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OIL REFINERY LANDSCAPE IN THE BAY

UC DAVIS LANDSCAPE ARCHITECTURE
SENIOR PROJECT
LUCY WU

TABLE OF CONTENT

Introduction

- 06 Abstract
- 07 Introduction of Oil Refinery
- 08 The Context of Castro Point
- 10 Problem statement

Site Analysis

- 12 Site Overview - Area of Function
- 13 Site Overview - Vision of Future
- 14 Site Condition - 01& 02
- 16 Site History - Chevron Oil Refinery & Castro Point
- 18 Ecological Setting
- 19 Social Setting
- 20 Species on Site
- 22 Constraints and Opportunities
- 24 Vision & Goals

Research

- 26 Case Studies
 - Houtan Park
 - Deconstructed Salt Marsh
 - Freshkills Park
 - BP Oil Park

Design

- 33 Master Plan
- 34 Design Components
- 35 Topography Design
- 36 Water Management: Current and Plan
- 38 System Build-up
- 39 Section
- 41 Vision of the Design
- 42 Perspectives
- 44 Conclusion



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OIL REFINERY LANDSCAPE IN THE BAY

By LUCY HAOTIAN WU

Submitted in partial satisfaction of the requirements for the degree of
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Approved: _____

Brett Milligan, Senior Project Chair

David de la Peña, Senior Project Advisor



INTRODUCTION

ABSTRACT

The Chevron Oil Refinery in Richmond, California, has a lot of severe environmental and social issues in its surrounding area that greatly affect residents' quality of life and visitors' experience. People in this area are exposed to highly concentrated air and water contaminants and are isolated from the waterfront area. Although the waterfront is currently a piece of vacant land, it has the potential to function as a space for outdoor recreation.

This project proposes a regenerative design in Castro Point, a district located on the west end of the refinery. It focuses on developing recreational space for nearby neighborhoods and visitors, creating natural habitat for local plants, and beautifying the view with the integration of industrial elements from the refinery. The ultimate goal is to improve people's outdoor experience around the refinery by making good use of the waterfront area.

INTRODUCTION OF RICHMOND OIL REFINERY

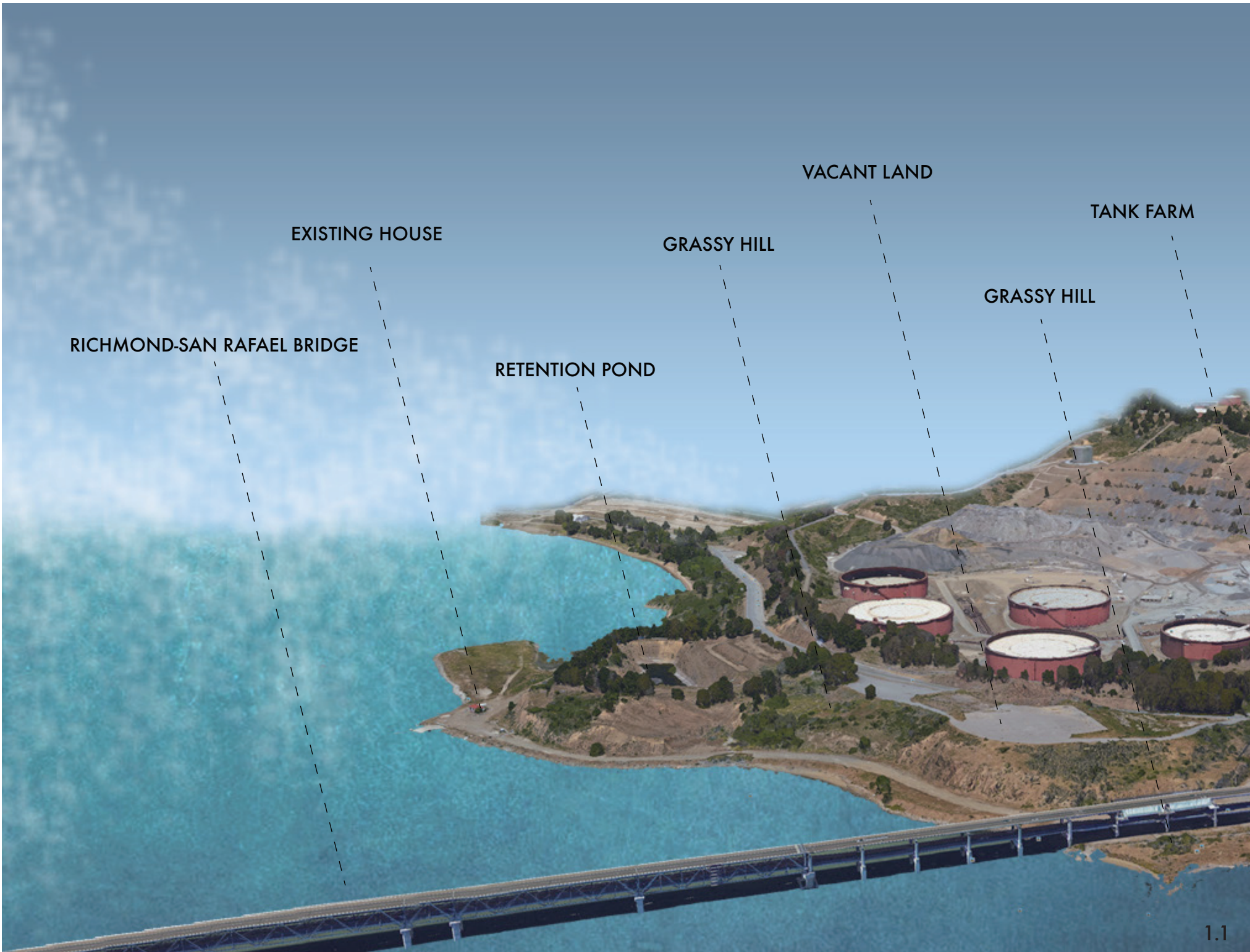
The Bay Area in north California is a geographic paradox, where hundreds of cities grew with industrial development. The Chevron Refinery, located at the City of Richmond of the Bay Area, is one of the contributors to this industrialized setting. The Facility receives crude oil via tankers and barges that discharge at the Facility over the Long Wharf, and store it in tanks at the Facility before being processed at the Facility. This crude oil is processed into a number of products, such as motor gasoline, jet fuel, diesel fuel, lubricant base oils and liquefied petroleum gas and sulfur. Additionally, the facility also produces steam and electricity primarily for its own use, and fuel gas and hydrogen solely for its own use. Its operations include the import of crude oils and gas oils by ship through the Richmond Long Wharf by exporting products by pipeline, ship, rail and truck.

The Bay Plain areas north of the Project site are generally undeveloped marsh and Bay mudflats, which are covered with seasonal plants and water. Adjacent to the ridge, the Bay Plain is developed with heavy-industrial facilities, equipment, and ancillary land uses such as storage areas and oxidation ponds. On the west side of the process facilities there are great number of large cylindrical storage tanks. The ridges appear partially developed, as tank farm area occupies the slopes along with grasses, shrubs, and trees.

THE CONTEXT OF CASTRO POINT

Castro Point, at the west side of Point Richmond, serves as a major transportation terminal between Richmond and San Rafael as well as between the Bay Area and places overseas. It hosts the shore landing for the Richmond-San Rafael Car and Passenger Ferry that crosses the San Pablo Bay, and is also the western terminal for the East Shore and Suburban Railway connecting trains from Downtown Richmond and Oakland. The Long Wharf located at the west side of the Richmond San Rafael Bridge, which is owned by the Chevron Richmond Refinery, connects a 36-inch-diameter pipe that moves up to 10 million gallons of crude oil per day off tankers from Alaska and the Middle East.

While still useful for shipping bulk materials, the Richmond refinery also has an industrial transportation corridor that uses pipelines to transport crude oil. In light of the depletion and contamination of its natural resources and the threat of rising sea levels on its infrastructure, the future of this refinery would be focusing on rebuilding regenerative landscape, generating new cultures, and educating and harnessing the energy of the surrounding communities.



RICHMOND-SAN RAFAEL BRIDGE

EXISTING HOUSE

RETENTION POND

GRASSY HILL

VACANT LAND

GRASSY HILL

TANK FARM

PROBLEM STATEMENT

Being right next to a tank farm, the Castro Point is exposed to air pollution and wastewater pollution produced from the Chevron Oil Refinery, which is harmful for visitors, local residents, as well as animals and plants that live on this place. Moreover, since it is isolated from dense population area such as downtown and big neighborhoods, very few people would find it as a good place to go. However, this site has a lot of potential to be developed into a nice public open space, for its colorful history, interesting landform, natural resources, etc. In this project, I will be seeking for design solutions that can develop this place into a more ecologically and socially friendly space, while maintaining the context under its industrial setting.

The design aims at visioning the future development of a piece of land next to the tank farm area. It is seeking design solutions to improve the ecosystem by providing more wildlife and plant habitats, as well as enhance people's outdoor experience by providing more interesting landscape and recreational activities. At the same time, it will appreciate the industrial landscape and encourage people to learn more about the history of this place.



