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BIOREMEDIATION & LANDSCAPE ARCHITECTURE

Can We Apply Bioremediation to Landscape Architecture Practice to Rebuild Communities?

Kennedy Wells



First, I would like to thank my faculty advisor, Brett Milligan, for all the guidance through this process, feedback and support throughout this entire project. I appreciated you being my sound board and helping me figure out what heck I was doing.

Thank you to Elizabeth Boults and Corey Park for the additional guidance and keeping our spirits up every Monday and Wednesday. I don't know what I would have done without those morning exercises.

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Matthew for being the basic white boi that have always wanted to be #mylittlesugaontheside

Id also like to thank those that work at the CSO (Julian, Jessica, and Chris) for distracting me and feeding me.



The purpose of my project is to create a design that articulates the processes of bioremediation and a larger interim design and use for Treasure Island in San Francisco during remediation. Treasure Island suffers from many complex environmental problems due its prior use as a military facility. Many of the sites on the island are plagued with nuclear radioactive material, petroleum, heavy metals and chloroethenes. The project is motivated by my desire to explore bioremediation as a viable method to clean-up the radioactive material on the site and how landscape architecture can phase in redevelopment as the island undergoes decontamination. My methods are based on a synthesis of extensive case studies to determine which theoretical approaches could best be applied to this site. Bioremediation practices are based on three different organisms: bacteria, fungi and plants. My initial findings have led to the creative potential and limitations of bioremediation and that the complexity of the problem of Treasure Island lies in the growing threat of sea level rise. The significance of this project is its application to improve the condition of other degraded environments rather than abandoning the landscape or developing a contaminated site without fully understanding the implications of its toxicity.

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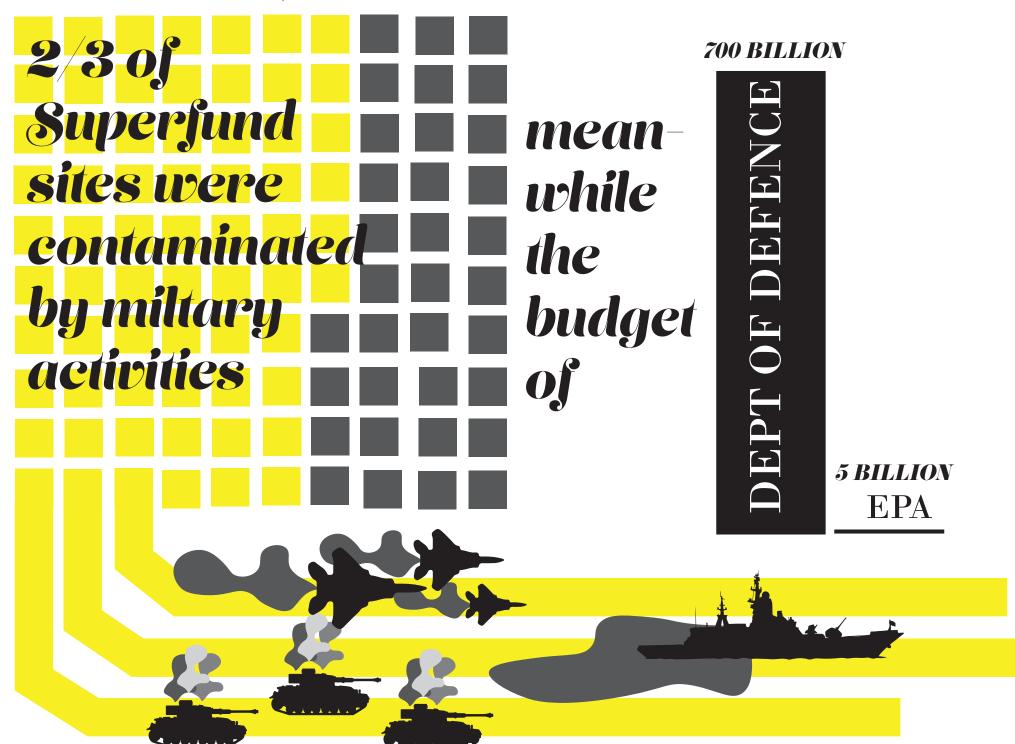
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MILTARY CONTAMINATION

The Pentagon has stated that the problem of cleaning up toxic hazardous waste sites at military facilities is its "largest challenge."(Wegman, Bailey 1994) So much so in 1993 President Clinton proposed a 5 year 5 billion clean up program to help the pentagon meet this challenge. However due to a political change in congress this funding was curtailed leaving huge delays in cleaning up such sites or even the abandonment of such sites. Being that the current budget of the military is 716 billion for national security, \$686 billion for the department of defense, one would think that there would be a bit of money towards cleanup the pollution created by the military. (Department of Defense 2018) But because the military clean ups have been put under the responsibility of the EPA, that's current budget is only 8 billion dollars and slowly declining, It makes it quite difficult to clean up these sites. (U.S. Environmental Protection Agency 2017) At military bases, contamination is

often hidden from view of military members serving there. With the exception of Camp Lejeune in North Carolina, neither the Department of Defense (DOD) nor the Department of Veterans Affairs (VA) has been required to notify service members or veterans that they were exposed to dangerous toxins as part of their military service. The health impacts of heightened exposure to environmental toxins are unclear, but some studies have shown a higher incidence of certain cancers among veteran populations.5 Localized concentrations of illness are particularly common around several military communities known to have environmental toxins. (Hamilton 2017)

Furthermore, after these sites are given back to the city for civilians to live there. they often can be not remediated and still highly contaminated. This leads to generations of people negatively affected by the contaminates.

By not addressing contamination you are making things worst. This project

addresses the contamination in a way that goes through the For example, in Madison Indiana, Jefferson Proving ground was once a facility that served as a major weapons testing facility for the army resulting in densely contaminated proving grounds. Due to high costs of cleaning it up, a total of 13 billion, The army were considering to declare it a 'national sacrifice zone' and walling up one hundred square miles from virtually all human contact. However, they neither cleaned the ground nor walled it off leaving many residents exposed the uranium contaminating the soils. The number of these sites increases throughout the years with new types of warfare and technology. These sites are accumulating throughout the world and are unusable due to the contamination. Each generation passes these contaminated sites to the next expecting the responsibility to either fall on either time or the next generation. Letting these sites remain fallow only increases the risks of spreading contamination to communities or continues to endanger communities.

FIGURE 1 (Left Top)
Budget of Department of Defence and EPA

FIGURE 2 (Left Bottom)
Graphic of the number of superfund sites.



For a lot of these sites, the contamination is so extensive it, the technology does not exist for saving these sites. However, new innovations have made remediation possible and with the correct type of remediation, cleanup is possible. Bioremediation can be a solution as it deals with the contamination on site and in a way that does not further negatively affect the environment. Bioremediation cleans the area by removing the contaminate completely by changing it into something not as lethal, or by making the contaminate removable by making it soluble. When it comes to radiative contaminants. currently, there is no solution to de-radiating radioactive material besides waiting for it to decay through time. Being that the half-lives of these materials can be a few seconds to thousands of years, this can pose a serious long-term problem when trying to develop these areas. This leads to radiated areas such as Chernobyl

and Fukusima being simply abandoned. However, by moving the waste elsewhere frees these communities from radiation. The current standard solution for radiated material is removal and protected storage. This works for small remediation sites but for sites of larger scales this can be too intensive to remove all the material or to cap it. Thus, many scientists have been working on a way to extract the radioactivity without all the of the material. By utilizing bioremediation, the contamination can be isolated and reduced in volume as with bioremediation you can extract the contaminate rather than removing all the soil. My experiment explores the possibility of remediation low radiation impacted communities in a way that engages the public and makes them aware of the impact of low radiation but also makes way for a new community.

FIGURE 3 (LEFT)

Cars of Fukishima by Polish journalist Arkadiusz Podniesinski Residents who were unable to take their vehicles simply abandoned them on the



