemical process involved (washing, centrifugation and drying)
component	chemical-free far less sodium chloride	adding additives like anti-caking agents or iodine
labor	3x	x
cost	expensive	cheaper
source	sea water/spring water	rock/mines
tool	hand harvest	machine



ABOUT THE SALT PRODUCTION AROUND THE WORLD

The diagram on the right top shows the salt production in the world. India, US, China become the main source for the salt export, Spain lost the competitiveness in the world salt market.

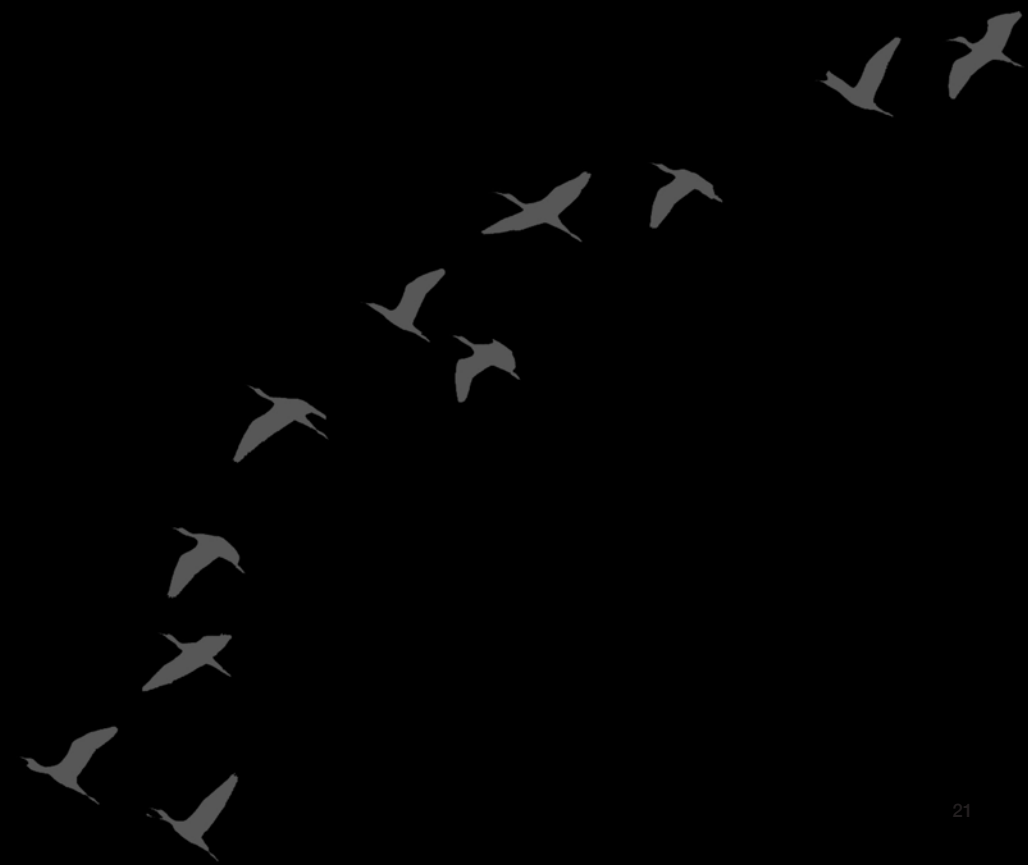


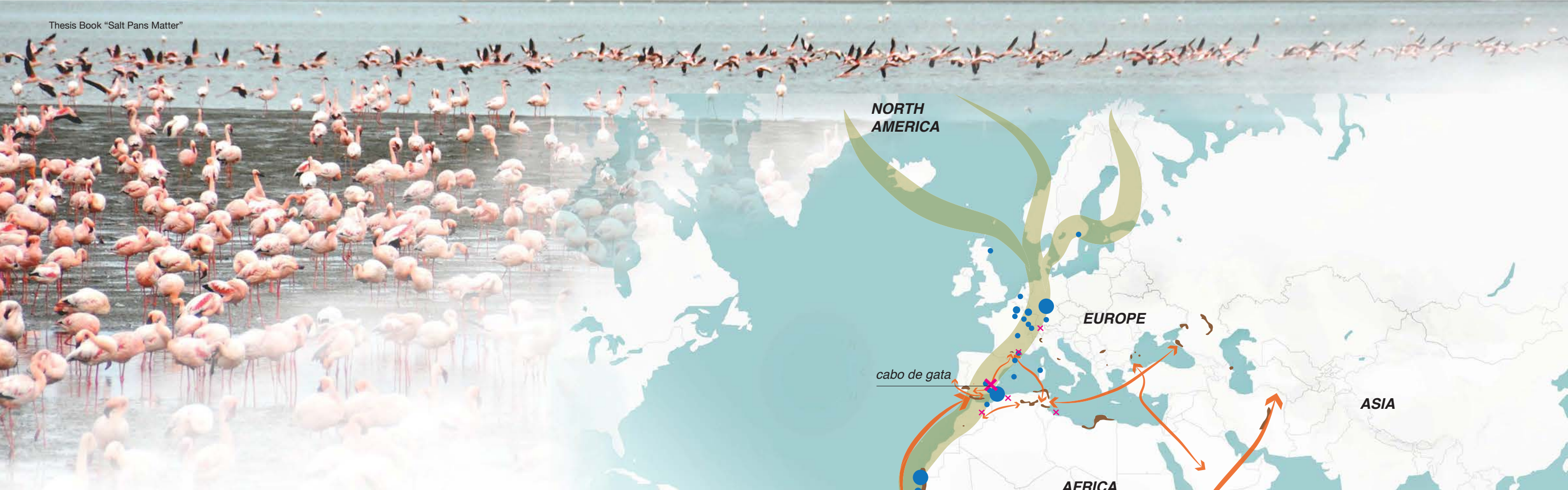
ABOUT THE SALT PANS AROUND THE WORLD

The diagram on the right lower shows the salt pans around the world show different characteristics. They have different reasons of formulation and different ways for salt production.



CHAPTER 2: THE BIRD



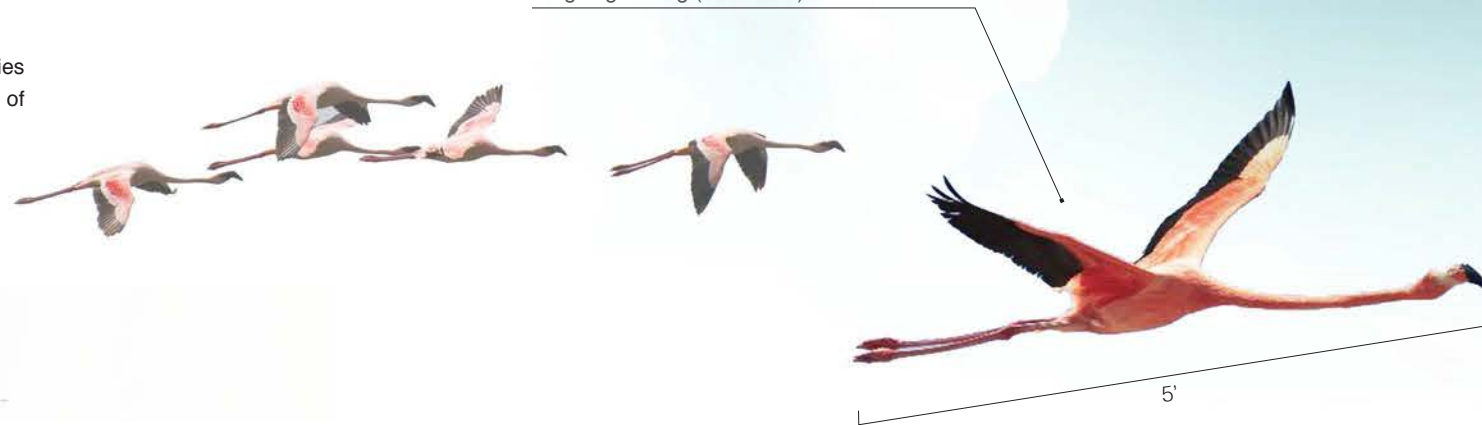


ABOUT GREAT FLAMINGOS

The greater flamingos (*Phoenicopterus ruber*) are the main migration birds in Cabo de Gata, they become the special view in the salt pans. They feed on brine shrimp and blue algae as well as larva, small insects, mollusks and crustaceans making them omnivores. They are very social birds which live in colonies.

"The greater flamingo breeds in large colonies on the coasts of the Atlantic Ocean and Gulf of Mexico in tropical and subtropical America." (<https://en.wikipedia.org/wiki/Flamingo>)

greater flamingo
110–150 cm (43–59 in) tall
weighing 2–4 kg (4.4–8.8 lb)

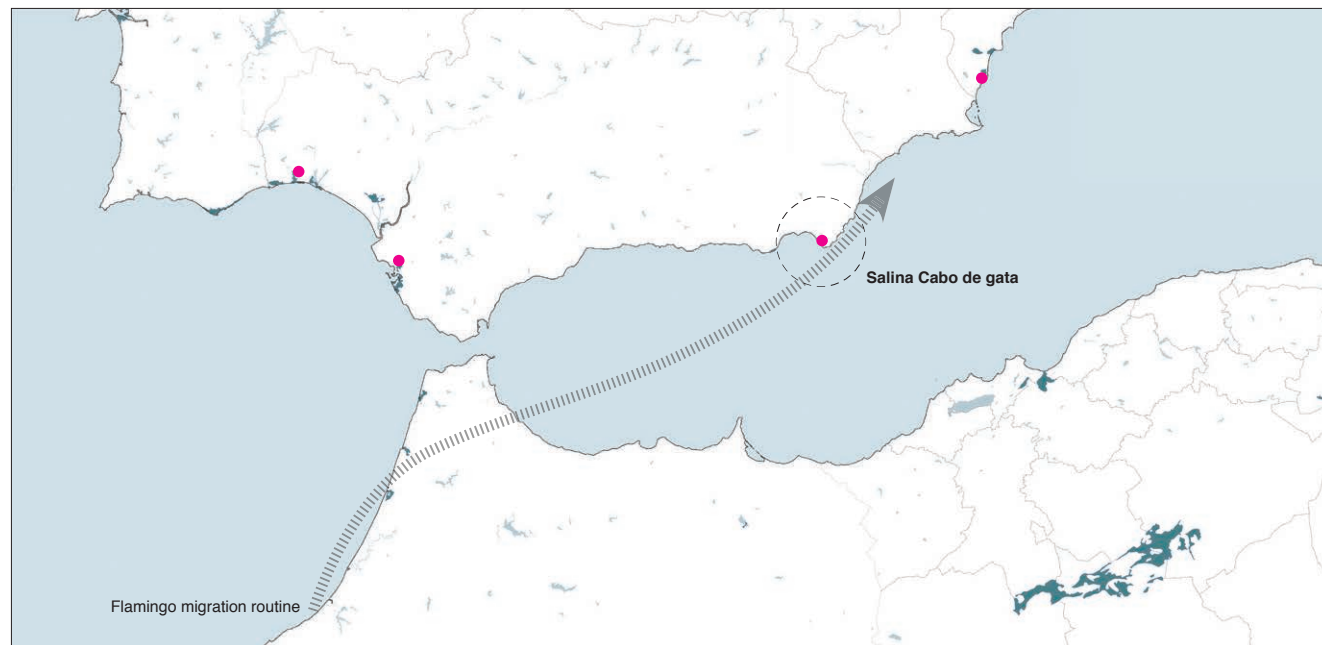


- east Atlantic flyway
- migration birds
- ✕ salt pans
- ➔ greater flamingo (feeding & breeding)
- ➔ greater flamingo migration route

