

LANDSCAPE OF EXPERIMENTATION: PIONEERING AND SUCCESSION ON HARBOR ISLAND

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ABSTRACT

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Intensive industrialization has left many cities with a variety of complex site conditions that necessitate innovative responses. Whether post-industrial and derelict or actively functioning under soon-to-be obsolete modes of operation, industrial landscapes present a critical opportunity to transform degraded and destructive sites into vital and regenerative places. The residual and contaminated nature of these sites offers a venue to take risks, test new response mechanisms, apply innovative frameworks of urban ecological design, and engage the public through distinct site experiences. I propose such an approach at a site within the active industrial matrix of Harbor Island in Seattle, WA – a landscape of experimentation that will decontaminate, regenerate, and populate while embracing indeterminacy. This is a landscape in flux; a static design response shall not apply. The idea is to integrate ecological, industrial, and social infrastructure into a dynamic and synergetic system. My design proposes a successional series of experimental operations that engage goals of phytoremediation, shoreline habitat enhancement, industrial ecology, and insurgent appropriation of public space. The western edge of Harbor Island will become a living laboratory where novel forms of ecological infrastructure, progressive industrial operations, and unique social programming will be activated. Successful strategies determined at the local level can then be replicated elsewhere, effectively addressing various needs of industrialized landscapes regionally and beyond.

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Thank you to the following local professionals that graciously attended my final design reviews: Makie Suzuki (Gustafson Guthrie Nichol), Nate Cormier (SvR Design Company), Heide Martin (Swift Company), and Jake Woland (Hewitt). Extended gratitude goes out to Makie Suzuki and Nate Cormier for the engaging discussions surrounding my project that continued to evolve well after the design reviews.

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Thank you to my friend and Master of Architecture student, Sean Kelly, for the chance to collaborate ideas and build our thesis projects together on Harbor Island.

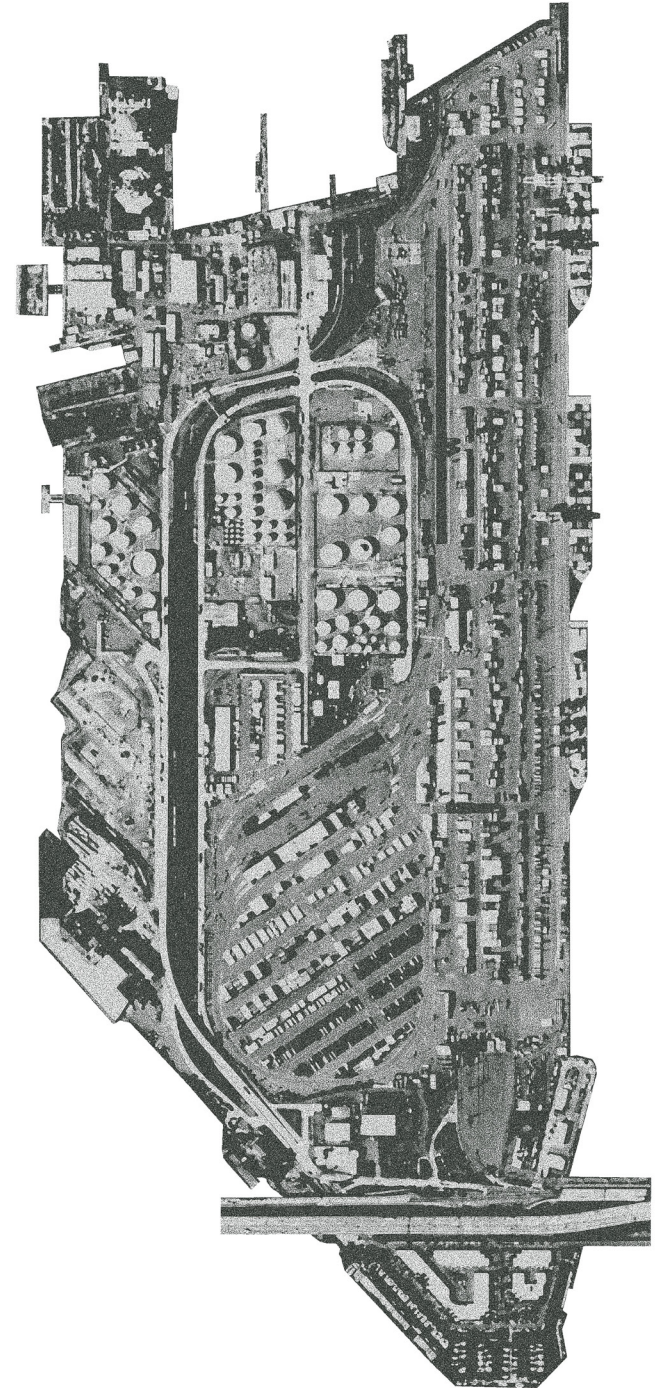
Thank you to all of my fellow classmates for the motivation and good company through an intense three years of graduate school and to all of the professors that have supported me during this journey.

DEDICATION

To Mom!

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PREFACE

INITIAL MENTAL RAMBLINGS: MARCH 1, 2012 (HOW I GOT HERE...)

Before I had any formal plan of what I wanted to work on for my thesis, I wrote down some of my initial thoughts for a thesis prep course. This broken narrative was written as follows:

“The city – a living breathing organism, growing new cells while shedding the old. Like flakes of dry skin. Urban detritus. Defunct, broken places. Neglected, forgotten places. Contaminated, toxic places. Residual, liminal places. These shunned places are an escape to the real. The essence of the city. No rules, no management, no manicured shrubs or mowed grass, fenced off and left to be. And just by hopping this fence, you’ve been freed – released into the forgotten, the broken, the toxic, the residual. Anything is possible here...”

This improvised mental dribble represents where my guts wanted to take my thesis – to the residual, derelict, raw, and gritty. My long-lived place attachment to these kinds of environments inspired the context in which I wanted to generate design ideas. My keen interest in ecology studies and the potential to creatively bridge this science to the urban realm sparked my desire to adopt a strong urban ecological design methodology. My behind-the-scenes efforts to use urban spaces in unintended ways pushed me to consider how the insurgent appropriation of public space could be layered into this equation. These were the seeds. The last thing needed was fertile (or contaminated) ground to plant these seeds (i.e. a site). I don’t quite remember how it happened – whether I found the site or the site found me – but it was set. Harbor Island, an active industrial landscape in Seattle, WA, was chosen as my subject of exploration, research, analysis, and design.

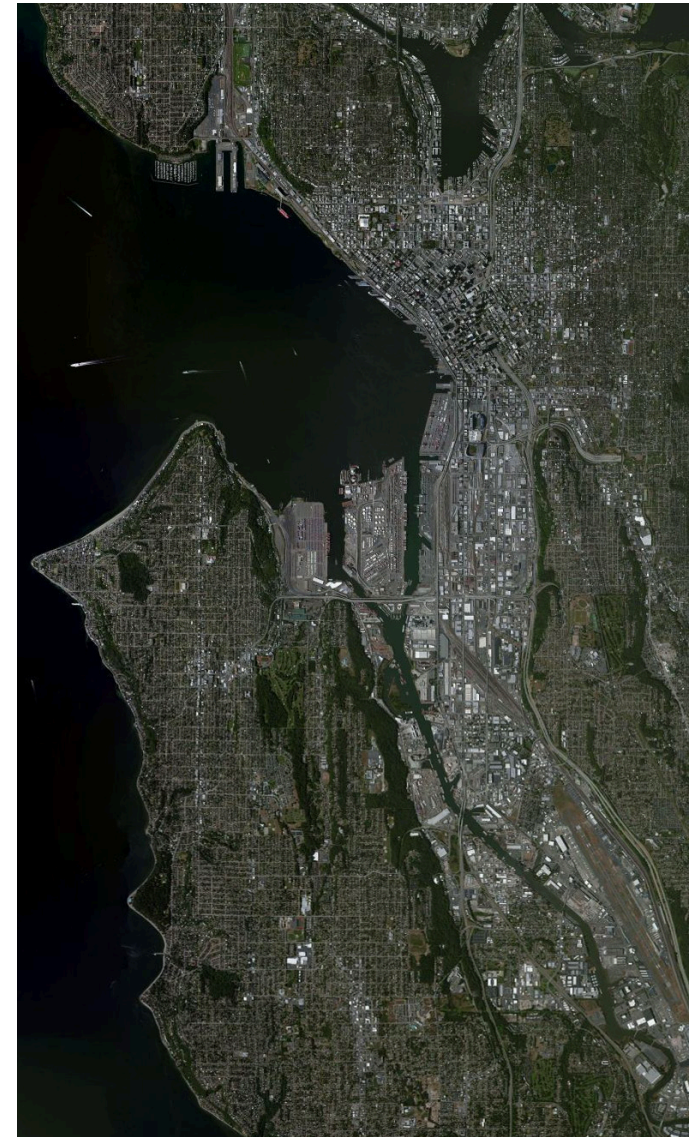


INTRODUCTION

SPATIAL/TEMPORAL CONTEXT: HARBOR ISLAND AND THE LOWER DUWAMISH RIVER

Harbor Island is located in South Seattle, approximately one mile southwest of the downtown core. It is prominently positioned at the mouth of the Duwamish River, on the southern edge of Elliot Bay, in the Puget Sound. Harbor Island is a heavily industrialized landscape and is a major part of the Lower Duwamish River industrial area. The island is not natural, but rather a constructed landform that was built to provide space for industrial operations. There is a dramatic contrast between the industrial character found along the Lower Duwamish River today and the ecological and cultural conditions that personified this area before Seattle's development. This stretch of the river once exhibited a wide, shallow, meandering form and the strong estuary influence on this area supported a diverse and dynamic intertidal ecosystem. The native ecology of this intertidal system was characterized by low-lying sand and mud flats, salt marshes, and forested wetlands (Port of Seattle 2009) that supported robust populations of wildlife characteristic of estuary environments. The meandering river channel also provided critical riparian habitat and nutrient-rich estuarine floodplain. Prior to the settlement and development of Seattle, the banks of the Lower Duwamish River were inhabited by a native band of people later called the Duwamish Tribe. "All along the waterways flowing through their homes was a plethora of resources. Dense clumps of eelgrass, hidden beneath the tides at the Duwamish River's mouth, covered the mudflats, protecting salmon, rockfish, and crabs. Beneath the slick green mats, buried in the mud or clinging to exposed rocks, lived an astounding variety of mollusks... Salmon spawned on the gravelly beds... Wooded banks housed deer, game birds, and other quarry. Lowland forests, tall Douglas fir or red cedar trees, became canoes and homes" (Klinge 2007).

With the arrival of settlers in the mid-1800s, a trajectory was set for major transformations to take place in this landscape. The development of Seattle resulted in extraordinary engineering of the region's complex hydrological system. Seattle's drainage basin was essentially treated like a residential plumbing system going through an intensive remodel. Rivers were redirected and flows were diverted in order to facilitate rapid urbanization and economic growth. Along the Lower Duwamish River, tidelands were filled in and a new



Source: Google Maps

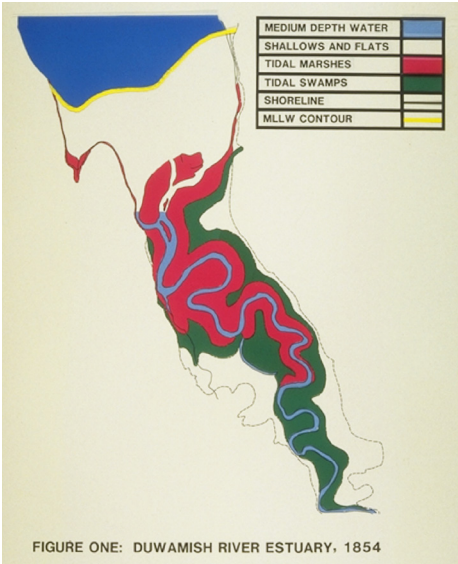


FIGURE ONE: DUWAMISH RIVER ESTUARY, 1854

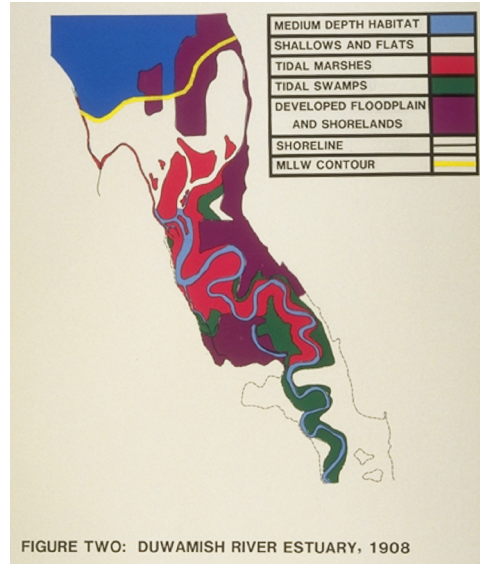


FIGURE TWO: DUWAMISH RIVER ESTUARY, 1908

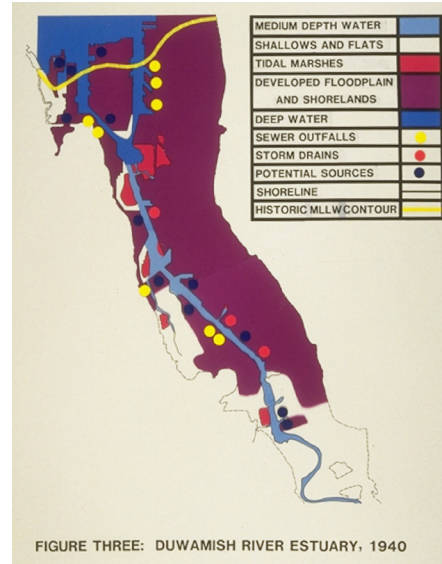


FIGURE THREE: DUWAMISH RIVER ESTUARY, 1940

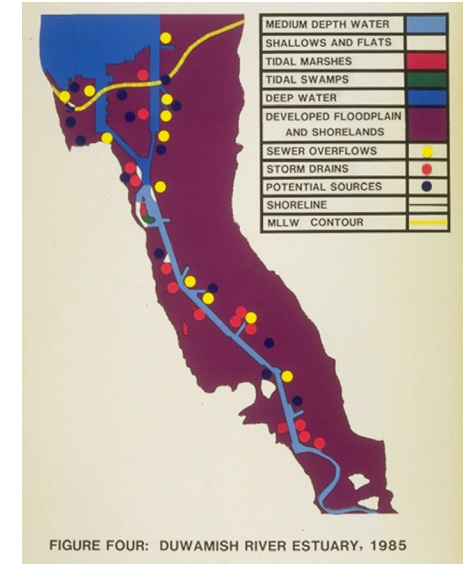
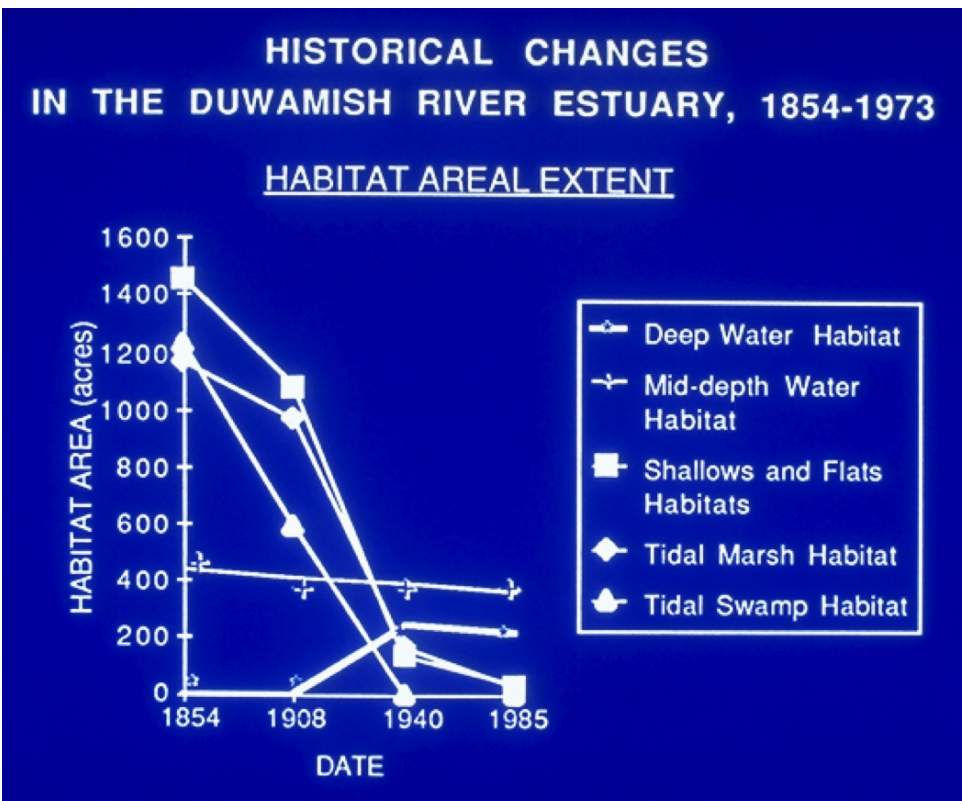


FIGURE FOUR: DUWAMISH RIVER ESTUARY, 1985

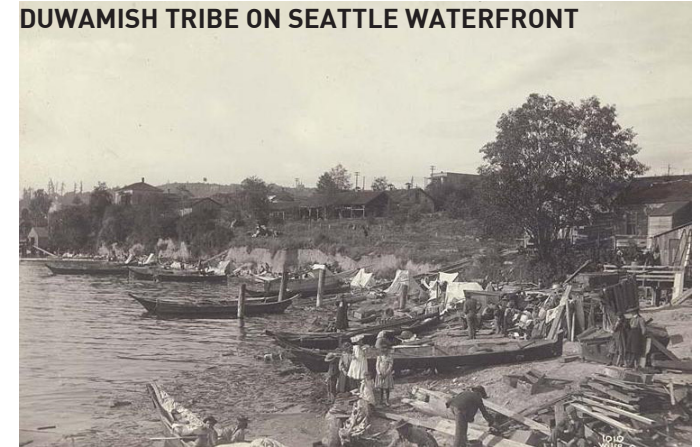


A LANDSCAPE TRANSFORMED: Over time, the undeveloped dynamic ecology of the Lower Duwamish River gave way to a completely industrialized landscape that is seen today. The image to the left shows the pre-development shoreline (recorded in 1854) overlaid on top of the current urban industrial shoreline, clearly illustrating the degree to which urban and industrial land uses have been constructed in former intertidal and estuarine floodplain area (identified by the dark green shading). All images sourced from George Blomberg, Port of Seattle.

industrial center began to emerge outward. Early on, the native tribes that existed in this area were assimilated into the labor force and tribal reservations were advocated for in this quickly changing environment (Klingler 2007). While the land-holding legislation and local policies associated with Seattle's early settlement initially allowed native tribal populations to integrate within the central areas of development, elevated hostility, violence, and disease eventually led to widespread segregation and displacement of these people. By the early 1900s, the Lower Duwamish River had been transformed from a complex, shallow, meandering channel into a straightened, dredged, and armored waterway. Filling and development of the riverbanks caused the elimination of 97 percent of the native intertidal mudflats and salt marshes and a complete loss of forested wetland areas (Port of Seattle 2009). Meanwhile, the hydrological engineering of the region resulted in significant decreases in river flow and over a 90 percent reduction in the area of stream spawning habitat accessible by migratory fish (Port of Seattle 2009). This major salmon migration route had become an industrial thoroughfare, possessing few natural habitat features.