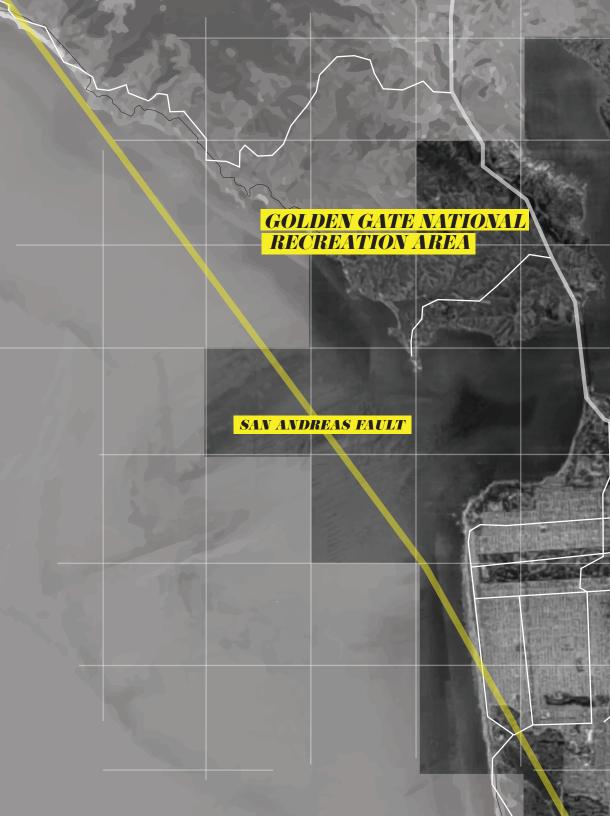


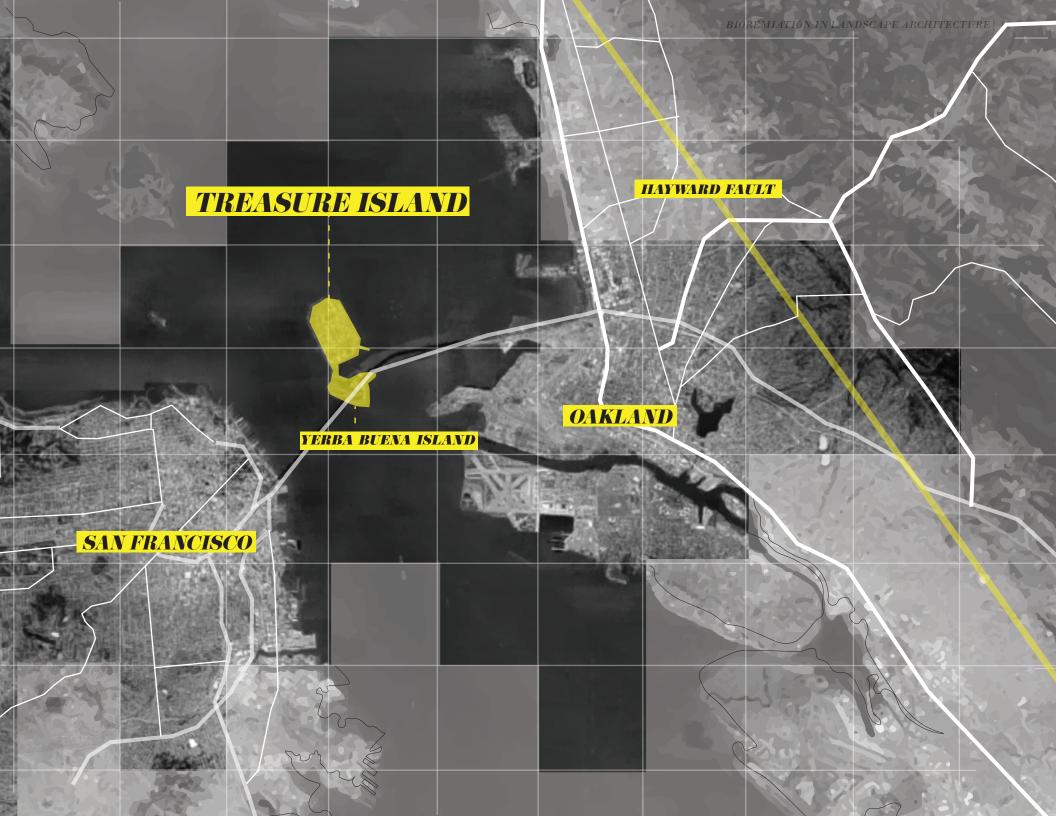
TREASURE ISLAND

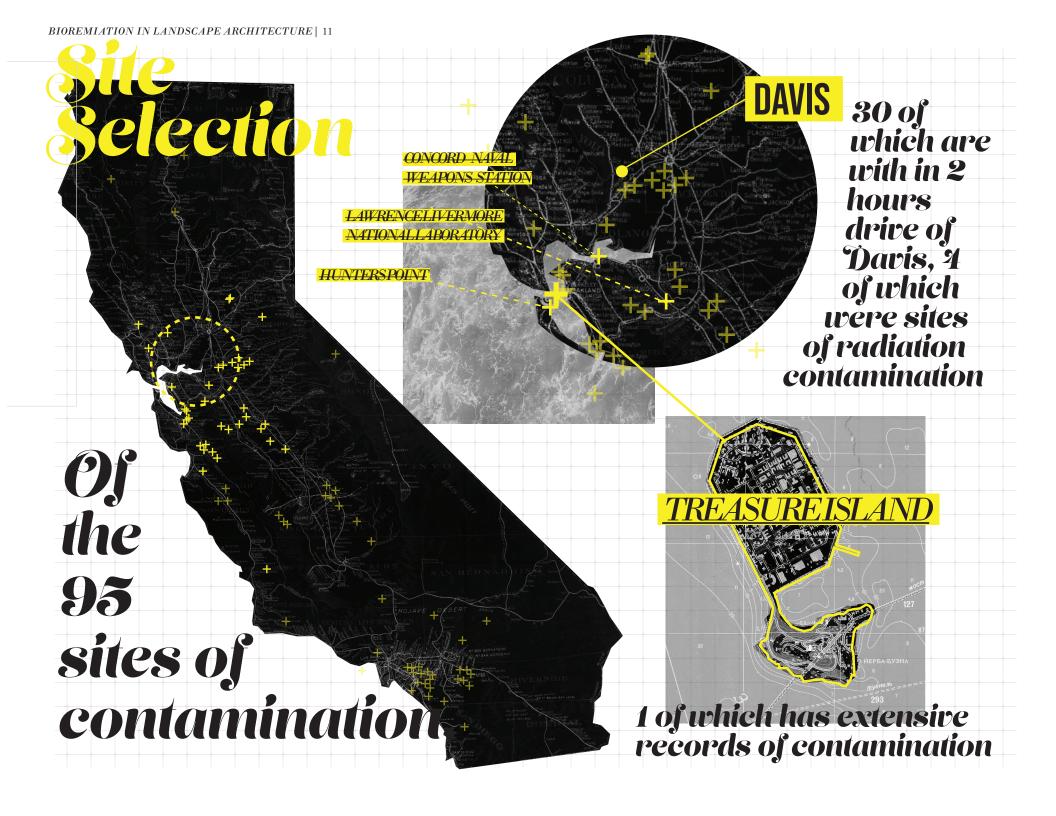
Treasure island is a manmade island covering approximately 403 acres of the bay 3 miles east of San Francisco. It was create by filling in the yerba Buena shoals and sand spit with 25 to 50 ft of dredged material composed of miscellaneous bay sands and muds. The Island essentially flat with the highest elevation being around 12 feet. Because of the island consists of mostly sandy material and the proximity to the Hayward and San Andreas faults, it is highly susceptible to violent ground shaking. An earthquake of around 6 on the Richter scale on any of the nearby fault lines could cause liquefaction. The ground water exists depth of between 30 and 72. The ground water are at depth of between 30 and 72 inches. The weather is moderate with highs between 56 F to 72 F and lows 43 F to 56 F. The winds are mostly westerly.

FIGURE 4 (LEFT)

Treasure island in the surrounding Bay Area.



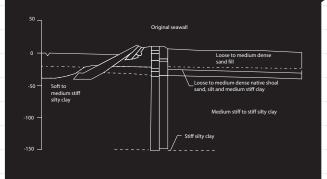




Location of highest rate of sediment subsidence?

SEDIMENT SUBSIDENCE

This section of Treasure Island has been determined as being one of the fastest sinking areas in the bay area. Below is a section of the Northwestern Corner of the island.



Known location of contamination?







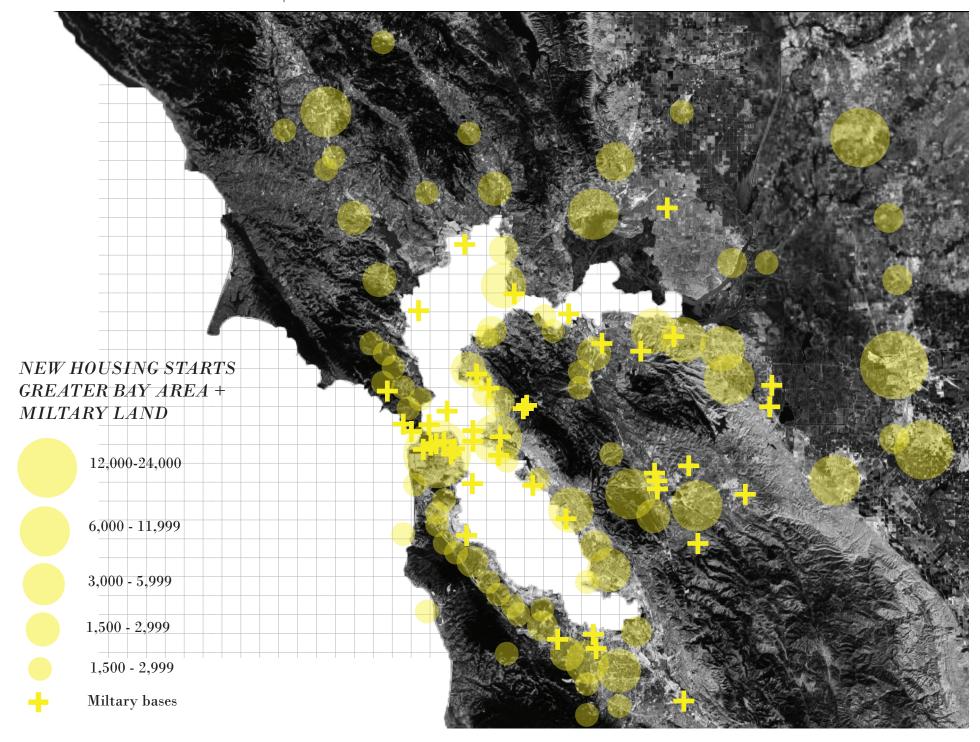
SWDAB

USS PANDEMONIUM I



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Flowchart of how specific site was found.



OVERDEVELOPMENT

It is well known that Bay Area has an overdevelopment problem. The Bay Area as a whole will need 1.1 million additional jobs and 660,000 new housing units to accommodate an estimated 2.1 million more people who will move to the city by 2040. To meet the demand for new residential and development, companies have turned to postmilitary properties especially one that have the potential to the have the luxurious view that would bring in money. Since 1995, there have been 3 tech booms San Francisco median income has be skyrocketing upwards These tech bubbles have brought in investment and venture capital into local companies, that inturn increased stock values especially effected a market of 6 figure salaried twenty somethings which has in turn made the entire bay area into one of the hottest housing markets. Meanwhile, middle class family have been moving out of the city in droves landing themselves in the suburbs of Oakland, Daly city and even as far out as the central valley.