SALT MARSH DISTRIBUTION



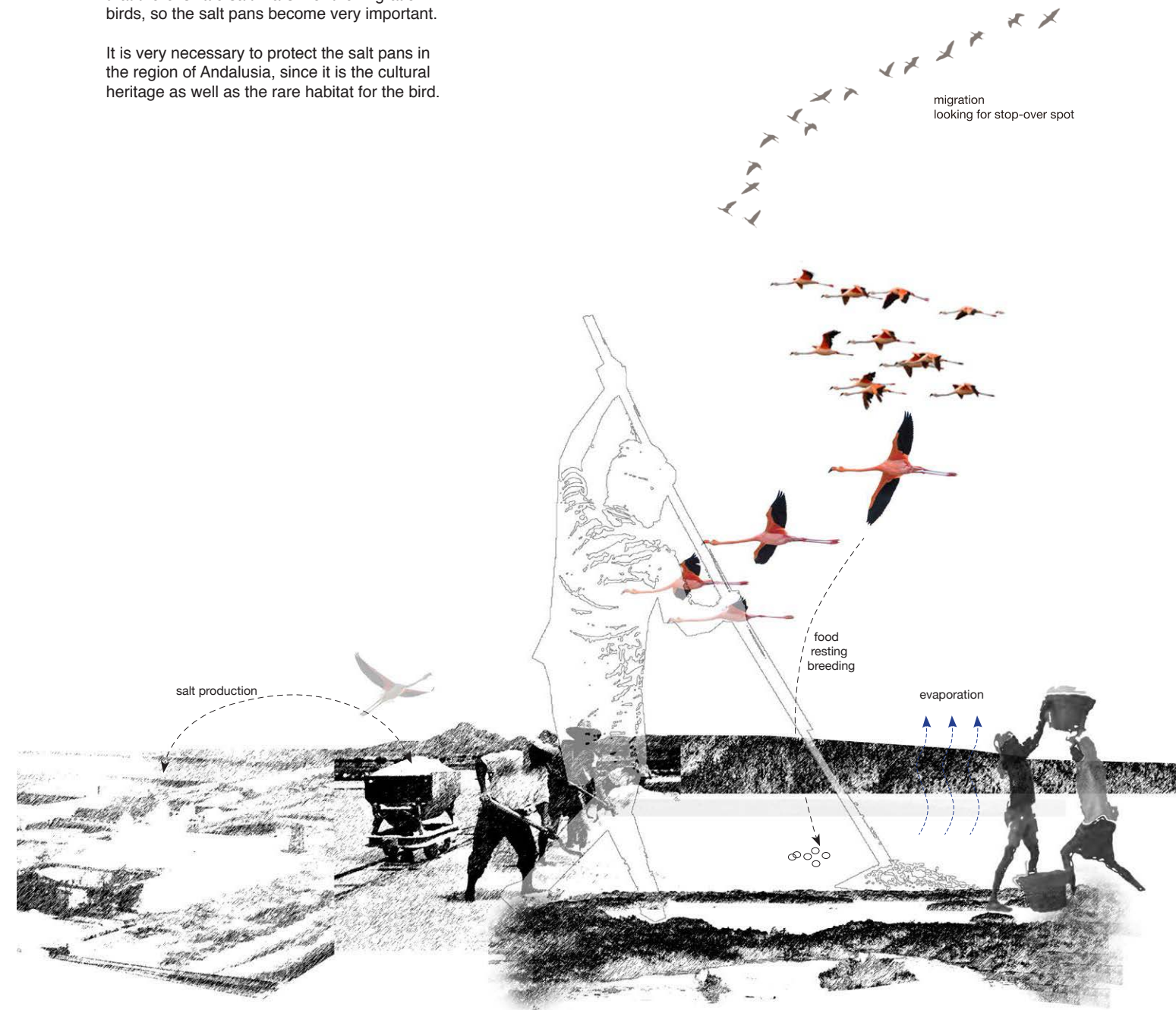
EXISTING SALT PAN DISTRIBUTION



THE IMPORTANCE OF SALT PANS

The diagrams on the left show the existing salt marshes and salt pans in this area. We can find that there is little salt marsh for the migration birds, so the salt pans become very important.

It is very necessary to protect the salt pans in the region of Andalusia, since it is the cultural heritage as well as the rare habitat for the bird.



SALT PANS AND BIRDS

Salt pans - for sea water circulation and salt-loving vegetation, an ideal resting place and an abundance of highly nutritious food to large numbers of migratory birds. As each basin has a different water level, many species of waterbirds - big and small - are able to feed on the mollusks, crustaceans and algae found in them. This makes salt pans the perfect stop-over sites for migratory birds on their journeys.

(http://www.birdlife.org/sites/default/files/vbn_savingsalt pans_brochure_english_mail_0.pdf)



when it evaporates, and each flat becomes saltier than the last until the crystals form at the bottom.

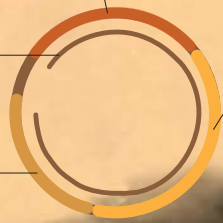
early spring
maintenance for the pans

migration birds
appearance

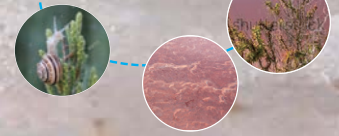
Mar.-July

2nd harvesting

July-Sept.
2nd harvesting



molluscs,
crustaceans
algae



1 feet

large salt crystal collected on the one side of the deck where salty water once dry up

0.2 feet

IMAGE TITLE 8/12 Regular Helvetica Neue

CHAPTER 3: SYMBIOSIS



Research Question:

How could the artificial salt pans left in Spain transform as new opportunity for local ecotourism and habitat restoration that recall the traditional salt craft culture?



“The craft of the salt?
The craft of the landscape?”

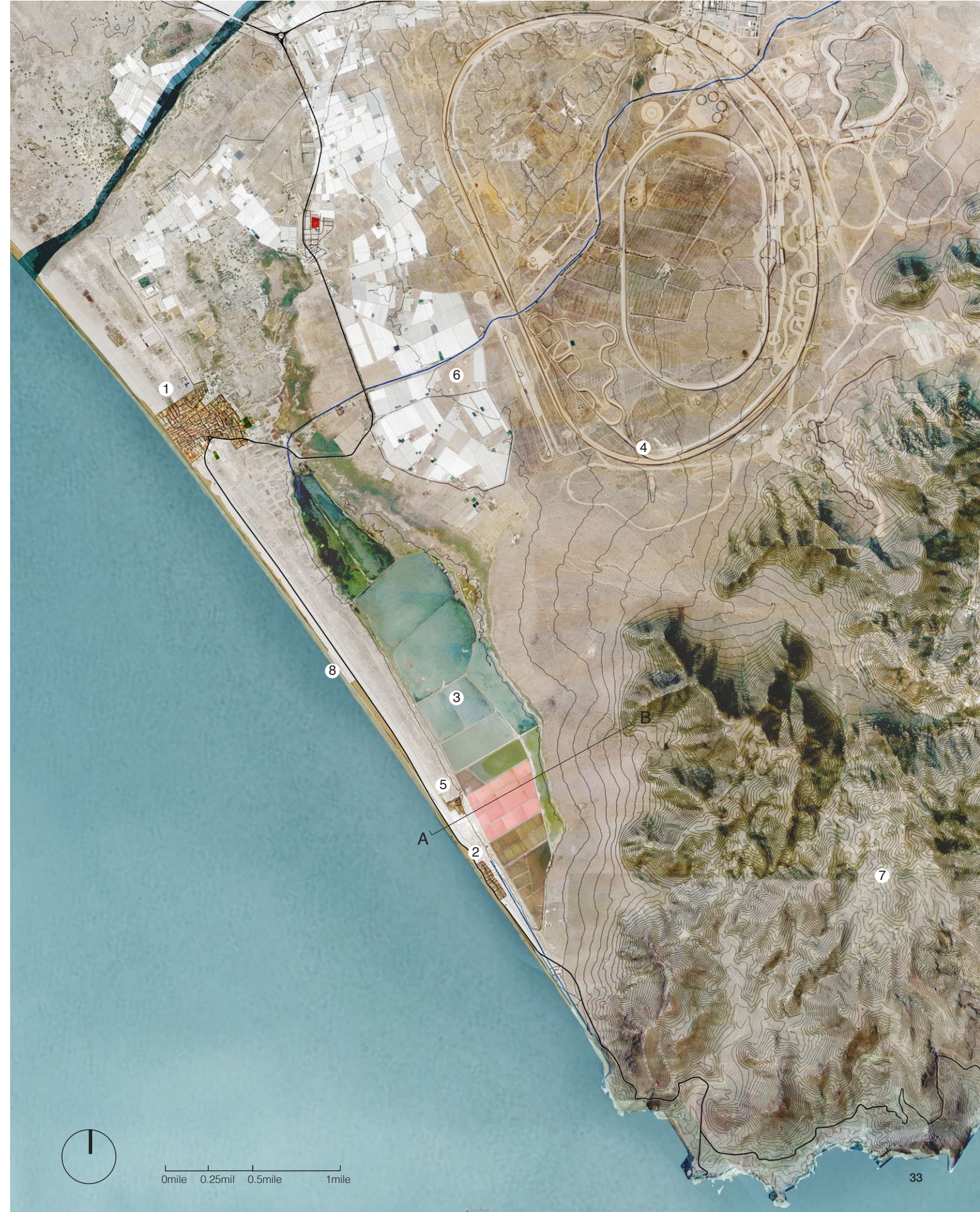
ABOUT THE SITE - SALINA CABO DE GATA

Located in the southeastern corner of Spain, Cabo de Gata is Andalucía's largest coastal protected area. It is known as a wild and dry landscape with some of geological features. The mountain near the salt pan is Spain's largest volcanic rock formation with deep slopes and a large amount of sediments.