The industrialization of this region reached a climactic peak with the construction of Harbor Island at the mouth of the Duwamish River. The Puget Sound Bridge and Dredging Co. constructed the island by filling in the river's delta with 24 million cubic yards of sediment and soil provided by dredge spoils from the Duwamish River and excavated material from the city's regrade projects (Wilma 2001). The project was completed in 1909 with a total area of 420 acres (EPA 2010). Harbor Island became home to a variety of commercial and industrial enterprises, including flour milling, ocean and rail transport operations, bulk fuel storage and transfer, secondary lead smelting, lead fabrication, shipbuilding and repair, and metal fabrication (EPA 2010). Over time, unregulated industrial activities turned the island and the whole Lower Duwamish River industrial area into a highly contaminated regional landscape. Remedial investigations began on Harbor Island in 1980 and soil contamination was determined to be well above acceptable human health risk levels. Widespread contamination ultimately resulted in both Harbor Island and the Lower Duwamish Waterway to be federally designated as Superfund Sites.

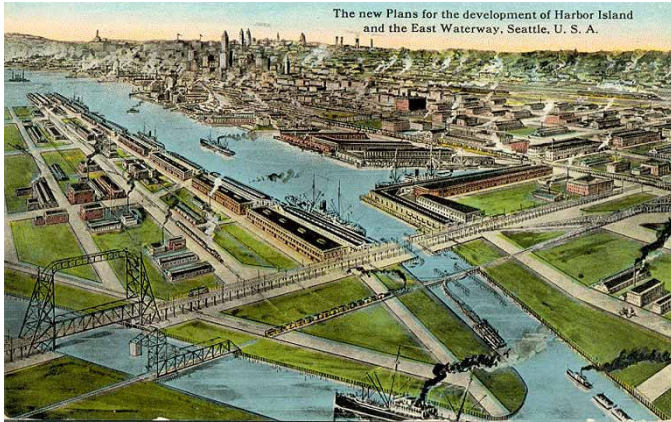
The Environmental Protection Agency, Port of Seattle, and a myriad of other governmental, private, and non-profit organizations are now heavily involved



Source: <http://www.duwamishtribe.org/elliotttreaty.html>

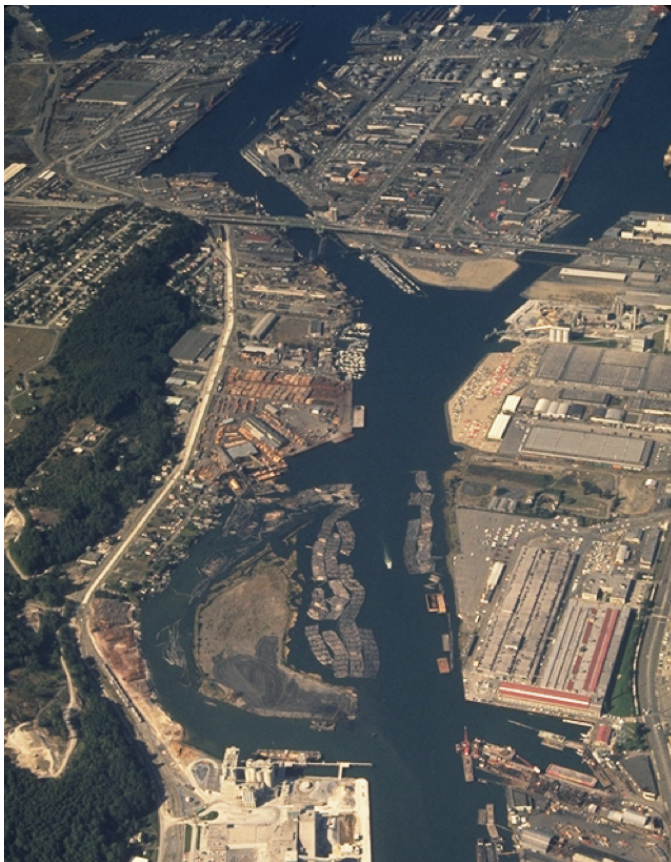


Source: George Blomberg, Port of Seattle



Source: <http://pnwblog.wordpress.com/tag/harbor-island/>

with the remediation and restoration of the Lower Duwamish River and Harbor Island. There are many stakeholders invested in the future of this region and many issues of contention. Issues such as legal responsibility, funding, public health, environmental justice, and tribal fishing rights have made responding to these degraded environments a slow and difficult process. The process is moving forward though – the EPA and other public partners have begun long-term remediation of the region and the Port of Seattle has produced a habitat restoration plan for the Lower Duwamish River. Over the course of 100 years, Harbor Island has evolved from a freshly constructed, blank canvas, ripe with economic promise, into a complex site riddled with a legacy of contamination and largely devoid of ecological value. This is a dynamic place with multiple identities: a dramatically transformed urban ecosystem, an economically productive industrial nucleus, an opportunity-rich landscape that demands creativity and innovation in planning and design.



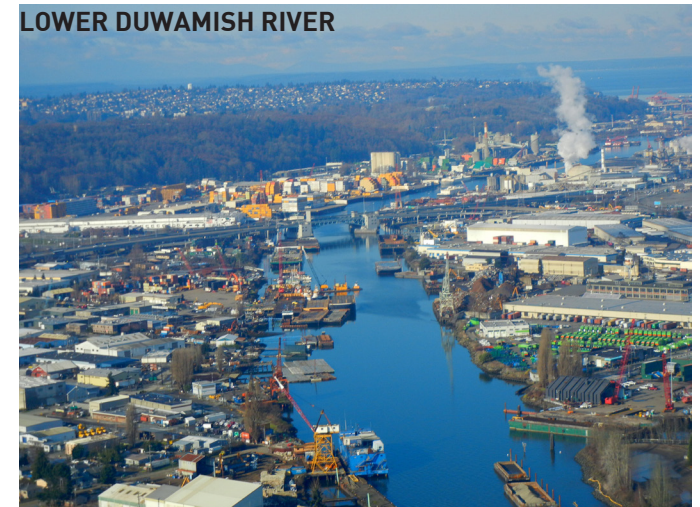
Source: George Blomberg, Port of Seattle

**PROBLEM STATEMENT +
CRITICAL STANCE +
CONCEPTUAL FOUNDATION**

PROBLEM STATEMENT

The industrialization processes that have taken place in cities worldwide have been relatively singular in their goal – to maximize economic growth. In an effort to separate noisy, dirty, and potentially dangerous industrial activity from where people live, cities have implemented zoning regulations, resulting in homogenized industrial landscapes disconnected from the public realm. While industrialization has helped generate robust economies, in many cases it has simultaneously eradicated critical ecological functions and ignored any form of public engagement. Over time, economic shifts and a legacy of unregulated manufacturing and production processes and left many sites within these segregated industrial centers abandoned and contaminated. Industrial zoning and residual contamination increase the difficulty for redevelopment of these sites and the potential that they will remain neglected and fenced off from public access for long periods of time. The industrial homogenization directed by zoning regulations has produced a monoculture within our urban landscapes. The limited diversity of land use and social and ecological functions exhibited by these industrial monocultures results in greater difficulty adapting to changes within dynamic urban systems. Cities are finding themselves with a ubiquitous problem – vacated post-industrial sites with varying levels of toxicity, often within close distance to the urban core, with limited economic and ecological value.

In many cases, redevelopment of industry at these sites happens slowly or not at all. Remediation of pollution and ecological restoration may be the first formal actions of response, but these initiatives are often completed in ways that miss many opportunities to creatively engage the public, express the dynamic history of the site, and explore new ecological enhancement strategies in highly degraded urban conditions. Remediation and restoration of contaminated post-industrial sites have become limited in their scope and outcomes. Contamination is typically addressed through excavation, removal, and capping. This method effectively displaces the problem somewhere else and/or hides the pollution on site. Ecological restoration efforts usually involve the reconstruction of native habitat conditions. An attempt to restore these sites to pre-development ecological conditions not only erases part of the site's cultural history, but fails to acknowledge the degree to which the environmental conditions have been transformed by urbanization and industrialization – ecological models that



Source: Griffin Strecker



Source: George Blomberg, Port of Seattle

AN UNDEVELOPED RIVER MOUTH



Source: George Blomberg, Port of Seattle

A RIVER MOUTH INDUSTRIALIZED



Source: George Blomberg, Port of Seattle

worked in the past may not work in the present. Both of these standard responses to remediation and restoration have a tendency to hide the associated problems and miss major opportunities for promoting synergetic relationships between industrial, social, and ecological processes.

At a larger urban scale, the standardization and privatization of public space presents its own set of issues. Seattle's public realm, like many other cities, is characterized by heavily manicured and regulated public spaces. While these sites are considered public, their sanctioned uses are typically restricted to what is deemed appropriate by law and social norms. Therefore, many citizens who live in the city and fall outside of what is considered normal are unable to engage with public space in a way that meets their personal needs. The prevalence and continued development of these hyper-sanitized places can not be expected to comprehensively serve the diverse populations associated with large cities such as Seattle. It is important to recognize the connection between this problem of public space and the problems of industrial centers and that a solution to one can become a solution to the other.

We are left with the questions: How can we effectively reactivate these toxic, residual, post-industrial sites that lay embedded within working industrial landscapes? What are innovative ways of regenerating these sites with integrated industrial, social, and ecological functions? How can we diversify industrial landscapes, enliven the public realm, increase resiliency, and set new trajectories for how we reincorporate these sites back into urban ecological systems? This problem statement directly applies to the heavily industrialized segment of the Lower Duwamish River in Seattle, WA. There are numerous sites along this corridor that are waiting for a decision on their future use or have been remediated and restored using the traditional approaches. Harbor Island rests at the beginning of this industrial corridor at the mouth of the Duwamish River and is the place where I will explore design solutions to these problems.

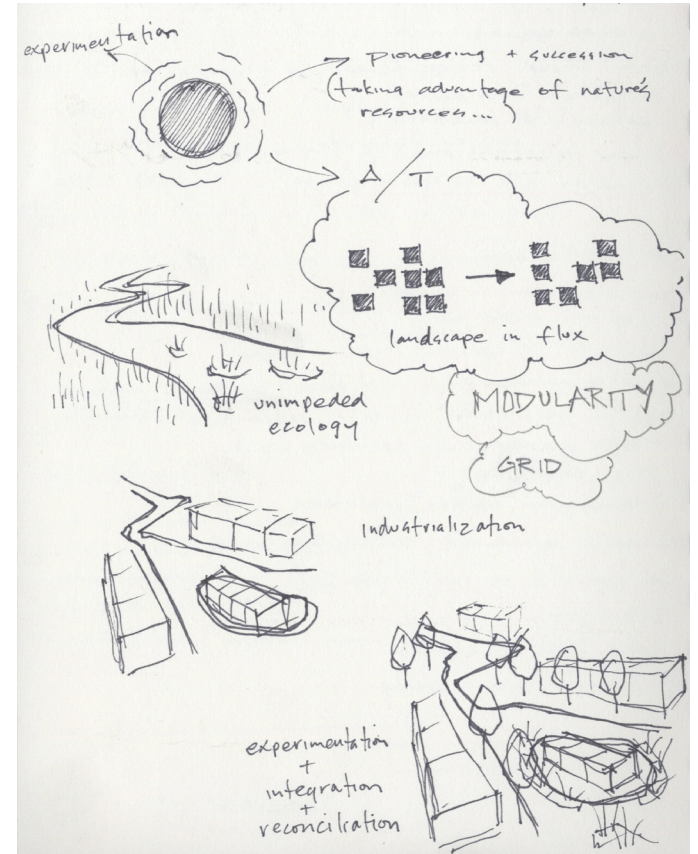
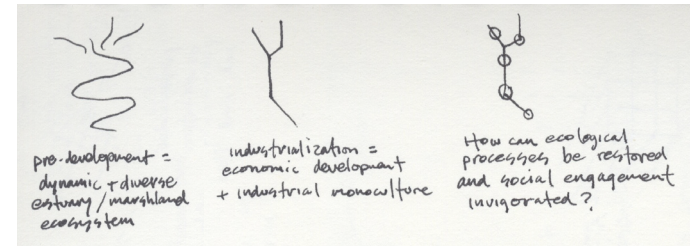
CRITICAL STANCE

The ecological, cultural, and industrial histories of this region have embedded my site with powerful narratives and meanings. Harbor Island can be viewed as

the apex of the industrial domination that defines the current character of the Lower Duwamish River. This is a unique and dynamic landscape, completely constructed for the purposes of industrial proliferation. The constructed island, accompanied by the dredged and channelized waterways, represent the heightened degree to which the local river ecology was transformed and cultural impositions compromised environmental health. Harbor Island also serves as a visual centerpiece for this industrial corridor through its prominent form, spatial orientation, and proximity to downtown Seattle. This place presents a poetic opportunity to explore our cultural relationship with this constantly changing landscape and to promote reconciliation with this damaged environment.

The remediation of industrial pollutants and reestablishment of ecological function on Harbor Island should be implemented in a way that encourages interpretation of the site's historical narratives and our place within this unique landscape. Harbor Island offers an important venue for exploring new methods of ecological design that can restore critical functions while stimulating understanding of site processes and supporting a new typology of public space. While the remediation and ecological regeneration of this industrial landscape will be intentionally implemented as the foundation for site design, this framework will be applied in such a way that strategically reinforces an experiential quality and social program distinct from the many parks and other standardized public spaces found in Seattle. Subtle programmatic elements and site furnishings will be integrated within the ecological framework and industrial matrix to further support a variety of creative outlets and human needs that are typically outlawed in the public realm (e.g. graffiti and sleeping).

As discussed, contaminated industrial and post-industrial sites present a variety of complex problems with respect to the more immediate needs of addressing lingering pollution and longer term desires to reactivate ecological and social functions and potentially redevelop. I am approaching the design of my site in a way that turns the complications of residual toxicity, degraded ecological function, and limited social engagement into unique opportunities for experimentation in the landscape. The degraded and contaminated nature of these sites, their diminished ability to support various functions, and their contextual location within active industrial landscapes make them perfect places to test novel methods of landscape recovery. Experimentation in remediation, ecological



SPOKANE STREET CORRIDOR, 1898 - VIEW WEST



Source: George Blomberg, Port of Seattle

SPOKANE STREET CORRIDOR, 1998 - VIEW WEST



Source: George Blomberg, Port of Seattle

design, and social programming are profound ways of diversifying these industrial landscapes, generating resiliency within our urban systems, and connecting the public realm to critical industrial and ecological processes. Through this approach, the site becomes a testing ground and living laboratory for various operations that can bring new life to derelict landscapes. Experimentation takes the role of catalyzing the “transformation of mono-functional industrial structures to the design of multi-layered, urban-ecological systems” (Belanger 2009).

Although my site design proposal will be focused on localized enhancements, the proposed interventions are intended to be part of a larger scale influence on how we can respond to the needs of the Lower Duwamish River industrial corridor as a whole. Therefore, relatively short-term design impacts at my site could become part of a long-term vision and local site interventions could be linked into a systemic network of efforts. Not only will design ideas at my site have the potential to inform a large-scale regional strategy for the Lower Duwamish River, but the findings that would theoretically be determined from experimental operations at my site could be used to replicate effective procedures elsewhere. I have selected an area along the western edge of Harbor Island as the place to explore innovative design responses to the prevalent problems in this industrial area. Different types of site conditions exist along this edge (upland and shoreline) and I expect that my design ideas will help inform alternative approaches to remediation, habitat enhancement, and public space at various types of sites along the Lower Duwamish River and beyond.