SITE ANALYSIS

SITE OVERVIEW: AREA OF FUNCTIONS



2.1



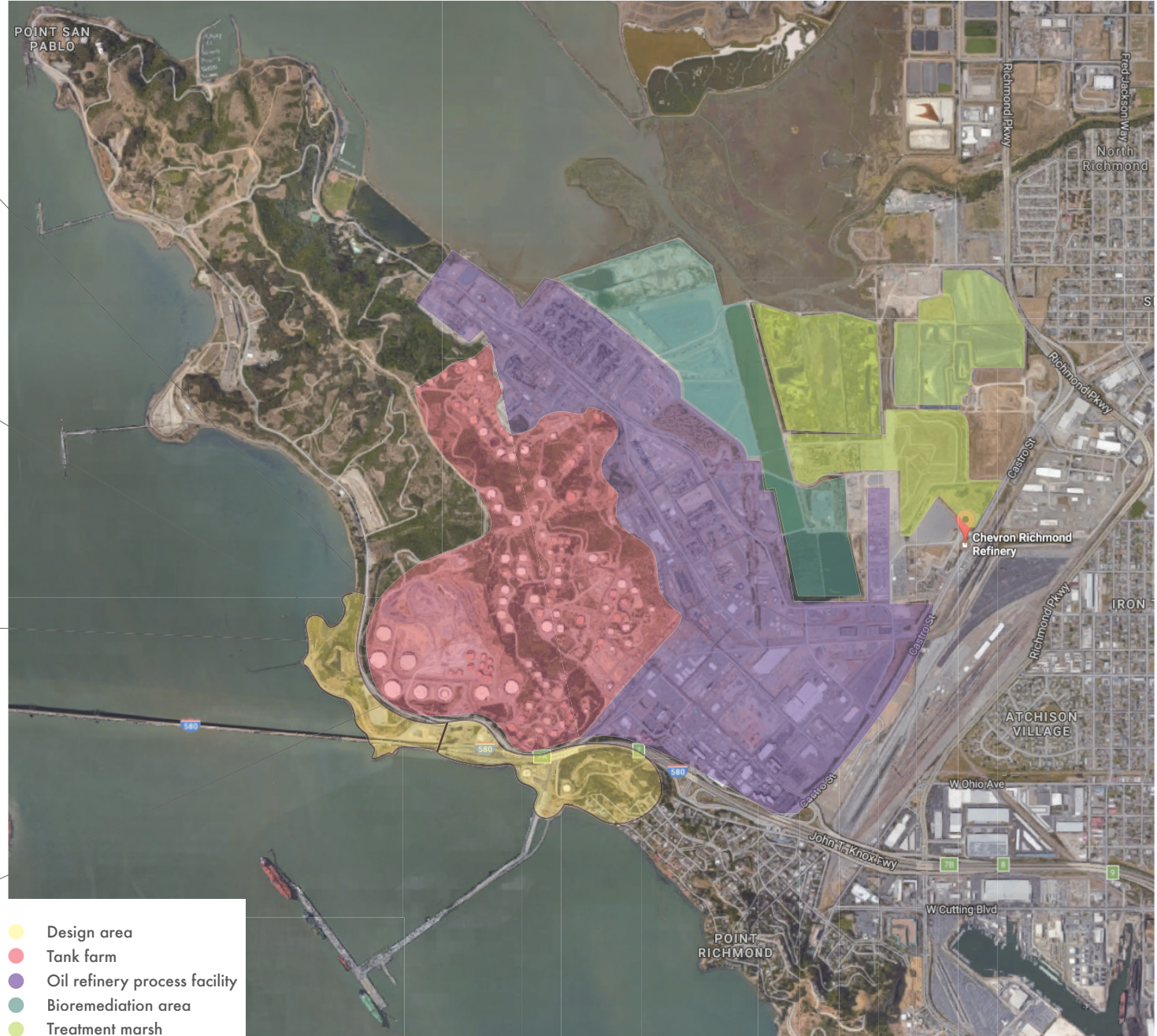
2.2



2.3



2.4



- Design area
- Tank farm
- Oil refinery process facility
- Bioremediation area
- Treatment marsh

2.5

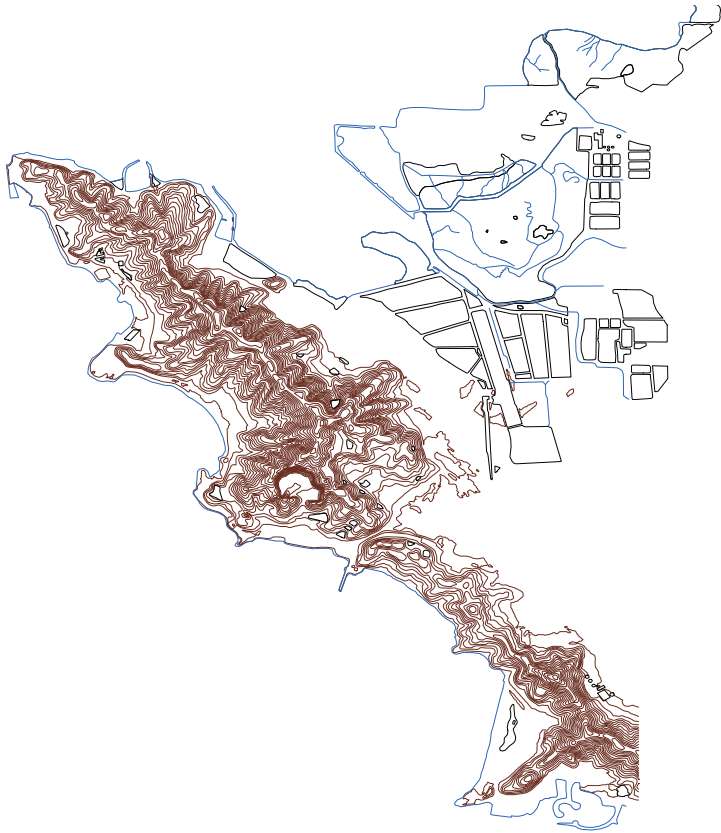
SITE OVERVIEW: VISION OF FUTURE

AREA SIZE:
54 ACRES

- BEACH PARK
 - OLD MILITARY BASE
 - RETENTION POND
 - ABANDONED WHARF
 - SHORELINE BEACH
 - BRIDGE
-
- WATER ACTIVITIES
 - EDUCATION
 - RECREATION
 - HABITAT ZONES



SITE CONDITION - 01



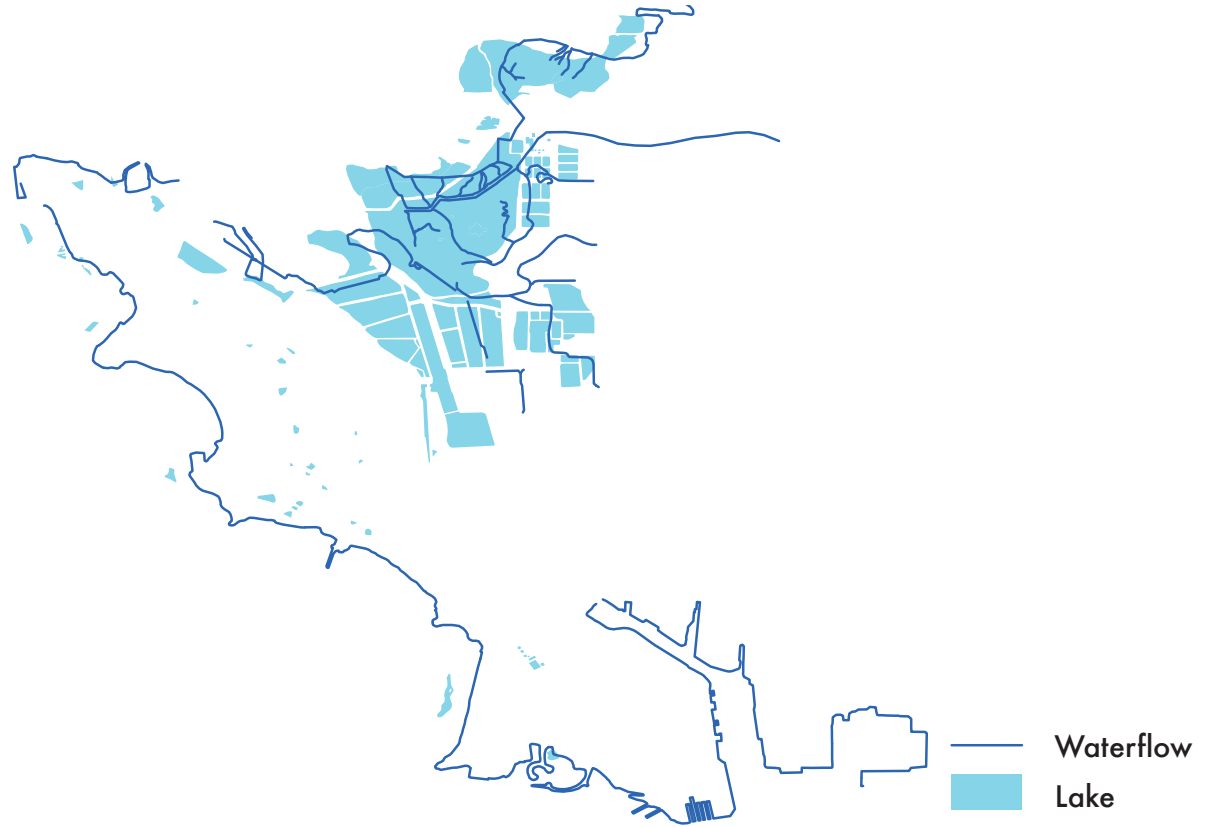
TOPOGRAPHY 2.7

Challenge: Complicated topography

The refinery is located at a mountain area, where elevation varies from 70ft to 160ft. This is a very unsmooth place, and it is hard to conduct many activities.