City: Cabo de Gata
Municipality: Almería
Population: 1323

Important spots:

1. San Miguel de Cabo de Gata
2. Almadraba de Monteleiva
3. Salina Gabo de gata: Area: 800 acre
Perimeter: 6 mile = 90 minutes walk
4. Tracks
5. Church (heritage)
6. Industry and farming
7. Volcano
8. Beach

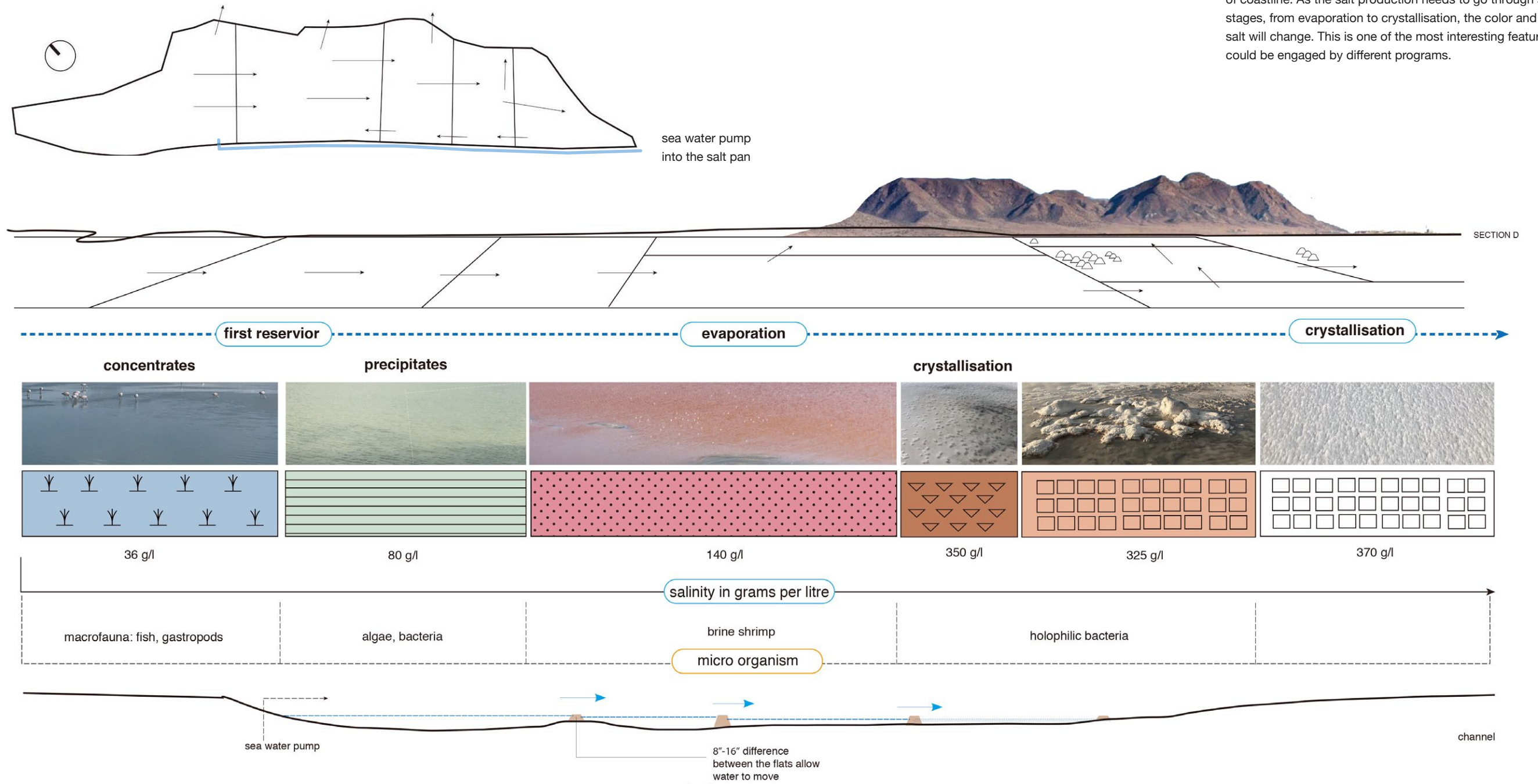




THE GEOLOGICAL SYSTEM AND SALT PAN

The site is facing the sea and right beside the volcano. The scale shifts from the deep topography to a vast flat, expanding and melting to the sea. It is a land art for both natural landscape and artificial landscape. The deep alluvial fans bring a lot of sediment and currents seasonally.

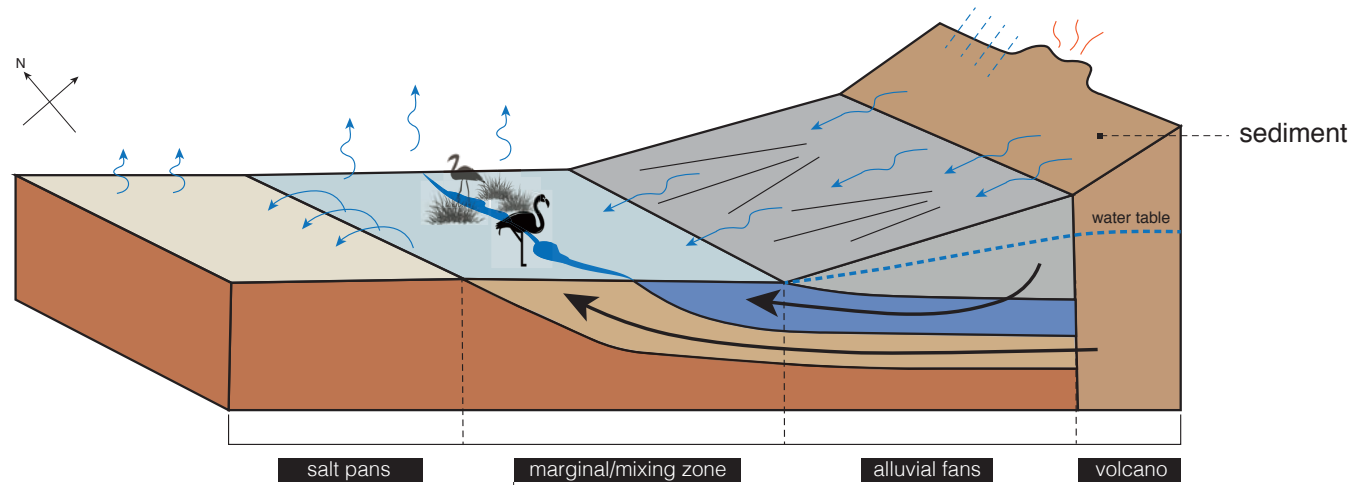
SALT PAN WORKING PROCESS



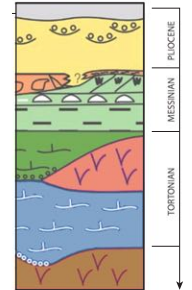
THE SALT PAN AND SALINITY

Cabo de Gata Las Salinas pumps sea water from the south corner of coastline. As the salt production needs to go through several stages, from evaporation to crystallisation, the color and forms of salt will change. This is one of the most interesting feature which could be engaged by different programs.

THE GEOLOGICAL DYNAMICS



soil structure

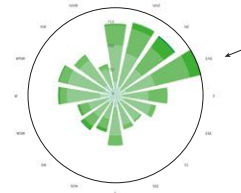
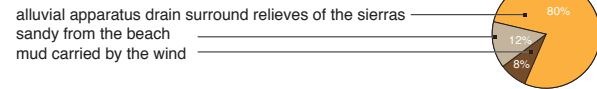


- Undifferentiated Recent detritus
- Conglomerates
- Bioclastic Sands
- Marl, Mud and Sand
- Calcareous Breccia
- Carbonates with oolites and stromatolites
- Gypsum
- Coastal reefs
- Bioherms, patch reefs
- Reef Blocks, slumps
- Marls, at times with intercalated diatomites or calci-turbidites
- Bioclastic carbonates, locally volcanoclastic conglomerates
- Volcanic rocks of around 8 million years old
- Bioclastic carbonates, locally volcanoclastic conglomerates
- Volcanoclastic rocks more than 9 million years old or undifferentiated
- Betic Substratum: Micascists, Quartzites, Dolomites, Amphibolites, etc

future potential?

- sediment collection
- breeding zone
- flooding buffer zone
- human activity
- transition zone (artificial landscape-natural)

where is the sediment come from?