My thesis takes the stance that standardized strategies of remediation and restoration of contaminated post-industrial sites are limited in their scope, missing unique opportunities to explore new ways of supporting critical industrial and ecological processes while simultaneously enhancing Seattle’s public realm. My design proposal provides a counterpoint to EPA remediation plans and Port of Seattle habitat restoration plans by supporting synergetic relationships between industrial, ecological, and social processes and capitalizing on the distinct opportunities that these complex post-industrial sites have to offer. This design effort will also serve as a counterpoint to the heavily manicured and regulated public spaces that dominate the public realm. Through my research and design process, I propose the strategic implementation of ecologically driven phytoremediation strategies that decontaminate the land while promoting

greater understanding of site processes, habitat enhancements that prioritize the exploration of novel constructed ecologies over the goal of restoring to native conditions, public space that offers unique experiential qualities and possibilities for appropriation in Seattle, and adaptive reuse of industrial facilities that can be fluidly integrated with each of these new strategies of site regeneration.

CONCEPTUAL FOUNDATION: PIONEERING, SUCCESSION, AND EXPERIMENTATION

Pioneering and succession have defined the evolution of the Lower Duwamish River through varying periods of history in both ecological and social contexts. Prior to the development of the region, this landscape exhibited pioneering and successional processes characteristic of dynamic river ecology. As a landscape constantly in flux, disturbance regimes would periodically allow pioneer species to exploit opportunities for establishment, thereby initiating growth of successional species. After discovery of this ecologically productive area by native Northwest tribes, a period of cultural pioneering and appropriation of natural resources took place. It is important to note that these cultural advancements largely occurred in symbiosis with the surrounding ecological processes. The arrival of American and European settlers in the Duwamish River valley resulted in cultural succession in which the native tribal culture was largely eradicated and displaced to make way for the development of Seattle. This cultural succession and urban development fostered the establishment of industrial pioneers along the Lower Duwamish River and the subsequent appropriation of the river and its tidal marshlands and mudflats as an industrial landscape. Growth and succession of industry along the Lower Duwamish River has proceeded to this day and the ecological character that existed in this region prior to development has been largely erased. As this dynamic river ecosystem was transformed into an industrial waterway, biodiversity was sacrificed for a largely singular land use and ecological productivity was traded for economic productivity.

Over time, industrial activities have left the Lower Duwamish River heavily polluted, both in the river's sediments and throughout various upland sites. While most of this industrial corridor is still an active part of Seattle's economy, the entirety of the Lower Duwamish River and Harbor Island have been federally



Source: <http://www.portseattle100.org/properties/terminal-10>



Source: <http://www.portseattle100.org/properties/terminal-10>

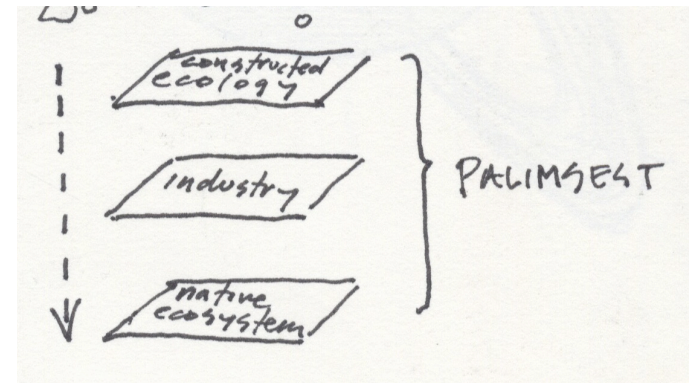
designated as Superfund sites. Although this industrial monoculture has a limited ability to respond to public and ecological concerns, the economic shifts and legacy of pollution that have produced numerous underutilized and contaminated post-industrial parcels along the Lower Duwamish River can be viewed as a valuable disturbance regime. The degradation of these sites serves as an opportunity to pioneer novel land uses and operations, to establish new successional trajectories, and to generate a more diverse and resilient landscape.

The concepts of pioneering and succession encourage the exploration of new solutions to the widespread problems associated with these sites. The production of an experimental landscape capitalizes on a diverse array of successional processes. Through the strategic application of diverse experimental operations, derelict and residual sites can become places of investigation and breeding grounds for innovative methods of landscape recovery. Experimentation implies that the outcome of the design is unknown to a certain degree and that monitoring succession throughout the site will allow the determination of the most effective site design strategies, whether ecological, social, or industrial in nature. Regeneration of ecological function and promotion of social appropriation on Harbor Island should be approached through a scheme that embraces open-endedness and indeterminacy. The pioneering of new ecological and social processes within an active industrial landscape has minimal precedent and therefore should not be based on a master plan model with a pre-determined outcome. In this sense, my design strategy does not treat succession as a procession toward a final product or climax system but rather as the evolution of a constantly changing dynamic equilibrium. The design intent is less about product and more about the process of testing novel reclamation strategies in these highly degraded and contaminated environments – ecological and social experiments in an industrial laboratory. Even the concept of an experimental landscape is not meant to be a permanent fixture at the site. Instead, this proposal is intended to play an intermediate role of revitalizing the site through adaptable and flexible interventions until a previously established or different pioneering land use takes over (e.g. industrial redevelopment, public park, inundation from sea-level rise, etc.).

The ideas of pioneering and succession give my thesis a conceptual grounding in which my site can be viewed as part of a temporal continuum – an ongoing

“They are nevertheless not so much a problem as a challenge and a chance. Experimentation, the search for new forms of reanimating and appropriating space is the common thread between numerous temporary projects. There are also projects that, although originally intended to be of limited duration, put down roots in one location, grow, develop and become professional. They thus contribute to a location’s long-term, sustainable development. Yet it is the pioneering spirit of such projects that we can detect first and foremost. Urban pioneers aim to draw on the richness of everyday experience: this variety, these differences and contrasts are today elements of urbanism” (Senatsverwaltung 2007).

story where historic patterns of pioneering and succession have directed the evolution of this dynamic landscape in different ways and where critical changes can now be initiated and new regenerative processes can unfold. "Cities are not static objects, but active arenas marked by continuous energy flows and transformations of which landscapes and buildings and other hard parts are not permanent structures but transitional manifestations" (Berger 2006). This landscape has moved through phases of uninhibited ecological dynamism, cultural settlement, intensive industrialization, and severe degradation. We now find ourselves with an opportunity to catalyze a new wave of landscape succession along the Lower Duwamish River that is ecologically, socially, and industrially productive. Experimentation will become the method of initiating these new pioneering and succession processes and generating an operative capacity on the ground. Through pioneering new forms of ecological design, public space programming, and industrial operations on Harbor Island, we effectively set a new successional trajectory for the industrial landscape of the Lower Duwamish River and beyond. The goal of this endeavor is to instigate the evolution of a synergetic system of seamlessly integrated ecological, social, and industrial infrastructures.



LITERATURE REVIEW: BUILDING A THEORETICAL FOUNDATION FOR DESIGN

INDUSTRIAL, POST-INDUSTRIAL, CONTAMINATED, RESIDUAL

The economic growth and physical expansion associated with urban development has come at the cost of intensive natural resource consumption, environmental degradation, and waste production. These metabolic processes of resource use, growth, and waste production are the foundation of urbanization and economic development. The respiration resulting from urban growth becomes vivid as we confront the legacy of pollution left in our urban landscape from past industrial activity. These contaminated lands, are ubiquitous – on waterfronts, along rivers, in outlying areas. These economically and environmentally degraded landscapes pose challenges for soil and groundwater scientists, engineers, legal and regulatory agencies, planners and designers, neighborhood communities, and the public at large (Hough 2001). Ultimately, there is no growth without waste, and in some ways, waste landscapes can be seen as indicators of healthy urban growth. Alan Berger uses the term *dross* to describe the waste landscapes found in urban areas stating that “the challenge for designers is thus not to achieve *drossless* urbanization but to integrate inevitable *dross* into more flexible aesthetic and design strategies” (Berger 2006).

In America, the contamination of these properties and their respective liability is a prioritized concern. While other countries (e.g. Germany) have had an easier time opening post-industrial sites to the public, the perceived fear, heavy regulations, and liability issues associated with their contamination has stifled domestic redevelopment. The remediation of these legacy contaminants remains a major financial challenge for post-industrial sites but progress is being made. Collaboration between scientists and engineers has resulted in the development of economically viable clean-up strategies that support the adaptive reuse of complex industrial structures, allowing increased flexibility in landscape design and pioneering new site uses (Hofer 2012).

There are many different ways to approach the reclamation of these types of sites and generally any formal reaction is usually thought of as an improvement, whether this involves simply capping leftover toxic soil and hauling away contaminants or restoring some economic function. It is important to consider



Source: <http://www.friendsoftheireishenvironment.net>

that “while the recycling of derelict industrial land to alternative urban uses has been accepted practice for many years, it has frequently been accompanied by developments that have too often done little to enrich the environments they have replaced” (Hough 2001). The time has come to embrace these post-industrial, contaminated, and derelict landscapes as unique opportunities for implementation of innovative reclamation and restoration strategies along with progressive methods of planning and design. The question now is not why we should reclaim these sites, but how.

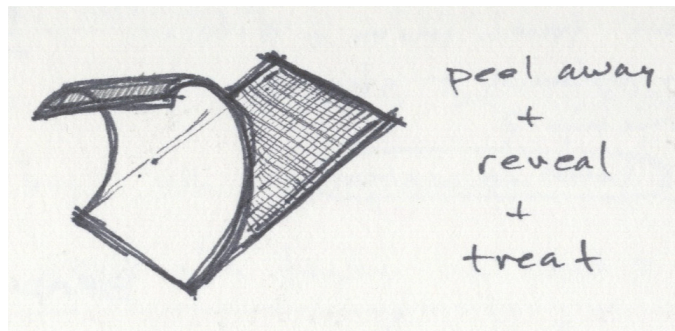
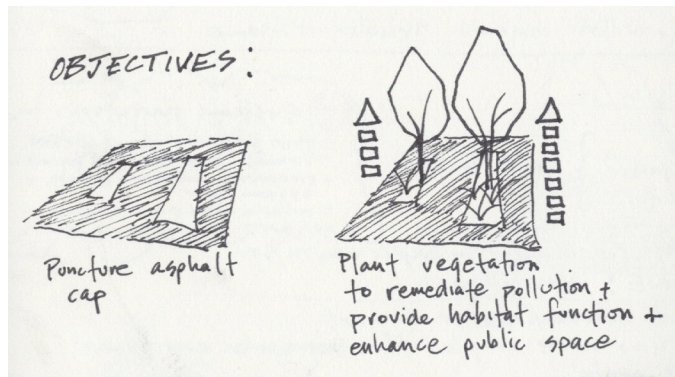
Post-industrial sites have now become a hot topic in the landscape architecture world. As more and more of these contaminated and abandoned sites are being identified by cities for redevelopment, landscape architects are being increasingly called on to help regenerate and transform these supposed wastelands into something new and beautiful. The recent influx of numerous international design competitions based on a variety of contaminated landscapes are a testament to this new wave of attention. We are now witnessing a transition toward a new approach to post-industrial site reclamation. Environmental, ecological and social factors have begun to challenge the conventional roles of economics and urban development as the determining priorities for redevelopment (Hough 2001).

Although scientists and engineers have strengthened our technical ability to address site pollution and redevelop these landscapes, methods of remediation and redevelopment often miss many opportunities for innovation and creativity. Once there is momentum to address the pollution and reclaim these types of sites, a common response is to erase their character, wipe them clean of their dirty history, and start over with a tabula rasa approach. Traditionally, the clean-up of industrial sites has been limited in scope – involving the excavation and hauling away of contaminated soil and other material to hazardous waste dump sites or alternatively, the entombment of contamination under an asphalt or concrete cap (Jackson 2001). It is as if we are ashamed of the site’s previous industrial life and the way the land was treated. Contamination is capped or hauled away and ultimately hidden from view. Industrial structures are torn down and removed. The site’s previous use is covered up by the restoration of a pre-development, native landscape. Through each of these site responses, history is expunged as a new utopian vision replaces the former wasteland.

Although this cycle remains relatively commonplace today, there is a concurrent movement in contemporary landscape architecture to look at post-industrial sites through a different lens and to approach their redesign in a much more sensitive way. Julie Bargmann of D.I.R.T. Studio notes the visceral awareness of these degraded landscapes that exists today and the conflicted feelings about these sites. The need to move past the business-as-usual response and identify alternative approaches to post-industrial redevelopment has emerged but there is still a prevailing gap in understanding how a more restrained and sensitive approach can be implemented successfully. Bargmann has directed the work of D.I.R.T. Studio toward promoting a new model for working with these sites, treating them as valuable cultural landscapes. Rather than following in the engineer's footsteps, which typically leads to cleaning up contaminants while simultaneously erasing the site's history, Bargmann implores the need to address the cultural and ecological needs of the site while elucidating its historical layers. She goes on to note that the implications and consequences of these sites need to be made visible and that the engineering of these systems are culturally significant acts that designers need to make legible (Bargmann 2006).

The recent development of remediation practices reveals a potential paradigm shift – moving from strategies of mechanically cleaning a site to biologically based solutions (Jackson 2001). “Industry and universities, or other research institutions, may benefit by collaborating on experimental sites to determine larger plant palettes for remediation, and to monitor the effectiveness of selected plants – especially as a huge range of sites worldwide may need attention” (Jackson 2001). “In the early stages, these projects should become design laboratories, where process and results are evaluated with data created for further refinement and integration in subsequent projects” (Carman 2001). “Because of their contamination, industrial contexts, and secured perimeters, brownfield sites offer a viable platform from which to study urban ecology while performing reclamation techniques. These sites have the potential to accommodate new landscape design practices that concurrently clean up contamination during redevelopment, or more notably where reclamation becomes integral to the final design process and form” (Berger 2006).

While remediating site toxicity is a major need with its own scientific and technical requirements, making the transition from a neglected, post-industrial landscape



“A large park on a disturbed site provides an immersive, aesthetic, collective experience in a vast landscape, one too large to grasp at a glance and so extensive that it implicates multiple systems and processes. This somatic, haptic, and yes, aesthetic experience transforms abstract knowledge into embodied knowledge” (Meyer 2007).

into a public space brings in another layer of complexity. The desire to meet multiple objectives at these sites presents a major opportunity to integrate site remediation, ecological improvements, and public space programming into a synergistic system. There is potential to transform these wastelands into unique living laboratories that embrace existing industrial activities, experimentation in remediation, and regenerative design while allowing new social ecologies to proliferate. In moving toward this goal, phytoremediation and site design can intersect through the use of vegetation to cleanse the soil while simultaneously forming spatial relationships, marking activity areas and circulation routes, creating aesthetic compositions and forms, and providing habitat for wildlife (Carman 2001). Once barren landscapes can be strategically populated with trees that extract legacy contaminants while enhancing the experiential qualities of the site and informing its use as public space.

Through embracing the full breadth of these sites’ histories and making the remediation of toxic leftovers a visible process, we can effectively create connections with the public and generate understanding. Through understanding, we can begin to change values. Post-industrial sites act as palimpsests with layers of meaning, offering critical opportunities to interpret human relationships with our urban ecological habitat. There are many narratives embedded in these sites – the degradation of native ecosystems, the economic growth spawned by industrial domination, and the cultural reconciliation involved in cleaning legacy pollutants and restoring ecological function. Design is the mechanism by which these narratives can be expressed in the landscape and communicated to city inhabitants. In paradoxical fashion, “we can heighten the desire for new interactions between humans and nature where it is least expected: in derelict spaces” (Balmori 2010).

While this more responsive approach to post-industrial sites will help inform my design process, it is important to note that as a whole, Harbor Island is not post-industrial. In fact, it is a place where industry is thriving. Harbor Island is home to a variety of industrial functions, including shipbuilding and repair, fuel storage, and significant container shipping/cargo transfer. Although industry is alive and well here, the island does house some abandoned post-industrial parcels and other underutilized sites. Much of Harbor Island’s soil is contaminated and capped while some parts of the island’s edge have been partially restored with

a messy beach-like character. The historical narratives of this area, which have layered upon one another and left the site with many meanings, are reflected in the island's varied physical character. Harbor Island can now be described as a place of active industry, a place where industry has phased out and left land vacated, a place where toxic soil is hidden, and a place where plans to reestablish 'nature' have taken place.

There are a multitude of unique land uses on Harbor Island and somehow this place maintains a distinct experiential quality. The architecture, materiality, spatial scale, and activity of this industrial landscape and its simultaneous post-industrial flavor leave Harbor Island feeling raw, gritty, honest, and somewhat surreal. It is a place of energy flows and changing physical fabric – from the movement of cargo ships and semi-trucks to the decay of old buildings and creosote pilings. All the while, the Duwamish River surrounds the island and reminds us of the site's dramatic environmental history. Harbor Island is unintentionally beautiful – the beauty of the industrial sublime. It offers a visceral experience unique within Seattle, a type of experience that should be held sacred.

SOCIAL PROGRAM: A TENSION OF SORTS

We are at a point in time where public space is being increasingly demanded in dense urban settings but the 'publicness' of these places is becoming increasingly unclear. Public space is a broad term that can take on numerous meanings within many different types of urban spaces. In many cases, what is deemed as public space is in fact designed to encourage certain kinds of uses and is therefore designed for certain kinds of people. There is a gradient of tightness in which public spaces find themselves. Some places are designed and managed in such a way that use of the space may be quite limited (e.g. seats and tables provided for consuming purchased goods in the midst of watchful security guards) while other places provide a much more open forum for activity (e.g. large open fields offering different types of relaxation and recreation with periodic check-ups by park management). Despite this gradient of tightness, people will tend to appropriate these spaces in a way that suits their desires, and if told not to do so, they will find somewhere else that they can satisfy their personal needs.

“When architecture and urban design project their desire onto a vacant space, a terrain vague, they seem incapable of doing anything other than introducing violent transformations, changing estrangements into citizenship, and striving at all costs to dissolve the uncontaminated magic of the obsolete in the efficacy” (Sola-Morales 1995).