Opportunity: Interesting landform

The dramatic topographic change creates natural habitat zones for different kinds of plants and animals as well as recreational spaces for people.



HYDROLOGY 2.8

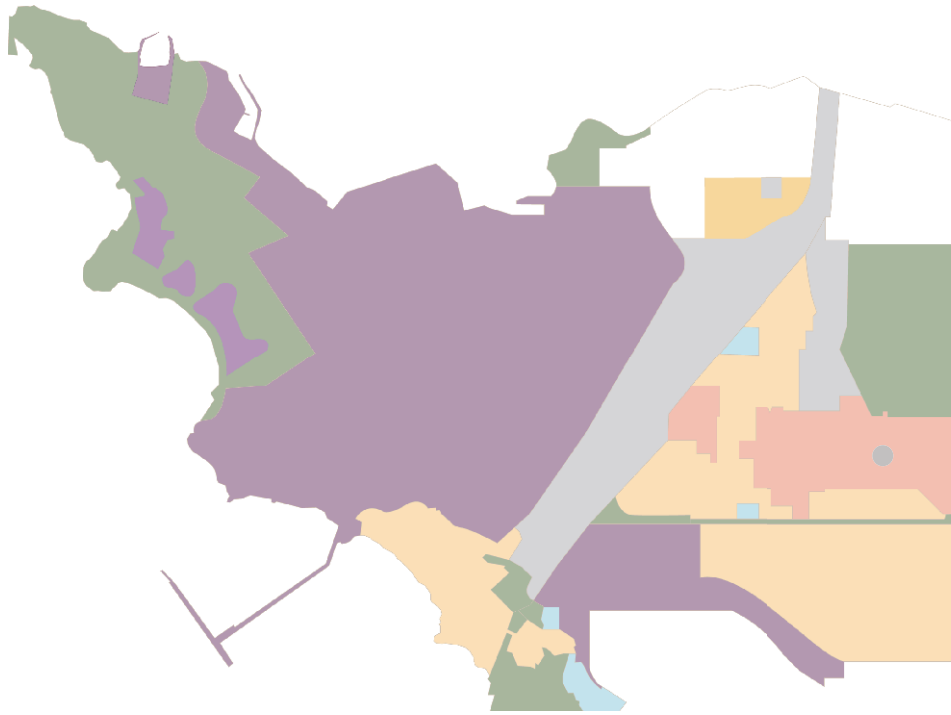
Challenge: Contaminated water

Although the refinery has a lot of water resources, most of the pond water is either contaminated industrial or wastewater.

Opportunity: Close to the Bay

Not only the location of the site provides great ocean scenery for people, but the bay water is also a nice resource for local plants and animals

SITE CONDITION - 02



- Industrial
- Light Industrial
- Neighborhood mixed use
- Residential
- Park
- Public, Cultural, Institutional

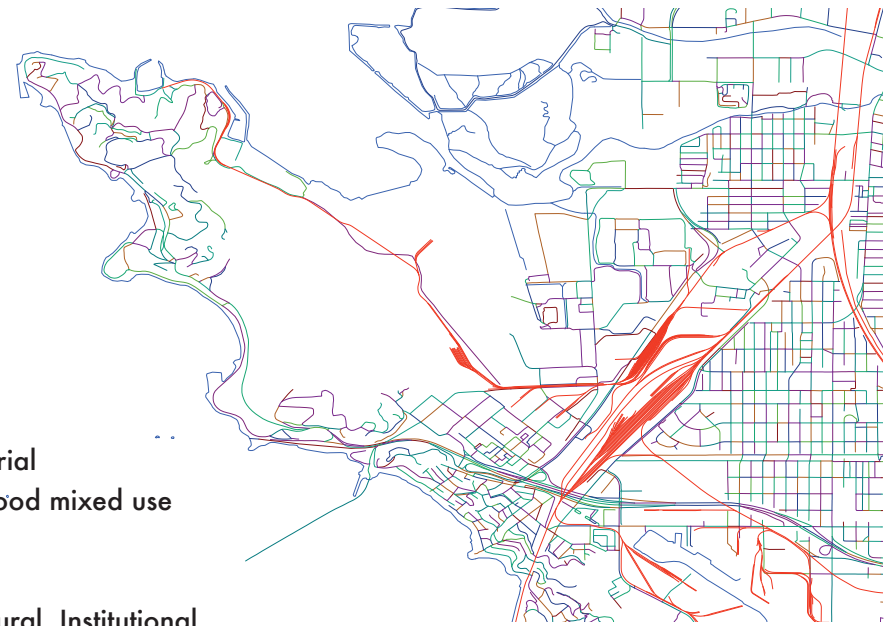
LANDUSE 2.9

Challenge: Large area of industrial use

The context of oil refinery determines the landuse of most part of the area. It is occupied for either storage purpose or process use.

Opportunity: Link between residential and green public park

The site locates in between a neighborhood and an existing park, both of which ensure people's engagement within the area.



TRANSPORTATION 2.10

Challenge: Lacking access to the site

There's only one road that directs to the site, and it is in a bad condition. Pavement is cracked and it has many holes in it.

Opportunity: A busy terminal

It serves as a major transportation terminal between Richmond and San Rafael as well as between the Bay Area and places overseas.

SITE HISTORY - OIL REFINERY

BEGINNING



the Pacific Coast Oil Company made it a refinery factory based on an abandoned farm house.

GROWTH



In World War I and II, it became an important source of for machines like trucks and tankers. Production was shifted to fuel and other products to meet military needs

MODERNIZATION



The refinery was transformed to produce higher-value, higher-volume fuels and lubricating oils. New development calls for reducing air emissions and waste, treating water, and preventing oil spills.

PRESENT



People protested for environmental justice and better environment.

SITE HISTORY - CASTRO POINT

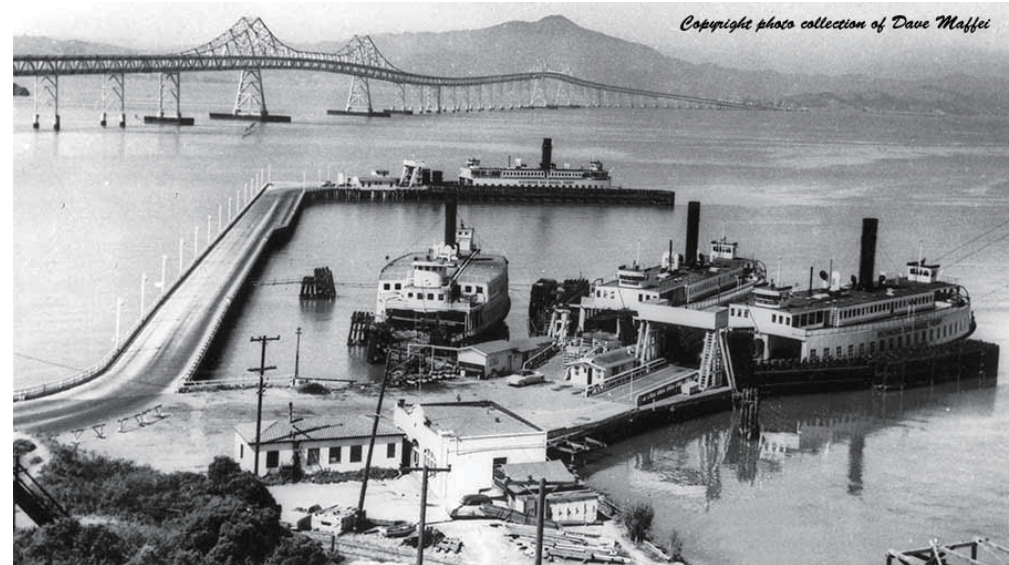


2.19

Castro Point was once the east shore landing for the Richmond-San Rafael Car and Passenger Ferry that crossed the San Pablo Bay. Ferries ran continuously from point Castro to San Quentin Point until 1956, and then the Richmond - San Rafael Bridge was built to connect Marin County to Contra Costa County and the East Bay.