THE IDEA OF MIXING ZONE

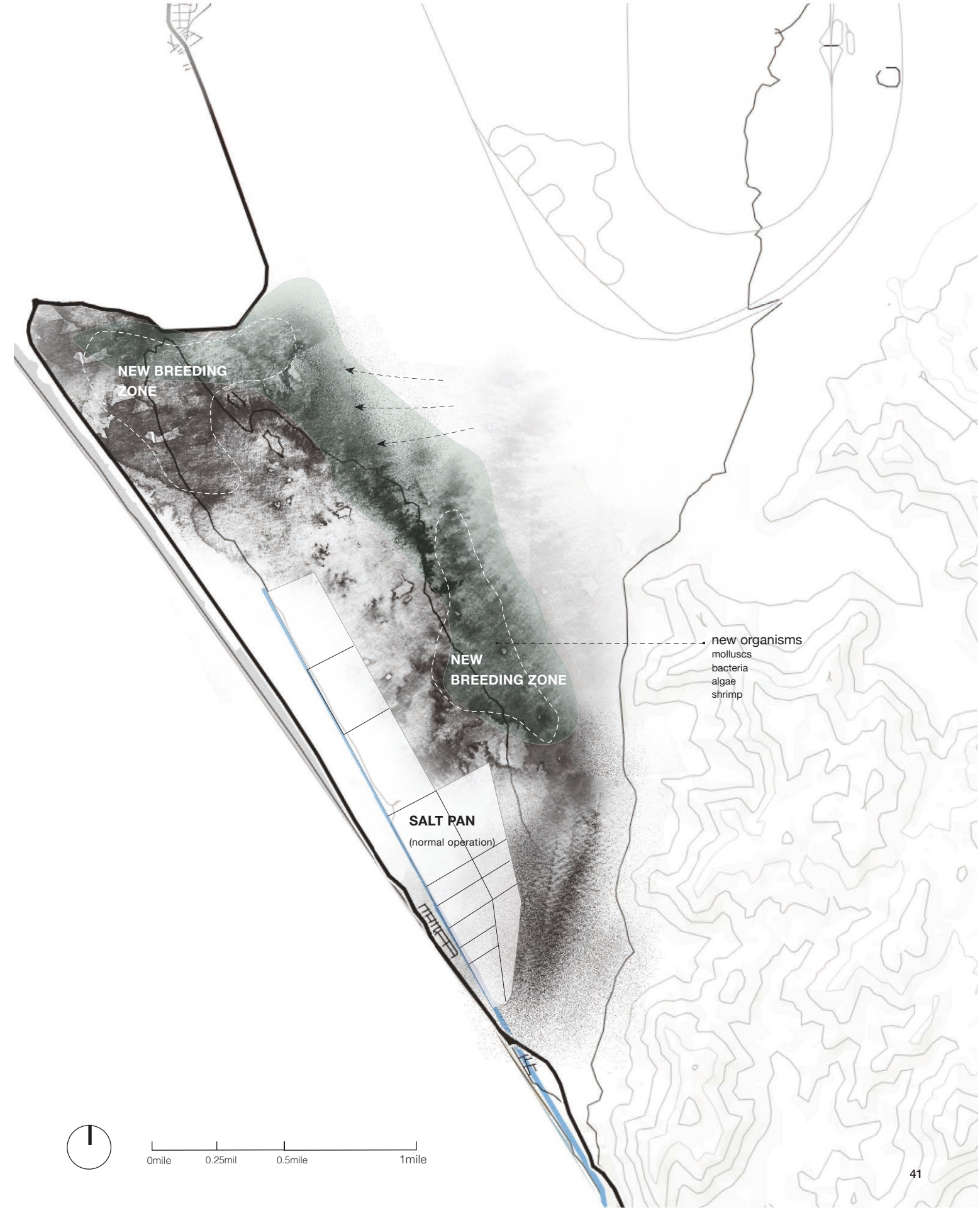
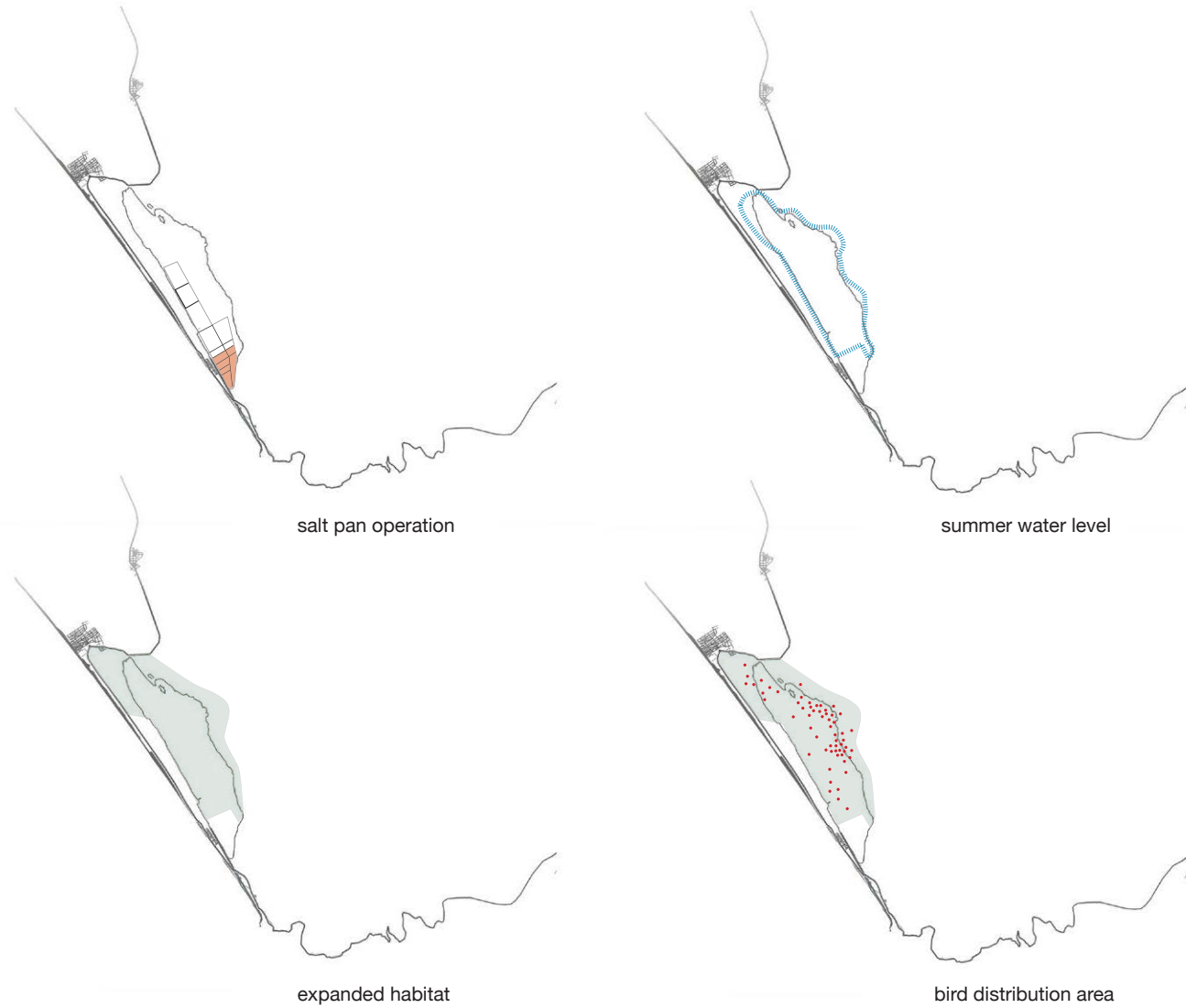
Salt pan as feeding ground for bird life revolves water levels of the lagoons, regulated throughout the year. The edges of the salt pans has the potential for the mixing zone which could become the mixing zone for both artificial and natural landscape.

(data from http://www.juntadeandalucia.es/medioambiente/web/ContenidosOrdenacion/red_informacion_ambiental/PDF/Geodiversidad/Geology_of_the_arid_zone_of_Almeria/The_Almeria_Nijar_Basin.pdf)
(data based on wikipedia)

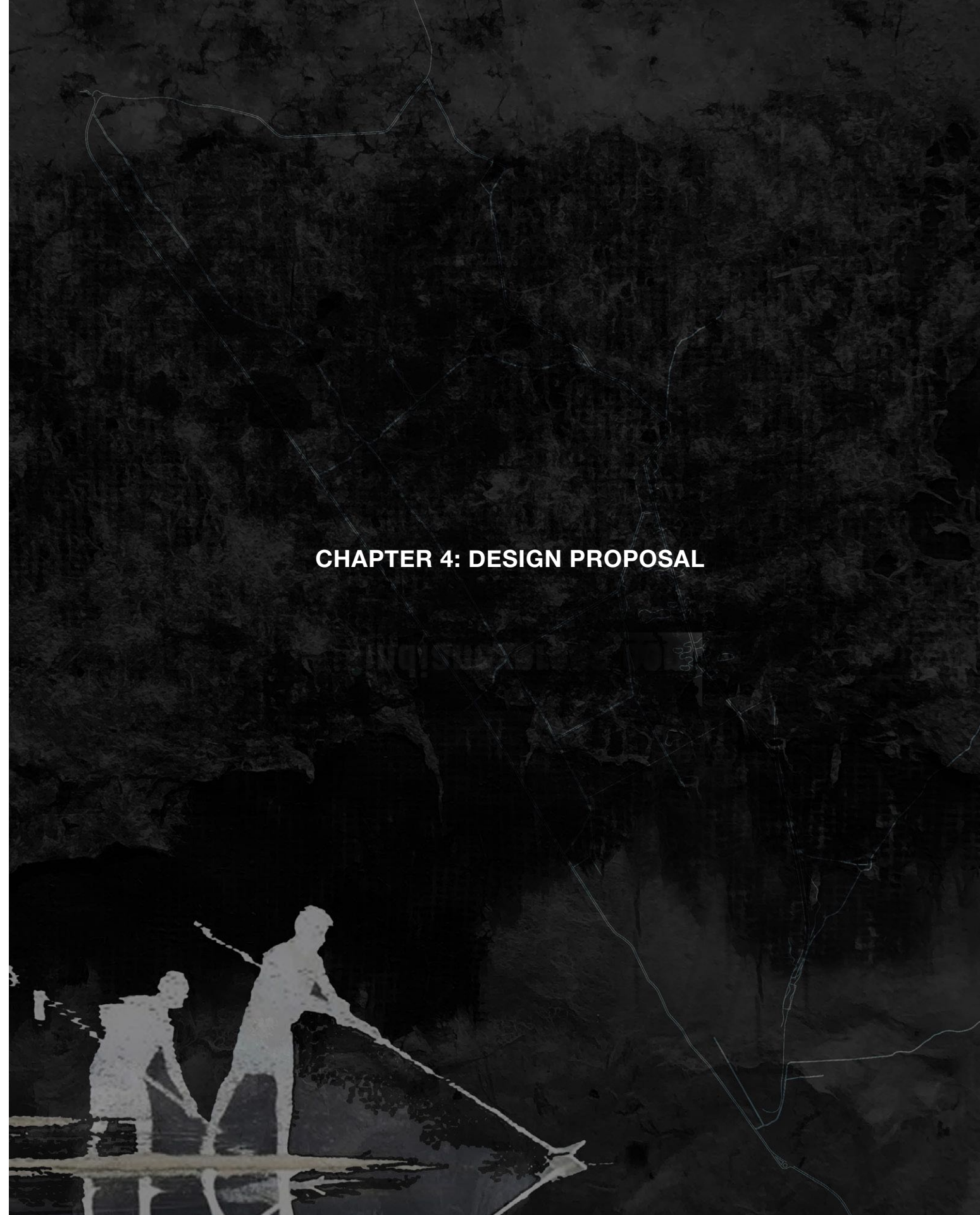


PROPOSED ECOSYSTEM CHANGE

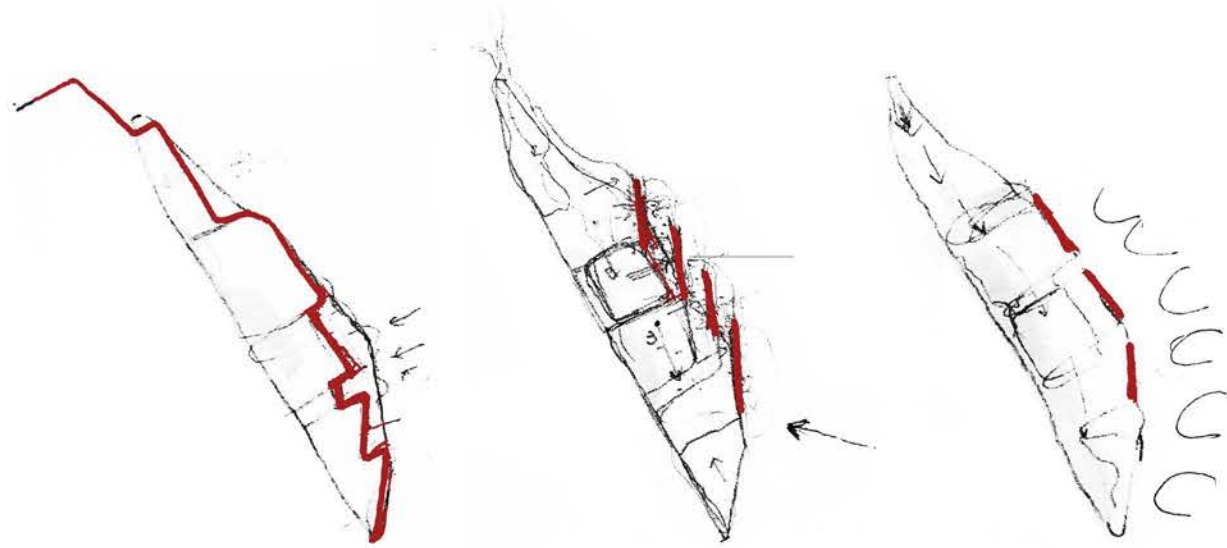
The edge or the “mixing zone” between natural and artificial ecosystem actually holds a great potential for habitat diversity, including new breeding zones. The design proposal is to shift and diversify this “edge” through management of the lagoon system and salt pan system.