AS SEEN ON HARBOR ISLAND - AESTHETIC OF THE INDUSTRIAL/RESIDUAL





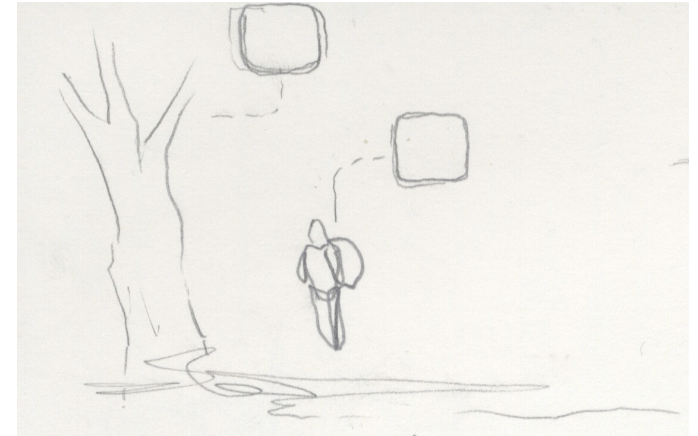
Although this individual appropriation of public space increases the dynamic nature of these environments, public spaces are often relatively homogenized in their spatial features and intended programs. Pocket parks, plazas, and promenades in the downtown urban core may be designed with seats, tables, open area, trees, art, and/or fountains and are usually intended for very specific uses. These types of public spaces are typically heavily regulated in order to minimize any activities that cause any sort of disturbance (e.g. skateboarding), are unlawful (i.e. public drinking), and that are simply not normal (e.g. sleeping on a bench or climbing a tree). As one leaves the urban core, larger park environments are usually found scattered through various neighborhoods. These peripheral public spaces typically become looser in their social activities but they commonly exhibit formulaic designs with the intention of promoting only park-appropriate behaviors. Many park spaces seem to be created with a cookie cutter that continually replicates the same features: open lawn, sports fields, basketball court, playground, benches, tables, pathways, trees, maybe a covered area, maybe BBQ pits. These parks are valuable amenities in urban environments but their repeated design frameworks only encourage common recreational and leisure activities. Other activities such as homeless encampment, art production, drinking alcohol, skateboarding, and making modifications to the site have limited opportunities to take place and/or are prohibited. Active policing of prohibited activities of larger parks is applied similarly to public spaces in a downtown area but usually with less frequency. The fact is, the design and physicality of public space, along with its degree of management, maintenance, and regulatory oversight, all have major impacts on what activities will take place. In many cases, there are limited opportunities within public spaces to engage in activities that much of society considers transgressive, yet there is a significant population of people that have the need and desire to participate in these types of activities.

Loose space is a term that describes public space at the opposite end of the spectrum – “space apart from the aesthetically and behaviorally controlled and homogeneous “themed” environments of leisure and consumption where nothing unpredictable must occur” (Franck 2007). Loose space therefore becomes “the breathing space of city life, offering opportunities for exploration and discovery, for the unexpected, the unregulated, the spontaneous and the risky. Loose space is, by definition, space that has been appropriated by citizens to pursue activities not set by a predetermined program. Many of these spaces possess particular

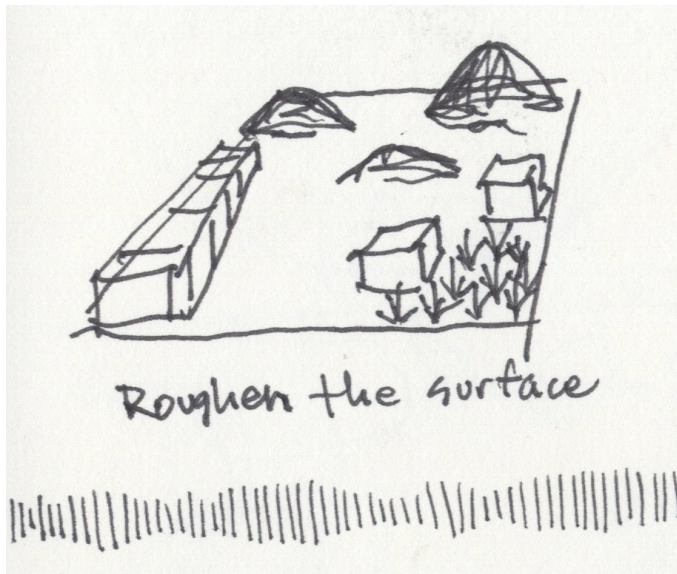
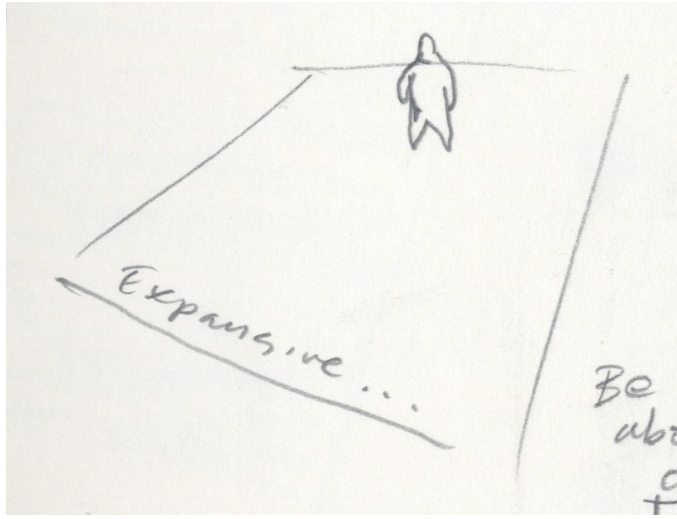
physical features that invite people to appropriate them for their own uses” (Franck 2007).

Within the context of post-industrial and/or contaminated sites, many larger scale reclamation schemes focus on the desire to cleanse and transform the landscape as a first step for significant redevelopment. In some cases this redevelopment is based on major economic investment and takes the form of commercial, residential, or mixed-use construction. When public space is the goal, these sites are often designed to become grand public parks in their respective cities (i.e. Brooklyn Bridge Park in New York and Crissy Field in San Francisco were both constructed on contaminated lands and have both become central cultural attractions). In thinking about the issues concerning public space that were previously discussed, it is important to consider the potential that contaminated lands in transition offer to reimagine how public space can perform in the urban realm. “Lacking officially assigned uses, leftover spaces and abandoned spaces lie outside the “rush and flow” as well as the control of regulations and surveillance that come with the established uses of planned urban public space. They are the negative or void to the city of named and fixed types of open space (park, plaza, street, sidewalk) – the “other” places” (Franck 2007). It is in these residual and derelict landscapes that new typologies of public space can be tested. “Public space in the city must surely be more than mere token compensation or vessels for this generic activity called “recreation.” Public spaces are firstly the containers of collective memory and desire, and secondly they are the places for geographic and social imagination to extend new relationships and sets of possibility” (Corner 2006). Harbor Island presents a unique opportunity to pioneer a novel form of public space within Seattle – a loose space where appropriation is encouraged and many pursuits that are prohibited elsewhere can unfold.

The contextual character of Harbor Island as an active industrial, post-industrial, contaminated, and spatially removed landscape which is perceptually separated from the ‘everyday city’ has important implications for its potential as a future venue for public use. Visiting these kinds of sites can evoke a sense of escape and freedom. “Tightness of programming suddenly unravels, allowing the insertion of activities in search of a home. Such spaces may be oddly shaped or difficult to get to, they may lack a name or be secret; yet they become places of expression



“Landscape can create meeting places where people can delight in unexpected forms and spaces, inventing why and how they are to be appreciated” (Balmori 2010).



and occupation often because of these very characteristics" (Franck 2007). The residual complexion found on Harbor Island imbues it with a sense of looseness, laying a distinct foundation that can effectively support programming not typically found in urban public spaces. It is conversely the lack of delineated programming and absence of intentional public space design that promotes this looseness as abandoned buildings and publicly owned yet vacant parcels of land invite visitors to explore and appropriate the site in unforeseen ways. "If public space is where identities, meanings, and social relationships in cities are produced, codified, and maintained, it is through insurgent public space that alternative identities, meanings, and relationships can be nurtured, articulated, and enacted" (Hou 2010).

Current users of these spaces on Harbor Island include homeless people that have taken shelter in various ways, graffiti artists who leave their marks throughout abandoned buildings and on train cars, skateboarders who have found features to get tricky with, and other miscellaneous creative types that visit the site for personal explorations and documentation. While social programming in an active industrial landscape such as Harbor Island could be initially thought of as counterintuitive (per the norms of urban planning), the reality is that loose space is significantly lacking in Seattle's public realm and Harbor Island presents a unique opportunity for this limited resource to find a stronghold. If social programming were initiated here, it would be logical that the public space be quite distinct in appearance and program when compared to other existing public spaces. The design for the Seattle Central Waterfront provides a lens for which to characterize this contrast. On one side we have the 'front porch' of the City linking downtown to Elliot Bay – forecasted as being Seattle's grandest public space and rendered as a cultural attraction where people will come to celebrate utopian harmony. On the other hand, the site on Harbor Island becomes the 'dark side of the moon', providing a counterpoint to the grandness of the Seattle Central Waterfront. This public space is different – embedded in an active industrial landscape, removed from the 'everyday city', and defined by its embrace of a transitory environment pulsating with patterns of appropriation which are typically discouraged.

SEATTLE CENTRAL WATERFRONT PROPOSAL



Source: James Corner Field Operations

VISION OF "THE OTHER"



DECONSTRUCTING DESIGN

A critical part of my thesis project is to question how design should be approached at Harbor Island. What does design mean for a site that is not intended to become a grand public space, but rather fit within an existing industrial landscape? How can design be implemented in a way that will regenerate local ecology and address widespread contamination while simultaneously invigorating social function? How should a site be designed when the intention is not a predetermined outcome, but rather a sequence of successional and operational processes? A primary goal is to “create an environment that is not so much an object that has been “designed” as it is an ecology of various systems and elements that set in motion a diverse network of interaction” (Corner 2006). While it is important to think about this site abstractly in terms of operational systems and relationships evolving over time, it will be essential to simultaneously consider how to strike a balance between process and form and to embrace existing site experiences that make the place unique. Harbor Island presents an incredible opportunity to promote a synergetic integration of landscape and urbanism that fosters new systemic relationships between culture and ecology. Ecological design strategies, the infrastructural capabilities of landscape, and implications of form are investigated and discussed here in order to comprehensively ‘deconstruct’ my design approach on Harbor Island.

ECOLOGICAL DESIGN

What is ecological design? The term has become commonly used in the field of landscape architecture, yet it can be defined in a number of ways and possess multiple meanings. It is similar to the term sustainability in its broad scope and often times ambiguous delivery. As ecological design will play a significant role in my design process and proposed intervention for Harbor Island, it is important for me to explore the prevailing definitions of the term and articulate the particular approach that I will be applying to my project development. The Lower Duwamish River has been completely transformed from a shallow tidal marsh system with adjacent riparian areas to a deep, constricted waterway largely devoid of any vegetation. This landscape has taken on a totally different identity and ecological

character. Harbor Island itself is completely unnatural – a human construct built as the Duwamish River was dredged and land was filled for industrial purposes. While general ecological design goals will apply to this site, the specific design strategies must acknowledge the drastic changes that have occurred here.

In their book *Ecological Design*, Sim Van der Ryn and Stuart Cowan define the term as “any form of design that minimizes environmentally destructive impacts by integrating itself with living processes.” They articulate an approach that “respects species diversity, minimizes resource depletion, preserves nutrient and water cycles, maintains habitat quality, and attends to all the other preconditions of human and ecosystem health.” There is a large spectrum of ways in which ecological design can be applied. Examples include design that preserves unique habitats and biodiversity, uses the landscape and various biota to satisfy urban needs, and refers to ecological system dynamics as a model for non-biotic urban systems (e.g. industrial ecology). Landscape architecture is a field largely concerned with ecological design and efforts to design in this fashion can be realized in a multitude of ways. Restoration of ecological processes, implementation of green stormwater infrastructure, bioremediation of contaminated sites, and environmentally sensitive material use all fall under the purview of landscape architecture. Landscape architects design biotic systems and therefore hold high potential as ecological designers. There is significant opportunity for ecological design strategies to guide novel pioneering and succession processes on Harbor Island.

Since the concept of ecological design is quite broad, it is worthwhile to identify some specific aspects of the approach that may resonate particularly well for site development at Harbor Island. Ecological design strategies are derived from ecology in multiple ways. Ecosystem dynamics play a critical role in ecological design through the actual restoration of biotic systems and through their ability to act as a systematic model for design processes and urban development. As a model, the field of ecology gives us a valuable tool for observing and understanding complex urban systems and for interpreting how pioneering and succession might play out on Harbor Island. “Dynamic relationships and agencies of process become highlighted in ecological thinking, accounting for a particular spatial form as merely a provisional state of matter, on its way to becoming something else” (Corner 2006). Ecosystems provide critical functions for the

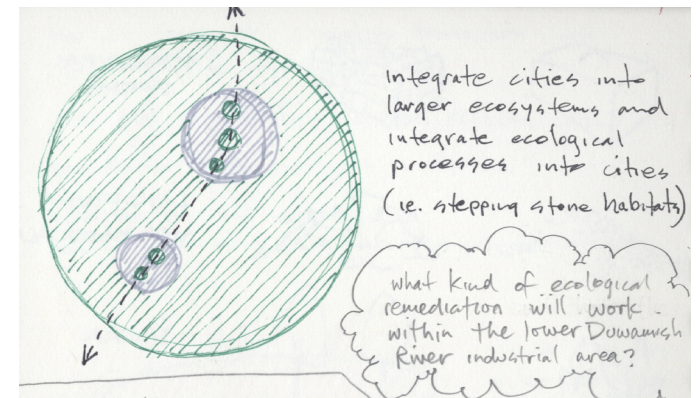
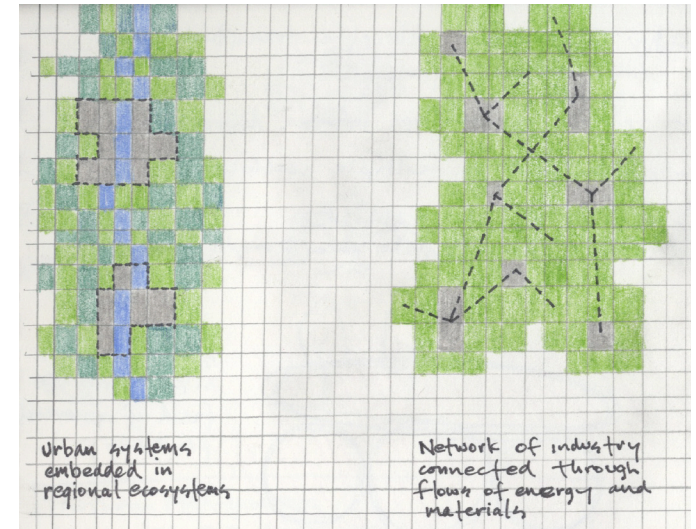
survival of life and also serve as a guide for environmentally sensitive urban planning and design. Ecological design strategies can be applied to Harbor Island in a way that reinvigorate valuable ecological processes on the Lower Duwamish River, actively respond to a legacy of pollution in the landscape, and connect the public to critical urban ecological systems.

The field of ecology has made significant leaps in understanding over recent decades, having direct implications on the application of ecological design. Ecosystems were previously viewed as steady state systems – assemblages of biota that evolve in relatively linear fashion towards respective climax communities. The recent transition in ecological theory has reformed this understanding of ecosystems toward a nonequilibrium paradigm in which landscapes are seen as “composed of shifting nodes of interaction, driven by dynamic temporal relationships rather than deterministic trends” (Hill 2005). This theoretical development refutes the idea of living systems existing in a stable state and instead supports the concept of a “meta-stable” set of conditions that constantly disappear and reappear. “The nonequilibrium view of ecology has very significant implications for the idea of sustainability in both human and nonhuman environments. In this new paradigm, sustaining a particular set of conditions is less meaningful than adapting to a fluctuating set of contextual variables. Attempts to hold systemwide conditions constant in a complex set of interacting variables are unlikely to succeed, if not impossible” (Hill 2005). As humans and their associated environmental impacts have also been widely incorporated into contemporary ecological thinking, it is essential to consider how these impacts affect ecosystem dynamics and how to adaptively manage rapidly evolving urban ecologies. Urbanization has become so intense and spatially encompassing that novel ecologies are becoming omnipresent. These unprecedented ecological scenarios no longer resemble pre-development, native conditions in any way (e.g. large scale hydrological engineering, widespread contamination, expansive impervious paving, agricultural monocultures, marine ‘dead zones’, desertification, climate change, etc.) and these vast landscape transformations necessitate an innovative approach to conservation and regeneration of critical ecological processes. The nonequilibrium view of ecology applies here – urging novel adaptation over deterministic restoration of past landscapes. Promoting ecological regeneration on Harbor Island must be done in a way that works within the highly degraded and transformed ecological context of the Lower Duwamish

River. Restoration of native ecologies may not make sense in these conditions, as the local environmental processes are now completely different than they were pre-development.

The dynamic indeterminacy expressed in ecological science is rooted in complex interactions of systems. Ecology is based on systems thinking. "Contemporary ecological theory does not see sites as the fundamental unit of prediction for future state of nature; instead, it must consider systems that exist at both larger and smaller scales than the site" (Hill 2005). Site design must be approached in a way that promotes the interconnection between the site and the large-scale geographical, geomorphological, ecological, social-cultural, and infrastructural systems in which it is embedded. Site design also needs to respond to the small-scale, fine grain systems that exist within, and transcend beyond, the site itself. Ecological design "integrates design across multiple scales, reflecting the influence of larger scales on smaller scales and smaller on larger" (Van der Ryn 1995).