Now the remains of the ferry terminal and pier are crumbling away below the bridge, and a collection of sunken hulks lurk off the pier and the shore. Those were part of an effort to create a breakwater for the Red Rock Marina, an operation that replaced the former ferry terminal area, and also disappeared some time ago

The Site used to be the western terminal for the East Shore and Suburban Railway connecting trains from Downtown Richmond and Oakland in the past. The train went past the shoreline to transport industrial products.



2.20

ECOLOGICAL SETTING



To the north and northeast of the Project site are subtidal habitats of San Pablo Bay and coastal salt marsh areas along the shoreline of San Pablo Point.

Chevron has planted vegetation to serve a variety of purposes, ranging from operational processes, to remediation, (stabilization planting on areas of the site that are "capped" to prevent migration of subsurface pollutants), to geotechnical stabilization (hillside plantings), to aesthetics (ornamental plantings).

Landscaped areas around the Tank Farm Area include stands of previously planted trees (including eucalyptus (*Eucalyptus* sp.), Monterey cypress (*Cupressus macrocarpa*), Monterey pine (*Pinus radiata*), and revegetated areas that support a mix of native and ornamental shrub and herbaceous species.

In the Castro Cove/Chevron Richmond Refinery FINAL Damage Assessment and Restoration Plan, it is stated that "The Trustees' restoration strategy in this case is to identify and implement projects that improve the ecological function of habitats in San Pablo Bay that are not fully functional at present, and that are identical or similar to habitat injured in Castro Cove (i.e., intertidal mudflat, salt marsh, and shallow subtidal habitat). Therefore, restoration projects that were beneficial to the San Pablo Bay ecosystem were considered."

SOCIAL SETTING



INTERVIEW

According to the interview conducted around the site (mainly in the Point Molate Beach Park located in the north), people would come to this place for picnic, beach activities, and just enjoy the sun and chill.

The place has been closed until last year, and as it opened its access, few people have been starting to come. They see it as a simple waterfront park, but would also want it to be more fun.

They also complained about not having food sources nearby and they had to go all the way to central Richmond or across the bridge to get food if they didn't bring enough things with them. They expressed their willingness of getting some kinds of convenient store around the place.

SPECIES ON SITE

PLANT SPECIES



Monterey pines
Pinus radiata



Wild radish
Raphanus sativus



Monterey cypress
Cupressus macrocarpa



Wild oat
Avena sp.



Ripgut brome
Bromus diandrus



Prickly ox-tongue
Helminthotheca echioides

ANIMAL SPECIES



Rock dove
Columba livia



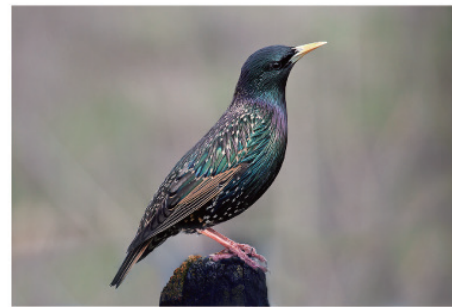
Myrtle's silverspot butterfly
Speyeria zerene myrtleae



House sparrow
Passer domesticus



Short-eared owl
Asio flammeus



Sturnus vulgaris
European starling



Bumblebee scarab beetle
Lichnanthe ursina



CONSTRAINTS

- **Bad public access:** The site is currently very isolated from the public. The only way to get in there is to go along HW 580 and exit to a narrow road called Stenmark DR. It is not connected to the Point Molate Beach Park on the north, which has already been developed into a nice public space and people can hardly travel between the two areas because of the overwhelmed bushes and tree branches. The condition the roads should also be improved. Most of them are cracked, and partially filled with dirt and water. This can be a bad experience for travellers and should be fixed as the design goes.
- **Lack of wildlife habitat:** The industrial areas include structures, roadways, and paved surfaces that provide little to no habitat for plants or animals. While in theory some urban- adapted birds could make use of structures for roosts or other purposes, the high and constant amount of disturbance involved with operations, in addition to the large continuous areas lacking in vegetation and associated food resources, and the numerous barriers to movement are likely to dissuade even occasional use by wildlife. Restored areas with mixed ornamental and native plant species have low overall wildlife habitat value, but may provide limited shelter, foraging opportunities and nesting sites for common, disturbance-adapted songbirds, reptiles and rodents such as rats, mice, voles, and gophers.
- **Lack of recreational activity options:** Although the site is at a good location for ocean view, it is not providing any recreational facilities at this point. Rarely anyone would come for visit as there is nothing to do here besides looking at the ocean.
- **Unclean wastewater discharge:** The retention pond on site is functional by collecting extra wastewater and stormwater from the tank farm and let pollutants settle down before discharging them to the bay through pumping. But the process takes a long time and there's no guarantee for the quality of the treated water.

OPPORTUNITIES

- Close to the ocean: The waterfront setting gives it a nice natural view from the site. Water really provides multiple possibilities for development.
- Existing green cover: The place is already covered with many trees, shrubs and weeds, which has created a forest feeling.
- Close to the existing Point Molate Shoreline Park: Visitors will have more space to explore and enjoy in this area.
- Interesting landform: The complicated topography gives more varieties in plant selections and activities types.

VISION & GOALS

The design aims at envisioning the future development of a piece of land next to the tank farm area. It is seeking design solutions to improve the ecosystem by providing more wildlife and plant habitats, as well as enhance people's outdoor experience by providing more interesting landscape and recreational activities. At the same time, it will appreciate the industrial landscape and encourage people to learn more about the history of this place.

BIG IDEA

The design reflects to the history of the site and reinterprets the land's relationship with the abandoned railroad, old wharf and the existing oil refinery tank farm. The site's industrial heritage is celebrated in an environmental framework of regenerating salt marsh and constructed wetlands and a social framework of applying simple contemporary structures to retain the visual and cultural prominence.



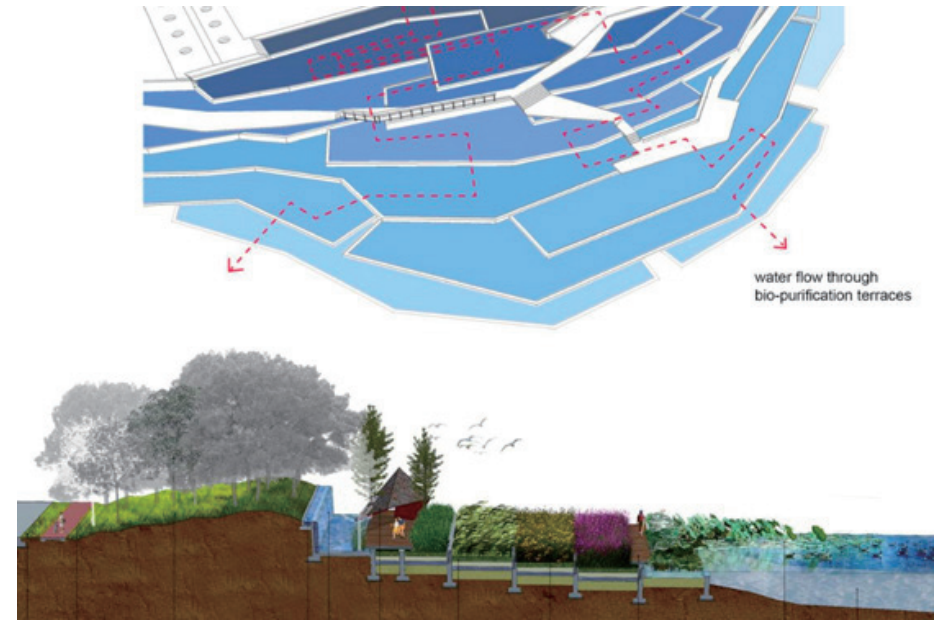


CASE STUDY

INSPIRATION - Houtan Park



3.1



3.2



3.3

This project was designed to reconstruct coastal habitat.