Throughout time, many of these spaces have been left to rot due to excessive cleanup. However, due to the lack of knowledge of the level contamination of these sites has led to many cases serious health problems for occupants. Research on how to clean up with these sites is dealing with several generations of these issues of letting sites like this just rot. Because most of these sites have been out of the way of development, even the highest levels of contamination has not been an issue. Now that the bay area is a great need for new real estate, these brownfields are attractive for development despite their contaminated state. In some of the worst cases, these sites developed already. These developments tend to be low income and the negative effects of living in proximity to contamination has already been down. Now, many of these sites have been exposed as contaminated that has given developers excuse to relocate people.

FIGURE 6 (LEFT)

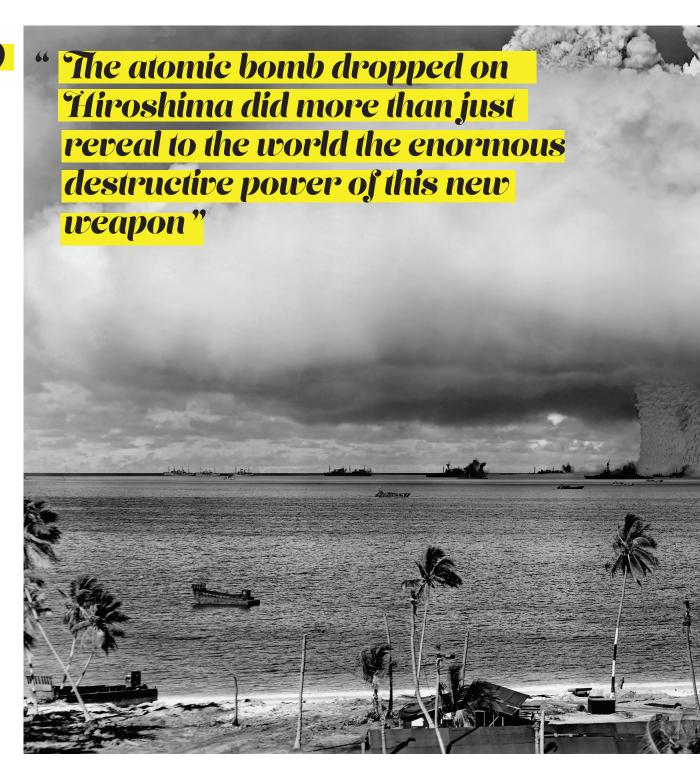
Development vs Miltary Bases This map shows the Bay Area hosuing starts, 2000-2010 by Richard A. Walker and Suresh k Lodka. and the locatons of Miltary bases in the Bay Area.

MILTARY AND THE ATOMIC BOMB

The military's presence in the bay has prevalent since the 19th century with the Spanish. (Dillion 2017) To the US military the bay was ideal area due to the protected arbors warm waters, deep ports, numerous channels and Mediterranean climate. This also made it a great place to work and live which was a great lure to recruit new soldiers. Specifically, the island was chosen because of its central location where it could consolidate training facilities and build more permanent naval base for training. As the a naval base, treasure island was used for naval exercise and receiving station.

During World War II, instruction in "damage control" was a huge part of the naval training. As nuclear weapons became both us postwar" global dominance and new treat to natural security, a new vulnerability of us naval fleet became apparent. The effects of Hiroshima and Nagasaki showed the raw power of atomic bomb and how it could seriously devastate "traditional" forms of warfare. The military thought it necessary to test Nuclear bomb on the rest of the military's fleet. In Bikini Atoll, Army-Navy joint task force took 242 ships, 156 airplanes, 42000 personnel and 5664 animals to test the material biological and environmental effects of two nuclear bombs. (Weisgall 1994)

After the nuclear bomb testing at Bikini atoll, scientists and military personnel were not prepared for damage that the bombs caused and the residual effects of the blasts. Not only did this badly damage the military equipment it hurt the people of who





were exposed to the blast as the military did not realize the reach of the radiation effects. Live animals including goats and soldiers were positioned on the ships and shore to test for the impact on living creatures. Many of the soldiers were commanded to jump into the water after detonation. All of the soldiers in this operation died of cancer (ie. most had leukemia or other rare cancers). These soldiers and their families were not compensated, given proper supports, or followed their future family members for possible genetic defects. In addition those living in the surround island were also effected by the fallout of the explosion.

FIGURE 7 (Above)

USS Independence (CVL-22)

View of the ship's port quarter, showing severe blast damage caused by the "Able Day" atomic bomb air burst at Bikini on 1 July 1946.

FIGURE 8 (Left)

The "Baker" explosion, part of Operation Crossroads, a nuclear weapon test by the United States military at Bikini Atoll, Micronesia, on 25 July 1946.



SEA LEVEL RISE + SEDIMENT SUBSIDENCE

Another aspect that coastal contaminated sites must deal with is sea level rise and sediment subsidence. According to most recent studies *, the northwest corner of Treasure Island has some of the greatest rates of subsidence (>>5 mm/years) due to the fact its ~10-m-thick anthropogenic landfill is overlying>20-m-thick bay mud deposits. (Shirzaei and Burgmann 2018) Subsidence rates in the northwest of Treasure Island relative to nearby bedrock on Yerba Buena Island had decayed to ~10 mm/year by 2000 and still amounted to ~6 to 10 mm/year in our 2007-2010 data set. In these areas of recent fill emplacement, our linear extrapolation may overestimate the expected LLS in 2100 by 5 to 14%, assuming a sediment thickness of 10 to 30 m. Not only are the contaminants affecting the land, but they could start or infiltrating the ground water and tidal areas around a site. Furthermore, these contaminants

render any reutilization of resources of these abandoned sites unusable. Clean ups of the site must consider the reutilization of these materials when these sites are eventually underwater. Design must expand past what is constructed and must consider for a future environment drastically different than the current one.

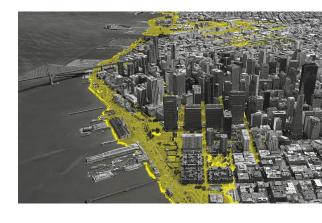


FIGURE 9 (Above) San Francisco effected by sea level rise. Illustration: Marcea Ennamorato and HyunJu Chappell // San Francisco Public Press. Edited by author.

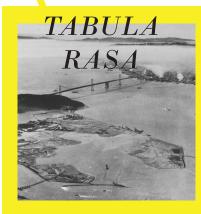
FIGURE 10 (Left) Areas effected by both sea level rise and sediment subsidence.

TIMELINE OF TREASURE ISLAND

AIRPORT

it was initially intended to be used as an airport, it was part of larger theme of the GGIE of Transportation and communication and was built along with the golden gate bridge and the San Francisco-Oakland Bay Bridge.

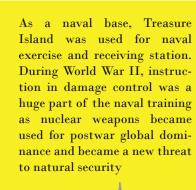


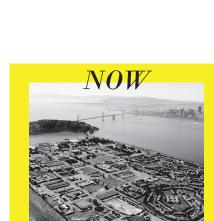


From February 11 to August 24, 1937, funded by the New Deal, treasure island was built on the "Yerba Buena Shoals." It was created by emplacing 287,000 short tons approximately 23 feet (7.0 m) of dredged bay sand filled the interior, was mitigated from salt, and then 50,000 cubic yards



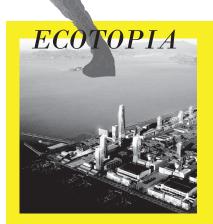
The Golden Gate International Exposition, held at San Francisco's Treasure Island, was a World's Fair celebrating, among other things, the city's two newly built bridges. The San Francisco–Oakland Bay Bridge opened in 1936 and the Golden Gate Bridge in 1937. The exposition opened from February 18, 1939 through September 29, 1940.





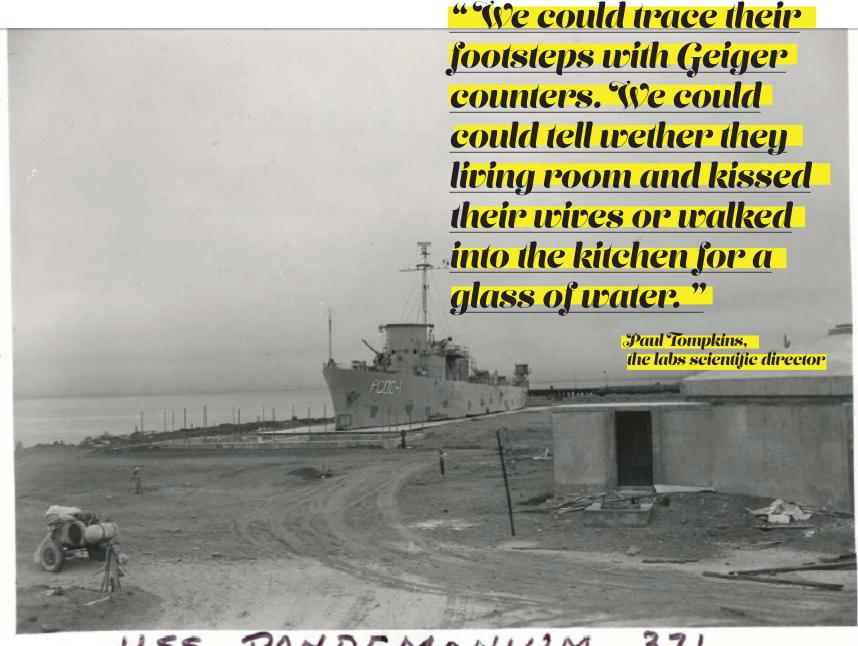
NAVAL BASE

The Island is currently in a state of dilapidation. It is home to affordable housing the Job Corps and TIDA (treasure island Development Authority. There are many wineries and 2 restaurants



2000

The future of treasure island lies in redevelopment into a multibillion dollar development. This new development is centered around sustainability which has been highly contested



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In World War II, with the creation of nuclear weapons came the consequences of their effects. Because of this, the US military had to develop ways to deal with nuclear fallout. On Treasure Island, the Navy ran various simulations that put soldiers in situations that would deal with nuclear material. In 1968, The navy created a 173-foot mock patrol boat called the USS Pandemonium built from salvage and scrap parts. (Dillion 2017) The training included with bromine-82, cesium-137 and radium-226. These exercises included using these materials and exposing them to air from their lead boxes to let the soldiers practice how to detect radiation. Some these exercises included pouring the radioactive material on the deck and letting it seep into the nooks and crannies of the boat. This then transitioned into becoming a boat that they would training soldiers how to decontaminate.