Biodiversity is another critical facet of ecological design (Van der Ryn 1995) and should inspire site design strategies at Harbor Island. Life on earth depends on the preservation of diverse ecosystem types in range of successional states, the rich populations of native species they support, and the ecological processes and disturbance regimes associated with ecosystems (e.g. hydrology, nutrient cycling, migration, fire, and flooding). Designing for biodiversity increases the ability of an ecosystem to effectively respond and adapt to change, thereby embracing uncertainty and promoting resilience in the urban realm. Biodiversity is directly connected to the self-organizing capabilities of biotic systems. Ecosystems are constantly in flux as they respond to changes in physical structure and material flows. Ecological design embraces the ability of these ecological processes to direct the most appropriate system structure. This self-organization depends on the existence of sufficient biodiversity. Once a system is seeded with adequate diversity of organisms it becomes capable of adapting to environmental conditions, ultimately generating a system structure in dynamic equilibrium with the surrounding environment. This emergent system maintains resiliency through its embedded biodiversity. "Self-designing systems respond well to a wide range of disturbances because they can strengthen whatever pathways are most valuable in a given situation, flexibly rearranging themselves to maintain



their overall integrity” (Van der Ryn 1995). Ecosystem dynamics are extremely complex and ecological design takes advantage of the self-organizing engineering capabilities of biotic systems. Self-organizing systems allow designers to address inherent complexities by catalyzing particular system dynamics and letting nature do the work.

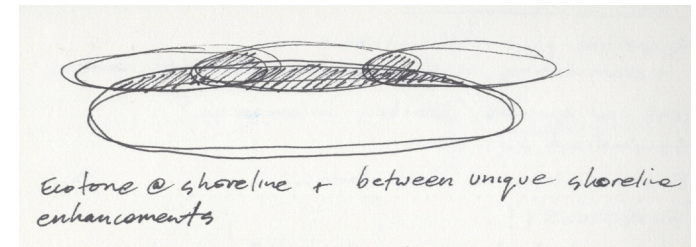
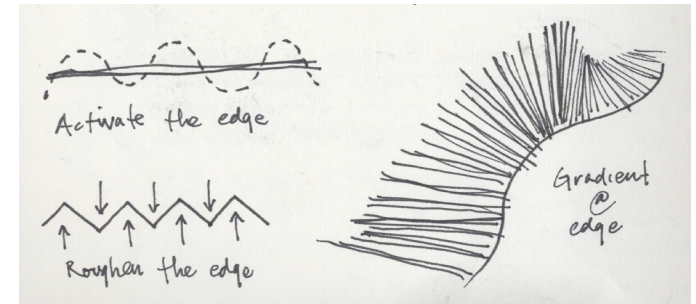
Harbor Island was built to support industrial expansion and since then has absorbed various forms of industrial waste – much of which has left the island largely contaminated. Ecological design recognizes the cyclic nature of ecosystems where waste from one process becomes food for another. In this sense, there is no waste in functioning ecosystems. This characteristic of ecosystem efficiency serves a model for closing the loop in urban systems where resource extraction and waste production are common. When waste becomes a resource for another process, the need for raw materials can be reduced and pollution can be avoided. Harbor Island holds many characteristics that make it an interesting place to explore innovative solutions to urban metabolic problems. As a landform that was constructed from dredged and excavated material and where dredging is still routinely implemented, a place that houses and is surrounded by industrial waste producing processes, and a landscape saturated with legacy pollutants, Harbor Island presents unique opportunities to transform waste into resources. There is not only potential to address the industrial contamination on Harbor Island but to reclaim underutilized, wasted space for innovative ecological operations and social programming. While these concepts integral to the field of ecological design, Alan Berger also suggests their critical importance within landscape architectural theory: “Studying how urbanization elegantly co-ops wastes, and reincorporates them in the service of efficiency, aesthetics and functionality, should be at landscape urbanism’s center.”

Harbor Island is a dynamic place, comprised of numerous highly active industries, abandoned buildings and land, partially restored river edges, and public space all circumscribed by the Duwamish River and Elliot Bay. The insertion of new pioneering land uses on the island in the form of ecologically productive industry and site development would further amplify this landscape diversity. While these unique land uses and the adjacent river are important in their form and function, their relationship to one another must also be considered. These relationships are represented in a guiding principle of ecological design – the

ecotone. Ecologically speaking, ecotones are edges where two or more different environmental typologies meet (e.g. where land meets water or forest meets prairie). These are places where intensified interactions and exchanges of materials and energy produce maximum biological diversity and productivity. These “soft” edges are critical parts of viable ecosystems but also serve as a metaphor for how to approach urban settings. “By designing ecotones rather than hard edges, we intensify interactions. We bring together a greater diversity of life in an ecological ecotone, and we encourage greater cultural and economic diversity in an urban ecotone. In doing this, we facilitate the flows of materials, energy, and information that can catalyze self-designing processes” (Van der Ryn 1995). The edge will play a critical role at Harbor Island.

The goal of pioneering new landscape typologies on Harbor Island brings with it an intention to uncover the unique environmental history of the Lower Duwamish River, to build awareness of local ecology, and to create an experiential connection to this industrial microcosm. Urban development has extinguished ecological processes from the landscape in favor of hard-lined engineering of the city. Simultaneously, urban technological systems are hidden from view as well. In many ways, both ecology and technology are rendered invisible. Not only have habitat-rich river edges and meandering floodplains been replaced with static sea walls, but stormwater disappears into underground pipes and garbage is transported to distant waste transfer stations and landfills, and industry is pulled away from public contact – out of site and out of mind. An essential foundation of ecological design is to restore visibility and generate connections to these processes. Ecological and technological processes are inexorably linked – ecological processes can perform technical functions in urban settings and urban technologies can have major impacts on associated ecosystems. “Visual ecology” (Thayer 1976) is an urban design approach that seeks to make complex natural processes visible and understandable, unmask systems and processes that remain hidden from view, and emphasize our unrecognized connections to nature. By elucidating these processes, ecological design serves to promote understanding of system dynamics and place and to reveal the processes, patterns, and relationships of which life depends.

Ecological design seeks to further establish connections between the urban and the ecological through the production of “active landscapes” (Van der Ryn



1995). This strategy is relevant to Harbor Island as a form of landscape design that provides ecological functions that simultaneously meet the needs of both people and other biological communities. “Landscape practice stands to gain momentum by widening its sphere of intervention to include the operative and logistical aspects of urbanization. Though they may seem banal, these aspects can help bridge the current economic-ecological gap” (Belanger 2009). Through the development of active landscapes, ecological design can enable a symbiotic relationship between the built and natural environments. There is potential for a managed ecology to take root at Harbor Island – for constructed landscapes to perform valuable services while integrating into the larger ecological processes. The concept of active landscapes connects ecology to technology and is directly related to ecological infrastructure, which is discussed in the next section.

LANDSCAPE AS INFRASTRUCTURE

In order to successfully integrate urban and ecological systems, it is essential to facilitate the processes that these systems are built on. Approaching the design of Harbor Island through the lens of infrastructure provides a mechanism through which to channel novel pioneering and succession processes that are critical for the evolution of viable urban ecosystems. Harbor Island is a place of working industry that actively supports the economy of Seattle. The island is emblematic of the distribution and production processes that characterize the Lower Duwamish River industrial area. There is great potential for design to be implemented on Harbor Island in a way that fits within the existing context of doing work. “One could imagine landscape/architectural/urbanistic projects conceived as functional infrastructures, ecological machines that process and perform, public spaces that literally “work”” (Reed 2006).

Infrastructure is defined as “the basic physical and organizational structures and facilities (e.g., buildings, roads, and power supplies) needed for the operation of a society or enterprise” (New Oxford American Dictionary). Infrastructure is the diverse physical framework that supports viability, growth, and metabolism of the urban system. Infrastructure supports movement, flows, collection, dispersal, transmission, and all the other processes that are necessary for urban systems to thrive. The concept of infrastructure is important for my design approach at Harbor Island because although infrastructure has a physical

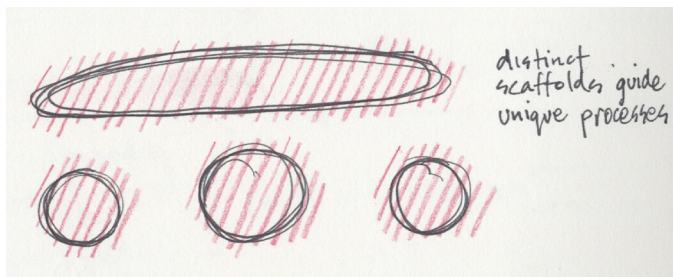
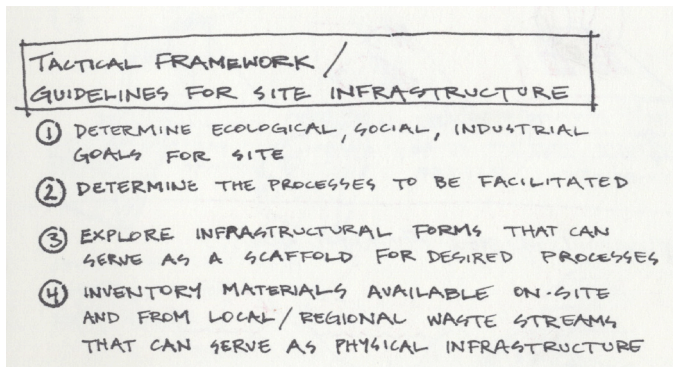
“The projection of new possibilities for future urbanisms must derive less from an understanding of form and more from an understanding of process – how things work in space and time.” (Corner 2006)

form, its significance arises more from the processes that it sustains. Here there is potential for the production of “fertile testing grounds that structure or initiate an unfolding of hydrologic, ecological, social-cultural, and urbanistic processes and adaptations – earthen infrastructures available for appropriation and transformation and whose form is valued for its performative rather than sculptural characteristics” (Reed 2006). Infrastructure is more concerned with the function it provides and the services it facilitates than what it looks like.

This functional role of infrastructure can be translated to my site through a description of infrastructural urbanism as “a practice engaged in time and process – a practice not devoted to the production of autonomous objects, but rather to the production of directed fields in which program, event, and activity can play themselves out” (Allen 1999). In this sense, infrastructure can perform the role of a scaffold at the site by initiating and supporting various desired processes. “Urban infrastructure sows the seeds of future possibility, staging the ground for both uncertainty and promise. This preparation of surfaces for future appropriation differs from merely formal interest in single surface construction. It is much more strategic, emphasizing means over ends and operational logic over compositional design” (Corner 2006). It is helpful to think of the infrastructure or scaffold as the organizing framework where future changes in the landscape will unfold. There is a distinct contrast between the framework itself and the processes that are bred within its supporting structure. “Although static in an of themselves, infrastructures organize and manage complex systems of flow, movement, and exchange” (Allen 1999).

Infrastructure is typically discussed in terms of roads, sewers, power lines, and other “grey” systems but there is now increasing discussion revolving around “green” and ecological infrastructure. The conventional meaning of modern infrastructure is being redefined through the amplification of the biophysical landscape that it has historically suppressed and the reformulation of landscape as a “sophisticated, instrumental system of essential resources, services, and agents that generate and support urban economies” (Belanger 2009). The field of ecological engineering embodies this transforming perception. While conventional engineering replaces nature with non-biotic structures and processes (e.g. sewer pipes and artificial levees), ecological engineering uses the structure and processes of biotic systems to satisfy urban needs (e.g. floodplains

“The processes of urbanization are much more significant for the shaping of urban relationships than are the spatial forms of urbanism in and of themselves.” (Corner 2006)



for flood control and wetlands for wastewater processing). “The engineering of basic elements such as topography, hydrology, and biomass as a system can be instrumental in the amplification of invisible yet fundamental processes that support urban development” (Belanger 2009). The landscape of infrastructure has become a highly effective vehicle for exploring the relationship between natural processes and the city (Mossop 2006). Landscape has the power to preserve and restore the ecological processes that our urban systems ultimately depend on, from stabilizing urban hydrology through stormwater infiltration to increasing biodiversity through habitat development. As we begin to reenvision urban systems as being fully integrated with ecological processes, it makes sense that the physical landscape that supports these processes be promoted as critical urban infrastructure. By embracing landscape as infrastructure that underlies other urban systems and waning off the traditional view of landscape as non-urban nature, we gain a much more workable conceptual framework for designing urban systems (Mossop 2006).

It is also important to recognize that an infrastructural framework does not need to be singular in its function, but can in fact be polyfunctional through its facilitation of multiple services simultaneously. At Harbor Island, an infrastructural approach to design not only has the potential to support the need for ecological enhancements and remediation of pollution, but to encourage processes that generate a social connection to the history of the site, the current industrial work, and the possible future of this human-constructed landscape. It is valuable to think of the Harbor Island as an infrastructural landscape that is polyfunctional and fluid – a place that provides multiple important services and embraces transformation. “Infrastructures are flexible and anticipatory. They work with time and are open to change. By specifying what must be fixed and what is subject to change, they can be precise and indeterminate at the same time. They do not progress toward a predetermined state (as with master planning strategies), but are always evolving within a loose envelope of constraints” (Allen 1999). In this way, we can begin to visualize various scaffolds that serve as a pioneering effort to change the trajectory in the landscape. After the transformation is initiated, these scaffolds support the evolution of different successional processes. Infrastructure provides the guiding framework for the pioneering and succession that is intended for the site.

FORM

Providing a scaffold for various site processes and embracing indeterminate trajectories will be fundamental to my site design approach but it will also be critical to adopt appropriate form in my design. With significant theoretical writings declaring process-based design as paramount (e.g. Landscape Urbanism), it is important to remember the necessity of form and aesthetics in landscape architecture and the impact these attributes can have on Harbor Island. Form can not be neglected. Form has the potential to promote understanding of this complex site – to elucidate the dynamic historical processes that have taken place and to create an experience where current site processes come to life. “Shifts are taking place before our eyes. Landscape artists and architects need to give them a name and make them visible. Aesthetic expertise is needed to enable the transforming relations between humans and the rest of nature to break through into public spaces” (Balmori 2010). Form and aesthetics will play a key role in generating a unique sense of place at the site and influencing social program.

While ecological design’s general goal is to promote ecological and cultural viability, it is important to amplify the relevance of design in this motive. The potential applications of ecological design are relatively unlimited but it is through site-responsive design that a project can have the greatest possible impact. In the case of Harbor Island, there is potential for an aesthetic form that expresses the symbiotic relationship between culture, nature, and design – where the formal qualities make nature and technology visible and draw us closer to the systems that ultimately sustain us. “Aesthetics is not a frill but a necessity: a form of engagement for the people who use the spaces described here. It can connect people to nature in a new way, changing their experience of it” (Balmori 2010).

Ecological design can be summed up as the effective adaptation to and integration with nature’s processes – a hinge that connects culture and nature through exchanges of materials, flows of energy, and choices of land use (Van der Ryn 1995). This connection to nature will be an important concern in my design process and as we break into an exploration of ecological design, we inevitably find ourselves needing to interpret nature. Nature is a term riddled with different meanings and interpretations and it is important to determine how

the concept of nature relates to ecological design and ultimately to my project. Nature is defined as “the phenomena of the physical world collectively, including plants, animals, the landscape, and other features and products of the earth, as opposed to humans or human creations” (New Oxford American Dictionary). This definition and the summary of ecological design that preceded it exhibit the well-established binary thinking that separates humans from nature. While it can be helpful to have a term that quickly expresses the physical and experiential qualities of trees, rivers, and wilderness, the dichotomy that we have created between humans and nature has become problematic in terms of how we view nature and how we live with nature, especially in cities.

“This art of landscape camouflage masks the histories and processes of disturbed industrial sites and obliterates a connection that might render these parks more meaningful to the public” (Meyer 2007).

Landscape architecture has long sought a unification of ecology and design but there has been a struggle to derive compelling solutions to urban problems exhibiting this fusion (Mossop 2006). Cultural perception of nature impacts the evolution of form and design of biotic systems in landscape architecture and innovative forms of landscape design conversely affect how we think about nature. The view of nature as something “out there” – separate from humans and oppositional to cities – perpetuates the segregation of aesthetic design and ecological sustainability into separate camps and stifles the growth of ecological concern in the public realm. The polarization of city and nature has resulted in a landscape architecture tradition of treating nature as an ideology and equating landscape with natural form. Nature has been embraced by the profession as beautiful visual scenery, resulting in cookie-cutter representations of pastoral nature in dense urban settings (e.g. Central Park in New York City). These “natural” landscapes were constructed as isolated modes of relief from the dirty city. Ecological restoration efforts have more of a functional goal of increasing habitat and preserving biodiversity but also typically invoke natural forms reminiscent of pre-development, native landscape conditions. While this type of environmental restoration is beneficial and urgently needed, the exclusion of urban form and process from these projects remains extremely problematic (Corner 2006). Even though these patches of “nature” are designed and constructed by the human hand, they are made to look natural and un-designed. “Wrapping new landscape designs in old forms is a failure. Doing so hides the story and the demands of a present in which a paradigm shift has occurred. Nostalgic images of nature are readily accepted, but they are like stage scenery for the wrong play” (Balmori 2010). This design approach has maintained the

opposition between natural form and urban form in cities, thereby exacerbating the prevailing binary thinking. It is necessary to consider whether putting urban populations in touch with “this fictional image called “nature” will predispose everybody to a more reverent relationship with the earth and with one another” (Corner 2006). By consistently developing purely natural forms in the urban landscape, we miss opportunities to tell stories, generate wonder, stretch the imagination, induce understanding, and generate change.