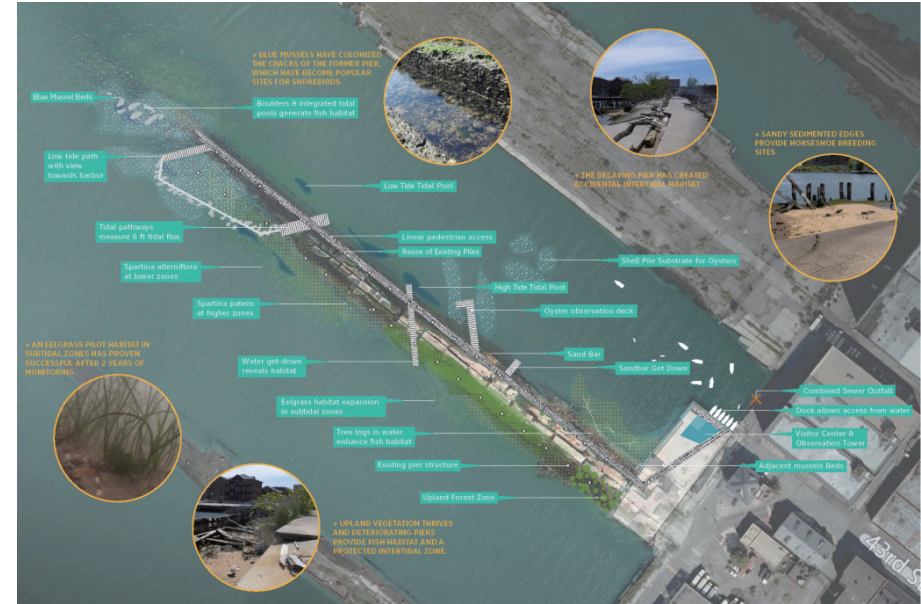
Built on a brownfield of a former industrial site, Houtan Park is a regenerative living landscape on Shanghai's Huangpu riverfront. The park's constructed wetland, ecological flood control, reclaimed industrial structures and materials, and urban agriculture are integral components of an overall restorative design strategy to treat polluted river water and recover the degraded waterfront in an aesthetically pleasing way.

Overlapped in the matrix of ecologically regenerated landscape are layers of agricultural and industrial past of the site and the future of the postindustrial ecocivilization. The park builds up a living system where ecological infrastructure can provide multiple services for new ecological water treatment.

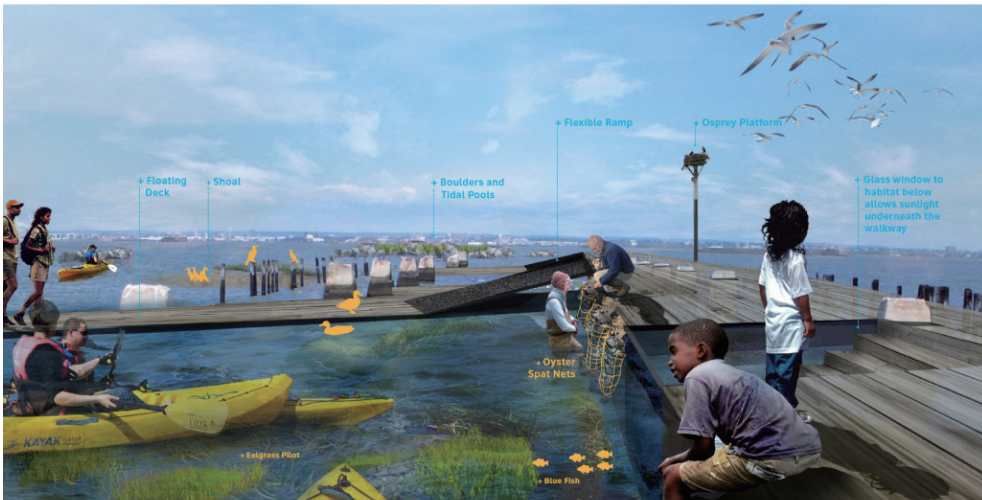
INSPIRATION - Deconstructed Salt Marsh



3.4



3.5



3.6

This project was designed to reconstruct coastal habitat.

It created a safe place for recreation, learning and monitoring on an existing coastal habitat that has already started to establish itself. The Pier is currently in a state of decay and has fallen into the water, generating an "accidental" inter-tidal habitat, which is rare in an urban context. The Deconstructed Salt Marsh proposal explores the opportunity to repurpose an existing yet collapsed pier as a learning laboratory for waterfront habitat and as a tool to generate civic engagement that will serve jointly as a host for science experiments for local ecologists. Besides creating a biological habitat, it also evolved a "soft edge" in the urban shoreline infrastructure, which is recognized as an important demonstration of dealing with rising currents and climate change.

INSPIRATION - Freshkills Park



3.7



3.8



3.9

This project was to redesign a landfill and improve its ecology.

The Freshkills Park Alliance supports the transformation of the Fresh Kills Landfill into an extraordinary 2,200 acre urban park that will be a model for sustainable waterfront land reclamation, a source of pride for Staten Island and New York City, and a gift of open space for generations to come. By transforming a landfill into a vast green space full of wildlife, this place is able to support multiple activities such as horseback riding, mountain biking, nature trails, kayaking, and large-scale public art. Demonstrating the role of wetland buffers in battling rising waters, Fresh Kills absorbed a critical part of the storm surge during Hurricane Sandy. With the help of advanced landfill gas collection infrastructure throughout the area, methane is actively harvested from the decomposing waste, providing enough gas to heat 22,000 homes.

INSPIRATION - BP Oil Park



3.10



3.11



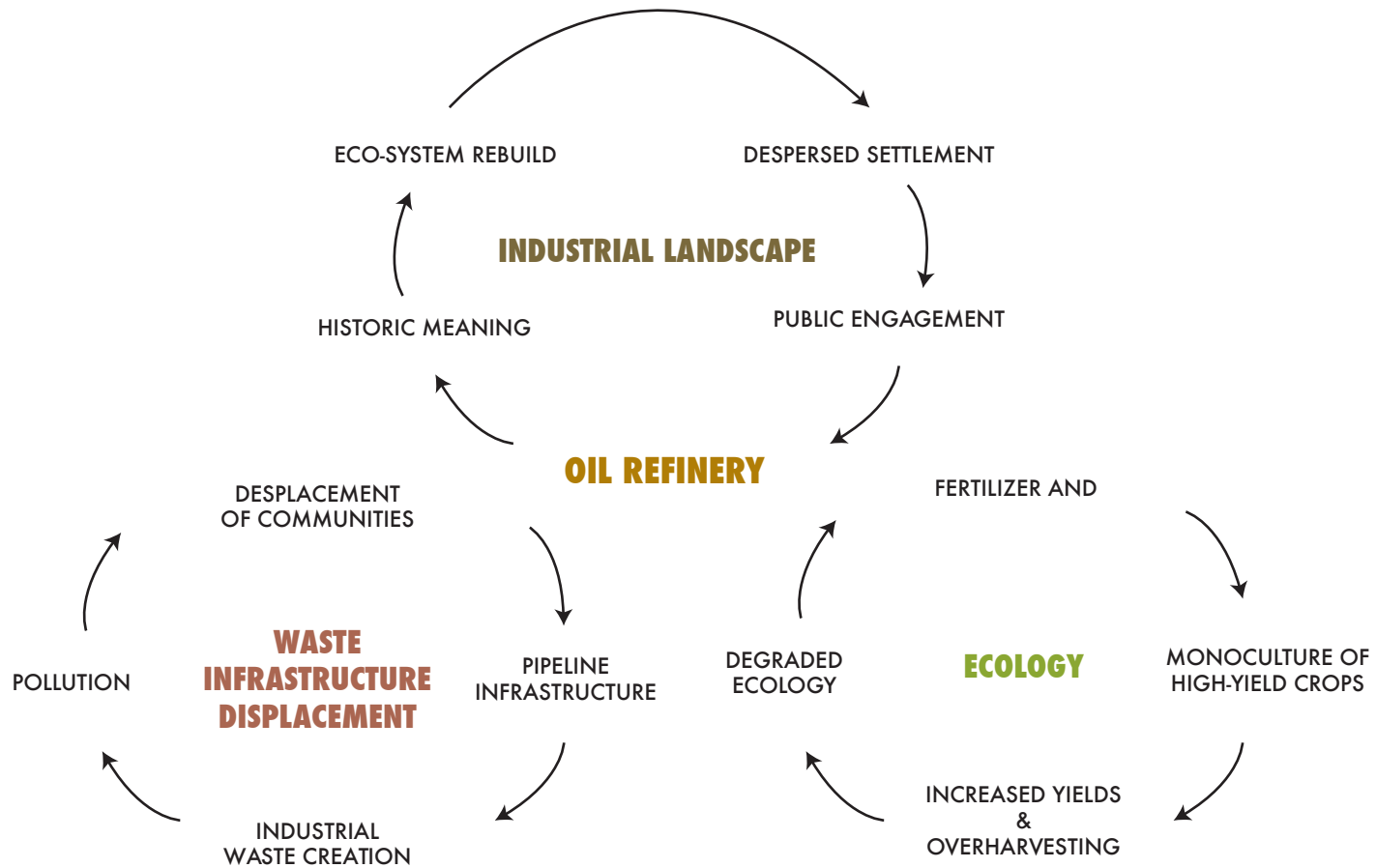
3.12

This project was to design an abandoned tank farm to a park.

The site has emerged from its polluted past to become a contemporary post industrial harbour front park. In its' former state, 31 oil storage tanks and ancillary facilities stood on massive concrete platforms carved from the sandstone bedrock. As a consequence of remediation to remove contamination, many industrial structures were demolished leaving behind dislocated historic fragments. The design reconnects these resilient fragments, then contrasts them against simple contemporary structures to retain their visual and cultural prominence. The site's industrial heritage is celebrated in an environmental framework of regenerating bush land and constructed wetlands. Viewing decks and walking platforms float over the dramatic sandstone cliff cutting's whilst concrete and steel stairs wrap over and around the topography.