Another example of the evolution of radiation safety standards starts with a 1974 memo. Navy safety inspectors ordered that a plastic bag full of glow-in-the-dark radium pieces be "disposed of as required." The Navy personnel manual from that era said such objects could be buried on-site. Today, standards call for packaging radioactive waste materials in strong, airtight, shielded containers and shipping them to secure radioactive burial sites.

Years later, workers involved in efforts to clean up the island for return to civilian control would uncover hundreds of radium pieces in former Navy waste pits and in the soil around military apartments built in the 1960s and '70s. It's unclear whether some were the pieces discussed in the 1974 memo. (smith 2014)



FIGURE 12 (Above) The USS Pandemonium I

FIGURE 13(Above)
Naval officers undergoing an clean up
excercise on the USS Pandemonium I



CURRENT CONDITION

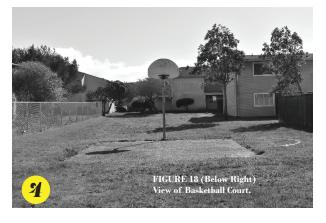
As of 2018, the island is a deteriorating hodge podge of its history and transitional usage. The remnants of the Golden gate exposition like the avenue of the palms still stretches north to south along the western side of island. Although the airport was never completed the Pan American hanger and art deco air terminal building have been converted for other uses such as being a movie sound stage and a Treasure Island history museum. Many buildings form the Naval Base have remained and become derelict. Some sit as destroyed ruins while others just sit filled with asbestos and cover with graffiti. The community that lives on Treasure Island is part of an affordable living program. This provides both affordable housing and housing for homeless as part of the Base closure community redevelopment and the homeless assistance act of 1994. (Horiuchi and Sankalia) The housing comprises of miniature island suburbia constructed out of cheap material. Streets comprise of cul-de-sacs that seem unware of the dramatic views that surround the houses.

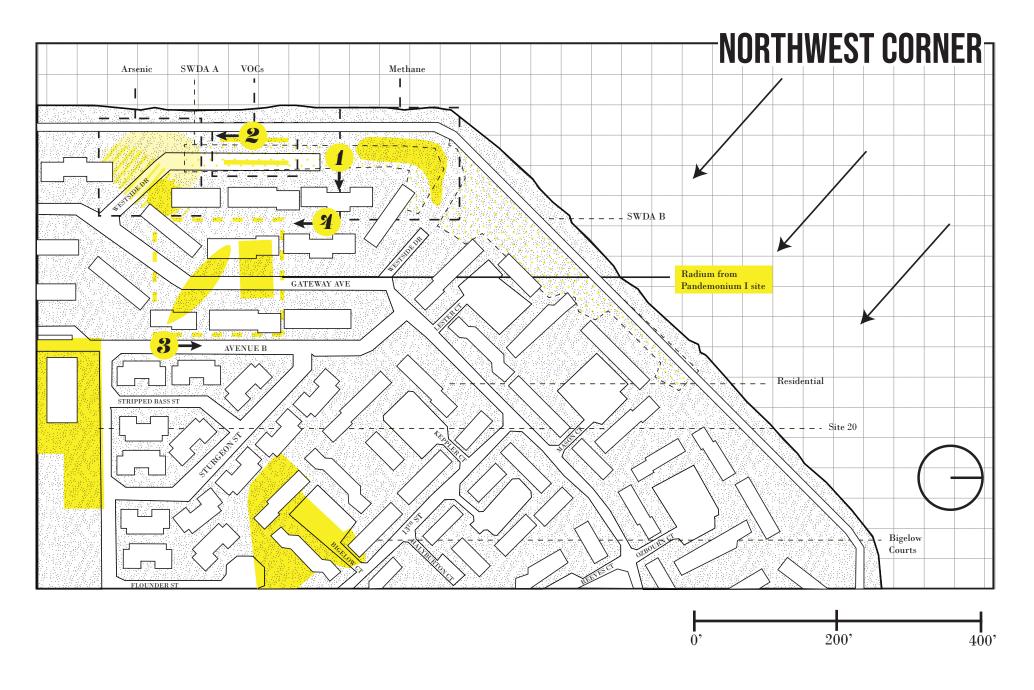
The air of danger surrounds the entire community. The community has been warned not to grow edible plants in their gardens due to the contaminates in the ground. In addition, most of the community does not drink the tap water fearing the effects of the pollutants.













$REDEVELOPMENT\ PLAN$

Treasure island has always been seen as a" developers dream"(Nolt 1991) Not only a place for outstanding opportunity but a perfect place for a ecotopia. And as the public debate over over housing demand in San Francisco grew, the necessity of new developments on treasure island grew. In 2011, the City and county of San Francisco approved a new redevelopment project form Treasure island and Yerba Buena island. This one of the many proposals to reinvent the island including a solar power field that would power San Fransico. The TICD (Treasure island Community Development LLC) is a joint venture between Lennar Urban a md KSWM which comprise of Kenwood Investments LLC, Stockbridge capital group and Wilson Meany LLC. (Horiuchi and Sankalia) This proposal includes a mix of open space and built form with densely grouped LEED certified condos. The open space areas would include manmade wetland, urban farmland, sport

fields and variety of trails. However, all of this is contingent on the Navy's ability to clean up all of the contamination.

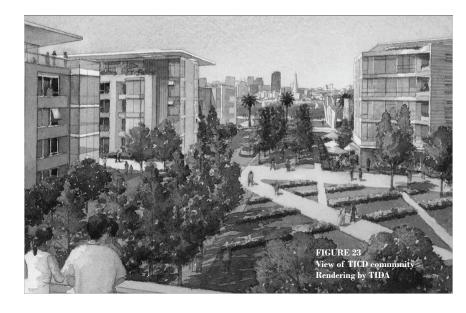
The design has receive strong positive response from urban policy groups and critics alike saying it was a triumph in "Green Design" (Biello 2008) and a utopian "eco-urbanism." (Jost 2010) However this same positive support was met with negative reactions from a group called citizens for a sustainable treasure island. Their arguments included the how the plan did not mitigate for better traffic congestion on the San Francisco- Bay Bridge, will not provide an adequate amount of affordable housing and would not properly deal with the toxic soils. They initiated a California Environmental Quality act law suit that was dismissed. Further more groups like sierra club and SF Public Press also claimed similar uses brought up in the lawsuit.

Any Development on this island should be

met with caution and this development does not seem to take the many issues of island seriously. The drive to make more money in this 'hot' market does not allow for an understanding that this development may tank literally. The investigation in to how truly contaminated this island is seems accidental rather than intended. And therefore seems misinformed. Some of those working on the project have little to no understanding of the contamination of the iste at all and those that do really don't grasp the long-term issues of the contamination. With the recent findings at Hunters Point and the myriad of other incidence of clean up mistakes that have occurred on Treasure Island shows ignorance bordering on negligence. The TIDA created this haven for those that could not afford rent without understanding the many problems of living on contaminated areas leading to many of the residence to have health defects.