There is increasing awareness in urban design professions that humans are part of nature and that there is no such thing as nature exempt from human influence. For better or worse, cities – along with the cultural, social, political, and economic spheres they encompass – are embedded in ecosystems and become part of these systems. There is a functional component of urban systems in which we have the responsibility to mitigate the damage of urban metabolism on the ecosystems that sustain us. There is also a cultural component to cities in which design and aesthetics of form are catalysts for inspiring behavioral changes and cultivating environmental ethics. Design needs to consider both function and form. The development of the field of urban ecology has led to new design strategies “that are based on an acceptance of the disturbed and hybrid nature of these landscapes and the idea that landscape design can be instrumental in working with natural processes to make new hybrid ecological systems. It is clearly not about making approximations of pristine natural environments, but rather making functioning ecologically based systems that deal with human activity and natural processes in the urban environment” (Mossop 2006). Contemporary landscape architecture practice is now reconciling with its past and proving that design and ecology can come together in powerful ways that go beyond simply mimicking natural forms. “We are inventing new structures that are closer to living ones. They are constructed systems which, while they take their cues from natural processes, do not emulate preexisting forms of nature” (Balmori 2010). Projects are now being enacted that provide ecological benefits, satisfy urban needs, and exhibit progressive aesthetic forms that are embraced by communities. “New form is a way of engaging people in imagining a transformed space, landscape, or city. Without the visibility of these new forms, neither a transformation nor a new engagement with nature can occur. With new forms we are able to engender a new relation with nature” (Balmori 2010). Ecological design is the mode of operations that can weave critical biotic processes back into

“The new paradigms of longevity and performance decisively break with the Old World pictorial, bucolic, and aesthetic tradition of landscape design. Instead, they give landscape planning and design a logistical and operative agency as a practice that deals with complex, multi-dimensional systems” (Belanger 2009).

cities, expose this integrated ecology in a culturally relevant way, and break the destructive dichotomies between the built world and nature.

Ultimately, form and process are not separate entities. Placing emphasis on processes should not negate spatial form, but rather seek to produce a “dialectical understanding of how it relates to the processes that flow through, manifest, and sustain it” (Corner 2006). Here we have an opportunity to design relationships between dynamic ecological processes and urban form, thereby capitalizing on the productive symbiosis between infrastructural character and formal design. Form and process are synergetic counterparts in design execution and when taking an infrastructural approach to landscape, the modern architecture ideology applies: form follows function. “We must put the twenty-first-century city in nature rather than put nature in the city. To put a city in nature will mean using engineered systems that function as those in nature and deriving form from them” (Balmori 2010). Harbor Island beckons for a unique aesthetic to take shape and for the site’s successional processes to merge with its formal qualities.

SAME SITE, DIFFERENT APPROACH

There are several past theses that have focused on the Lower Duwamish River and Harbor Island. I was aware of some of these projects before I selected my site, but most of them came to my attention after moving into thesis development. The Lower Duwamish industrial area is a fascinating place and it is no wonder that many design students adopt it for their work. Although part of me wanted to investigate an ‘undiscovered’ site and assert some form of personal ownership over the idea generation for that place, the Lower Duwamish River and Harbor Island are complex and robust enough in their history and present day character that there is limitless opportunity for unique design strategies. Although I am proposing a different trajectory for Harbor Island than what has been previously presented, there are some conceptual ideas that other thesis authors developed that I feel fit well with my approach.

One thesis by Brandusa Bularca (Master of Architecture, 2010) coincidentally proposed an intervention at the same site on Harbor Island that I have chosen.

The research for this project includes discussion on the value of embracing indeterminacy in site design. Bularca adopts the concept of the “Waiting Land Waterfront” as an applied strategy in which the Harbor Island site is allowed to take on intermediate functions prior to more permanent land uses that may evolve at the site in the future. Like myself, Bularca also expresses the need to develop a synergetic relationship between the industrial, ecological, and social processes at the site. In her conclusion, Bularca writes that “The processes of the clean-up can be the architectural landscape itself: pools of rust, debris collected, water marks, mounds of industrial materials, are all the traces of a process and activity which work with the industries and for the environment, and which become experiences for visitors and users. This way, architecture can manufacture a deeper public understanding of the issues of nature and industry through direct experience.” These are powerful ideas that resonate with my approach to Harbor Island – that the processes of regenerating local ecologies and detoxifying the landscape can become the landscape itself. Here, the processes that take place on the site become more important for resolving environmental needs than discrete physical forms. The physicality of the site retains its value because of its direct connection to these processes rather than from some unrelated formal qualities. These processes also play the critical role of amplifying social experiences on the site by providing a dynamic platform in which visitors can begin to understand the complex history, current functions, and possible futures of this place through direct visceral contact with the changing landscape.

Michael Lewis (Master of Landscape Architecture , 2010) produced a design thesis and focused on an abandoned, post-industrial site on the southwestern edge of Harbor Island. Lewis based his thesis and design approach on explorative immersion in the landscape and the experiential qualities of place. He used the physical act of walking to build a relationship with his site, achieve a deeper understanding of the site’s processes and character, and to ultimately inform a design methodology with the intention of being sensitive to the site’s history and existing subtle beauty. Lewis’s theoretical research of derelict sites offers inspiration in how to approach the design of post-industrial landscapes. These are places where uncertainty can be embraced. The unique post-industrial character of these sites offer respectively unique experiential qualities in the urban realm. An important idea that Lewis’s research promotes, is that “disturbed sites”

present an opportunity for design innovation – to capitalize on the disturbance as a mechanism to generate greater appreciation of the site’s historical narratives and to build cultural connections and understanding.

Another thesis by Victoria Halligan (Master of Landscape Architecture, 2011) provided particularly relevant theoretical foundations and design strategies for my approach but focused on a larger scale proposal taking on the entirety of Harbor Island. Halligan adopted a longer term planning approach in her design proposal through the phased development of coastal infrastructure that would respond to climate change and rising sea levels, provide protection for the industrial functions on Harbor Island, and regenerate critical nearshore habitat. Halligan expresses the need to integrate her site design with the dynamic, non-equilibrium system dynamics of the Duwamish River and does so through intensive development strategies and the adoption of multi-functional ecological infrastructure. The design calls for the relocation of industries vulnerable to inundation from sea level rise, development of an adjacent floating island for additional shipping terminal space, construction of a jetty system that serves as a scaffold for self-organizing salt marsh succession, and the production of phytoremediation mounds used to clean contaminated soil moved from areas at risk of inundation. Halligan’s work on Harbor Island presents potential ways of embracing dynamic systems, working with indeterminate environmental processes (e.g. river flow, tidal flux, sediment accumulation, species succession, and climate change), promoting resiliency, and implementing long-term synergetic responses to industrial and ecological needs. Process-based design and the use of landscape as infrastructure are developed quite thoroughly in this thesis. The idea of adaptable coastal infrastructure (jetty system built with different materials as means of generating diverse structural response mechanisms and allowing change in different ways over time in relation to varied environmental forces) is insightful and helpful in terms of thinking how an infrastructural scaffold might apply to a smaller scale design intervention at my site. Halligan promotes a strong link between ecological restoration and industrial preservation but I am also interested in exploring unique ways of enhancing the public realm. I am also less interested in attempting to restore a native ecological character but would rather investigate more experimental methods of ecological regeneration that respond to the novel urban ecology that has evolved along the Lower Duwamish River. Generally speaking, the conceptual

approach of this thesis is valuable for me consider but I expect my design interventions to be of a lower intensity and represented more completely at a finer scale.

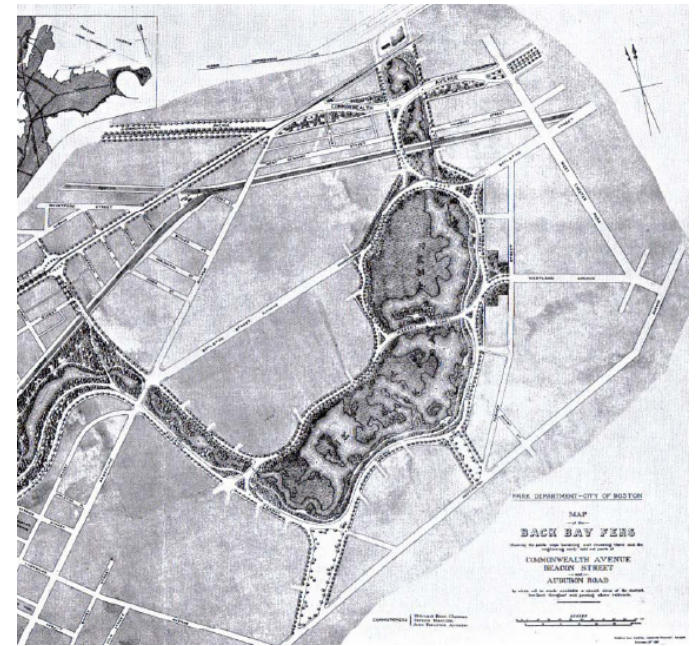
I feel that it was valuable to review some of these past theses in order to expand my research of the site, gain greater perspective of this part of Seattle, and interpret different ideas about the industrial, ecological, and social context and distinct historical processes of the area. Reviewing these theses helped me differentiate my approach to Harbor Island, ensure that what I'm doing hasn't already been done, and ultimately produce a thesis document that will bring something unique to the field of landscape architecture.

PRECEDENT STUDIES

Although I did not come across any built works or competition proposals that comprehensively represent my design intentions, a number of projects provided inspiration in a variety of ways and helped inform my creative direction. The following projects were selected for written review because they exhibit a diverse spectrum of design strategies and successional processes that embody distinct aspects of my approach to Harbor Island.

BACK BAY FENS (FREDERICK LAW OLMSTED)

Although most of the precedents I discovered were contemporary projects, it was illuminating to analyze a historical project that relates closely to the infrastructural goals of my design approach. Back Bay Fens is an urban park in Boston designed by Frederick Law Olmsted in 1878. Although the park has changed significantly over time, Olmsted's original design is exemplary of many urban ecological design principles. Even today, the design of Back Bay Fens serves as an innovative example of an infrastructural landscape. Early development of Boston's tidelands and floodplain resulted in the loss of the natural cleansing processes sustained by the tidal flushing and wetlands and increased property damage from flooding. In response to the transformed character of the local hydrology and intensive pollution, Olmsted initiated the reconstruction of a salt marsh system to mitigate the nuisance of foul waste, clean water on site, and prevent adjacent land from being flooded. This was essentially a call for a constructed wetland system and stormwater park, a novel idea for the time. "Olmsted considered the constructed, park-like landscape of the Fens itself as a piece of infrastructure – a basic component of the urban fabric, a component that made the city work" (Poole 1997). This conceptualization of the land itself as infrastructure was a groundbreaking departure from the conventional view of infrastructure in a park setting. Not only did the design of Back Bay Fens promote an ecological infrastructure that managed stormwater, mitigated flooding, and cleansed polluted sewer overflows, but it also incorporated a new sewer system, a parkway, and Boston's first streetcar line. A synergetic infrastructural system evolved through "the intertwining of transport infrastructure, flood and drainage engineering, the creation of scenic landscapes, and urban planning. Here the close collaboration between landscape design, urban strategies, and engineering produced a complex project integrating



Source: <http://landscapeandurbanism.blogspot.com/2010/11/artificial-rivers.html>



Source: <http://www.latzundpartner.de/projects/detail/17>

ideas about nature and infrastructure as well as health, recreation, and scenery” (Mossop 2006). Back Bay Fens is a valuable example of engineering, science, and aesthetics coming together to create a unique, multifunctional site that responded to infrastructural, ecological, and cultural needs.

LANDSCHAFTSPARK DUISBURG NORD (LATZ + PARTNER)

Latz + Partner’s seminal project in the Rhur Valley of Germany expresses a novel response to the reclamation, remediation, and design of public space at a post-industrial site. Landschaftspark Duisburg Nord is unique in its approach to the urban cultural landscape and its embrace of the site’s industrial heritage and dramatically altered natural conditions. Conceptually, the site’s disturbed and complex conditions were seen for their creative potential rather than as a nuisance that should be erased or camouflaged (Stilgenbauer 2005). While the project is largely known for its preservation and reuse of industrial structures associated with the site’s former use as a steel plant and blast furnace, I am more interested in the project’s integration of social programs with functional and aesthetic application of bioremediation and materials recycling. “A peculiar landscape beauty can be found on contaminated sites, such as Landschaftspark Duisburg Nord’s yellow moss atop slag heaps, or its forest of birch trees and its thickets of willow and butterfly bush colonizing contaminated railroad right-of-ways” (Meyer 2007). The project’s planting scheme is used as a way to communicate the disturbed nature of the site’s soils and processes of remediation at play. Material reuse is promoted on site as remnants of demolished structures were reused in planting substrates, recycled concrete, and for new paving materials. Similarly to Harbor Island, Landschaftspark Duisburg Nord has a major river cutting through the site. An important design move was to reestablish the ecological function of the river in a way that reinforced its industrial history and aesthetic, rather than “convert this reclaimed industrial channel into a pseudo-naturalistic, romantic, meandering waterway – as proposed by conservationists and other groups” (Stilgenbauer 2005).

MINNEAPOLIS RIVERFRONT DESIGN COMPETITION PROPOSAL (TURENSCAPE)

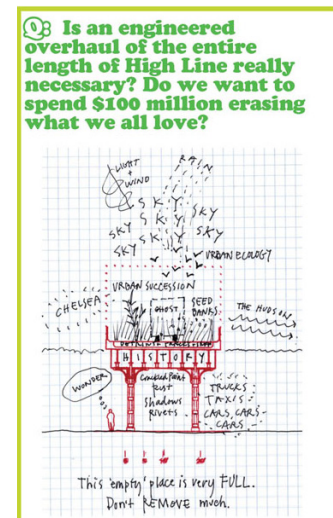
This design competition requested innovative proposals for the redevelopment of the industrialized and degraded Minneapolis Riverfront. The Turenscape Team's master plan submission focused on themes of ecological infrastructure and resiliency, supporting overarching goals of economic vitality, social equity, and ecological regeneration. The team's proposal includes a series of design ideas that connect particularly well with my design intentions. Suggested site interventions include the use of industrial buildings for murals and the implementation of phytoremediation to decontaminate the soil and provide new habitat. Industrial ecology is promoted through plans for a 'soil factory' that will remediate contaminated soils barged in from other riverfront sites, act as a composting facility for organic waste, and generate heat to be reused in winter garden greenhouses. A significant strength of this project proposal is the degree to which remediation processes, innovative industrial operations, and social programming are integrated on the site. The flexibility of the social program, from uninhibited exploration of the ecological and industrial infrastructure to defined education and research activities, helps keep the site loose and adaptable.



Source: http://minneapolisriverfrontdesigncompetition.com/docs/Turenscape_Proposal.pdf

HIGH LINE DESIGN COMPETITION PROPOSAL (D.I.R.T. STUDIO WITH MICHAEL VAN VALKENBURGH ASSOCIATES)

The design competition for the High Line in New York City requested visionary responses to the transformation of an out-of-commission, elevated railway corridor into a linear public park and circulation route. Even though this is a completely different context than Harbor Island, D.I.R.T. Studio and Michael Van Valkenburgh Associates drafted a proposal that embraces the idea of a successional environment in a profound and inspiring fashion. Their take on this project was to integrate the pioneering plant life that had evolved on this abandoned structure into the new design, simply inviting visitors up into the found wilderness of the elevated railway. "Proposing a process more than a product, the vision avoided packing the 1.3 mile long wildscape with the usual park



Source: <http://www.dirtstudio.com/#highline>



program and posed alternatives to big capital investments and high maintenance costs. Instead, the resourceful and restrained design intent was to allow visitors to explore the nuances of a degraded landscape's natural succession and experience that wildness in contrast to the other cultivated parks along the Hudson River" (D.I.R.T. Studio 2005). The idea of providing a counterpoint to other manicured public spaces and allowing people to experience a successional environment in its raw form closely resonates with my design intention at Harbor Island.

LESLIE STREET SPIT (UNDESIGNED)



Located on the shoreline of downtown Toronto, the Leslie Street Spit is an aquatic dumping ground turned wildlife refuge – a process that was completely unintentional. Construction of the Spit began in the late 1950s with the goal of forming a coastal barrier for the city's inner harbor. Ultimately, the Spit became a convenient place for dumping vast quantities of rubble and fill generated by Toronto's rapid growth in the 1960s and 70s. Over time, this dumpsite grew into five-kilometer long peninsula and due to fortuitous neglect, local ecology began to fill in. Emergent biota slowly colonized the landmass in the 1980s and 90s and eventually it became a significant urban wilderness on Toronto's shoreline. This ecological stronghold was "unplanned and undesigned, the accidental ecology of plants, birds, and mammals that took over this large wasteland" (Belanger 2009). The Spit has become a unique demonstration of pioneer plant communities and their succession in an area where industrial growth has destroyed much of the native habitat. Under the direction of the local government, the peninsula is now preserved as one of the most unique constructed wilderness areas in North America. The site now serves as multifunctional infrastructure, simultaneously operating as a dumpsite, wildlife habitat, recreation area, and coastal barrier. This project is a valuable example of the self-organizing capabilities of ecosystems and the potential for successional processes to generate diverse habitat structures. The Leslie Street Spit demonstrates how waste materials can become a scaffold for habitat development and the potential for these integrated systems to serve multiple infrastructural functions.

Source: <http://www.friendsofthespit.ca/>

Each of these precedent studies exhibit innovative design principles that inform my design process in distinct ways. Back Bay Fens provides a lens through which to view landscape as multifunctional operational infrastructure, in terms of both social and ecological enhancements. Landschaftspark Duisburg Nord consciously expresses the industrial history of a site and harnesses this narrative to effectively produce a unique and powerful aesthetic and experiential environment. The Minneapolis Riverfront design competition proposal shows how industry, remediation, and social programming could become synergetic counterparts in a reclaimed landscape while the High Line design competition proposal embraces process over defined product through the promotion of an unadulterated successional urban ecology. Finally, although the outcome was unintentional, the Leslie Street Spit represents the benefits of constructed ecologies and the potential for self-organizing biotic systems to emerge from a rather simple scaffold. These selected projects are valuable for my thesis as they show how some of my most critical theoretical concepts can be successfully translated into applied design.