DESIGN



MASTER PLAN



DESIGN THEME

- Wharf
- Railroad
- Refinery

salt marsh

walking pathway

water activity supply rental

seatings

memorial structure

picnic area

food trucks

shade structure

shade structure

viewing platform

memorial structure

salt marsh

4.1

parking lot

DESIGN COMPONENTS



4.2

Ecological:

Habitat restoration and resiliency:
Salt marsh

Green infrastructure:

- Layering retention pond
- Constructed wetland

Social:

Historic:
Railway food truck
Memorial structure in tank shape:
open space/vegetated area

Education:
Shade structure

Recreational:
- Grass sliding
- Kayaking
- Viewing deck.
- Walking trail
- Picnic tables and seatings



4.3

Layering Retention Pond and constructed wetland: Extra ponds are created around the existing pond to capture water and further clean it.



4.4

Salt Marsh: This wetland plant community that occurs sporadically along the shoreline can provide few terrestrial animals habitats.



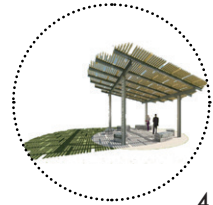
4.5

Memorial Structure: Mimicing the shape of oil tanks, this structure is given a sculptural meaning of "memorial". It reminds people's of the old industrial part about oil refinery.



4.6

Kayaking: This activity in here does not only have a recreational purpose, but also reflects the past of the water transportation using ferry.



4.7

Shade Structure: This is built as a gallery for displaying history of the Castro Point as well the Chevron Oil Refinery.



4.8

Food Truck: Located along the abandoned railway, these food trucks reflect to the memory of trains passing by.



4.9

Walking Trail: A bay trail along the shoreline will engage more public access and activities for people. It is connect the existing bay trail within the San Francisco Bay Area.



4.10

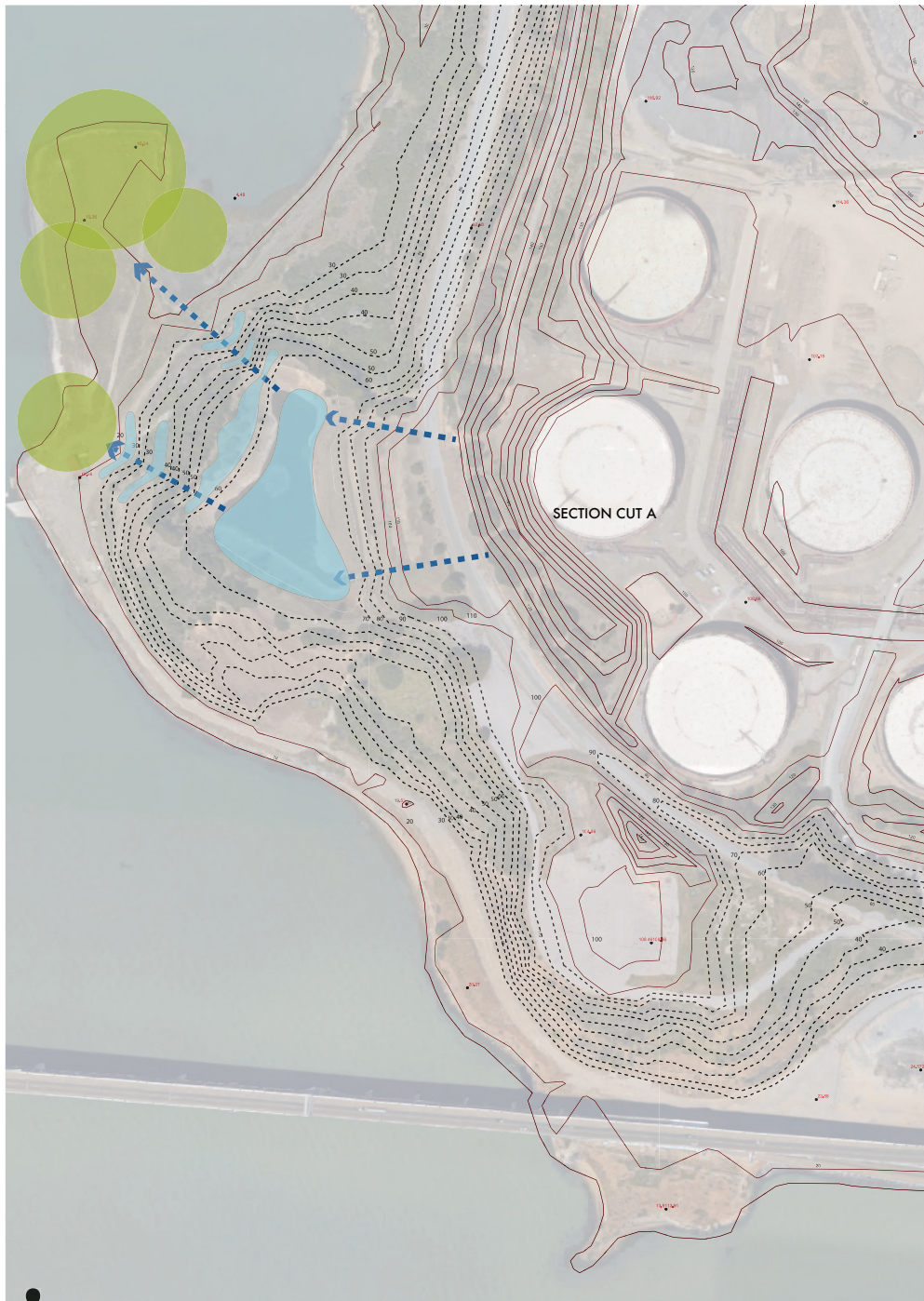
Viewing Deck: a viewing deck is built on the highest point of the site. People can go up to the platform through a staircase to get a glance at the tank farm on the east, and also the ocean view on the west.

TOPOGRAPHY DESIGN



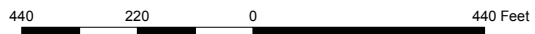
EXISTING

4.11



PROPOSED

4.12



WATER MANAGEMENT - EXISTING POND CONDITION

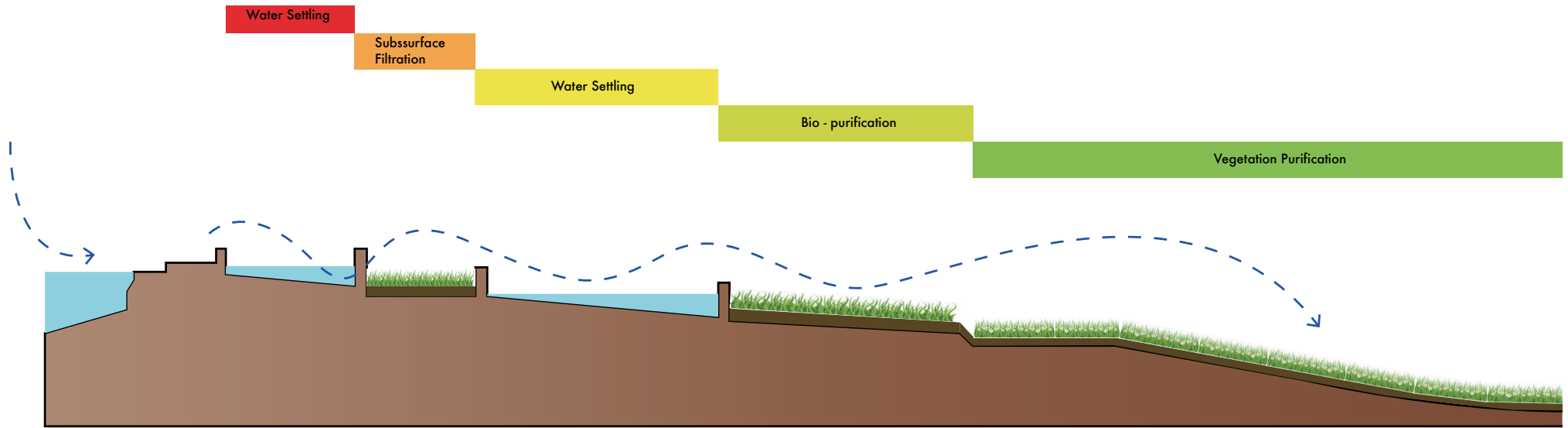


Retention Pond

The 9-Basin Stormwater Pond is used to capture stormwater leaving the facility, to prevent potentially polluted stormwater from discharging into the San Francisco Bay. The 9-Basin is an earthen basin that treats stormwater by physical settling. Once compliance with their effluent limits are confirmed, the facility performs a valve-controlled gravity discharge into the bay.