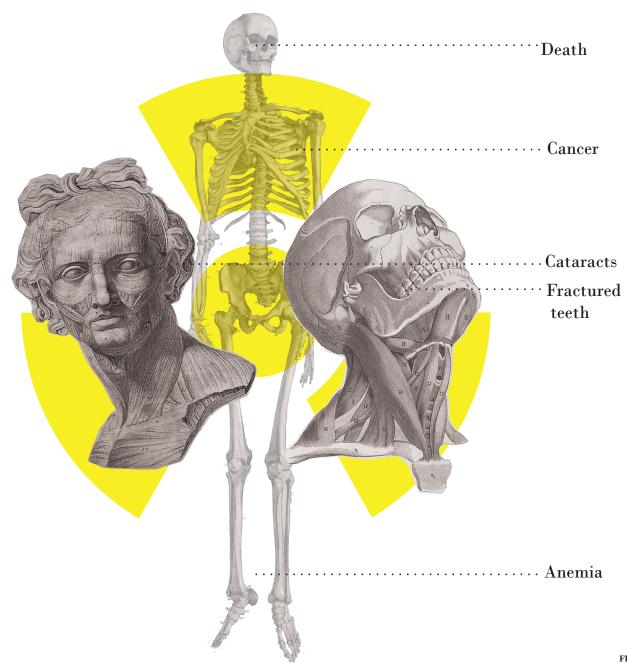


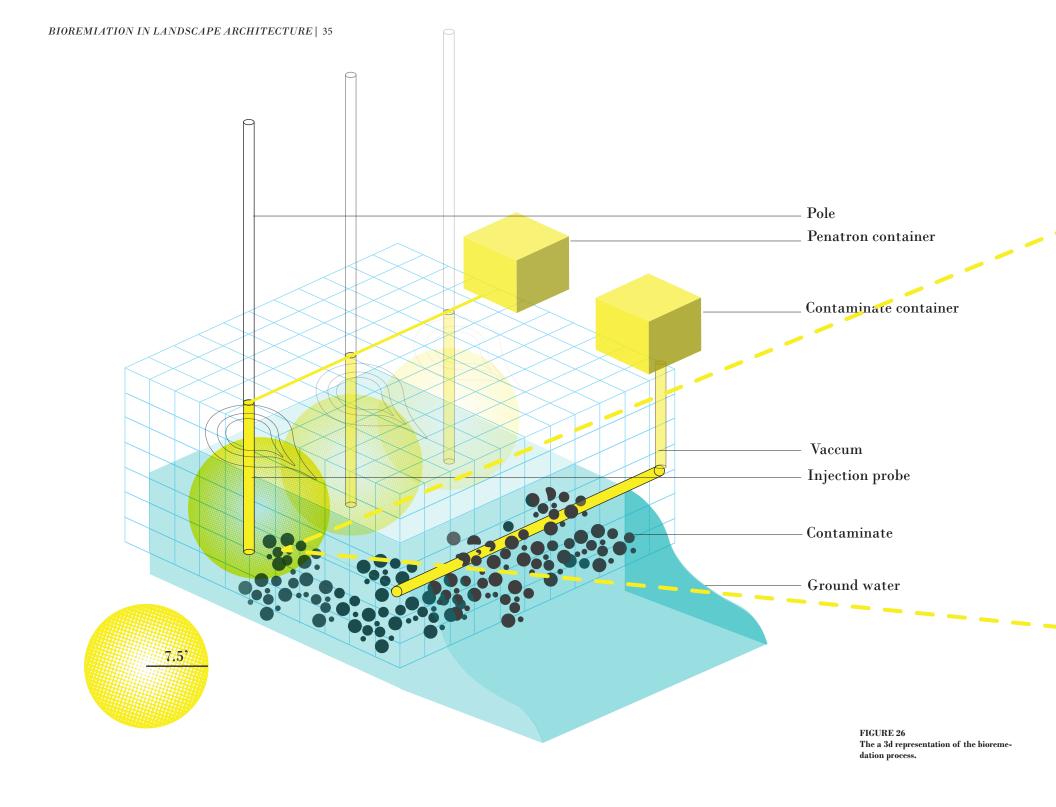
FIGURE 25 Effect of Radium on human beings.

RADIUM

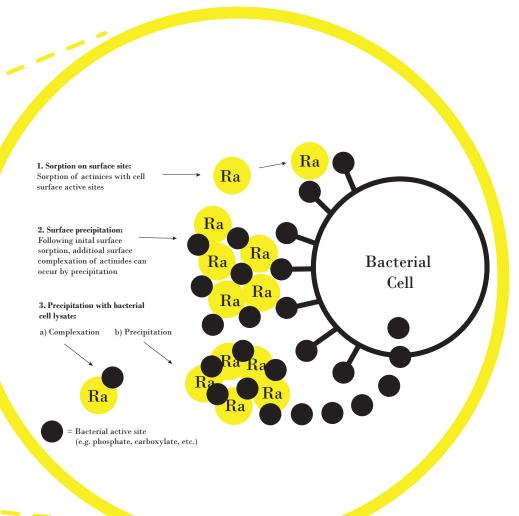
Radium is highly radioactive and its immediate daughter, radon gas, is also radioactive. With a half life of 1600 half-life, radium is 2.7 million times more radio cive than the same molar amount of uranium. (Crysler 2017) When ingested, 80% of the ingested radium leaves the body through the feces, while the other 20% goes into the bloodstream, mostly accumulating in the bones. Exposure to radium, internal or external, can cause cancer and other disorders, because radium and radon emit alpha and gamma rays upon their decay, which kill and mutate cells. At the time of the Manhattan Project in 1944, the "tolerance dose" for workers was set at 0.1 micrograms of ingested radium.

Some of the biological effects of radium were apparent from the start. The first case of so-called "radium-dermatitis" was reported in 1900, only 2 years after the element's discovery. The French physicist Antoine Becquerel carried a small ampoule

of radium in his waistcoat pocket for 6 hours and reported that his skin became ulcerated. Pierre and Marie Curie were so intrigued by radiation that they sacrificed their own health to learn more about it. Pierre Curie attached a tube filled with radium to his arm for ten hours, which resulted in the appearance of a skin lesion, suggesting the use of radium to attack cancerous tissue as it had attacked healthy Handling of radium has been blamed for Marie Curie's death due to aplastic anemia. A significant amount of radium's danger comes from its daughter radon: being a gas, it can enter the body far more readily than can its parent radium.



SOLUTION



Biological method was studied for remediation of soil/concrete contaminated with radium. By utilizing penatron a Organic Liquid Soil Treatment Complex, that was originally used for Biological Organic Activator AND Anti-Stress Agent. It was used to improved soil condition, reduce soil erosion, increase water penetration, increase plant uptake of fertilizers and micro-nutrients, relieve moisture and plant stress. Optimum experiment conditions for mixing ratios of penatron and soil, and the pH of soil was obtained through several bioremediations with soil contaminated with uranium and radium. It was found that an optimum mixing ratio of penatron for bioremediation of uranium soil was 1 %. Also, the optimum pH condition for bioremediation of soil contaminated with uranium and radium was 7.5. The removal efficiencies of uranium and radium from higher concentration of soil were rather reduced in comparison with those from lower concentration of soil. Meanwhile, the removal of uranium and radium in concrete by bioremediation is possible but the removal rate from concrete was slower than that from soil. The removal efficiencies of uranium and radium from soil under injection of 1 % penatron at pH 7.5 for 120 days were 81.2 and 81.6 %, respectively, and the removal efficiencies of uranium and radium from concrete under the same condition were 63.0 and 45.2 %, respectively. Beyond 30 days, removal rates of uranium and radium from soil and concrete by bioremediation was very slow.











THE SUBLIME

When it comes to the design of the bioremediation in the form It would take I decided to utilize the philosophy surrounding the sublime. As the project is about a systematic transformative landscape that needs to show the process of cleaning up as much as possible it seems logical to employ this type of design. The idea of the sublime originates from the 19th century landscape and the art that captured it. These landscapes captured an idea that nature has artless purposefulness. This idea of sublimity came from the fact that these landscapes were beautiful because they were nature at its most wild with depictions of raging rivers dizzing cliffs and canyons. These depicted the landscape as its own entity that creates awe do its matter of factness.

when it comes to contemporary philosophers like Jadranka Skorin-Kapov, the sublime roots in the intertwining of aesthetics and ethics. argues for sublimity

as the common root to aesthetics and ethics, "The origin of surprise is the break (the pause, the rupture) between one's sensibility and one's powers of representation... The recuperation that follows the break between one's sensibility and one's representational capability leads to sublimity and the subsequent feelings of admiration and/or responsibility, allowing for the intertwining of aesthetics and ethics... The roles of aesthetics and ethics—that is, the roles of artistic and moral judgments, are very relevant to contemporary society and business practices, especially in light of the technological advances that have resulted in the explosion of visual culture and in the mixture of awe and apprehension as we consider the future of humanity."

According to Paul Roncken, the landscape machine is defined by "its identification as a machine" and "parts of the machine may fade out or even vanish and

that new functional parts may come into being." (Roncken 2011) These qualities of the landscape machine play into the construction of a bioremediation landscape as they clean and change the environment. This implies that parts of the machine may fade out or even vanish and that new functional parts may come into being. Being that this site has a toxic past I would be important to create infrastructure that both cleans but acts as part the environment.

CASE STUDY

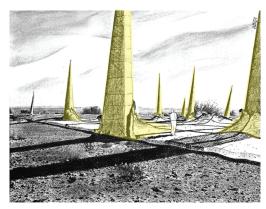


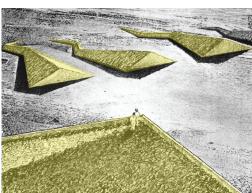
Being that radioactive material has the capacity to last longer than most human cultures, two teams composed of scholars and professionals from many different disciplines were created to devise a way to communicate to future groups of people that a certain area was radioactive. One of these groups focused on the "meaning inherent in a form" by exploring the psychological effects of monuments. These monuments were created out of the decisions that human being's natural language is spoken through architecture. They believed the irregular forms of their designs would repulse rather than attract like the perfect geometry of the Egyptian Pyramids. They believed an array of giant cubes, spikes bursting through a grid, lightning shapes, or a neat pile of rubble would not be seen as art by, and would even instill dread in, future Homo sapiens. Interestingly enough, Lomberg also suggested another proposal, equally unlikely ever to be adopted, to bury the waste near a highly populated urban center. The reasoning would be that the inhabitants of such a place, over the course of many generations, would "remember" what was there and retain the knowledge to handle an emergency. Yet no city has ever lasted four hundred generations, let alone four thousand, and if there were not an emergency within a few such generations, there might not be any impetus to remember what to do in case of a resurrection.

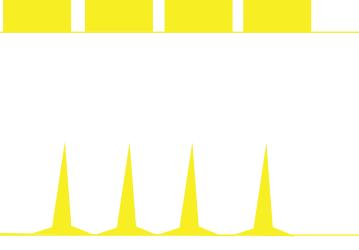












The Black Top (Figure 32)

This design utilizes the heat on a dark surface to create a hot surface, this creates an unconfortable environment for those who stumble on to the radioactive site. Changing the climate to be unconfortable in order to deter people

The Large Blocks (Figure 33)

This design was suppose to intimidate those who came across the site. These large blocks would create a space that would make those how came across it uncomfortable as they are tall and create a space in between the blocks

The Spikes (Figure 34)

This design was suppose to intimidate those who came across the site. These large Spikes create a sense of danger. problem with many of these sites is that they are bothintimidating but intrguing this being probably the most intigueing being it so starkly different from the surroungings.

The Chevrons (Figure 35)

Similarily to the Vietnam war memorial designed by Maya Lin this land form causes discomfort by creating spaces out of negative space.