CHAPTER 4: DESIGN PROPOSAL

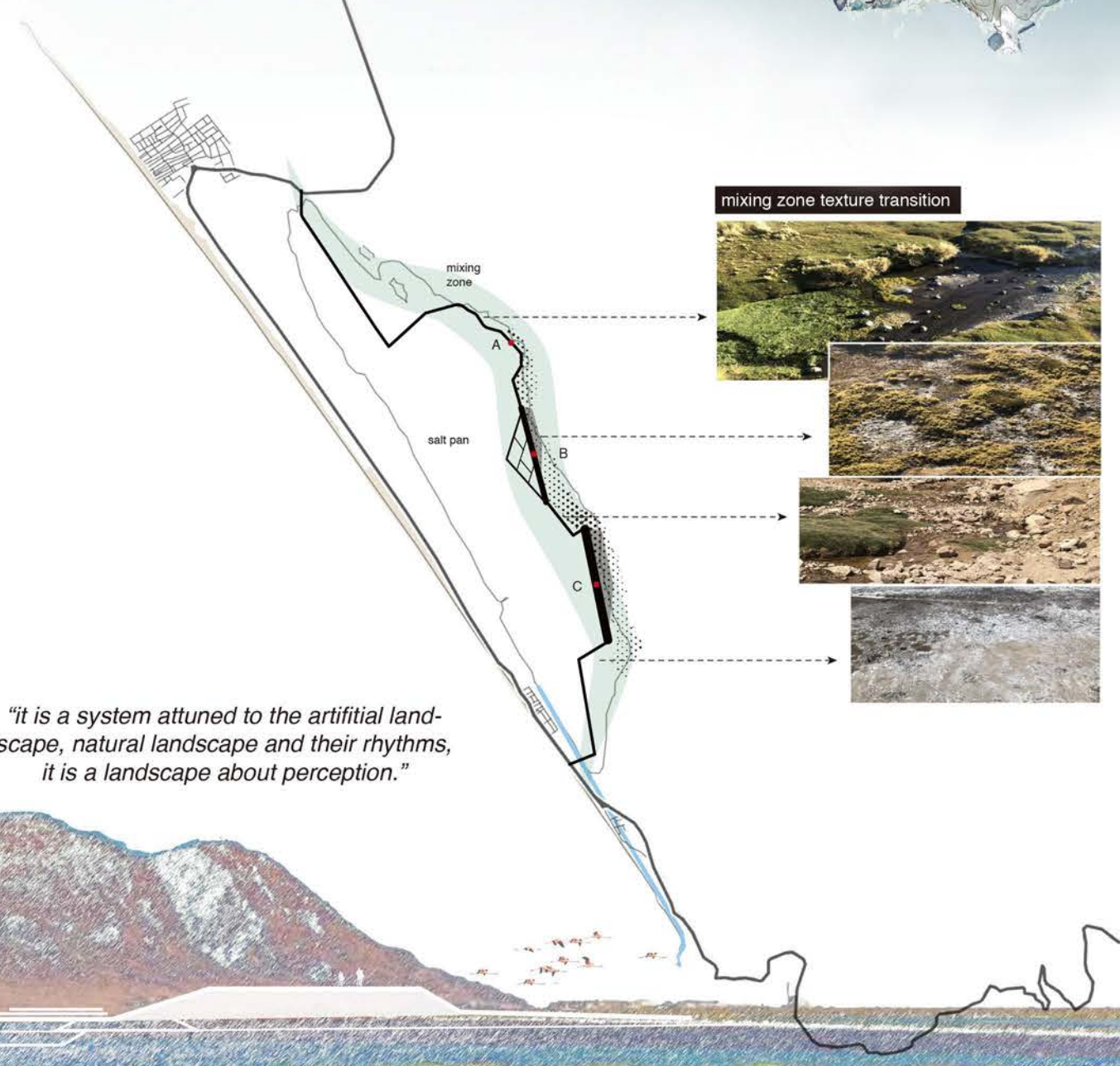


3 MODELS OF THE SEDIMENT MOVEMENT AND DEPOSITION

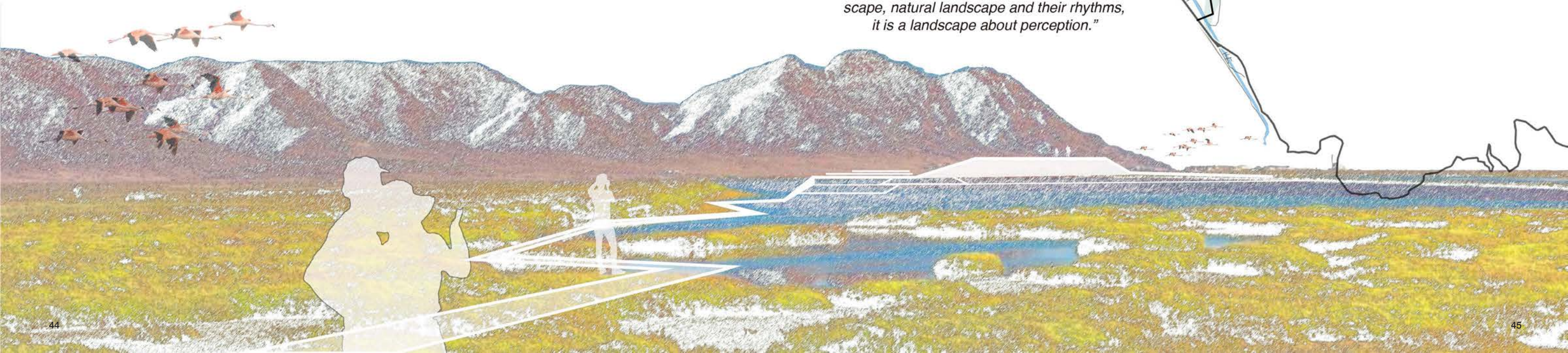


THE ALLUVIAL SYSTEM & SEDIMENTS

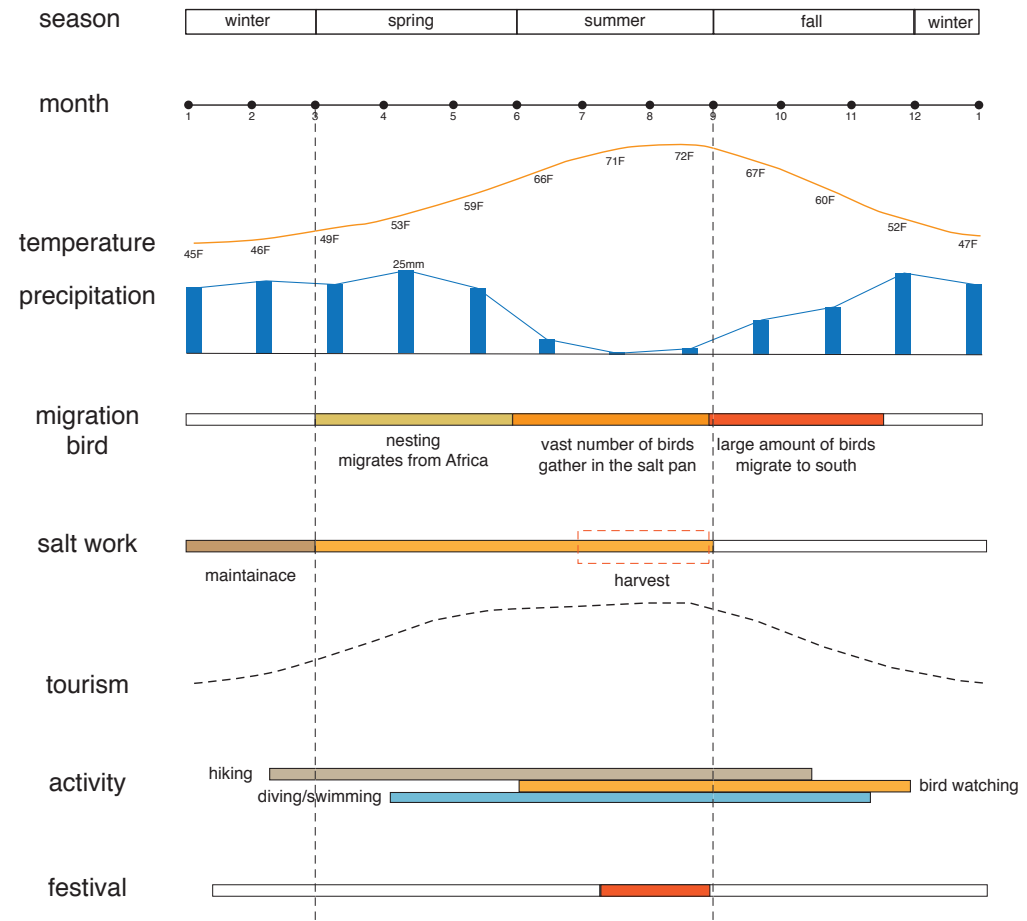
The edge between the salt pan and alluvial fans could become the potential feeding ground for the future habitat and programs. There are three models show how the sediment will influence the edge and change the environmental condition during the time.



"it is a system attuned to the artificial landscape, natural landscape and their rhythms, it is a landscape about perception."