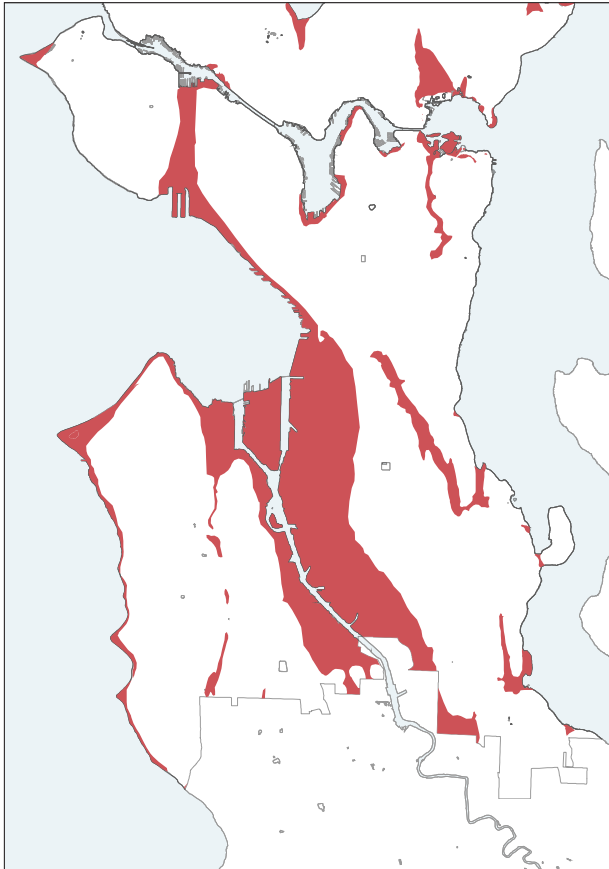
DESIGN: PROCESS AND PRODUCTION

SITE ANALYSIS

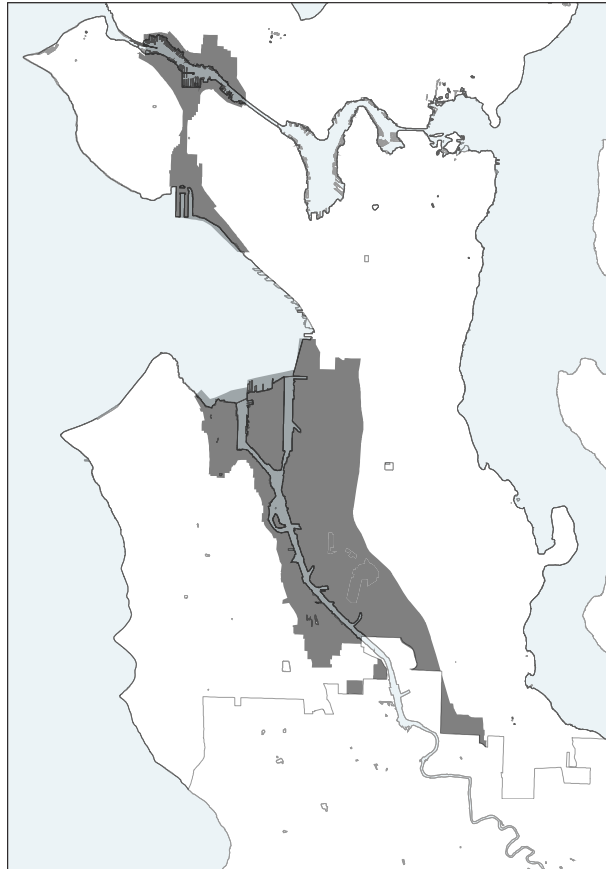
Harbor Island finds itself within a highly urbanized context. While it is located in South Seattle, it holds a relatively central location within the city. Harbor Island caps off the northern end of the Lower Duwamish River industrial area, sharing the edge of Elliot Bay with West Seattle, downtown Seattle to the northeast, and Interbay industrial area to the north. The Lower Duwamish River industrial area is the largest concentration of industry in Seattle, taking advantage of access to marine transport via the dredged Duwamish Waterway and its connection to Elliot Bay. Harbor Island is an apex to this industrial center – a period to the industrial dialogue that has dominated the conversation along the final reaches of the Duwamish River. There is a very close correlation between the geographical location of Seattle’s industrial centers and what is considered liquefaction zone within the city. This is because the industrial centers were primarily developed on fill as land was expanded outward from the native shoreline during Seattle’s early growth. This fill typically falls under liquefaction zone classification because of its higher saturation and relatively low structural stability (e.g. during earthquakes).

Industrialization and general urbanization have left Seattle’s landscape dotted with areas of pollution. The literal dots on the “Remedial Obligations” map represent sites registered with the WA Department of Ecology necessitating clean-up. These sites are seen to be concentrated through the Lower Duwamish River industrial area, from downtown Seattle up to South Lake Union (historical industrial center), and through the Interbay industrial area. The clear connection between contaminated and degraded areas of Seattle and industrial activity is further exhibited by the location of Port of Seattle properties that are designated as environmental concerns and/or remedial obligations (shown in dark red on the “Remedial Obligations” map).

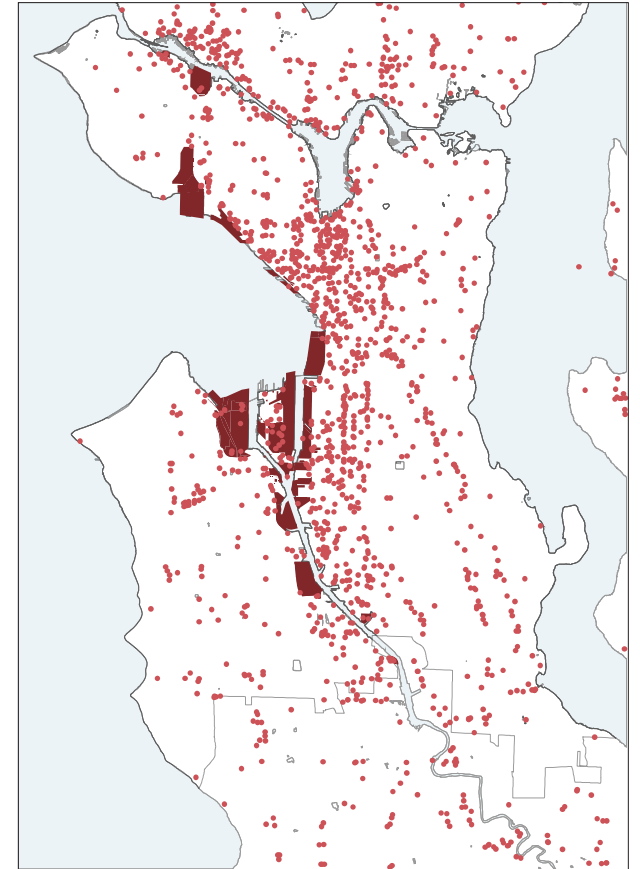
The dramatic ecological degradation that has taken place along the Lower Duwamish River is in many ways mirrored throughout Seattle. Intensive hydrologic engineering, shoreline filling, and removal of natural areas became widespread common practices enacted to facilitate economic growth, development, and urbanization of the city. While much of the pre-development ecological character of Seattle has been wiped out, some areas have managed to remain preserved and other areas have been restored (e.g. the wetlands at the



LIQUEFACTION ZONE

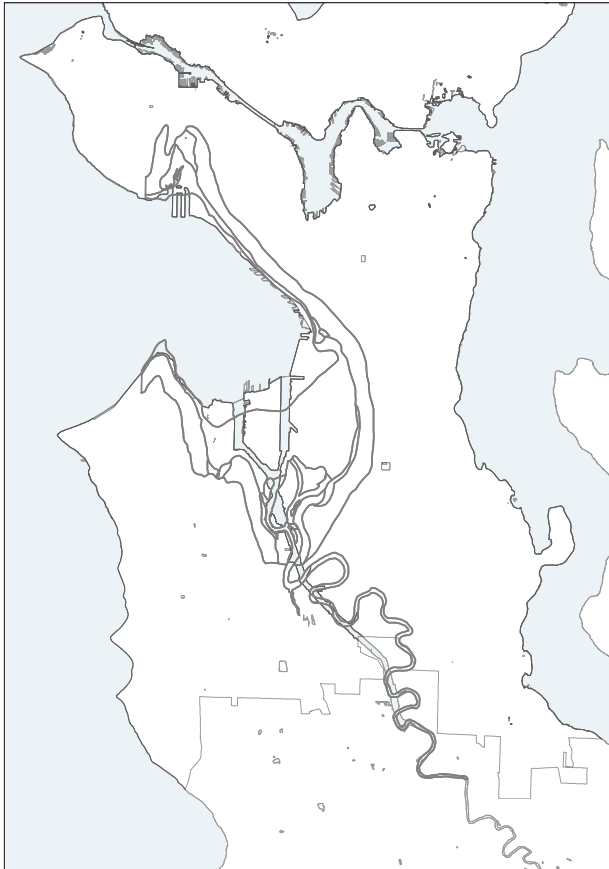


INDUSTRIAL CENTER

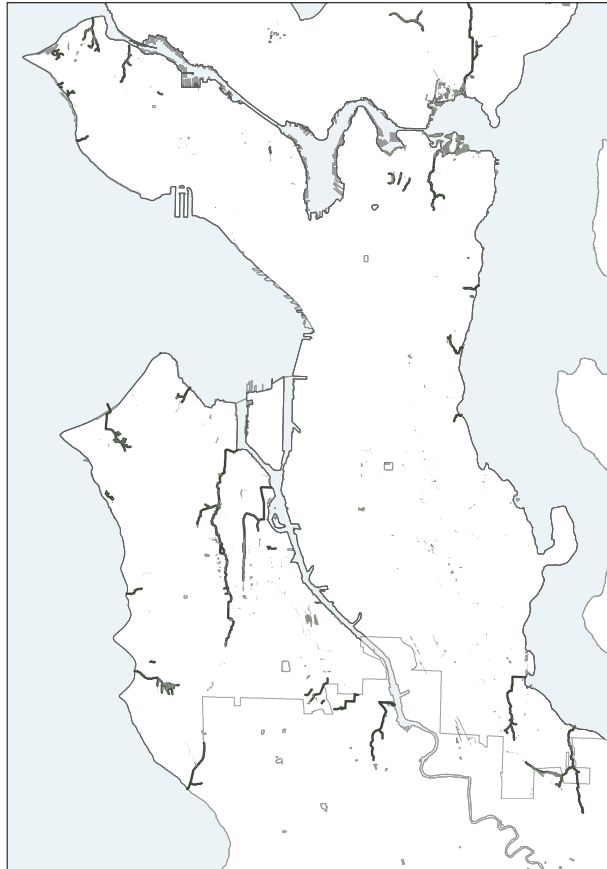


REMEDIAL OBLIGATIONS

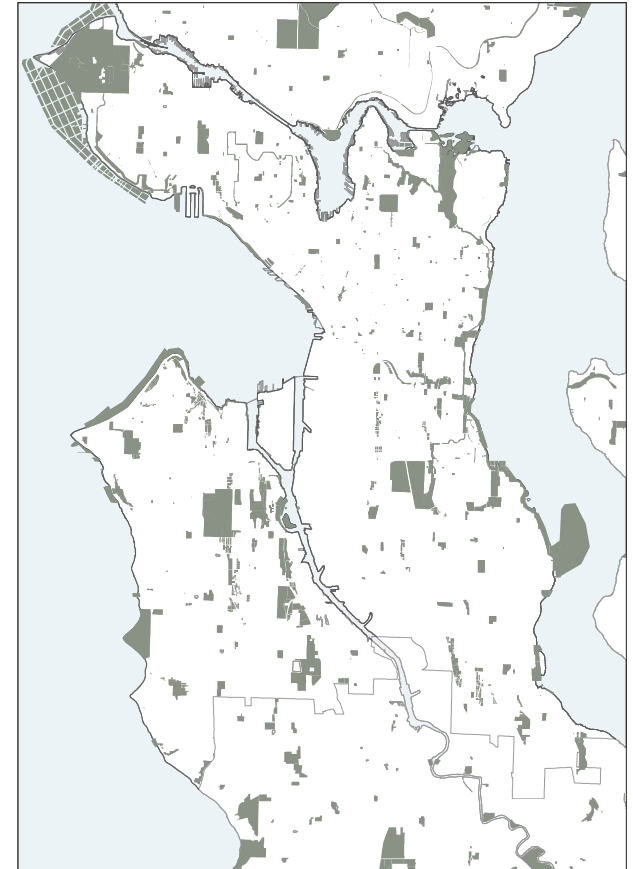
The Lower Duwamish River industrial area is the largest concentration of industry in Seattle, taking advantage of access to marine transport via the dredged Duwamish Waterway and its connection to Elliot Bay. Harbor Island is an apex to this industrial center – a period to the industrial dialogue that has dominated the conversation along the final reaches of the Duwamish River.



HISTORIC SHORELINE

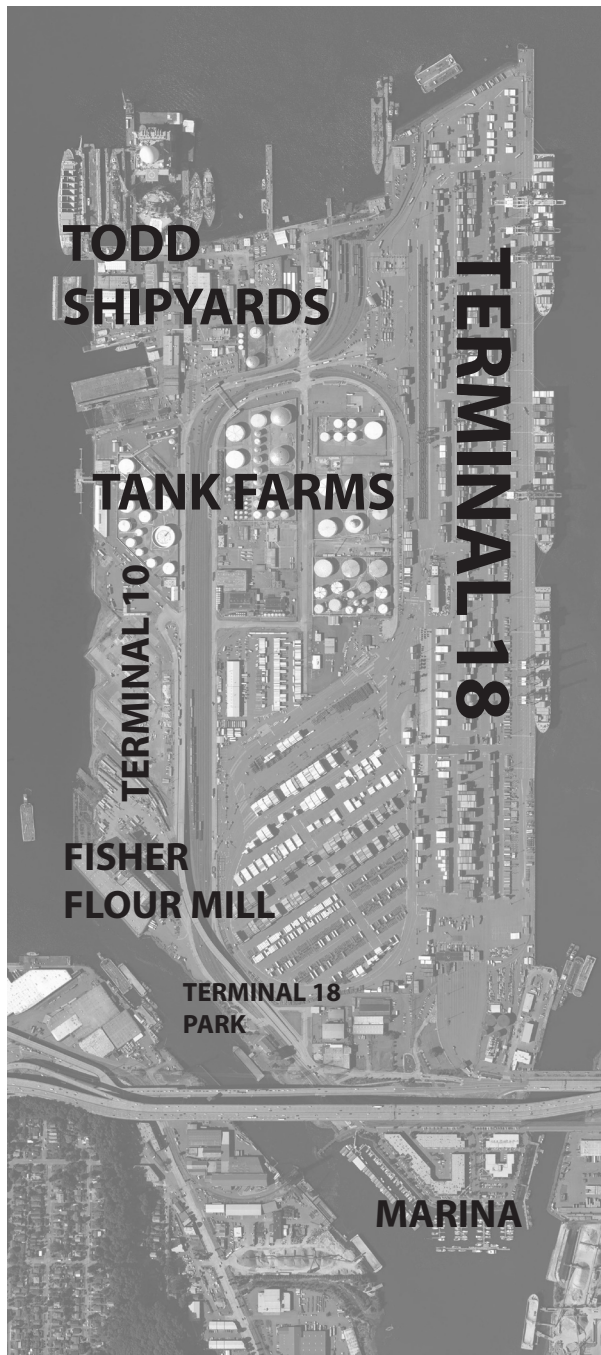


WETLANDS AND RIPARIAN CORRIDORS



PUBLIC PARKS

While much of the pre-development ecological character of Seattle has been wiped out, some areas have managed to remain preserved and other areas have been restored. The city's park system has also amended the urban landscape with plenty of green areas. Despite these efforts, there is still a prominent lack of green infrastructure at Harbor Island and in the Lower Duwamish River industrial area.