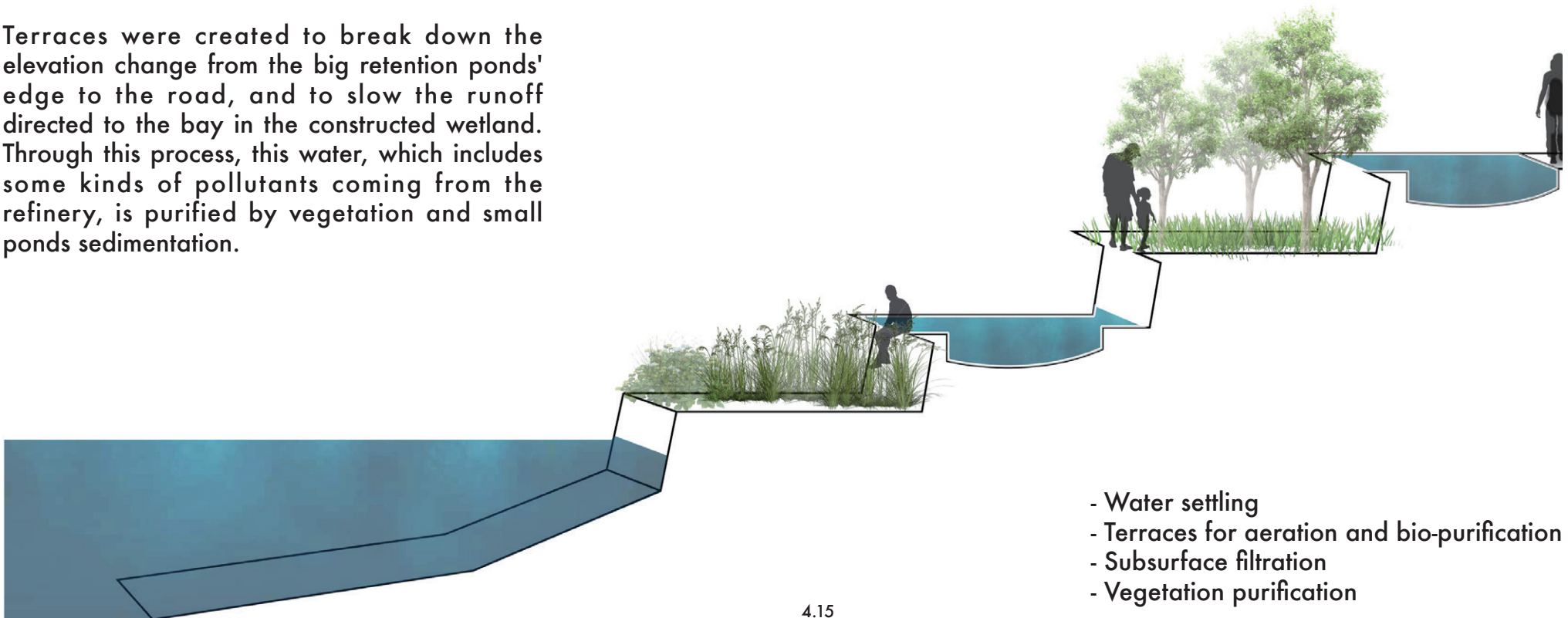
Occasionally, 9-Basin also discharges non-stormwater, including residual water from steam traps, fire protection system water, and hydrotesting water.

WATER MANAGEMENT - LAYER SEDIMENTAL ON TERRACE



4.14

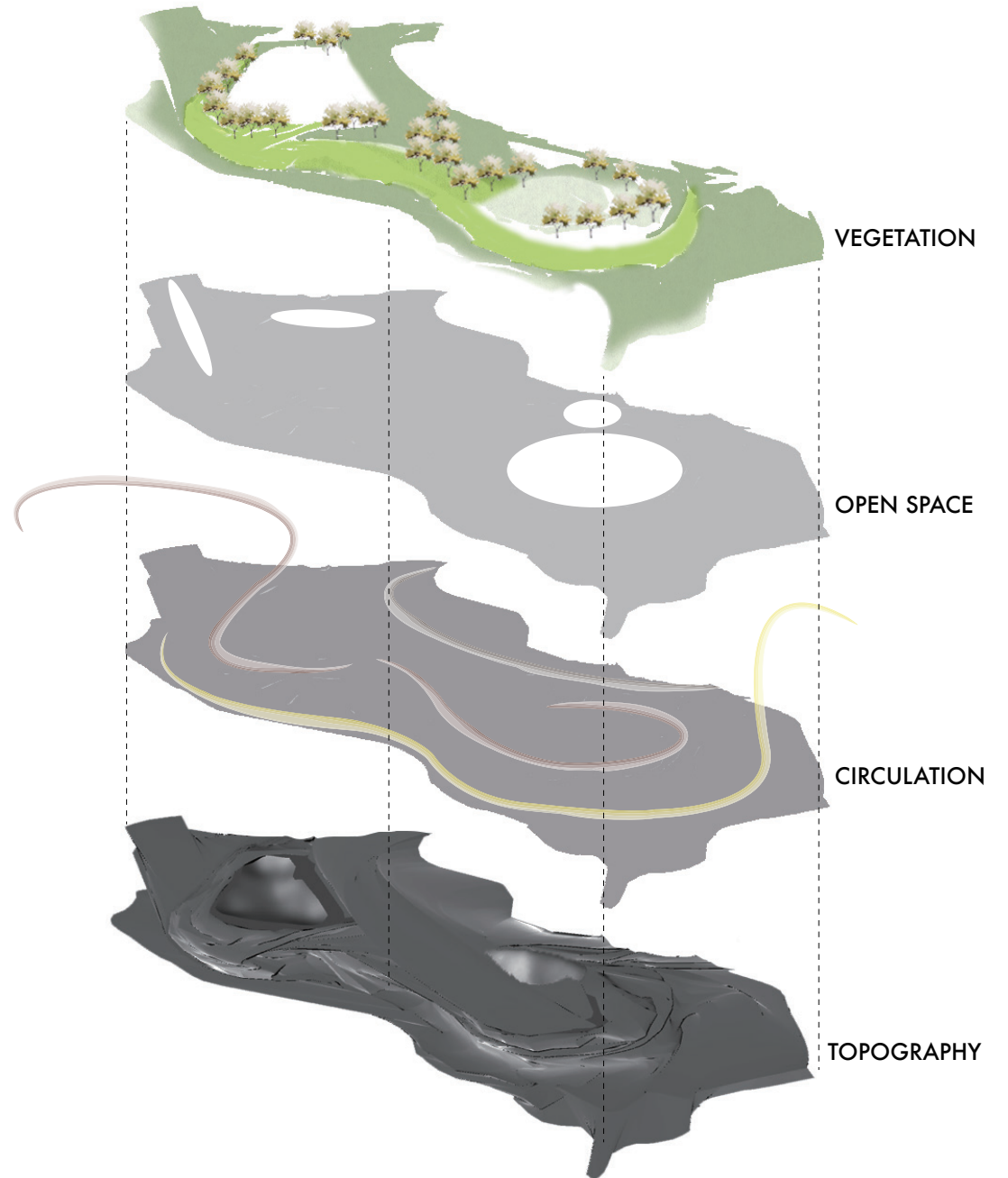
Terraces were created to break down the elevation change from the big retention ponds' edge to the road, and to slow the runoff directed to the bay in the constructed wetland. Through this process, this water, which includes some kinds of pollutants coming from the refinery, is purified by vegetation and small ponds sedimentation.