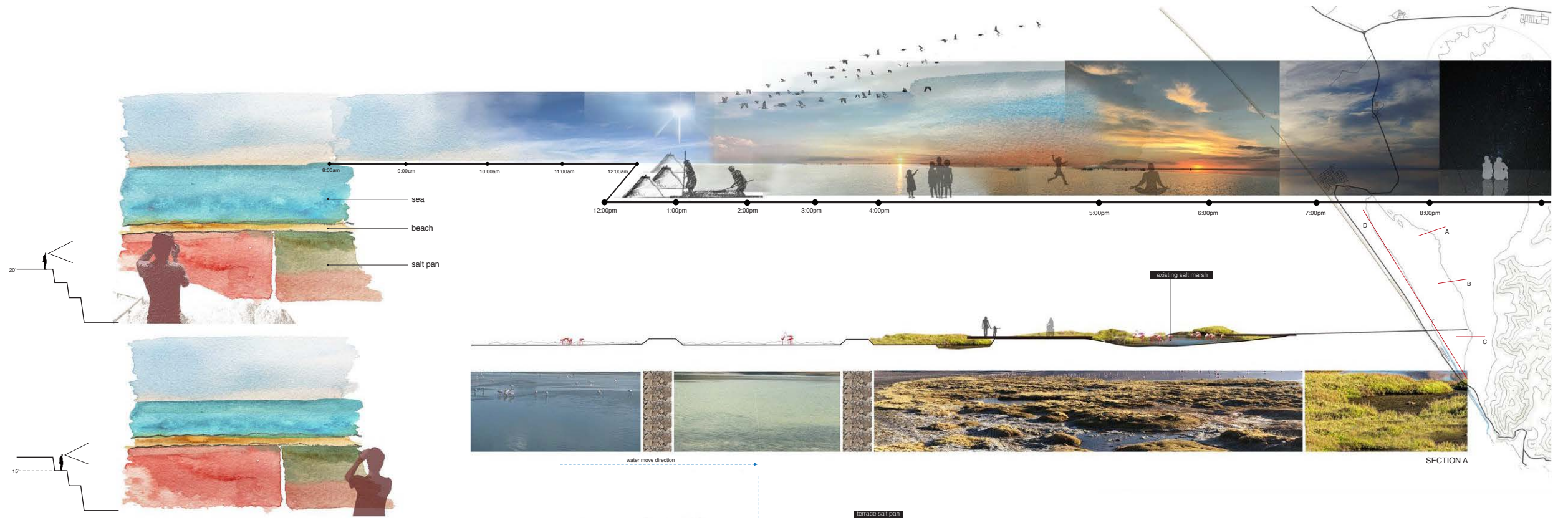


SEASONAL CALENDAR AND DESIGN PROPOSAL



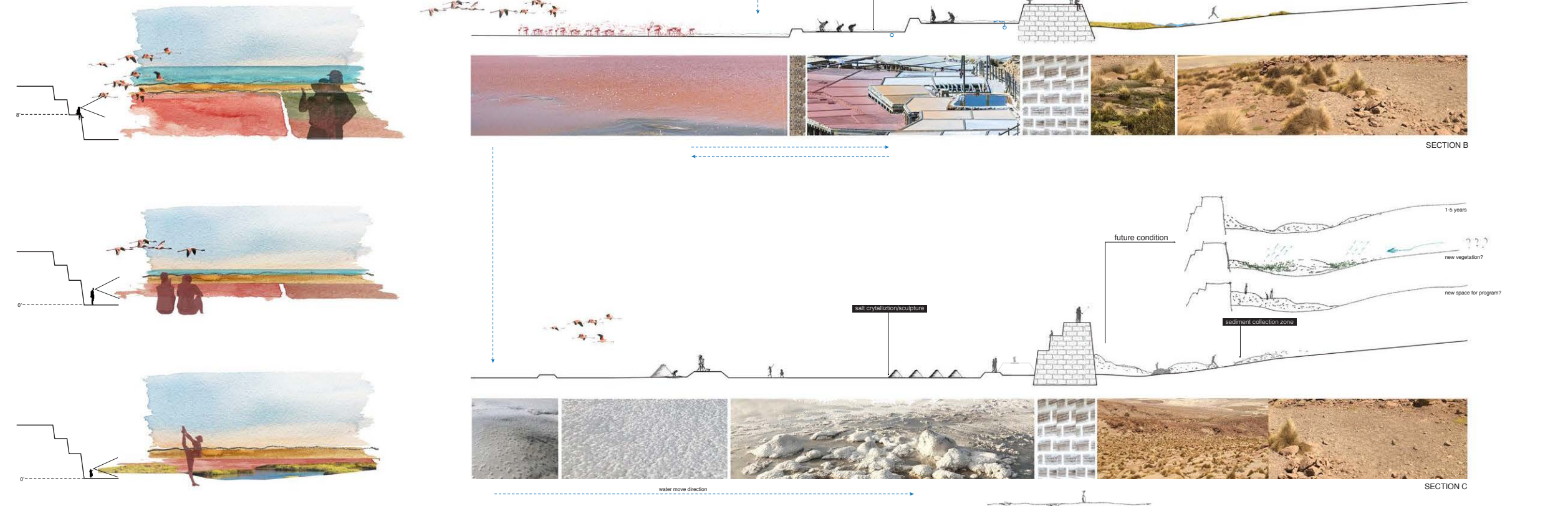
THE VIEW AND EXPERIENCE

The diagram on the right shows how the views and elevation will change. The view is dynamic because of the color patterns and colors change over the time.



DAILY AND SEASONAL ACTIVITY

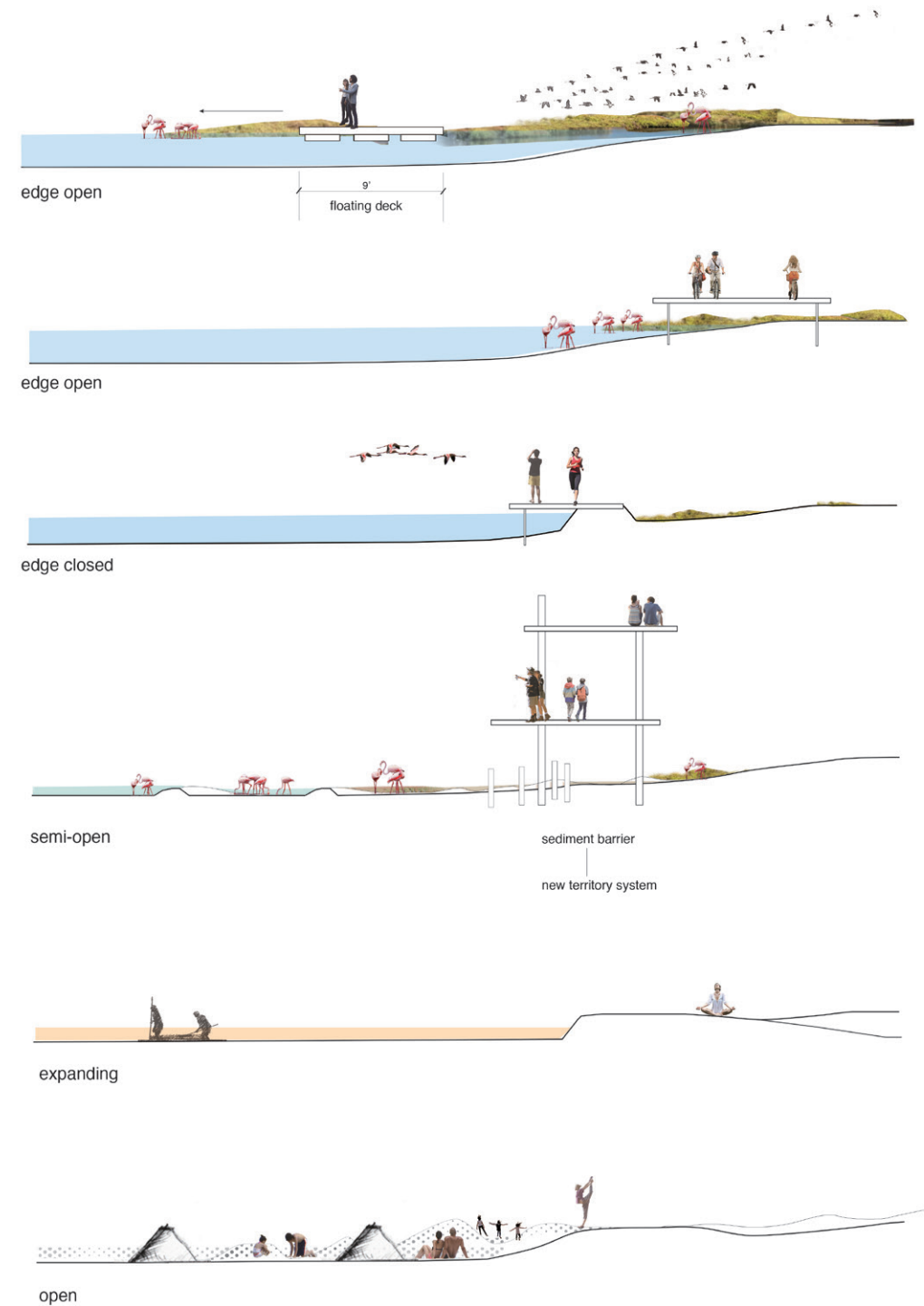
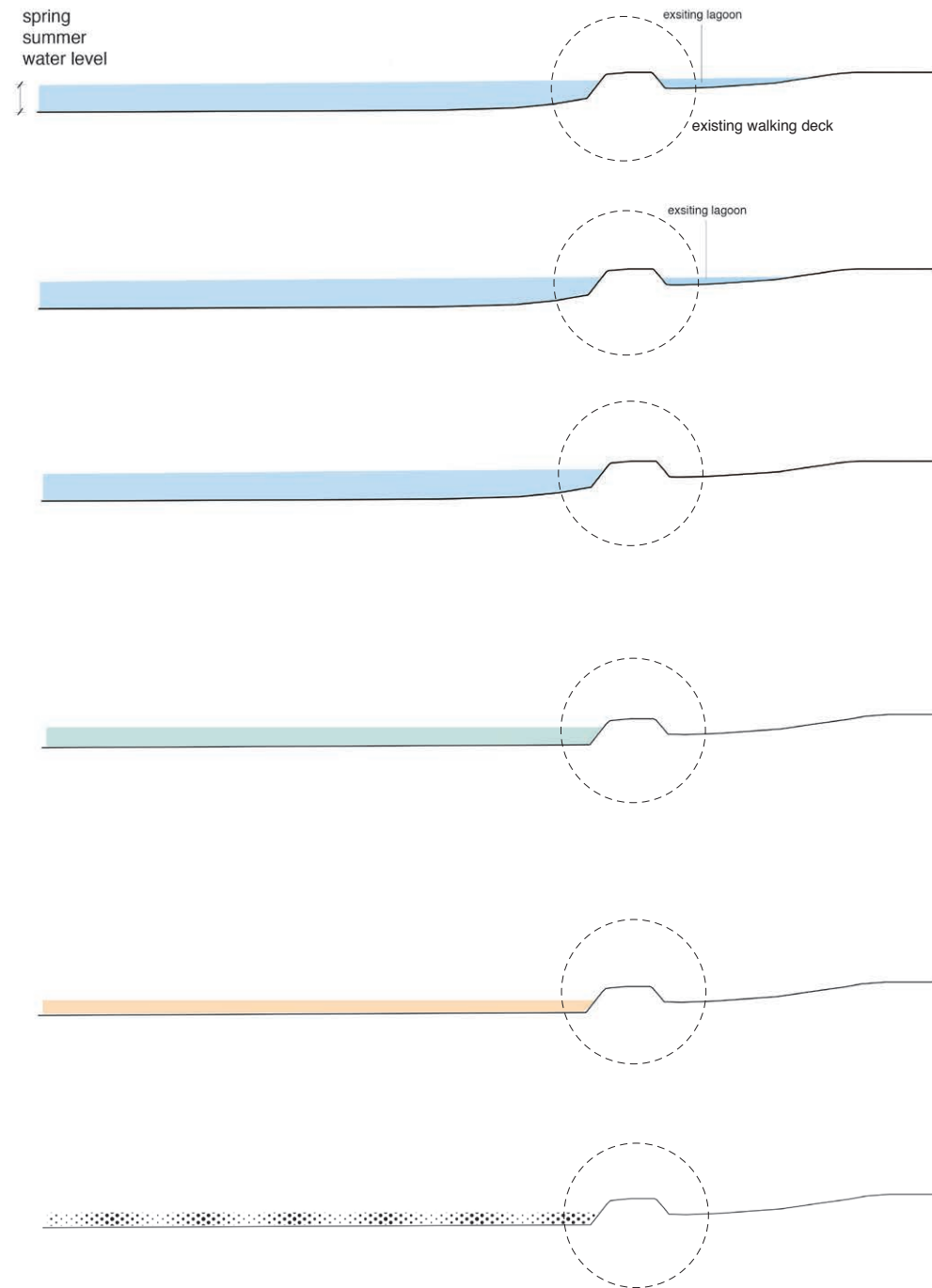
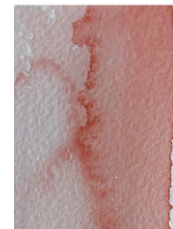
The diagram on the right shows the daily activity in the salt pan, and the sections below shows how the edge condition will change alongside the mixing zone.