CASE STUDY

Plan of Byxbee park. Hargreaves

BYXBEE PARK



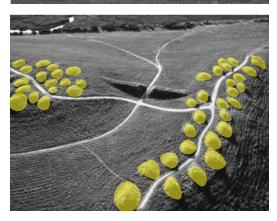
CONTAMINATE: LEACHATES

AND METHANE FROM GARBAGE

Byxbee Park was historically used as a landfill but it was closed in 1980s. This resulted in contamination a threat to water quality originating from existing tons of garbage stored on site. (Fred, & Jones, 1991). When waste was saturated with water or received artificial irrigation, it had the capacity to produce leachate and methane gas, which could result in potential ground water pollution that would harm human health (Pedersen, & Johnson, 1997). In order to address these threatening factors, hills and mounds of waste were creatively constructed on site. The hills consisted of 60 feet of garbage, covered by a one-foot thick impervious clay layer with two feet of soil on top (Hargreaves Associates, 2015). They were then covered with native grasses, wild flowers and small shrubs instead of tall trees in order to keep the clay cap from being disturbed or broken. No irrigation was provided, in order to prevent groundwater from being polluted by the leachates from the landfill. Garbage under the hills produced methane gas for decades, which negatively impacted the environment, as many greenhouse gases do (Horii, 2000). The mounds and paths were established to reflect site history: the mounds on site were arranged as a metaphor of the mounds of Ohlone Indians who first inhabited the area about 2000 years ago (Rainey, 1994). Trails made of crushed oyster shells gathered from the former landfill and a flare burning off excess methane gas served to remind visitors of the site's use as a landfill (Kirkwood, 2001)















The Pole Forest (Figure 37)

For example, they represented the existing topography by creating a pole forest made from 72 evenly spaced wooden telephone poles with different heights. The poles functioned like a gigantic sundial, casting shadows as the sun traversed the sky (Rainey, 1994).

The Wind Wave Piece (Figure 38)

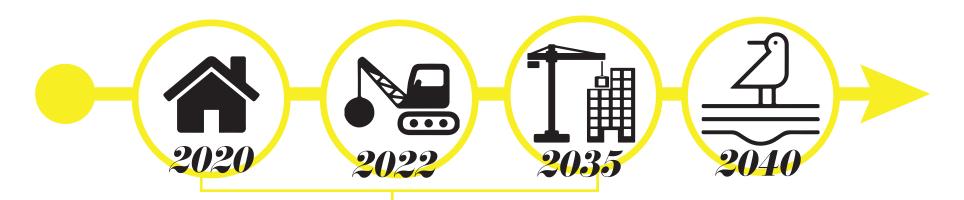
There is a 30 foot high 'wind wave piece' that reflects the wind's orientation, while emphasizing visitors' experiences of the Bay area's natural character (Rainey, 1994).

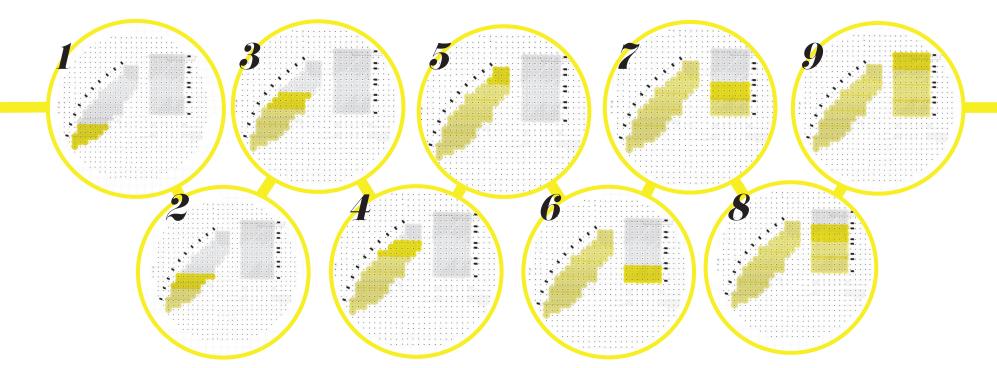
The Mounds and Paths (Figure 39)

Thesewere established to reflect site history: the mounds on site were arranged as a metaphor of the mounds of Ohlone Indians who first inhabited the area about 2000 years ago (Rainey, 1994). Trails made of crushed oyster shells gathered from the former landfill and a flare burning off excess methane gas served to remind visitors of the site's use as a landfill (Kirkwood, 2001)

Keyhole (Figure 40)

A keyhole-shaped waste gas burner was 34 added on site to address problems associated with the methane gas. This project was named "Keyhole" (Horii, 2000). The site location heavily influenced the natural system of the bay as well as the improvement of the quality of the environment.



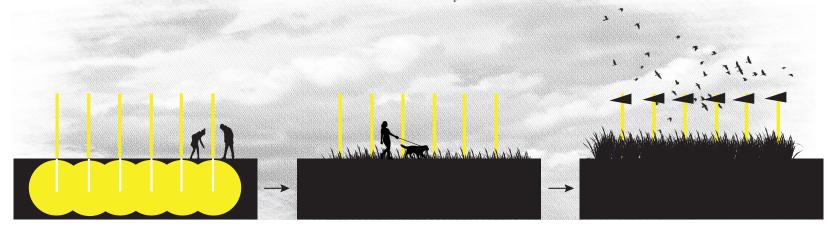


EVOLUTION

velopment, and wetland. The first stage ant to understand and design for change in remove the radium making it environment itat for marine birds. safer for the community.

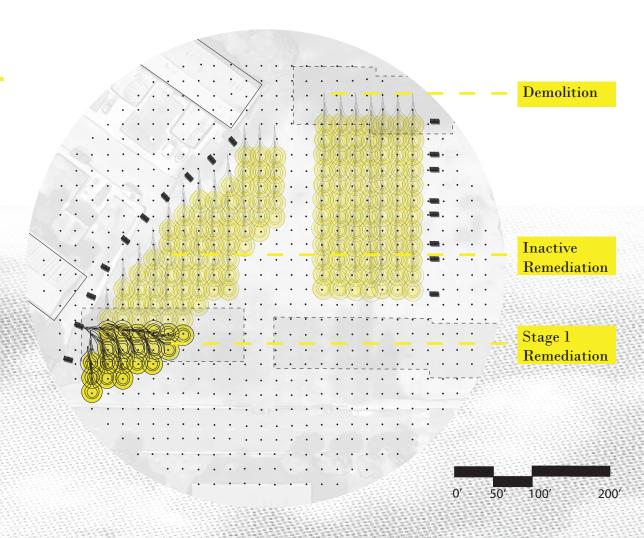
This solution breaks down into 2 simulta- In creating a design, there is often a belief neous timelines. The first timeline is the that once that design is built it change. design of the island. This consists of 4 This of course is not true. Infrastructure is stages: predevelopment, demolition, rede- built, changes, get destroyed. It is importconsists of installing the bioremediation in order to allow future generations to utilize the current community. The second stage spaces in their own way. By utilizing bioreconsists of continuing the remediation but mediation, the island will be able to be also removing the old buildings. The third safely utilized in many capacities. For consists of the construction of the build- example, if the island is deemed unusable ings and the phasing out of the bioremedia- for the people to live it can bused as sedition. The fourth consists of the creation of ment in the next hundred years. In accora lasting wetland. The second is the 9 dance with the idea of sublimity, I wanted stages of the bioremediation. Each stage the poles to change in function as well consists of around 20 wells which takes 4 acting first as to emphasize the bioremedimonths to remediate. This process is ation acupuncture but to later act as highly transformative to the soil and will symbol of the toxic past and even as a hab-

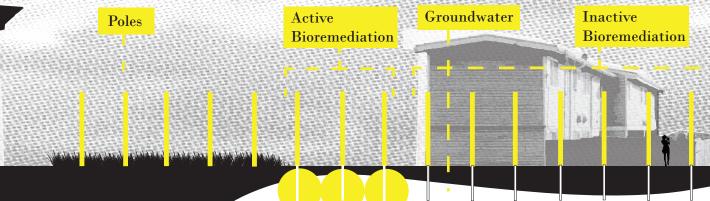
FIGURE 42 The Timeline of Poles



2020

The first part of the design is the initial introduction of the bioremediation process in the mist of the old houses and community. As they are phasing out the old community, they need work the remediation process with community there. This means the demolition of three buildings and the blocking off Gateview Ave and Avenue B. These houses will need to be demolished as the bioremediation process will be done subsurface. The poles will cause a significant change in the flow of transportation and pedestrian pathway.





Berm

Westside Dr

Gateway Ave

Circle of Remediation

Avenue B



FIGURE 43 (Top prevous page) Close-up Plan of 2020

This plan shows the poles in a pattern of a circle. the poles that do the bioremediation are in the middle. containers that feed the injection probes and containers that contain the pollunants are placed for easy installation.

FIGURE 44 (Below) Section of 2020

The section below shows how the poles relate to the rest of the enviroment. as Treasure island is flat these poles add a new dimention to the topography. they give more a gradient making them stick out.

FIGURE 45 (left) Context of 2020 design

As the environment around the bioremediation is decaying this landscape will be a both a start contrast in topography but also a stark contrast in healing vs decaying.