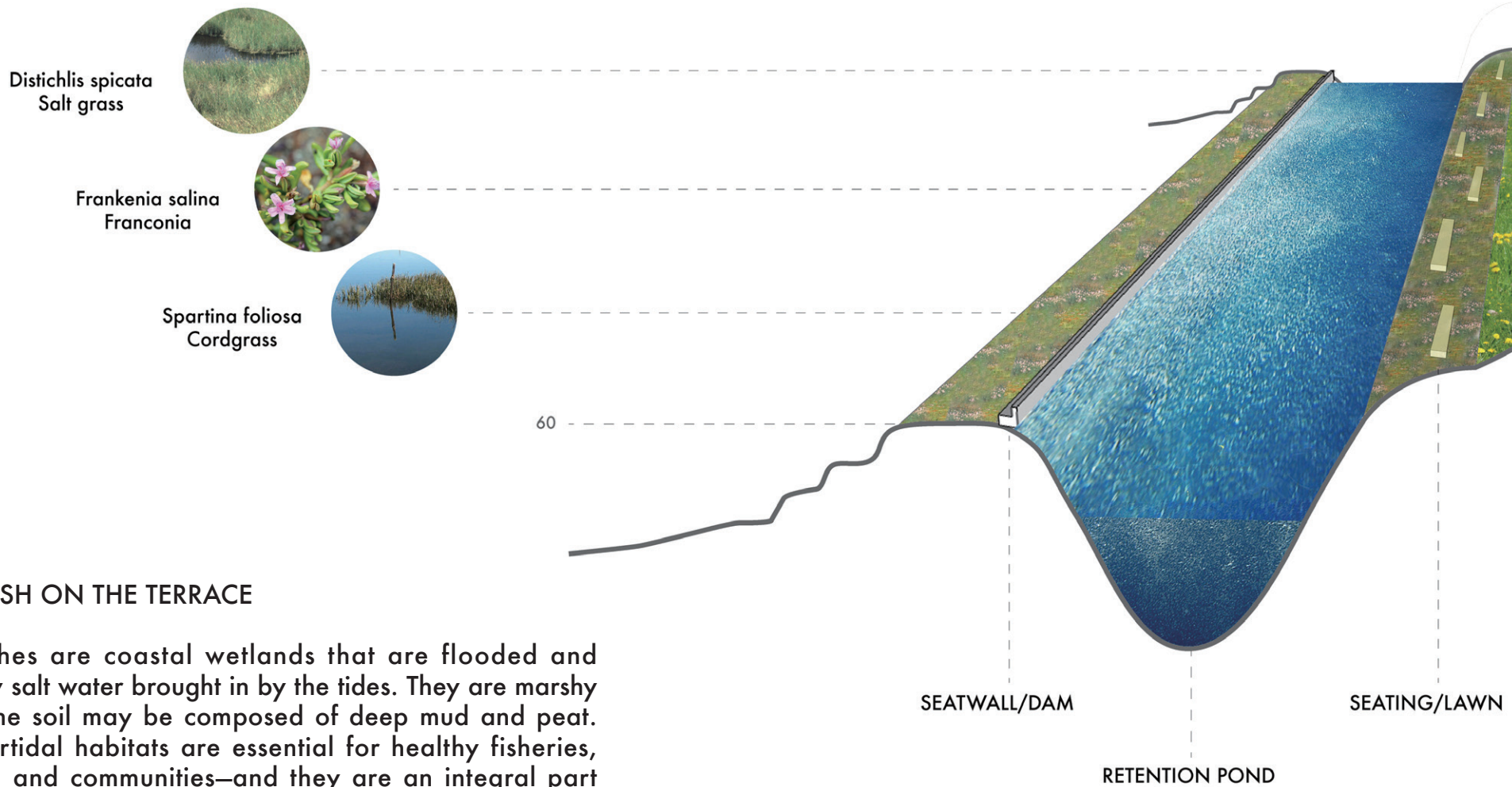
- Water settling
- Terraces for aeration and bio-purification
- Subsurface filtration
- Vegetation purification

4.15

SYSTEM BUILDUP



SECTION



SALT MARSH ON THE TERRACE

Salt marshes are coastal wetlands that are flooded and drained by salt water brought in by the tides. They are marshy because the soil may be composed of deep mud and peat. These intertidal habitats are essential for healthy fisheries, coastlines, and communities—and they are an integral part of our economy and culture. They also provide essential food, refuge, or nursery habitat for more than 75 percent of fisheries species, including shrimp, blue crab, and many finfish.

Salt marshes also protect shorelines from erosion by buffering wave action and trapping sediments. They reduce flooding by slowing and absorbing rainwater and protect water quality by filtering runoff, and by metabolizing excess nutrients.

4.16



FLOWERY LAWN

PICNIC AREA

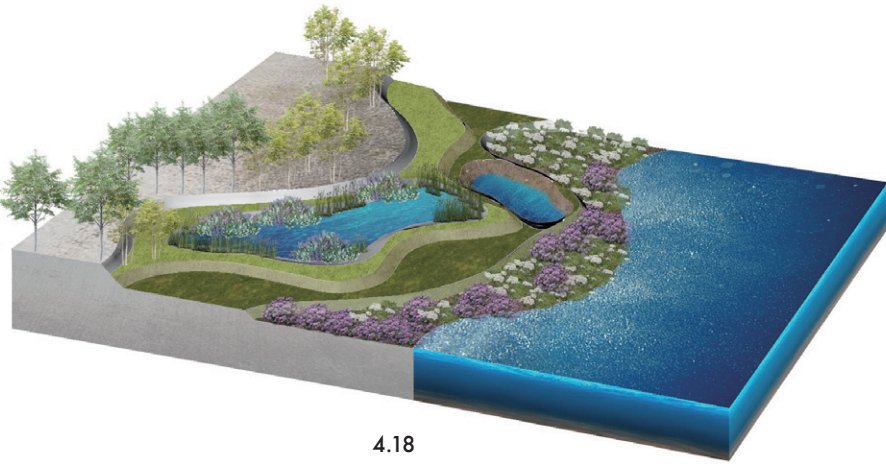
STENMARK DR

OIL TANK FARM

RETENTION POND

Retention ponds can be very effective in removing suspended solids, organic matter and metals through sedimentation, as well as removing soluble pollutants like dissolved metals and nutrients through biological processes. In landscape design, retention basins become part of a multi-use system, which encourages the design of retention ponds as an aesthetic part of a naturalized environment or to be expanded to include passive and/or active open space. Within each scenario, the retention basin can begin to define itself as more than just a drainage facility.

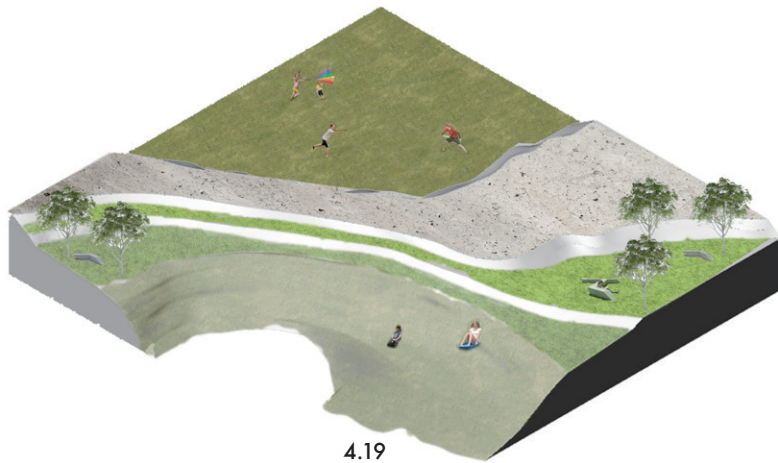
VISIONS OF DESIGN



4.18

LAYERED POND SYSTEM

This restorative design strategy treats polluted river water and recovers the degraded waterfront in an aesthetically pleasing way.



4.19

HILLSIDE ACTIVITIES

The big lawn area provides people with multiple recreational options. Climbing, grass sliding, kayaking and viewing deck, are all great activity choices.



4.20



4.21

PERSPECTIVES - 01



4.22

PERSPECTIVES - 02



4.23

CONCLUSION

This is going to become a nice public space that integrates ecological and historical elements of the place in the future.

THANK YOU

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LIST OF FIGURES

Introduction

1.0 Coolidge, Matthew, and Sarah Simons

1.1 Lucy Wu

Site Analysis

2.1 Lucy Wu

2.2 Lucy Wu

2.3 Lucy Wu

2.4 Lucy Wu

2.5 Lucy Wu

2.6 Lucy Wu

2.7 Lucy Wu

2.8 Lucy Wu

2.9 Lucy Wu

2.10 Lucy Wu

2.11 Richmond Confidential

2.12 Chronicle Staff Write

2.13 Anastasia Ustinova

2.14 Jacob Soiffer

2.15 Chevron Richmond

2.16 Chevron Richmond

2.17 Chevron Richmond

2.18 Chevron Richmond

2.19 The Point Richmond History Association

2.20 The Point Richmond History Association

2.21 Lucy Wu

2.22 Lucy Wu

2.23 Rod Allday

2.24 Milt McAuley

2.25 Summitcheese on Flickr

2.26 Jan Samanek

2.27 Carol W. Witham

2.28 Whiteway

2.29 Stan Wojick

2.30 Fred Pelsy

2.31 David Kelly

2.32 Leandro Herrainz

2.33 Evgeny Komarov

2.34 Bill Bouton

2.35 Lucy Wu

Case Study

3.1 Turenscape

3.2 Turenscape

3.3 Turenscape

3.4 SCAPE

3.5 SCAPE

3.6 SCAPE

3.7 James Corner Filed Operations

3.8 James Corner Filed Operations

3.9 James Corner Filed Operations

3.10 Mcgregor Coxall

3.11 Mcgregor Coxall

3.12 Mcgregor Coxall

Design

4.1 Lucy Wu

4.2 Lucy Wu

4.3 Turenscape

4.4 Ben Kimball

4.5 Mcgregor Coxall

4.6 Kailua Beach Adventures

4.7 Historic Fourth Ward Park

4.8 Michael Sykes

4.9 Atelier Christine

4.10 Safari Guide Africa

4.11 Lucy Wu

4.12 Lucy Wu

4.13 Lucy Wu

4.14 Lucy Wu

4.15 Lucy Wu

4.16 Lucy Wu

4.17 Lucy Wu

4.18 Lucy Wu

4.19 Lucy Wu

4.20 Pinterest

4.21 Pinterest

4.22 Lucy Wu

4.23 Lucy Wu