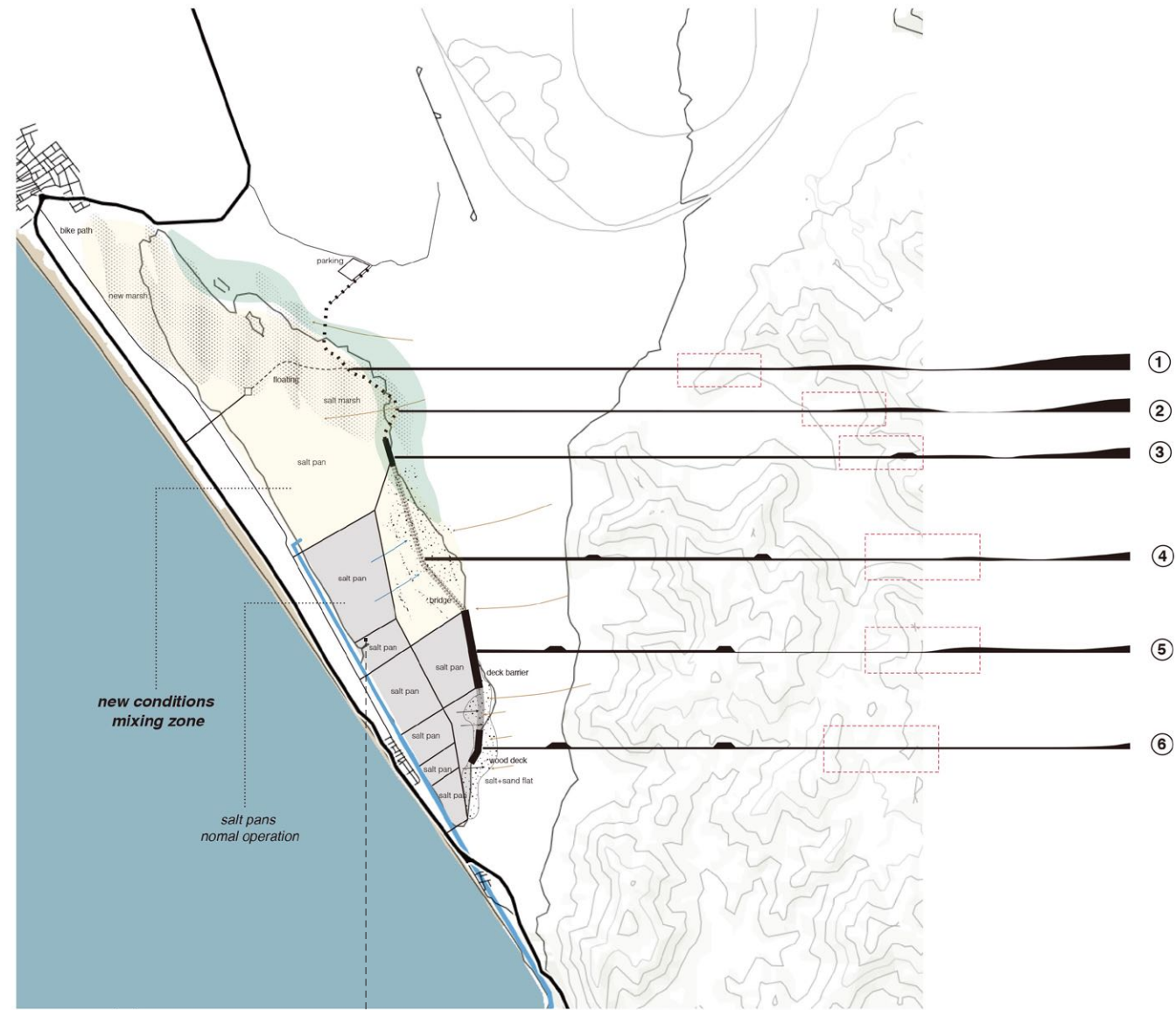
EDGE TESTING

EXISTING EDGE CONDITION

PROPOSED EDGE CONDITION

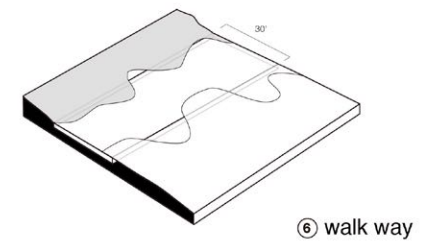
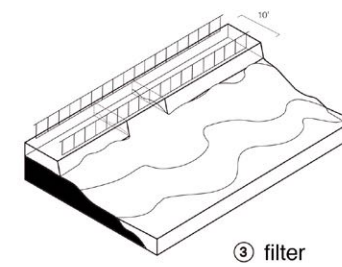
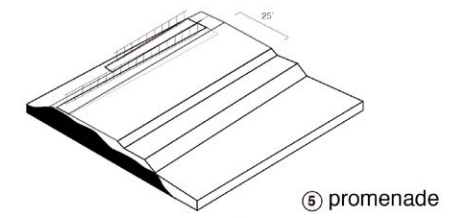
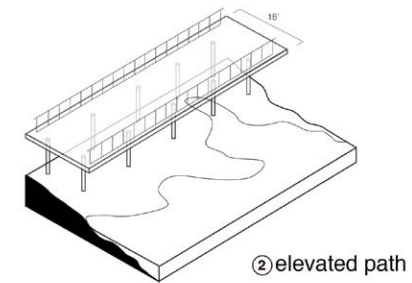
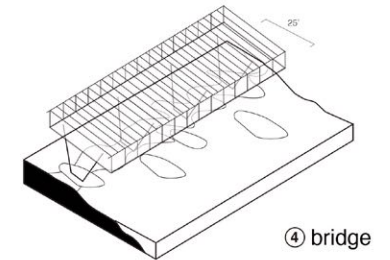
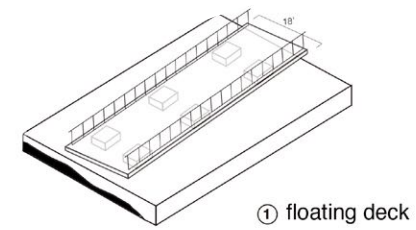
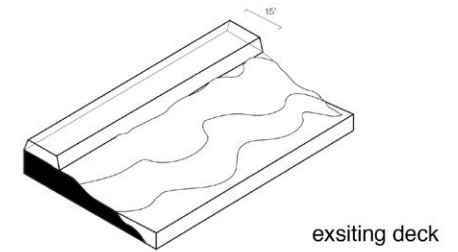
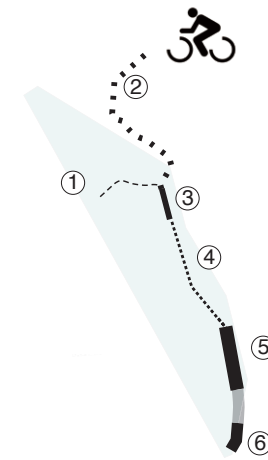


EDGE PROPOSAL - MARGINAL/MIXING ZONE



EDGE CONDITION MODELS

The new proposed edge has different permeabilities and spatial qualities. According to the permeabilities and salinity of the salt pan, when the salt and sediment meet, it will create the new environment. The edge is not just a path, but a boundary which could witness the ecological change.



SALT PAN PATHWAY

The existing salt pan edge is made by simple walking deck-stone and soil which is not easy to walk on. It is hard to get close to the salt pan and catch the wonderful view since there is no path. So the new proposal is to create a functional and experiential path way which could engaged people and species, bike will be the main transportation tool. At the meantime, it is a path system that could change the existing ecosystem and bring in new features to the site.

The idea is to keep some of the salt pans edge open for the “mixing zone”. Then shrink the salt crystallisation zone, which means reduce the salt production and leave most of the salt pans for the species.

As the salinity changes alongside the edge, it will create new conditions when the sediment collected. The whole walking system started from the floating deck and elevated path which are flexible react to the open edge. The bridge is semi-open edge for the sediment deposition. While promenade and salt walk lead to the salt harvesting zone. The path through the hills of the mountain could reach the wide view for the whole landscape.

Important features ----- salt pan process ----- salinity

Important features	salt pan process	salinity
• Floating deck	sea water	/
• Bike path	concentrates	+
• Elevated walk way	precipitates	++
• View catcher	evaporation	+++
• Bridge	concentration	+++
• Promenade	crystallisation	++++
• Salt walk	harvesting	+++++



“it is a system attuned to the artificial landscape, natural landscape and their rhythms, it is a landscape about perception.”