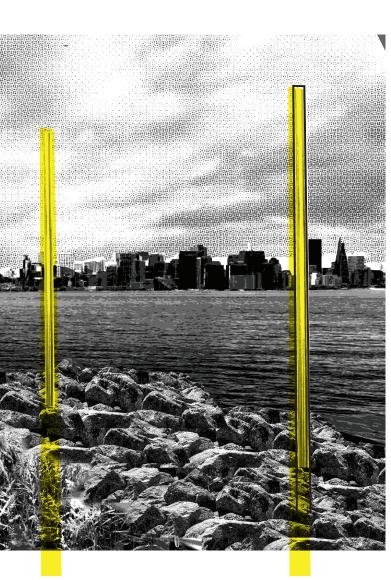
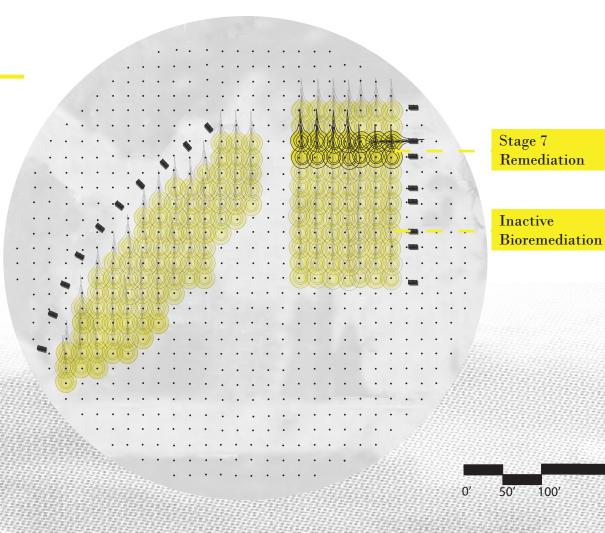
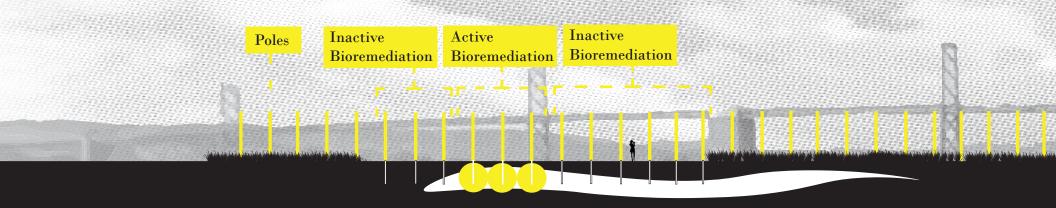


FIGURE 46
Perspective of 2020
The poles will eventually go to ocean entering the ocean as the pollutants have been slowly seeping into the sea for the last 60 years.

After the housing has been completely demolished and all of the remediation will be underway, treasure island will be barren and can be utilized in other ways. This is where the design takes shape as the sites of remediation become places of interest on a long trail of the treasure island coast line. This site along with # others will become lit up. Not only will this create an interesting destination, it will illustrate the bioremediation process to people. The hope is that the lights will also scare off the animals during the bioremediation part as it can be dangerous for them to consume



200



Access to Interstate 80

Treasure Island Trail

Other Sites of Radiation



FIGURE 47 (Top prevous page) Close-up Plan of 2022

This plan shows the remediation at its 7 step. at this point the buildings that have surrounded the area have been all demolished.

FIGURE 48 (Below) Section of 2022

At this point because most of the buildings have been removed topography is limited and the poles are very present on the island. Being that they will glow at night this will make the enhance the experience at night.

FIGURE 49 (left)

Context of 2022 design

the trail will allow those to go from area to area to enjoy the great views of the bay as well as the glwoing cleanig infrastucture.

Inactive Active Bioremediation 3 Bioremediation

Treasure Island Trail

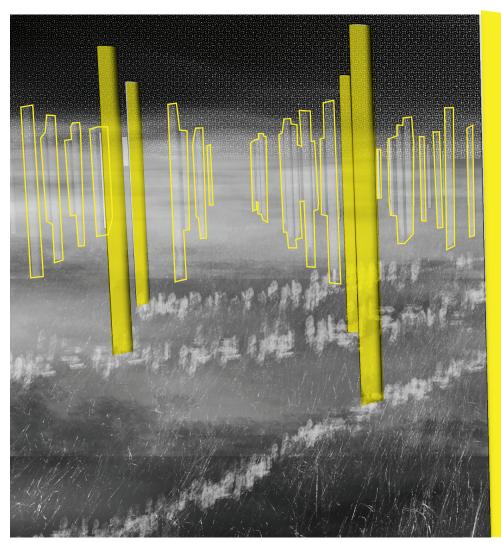
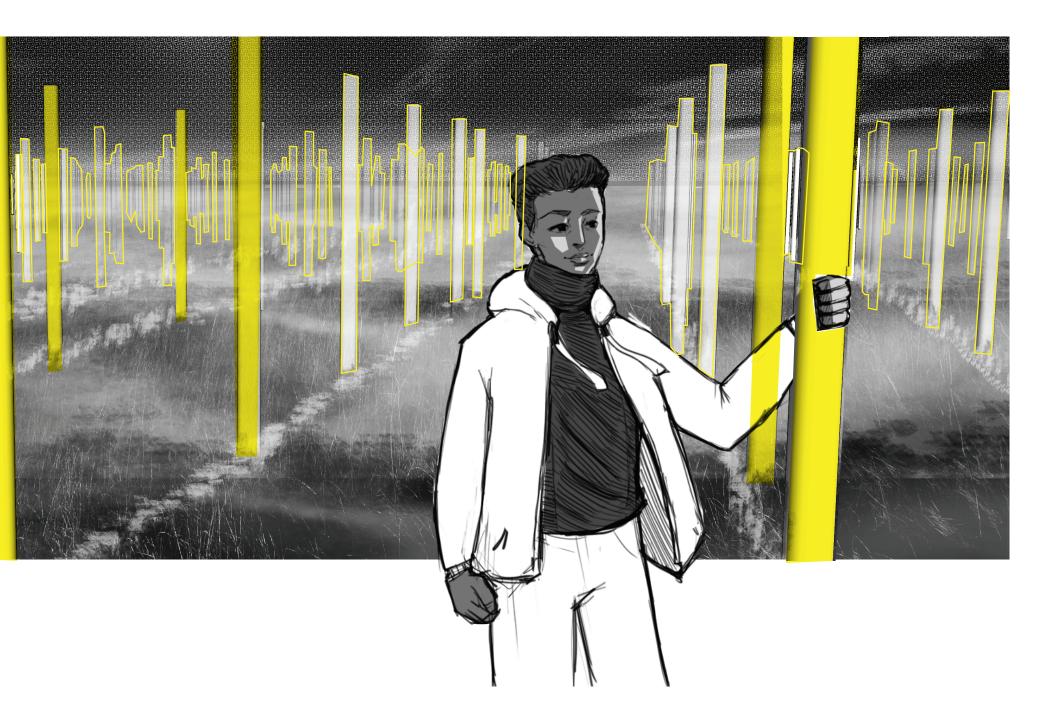


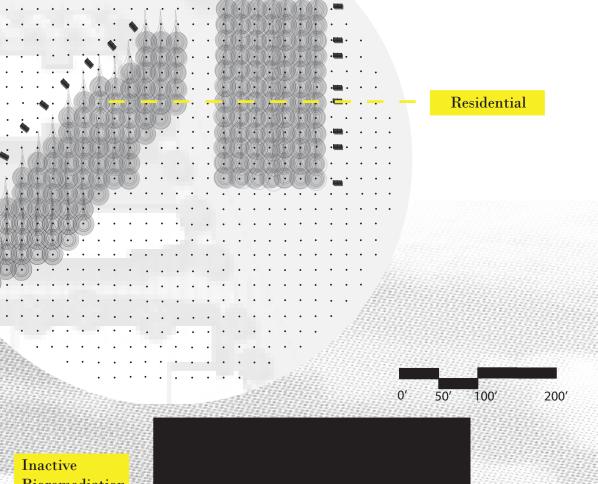
FIGURE 50
Perspective of 2022
as the poles will glow this will draw
attention to the island giving the
island an attraction in the day and
at night.

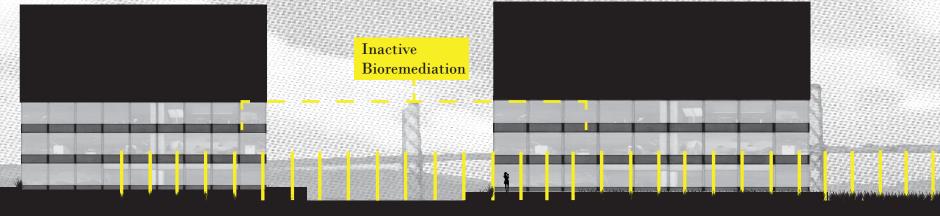


2035

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Ferry Port

Job Corp

Urban Agriculture

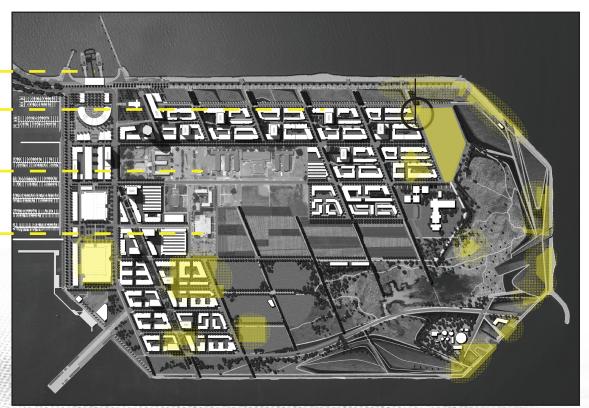


FIGURE 51 (Top prevous page) Close-up Plan of 2035

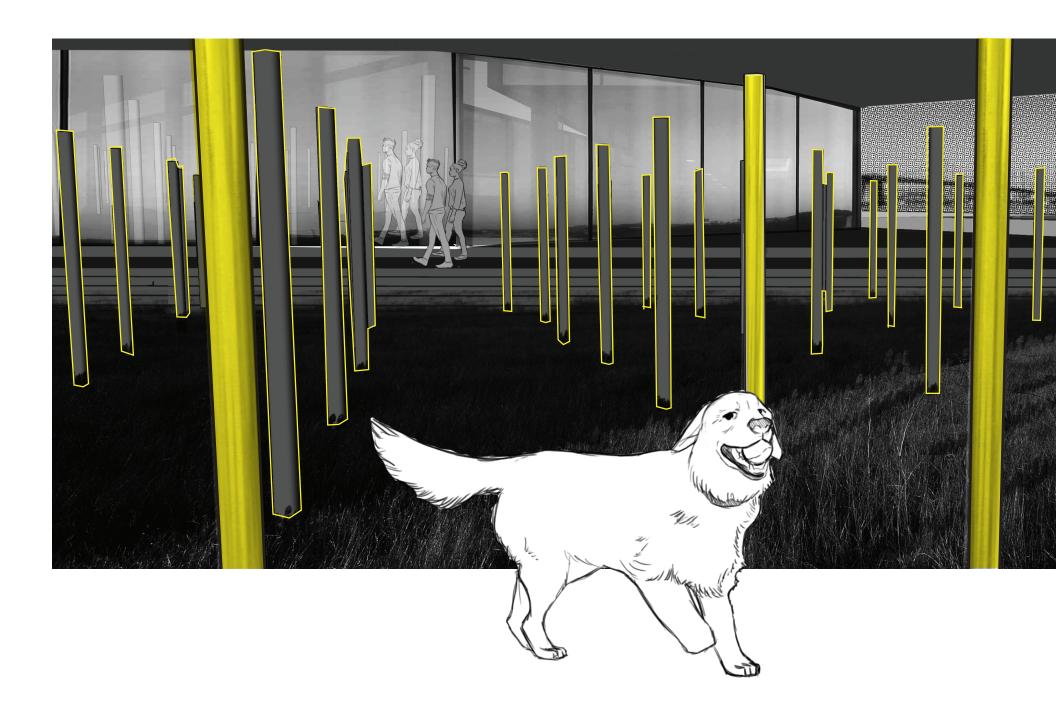
This plan shows the poles interacting with the new buildings. At this point the remediation is over. these buildings bend around the area with the poles giving the poles more presence.

FIGURE 52 (Below) Section of 2035

The section below shows how the poles relate to the buildings. As this area is mostly greens space it allows for an oppurtunity to again create visual topography.

FIGURE 53 (left) Context of 2035 design This plan created by TIDA has been altered by remeoving the the buildings int the highlighted block.





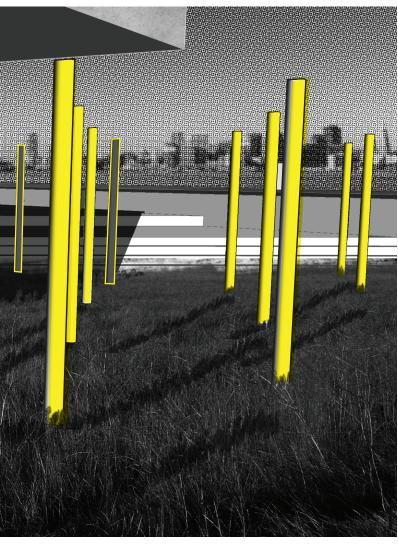
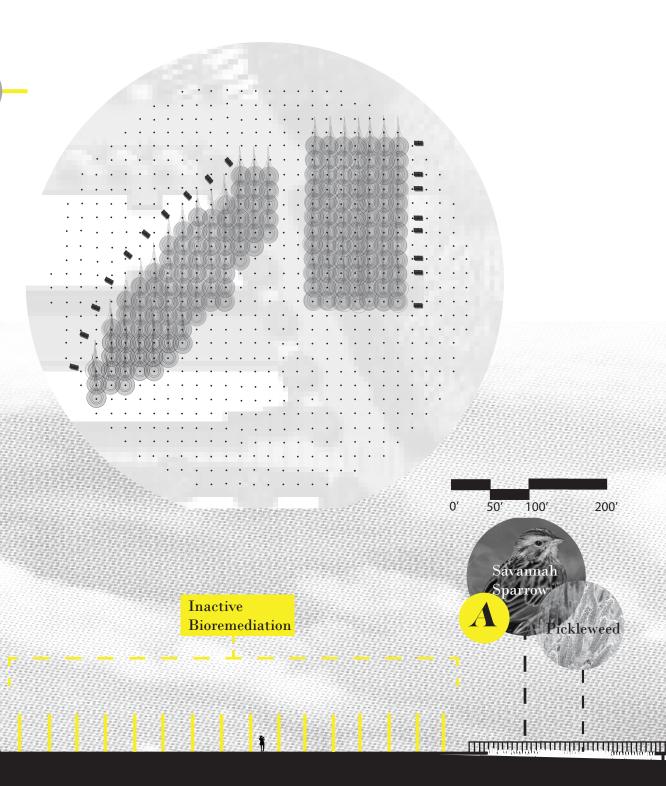


FIGURE 54 (left)
Perspective of 2035 design
as natural processes take over the
soil the landscape will return to a
wild state it has never experienced.

2040

The wetland both provide a safer alternative to development in the at northwestern corner of the island where most of the sediment subsidence is occurring. It's the final piece in the plan in that it gives the island a solution that will be helpful in reclaiming this land when eventually the development. The wetland will be created with ground water as the water table is quite high and I am uncertain about the effect of removing the northwestern side of the levee to the erosion of the island. The wetland will provide much needed habitat to numerous bird species including the California least tern and the Savannah sparrow.

Poles



Protected Inlet

Boardwalk

Wetland



FIGURE 55 (Top prevous page) Close-up Plan of 2040

This plan shows the poles interacting with the buildings and the new wetland.

FIGURE 56 (Below)

Comprehesive Section of 2040

The section below shows how the poles relate to the wetland. The boardwalk allows for engagement. There are places for the animls to hide and have their own space. This habitat focuses on the Savannah Sparrow and The CA Least Tern by creating a habitat with pickleweed, and increasing the beach in the northeast.

FIGURE 57(left)

Context of 2040 design

The wetland is acts a final transition for this once toxic wasteland. by transforming this into to tidal wetland you create both needed habitat and a more untamed experience for metropolitan San Francisco .

Slope to combat stagnantion

Inactive Bioremediation

Extended Beach

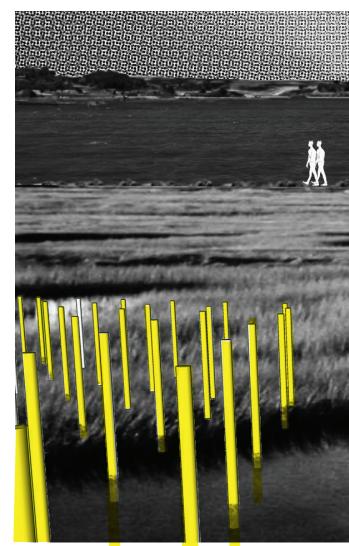
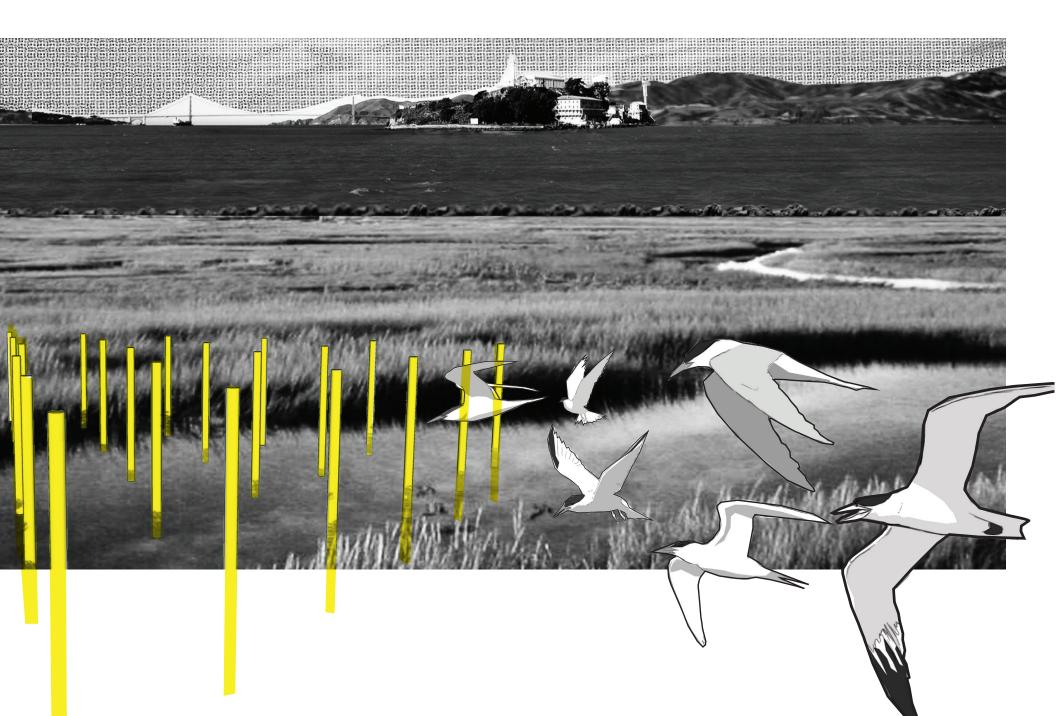


FIGURE 58
Perspective of 2040 design
by creating a wetland, this design
does not return it to its orginal
state but it makes it fit healthly in
the context of present day San
Francisco





This design acts as a draw to the process of bioremediation and reminder of treasure islands toxic past. This site has had many versions of its self-making it a very complex project. It was difficult to focus on one aspect of the island as has many social, political and contamination problems. Dealing with with the larger issues of why these sites is need to be remediated as This project overall was an experiment in seeing a landscape and how it interacts with its context. When the surrounding and the community changes drastically, it can radically effect the site and how people interact with it. In creating a design, there is often a belief that once that design is built it change. This of course is not true. Infrastructure is built, changes, get destroyed. It is important to understand and design for change in order to allow future generations to utilize spaces in their own way. By cleaning past contaminations, we give future generations a chance to do something better with the land rather than just past the bill on. It's important for our government to prioritize cleaning after its messes rather than letting it fallow. Each generation passes these contaminated sites to the next expecting the responsibility to either fall on either time or the next generation. Letting these sites remain fallow only increases the risks of spreading contamination to communities or continues to endanger communities.

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