City: Cabo de Gata
Municipality: Almeria
Population: 1323
tourists: 500,000/year
Area: 800 acre
Perimeter: 6 mile = 90 minutes walk

Almadraba de Monteleva



0mile 0.2mile 0.4mile 1mile





FLOORING DECK

SALT MARSH

BIKE LANE

LAGOON

VARIES

10

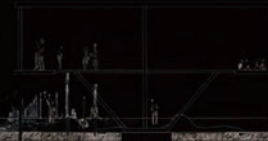
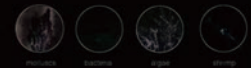
200

90

15

VARIES

SECTION A



SEDIMENT BARRIER - new breeding zone

VIEW CATCHER - salt + sediment retreatment

VARIES

30

200

90

VARIES

SECTION B

SALT PAN - Discipales

SALT PAN - PROMENADE

SEDIMENT COLLECTION

VARIES

60

VARIES

SECTION C

SALT COLLECTION

SALT WALK WAY

VARIES

100

100

30

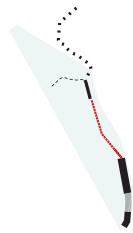
VARIES

SECTION D



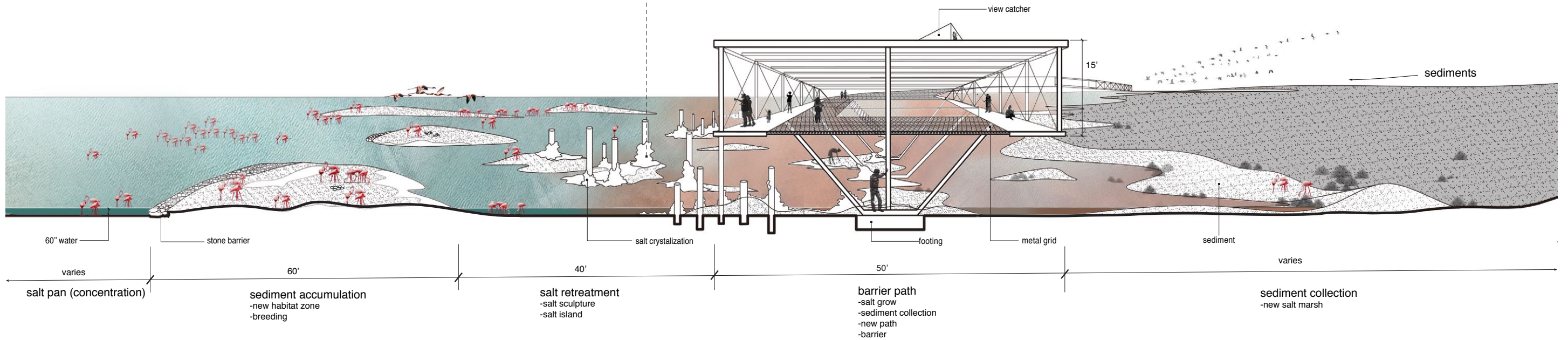
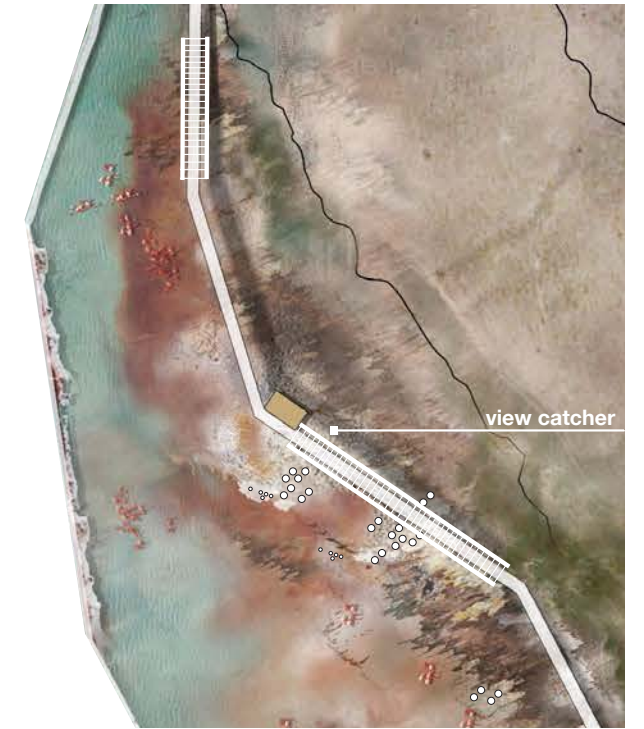
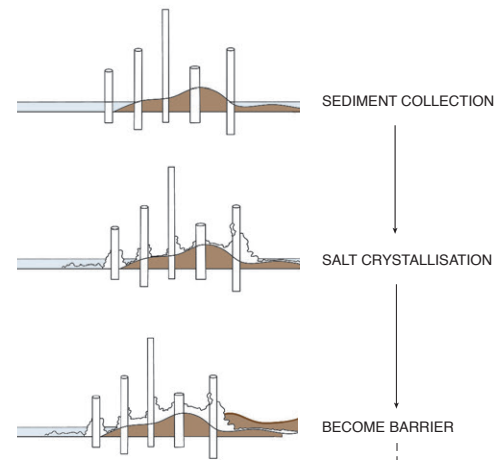
THE SALT MARSH HABITAT

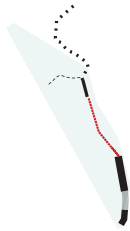
The walking system starts from the floating deck and elevated pathway, which ties alluvial sediment flows. They create the open edge for sediment flows into the salt pan and expand the existing salt marsh for species.



THE BRIDGE AND VIEW CATCHER

The bridge is a semi-open edge which could mix the high salinity salt water and sediment. High salinity salt will crystallized on the structure and become a barrier in the future. The new walk way will be created beneath the bridge. And the collected sediment could become the new breeding zone for the birds.

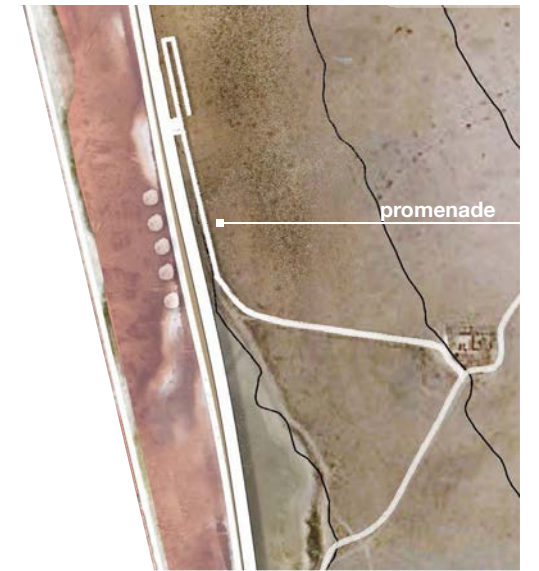
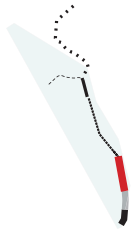




THE VIEW AND EXPERIENCE

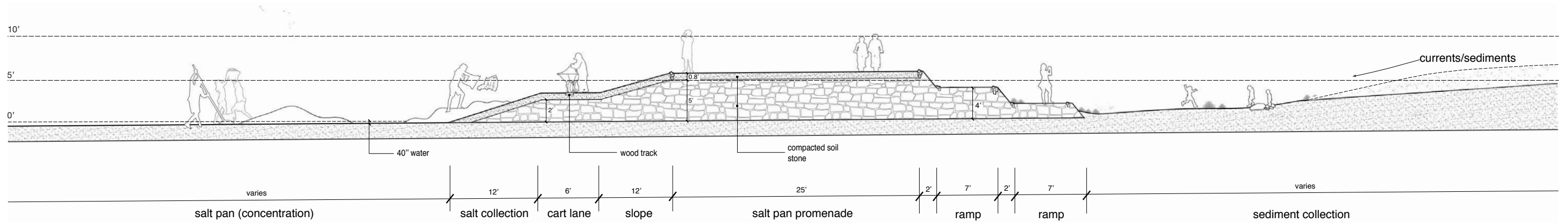
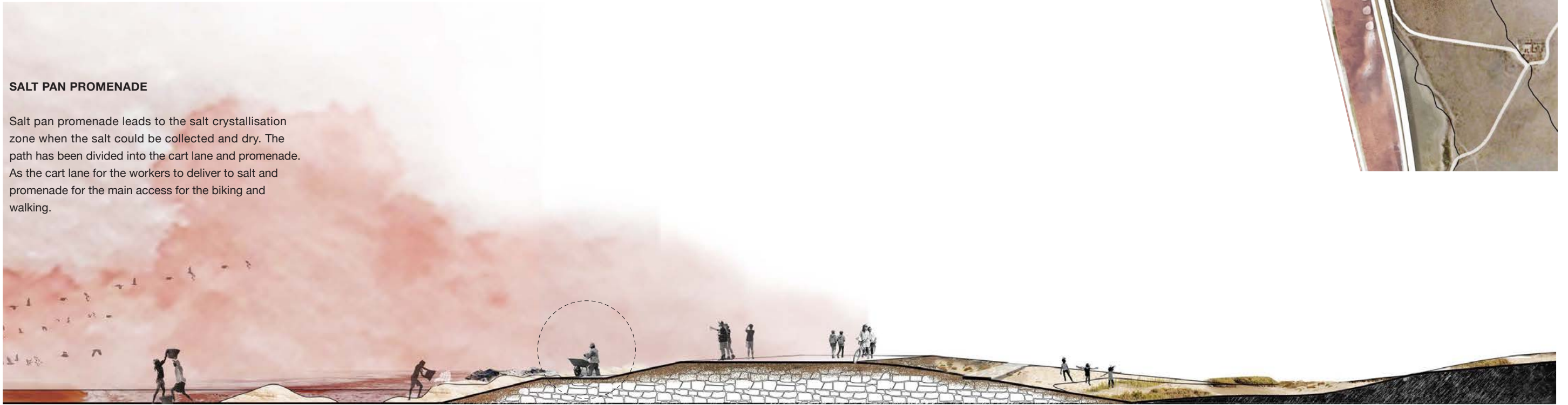
The drawing on the left shows the views and elevation when people passing through the bridge. The structure provides the shade for the sunny day and brings people the wonderful and brings people to a vantage point that provides a view of the salt pans below.





SALT PAN PROMENADE

Salt pan promenade leads to the salt crystallisation zone when the salt could be collected and dry. The path has been divided into the cart lane and promenade. As the cart lane for the workers to deliver to salt and promenade for the main access for the biking and walking.





THE SALT WALK

It is a very dry area for the salt final harvesting and delivery. The path takes place of the original deck and become the "blurring area" where people could directly see the white salt crystal meets the sediment from the alluvial mountain. It is interesting to see the two totally different textures mixing and interacting with each other. It is a journey of salt process, also a "magic" from wet to dry, from blue to white.



CONCLUSION

If there is no more economic value for the certain landscape, how could we find a way to preserve it. How could we cohabit with non-human species? Salt pan is one of the rare case that artificial landscape could actually benefit the species, it is an industrial landscape serves natural functions which similar to salt marshes.

During the whole thesis process, the main concern is how to balance the production and habitat, and find the way to benefit both artificial landscape and natural landscape, in order to create a dynamic landscape for the future development. Maybe we could bring in new elements for the ecosystem “transformation”- for the system and function, treat landscape in a controlled way.

The “edge” is a simple idea of creating circulation, but also creating new opportunities based on the existing conditions. It is a shifting zone for the ecological system change. When people pass through the path, they could understand the salt

production process but also understand the relationship between the materials and natural process.

The design part is very hard to define the salt pan for new functions, since the salt pan itself is already a fantastic land feature, so how could we explore the new identity for the site and create something beyond? Maybe the site is the answer, dry but full of potentials.

In this case, “cohabitation” is not just based on the resources sharing between human and species, but preserve the experience, visual value as well as the culture. Salt is not just the food, it becomes a bridge between manufacture and ecosystem, connects human with nature. The project serves as a model for salt works, migrating birds as the value of cultural landscape.

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