HARBOR ISLAND LAYOUT

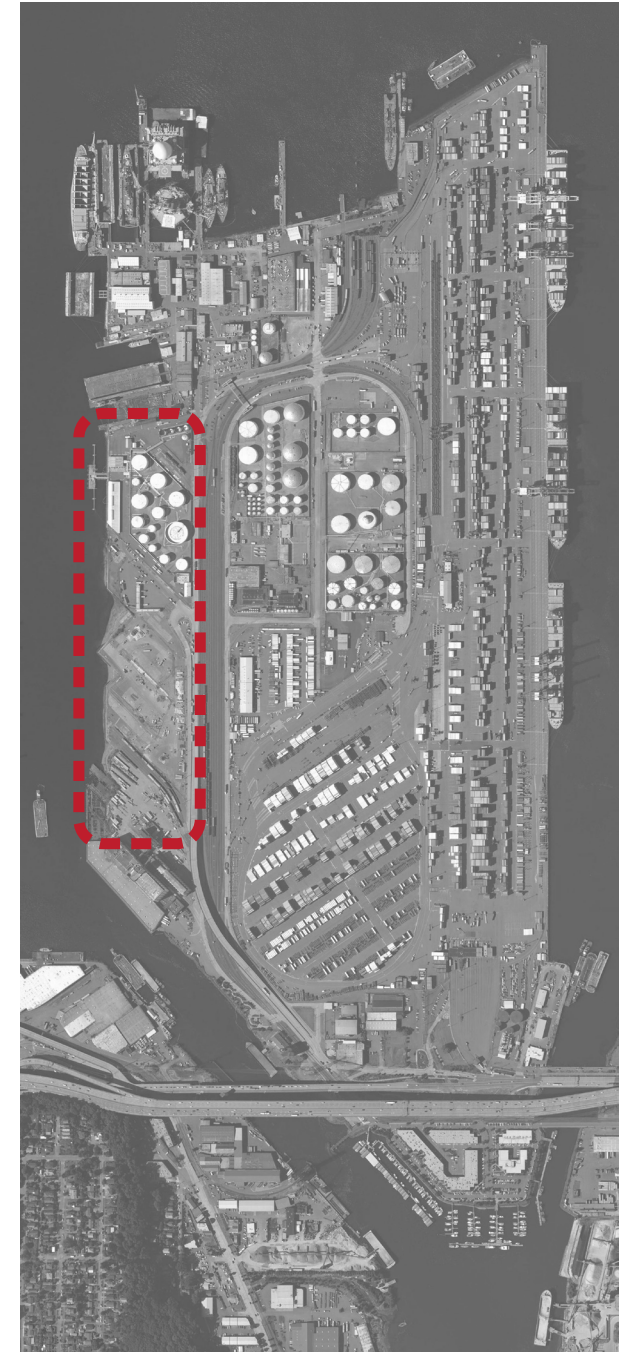
Union Bay Natural Area and Washington Park Arboretum shown northeast on the “Wetlands and Riparian Corridors” map). The city’s progressive park system has also amended the urban landscape with plenty of green areas. While these efforts have benefited local and regional ecological function, Seattle – like other major urban centers – represents a novel urban ecology where the built environment dominates the “natural.” Even though this is a larger scale urban phenomenon, the degree to which the Lower Duwamish River industrial area represents this character should be acknowledged. The “Wetlands and Riparian Areas” and “Public Parks” maps clearly communicate the prominent lack of green infrastructure in the Lower Duwamish River industrial area.

Although Harbor Island holds a central location is within close proximity to downtown Seattle, it is very much removed from the regularly accessed areas of the city. Not only is Harbor Island perceptually segregated from the ‘everyday’ city along with the rest of the industrial area that continues to the south, it is also physically isolated due to the fact that it is an island. Accessibility to Harbor Island is served via major arterials connecting to West Seattle but is often found to be rather difficult to navigate. Through a confusing mishmash of highway interchanges and braided surface streets, there are signs that direct you to the exit for Harbor Island and the industrial facilities that are housed there. The island is mostly accessed by vehicles but there are sidewalks and a bicycle path that provide access for pedestrians as well. Once you have arrived on the island, wayfinding does not necessarily become clearer. The street network appears to have been appropriately designed to maximize transportation efficiency of semi-trucks and trains that know where they are going. While Harbor Island’s convoluted accessibility and esoteric transportation network reinforce its segregation from the ‘everyday’ city, these qualities enhance the residual character of the landscape, bringing with it a sense of obscurity and curiosity. The involved process of navigating to Harbor Island promotes a strong feeling of arrival upon reaching the destination – as if you have left one dimension and entered another.

As previously described, Harbor Island is an active industrial landscape. The majority of the island area is dedicated to several large industrial operations, including Port of Seattle shipping container handling, storage, and cargo transfer (located at Terminal 18 along the east side of the island), bulk fuel storage and

transfer (located at the BP, Kinder Morgan, and Shell Oil petroleum tank farms on the central/northwestern part of the island), and shipbuilding and repair (located at Todd Shipyards on the northwest corner of the island). Other smaller industrial and commercial enterprises are housed on the Harbor Island along with a marina on the southern tip. Harbor Island is mostly devoid of any vegetation and is currently over 90 percent covered with impervious surfaces (EPA 2010). One noticeable dash of green on the island is Terminal 18 Park, located on the southwestern edge of the island, just north of the West Seattle Bridge. The park was an effort of the Port of Seattle to restore a portion of the shoreline and offer a point of public shoreline access on Harbor Island. Completed in 2002, this is the one official public space on the island. Terminal 18 Park includes a simple pathway through plantings, seating walls, and several picnic tables with shelters overlooking the Duwamish River. Throughout the course of numerous site visits, no visitors were ever seen at the park but there was evidence that skateboarders had begun to use some of the seating walls.

The area that I am prescribing a design proposal for is on the central western edge of Harbor Island. The site includes Terminal 10 to the south and the BP tank farm to the north. The site is bounded by the Fisher Flour Mill to the south, Todd Shipyards to the north, 16th Ave. SW to the east, and the West Waterway of the Duwamish River to the west. Terminal 10 is now Port of Seattle property but the site was formerly the Lockheed Shipyard – owned by the Lockheed Shipbuilding and Construction Company. The Lockheed Shipyard was a shipbuilding facility from the 1930s until 1988 (EPA 2013). The Port of Seattle acquired this land in 1996 with the intention of developing a cargo terminal, thereby adding greater capacity to the traffic that could be handled by Terminal 18. The Port’s plans for an additional cargo terminal never came to fruition and the land has since provided a variety of loose functions, none of which have required the total area available at the relatively large site. In the past, the Port considered using it as a staging area for trucks in transit between container terminals, rail yards, and distribution centers. Terminal 10 has since provided parking for Todd Shipyard and served as a construction material staging area (<http://www.portseattle100.org/properties/terminal-10>). After observing the site over numerous visits, it appears that a small segment of the property is still currently used for parking and storage of truck beds.



SITE DELINEATION

During the years in which the former Lockheed Shipyard was active, shipbuilding and ship maintenance activities at the site resulted in the direct disposal of waste into sediments of the West Waterway and Elliott Bay. Much of the pollution is believed to have been caused by sandblasting, a process used to remove paint and paint preparations containing copper, lead, mercury, and zinc (EPA 2010). Decades of unregulated industrial use have resulted in widespread contamination throughout the site. In response to the Superfund designation and federal legislation, significant remediation was implemented on the site after the Port of Seattle acquired the property. Clean-up was initiated in 2003, addressing contamination in both the upland and intertidal areas of the site. In the upland portion of the site, the remediation process involved excavation and removal of soils with concentrated contamination (hot spots) and capping of remaining contaminated soils exceeding cleanup goals (EPA 2010). Excavated 'hot spot' soils were disposed and/or treated off-site at distant landfills. The rest of the diffusely contaminated upland soils were covered with a three-inch asphalt cap to ensure containment on site and reduce rainwater infiltration and the subsequent migration of contaminants into the groundwater and out to the adjacent water bodies. Frequent problems have been recorded regarding the integrity of the asphalt cap (i.e. water ponding, plant growth, and surface cracking), thereby necessitating replacement of the barrier by the Port of Seattle in the near future (EPA 2010). Remediation of the intertidal/shoreline area of the former shipyard involved the removal of residual structures and contaminants and preliminary nearshore habitat restoration. Contamination was addressed through the demolition of leftover pier structures and the removal of approximately 6,000 creosote pilings off-site, dredging of contaminated sediments in the open river channel and off-site disposal, and application of a sediment cap to prevent exposure to contaminated sediments left in place. Nearshore habitat was benefited by coordinating dredging to preserve critical intertidal habitat elevations and adding a habitat friendly substrate compatible for marine organisms to the surface of the contaminated sediment cap (EPA 2010).

Moving north of Terminal 10, my design proposal also encompasses an existing fueling station and the BP tank farm. The tank farms on Harbor Island have been used for petroleum bulk storage and transfer operations since the 1940s (EPA 2010). Currently, there are three adjacent tank farm facilities separately owned and operated. BP West Coast Products manages the tank farm on the west side.

The tank farms are an endpoint to a major northwest fuel pipeline and include 70 large tanks and numerous smaller ones that store a variety of petroleum products. The total storage capacity of the tanks is nearly 100 million gallons. In addition to the tank structures, other infrastructure within the tank farm facilities include extensive distribution pipelines (above and below ground), pumping and manifold stations, fuel-transfer terminals for ships, railroad cars, and tanker trucks; and buildings used for storage, offices, and other purposes (EPA 2010). Over the course of the tank farm operations, spills and leaks of product have created several areas of concentrated soil contamination. Similarly to Terminal 10, the primary remediation response at the tank farms has been the excavation and off-site disposal of contaminated soil. Rather than placing a cap over the remaining soils with diffuse contamination, engineered in-situ remedial systems have been applied on site to treat leftover contaminated soil and groundwater. Natural attenuation processes are also expected to help with the groundwater remediation process but there is concern that contaminated groundwater is not being contained on site and is migrating to the adjacent West Waterway (EPA 2010).

In summary, the Terminal 10 site is essentially an expansive asphalt landscape. The site is programmatically underutilized with only a small portion of the area reserved for parking and storage. Although the upland soils have been partially remediated, diffuse contamination still remains underneath the deteriorated asphalt cap. The edge conditions of Terminal 10 are characterized by a sheet pile bulkhead that runs the length of the site and significant rip-rap rock placed adjacent to the bulkhead for shoreline armoring. Some shoreline habitat restoration has been initiated at the site though the construction of a gradually sloping nearshore shelf that meets the existing bulkhead. This shelf has resulted in a series of 'pocket beaches' that have been inserted where the Lockheed Shipyard's pier structures were once located. While the BP tank farm is still functioning as an active petroleum storage and transfer facility, discussions concerning diminishing petroleum reserves, peak oil, greenhouse gas emissions, and climate change have inspired me to envision an alternative future industrial program for the tank farm infrastructure. As is the case with Terminal 10, the BP tank farm site has been partially remediated but its soils and groundwater are still laced with residual contamination. The diffuse contamination that resides at both of these sites and on the rest of Harbor Island is representative of a legacy of

**THE SITE
(VIEW NORTH - FISHER FLOUR MILL TO TERMINAL 10 AND BP TANK FARM)**



BP TANK FARM



PETROLEUM STORAGE



FISHER FLOUR MILL



TERMINAL 10



FUELING STATION





DEGRADED PIER



POCKET BEACH



BULKHEAD AND ARMORING



**CREOSOTE
PILINGS**



SEDIMENT CAP/SHORELINE SHELF



HARD EDGE



TRAIN PARKING



END OF THE LINE



SHORELINE AND FUELING STATION

Soil

- Lead
- Arsenic
- PCBs
- Total Petroleum Hydrocarbon (TPH)
- Trichloroethylene

Sediments

- PCBs
- PAHs
- Arsenic
- Copper
- Lead
- Mercury
- TBT
- Zinc

Groundwater

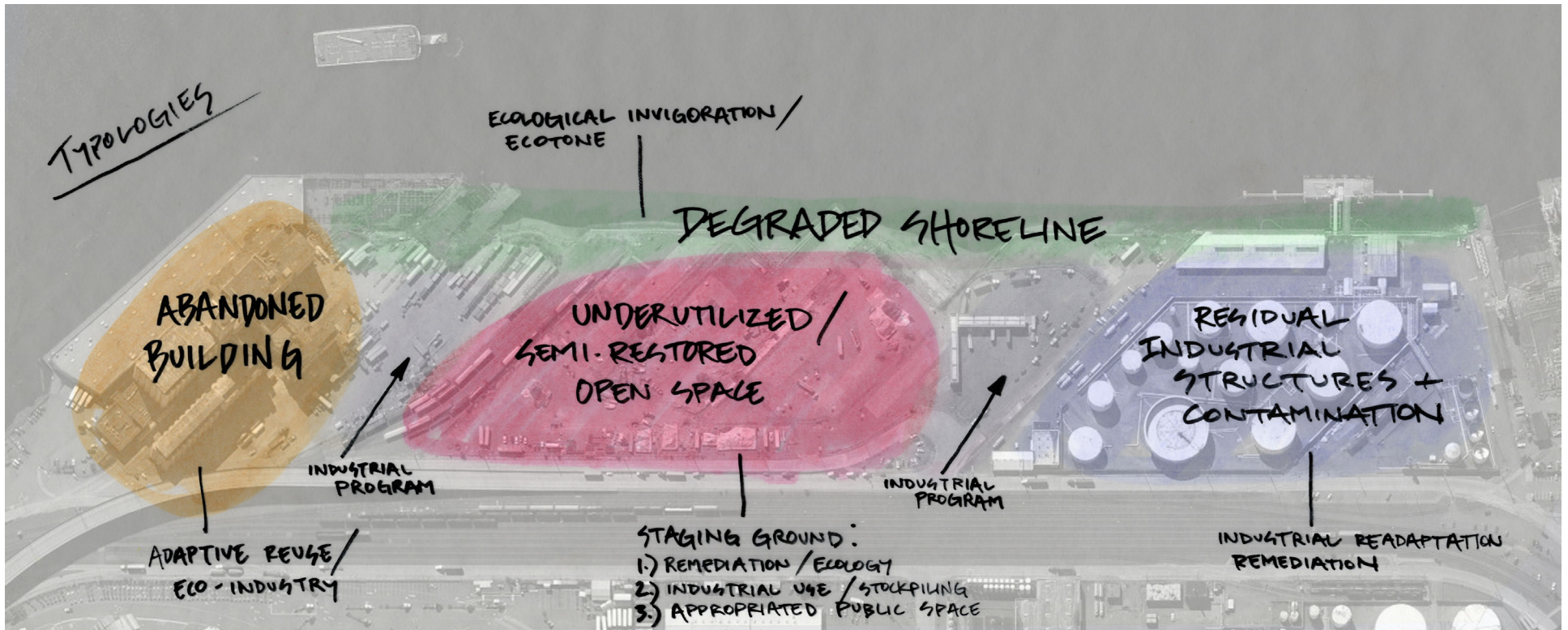
- PAHs
- PCBs
- Copper
- Trichloroethylene
- Tetrachloroethylene
- TPH (TPHG, TPHD, TPHO, BTEX, CPAHs)
- Arsenic
- Lead

MAJOR CONTAMINANTS ON HARBOR ISLAND

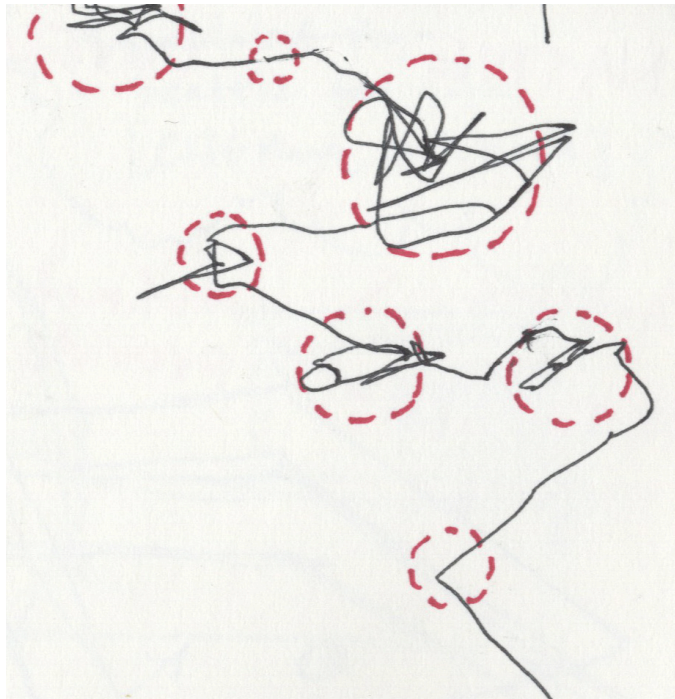
unregulated industrial practices that occurred locally and throughout the Lower Duwamish River industrial area. The primary contaminants that are currently found in the soil, sediments, and groundwater associated with Terminal 10 and the BP tank farm are summarized in the “Major Contaminants on Harbor Island” table.

There are a few other areas of the Harbor Island landscape that fall outside of the Terminal 10 and BP tank farm property boundaries that will be addressed in my design proposal. Although the pier structures and pilings associated with the Lockheed Shipyard were removed during remediation of the Terminal 10 site, a degraded pier structure and numerous pilings still exist just south of the site adjacent to the Fisher Flour Mill. There is potential for my design proposal to address these creosote-contaminated pilings along with the rest of the contamination present at Terminal 10 and the BP tank farm. There is also potential to respond to problems of contaminated sediment on the other side of the island, in the East Waterway adjacent to Terminal 18. While the contaminated nearshore sediment in the West Waterway adjacent to Terminal 10 was addressed through excavation and capping, the East Waterway is currently awaiting large-scale remedial action (EPA 2010). Another important consideration for my design proposal is the Fisher Flour Mill. This large, abandoned complex lies adjacent to the south end of my site. The facility had a long and productive history on the Harbor Island, opening in 1911 as one of the first industrial enterprises on the island and running flour milling operations until 2002 when it was shut down. The Fisher Flour Mill is now publicly owned by King County and serves as an exploratorium for graffiti artists, homeless people, metal scrappers, arsonists, and others who choose to trespass on the derelict property. Sean Kelly, a Master of Architecture student at the University of Washington, is currently developing a design proposal focusing on the adaptive reuse of this facility for his thesis project. It will be critical for my design proposal to make connections with the renewed vision for the Fisher Flour Mill complex, and vice versa.

By breaking down the programmatic and/or physical characteristics of the various sites, features, and materials that I will be engaging in my design proposal, I began to think of all these different spatial entities as distinct site typologies that would have counterparts throughout Seattle’s industrial areas and elsewhere (e.g. partially contaminated, underutilized sites and degraded industrial



SITE TYPOLOGIES



shorelines). In this sense, innovative design strategies that are proposed for each of these site typologies in my thesis project would have the potential to be monitored and replicated at other industrial and post-industrial sites if deemed successful. The production of replicable design strategies for these industrial areas increases the ability to respond to local, regional, and even global needs for reactivating these complex sites.

DESIGN PRINCIPLES

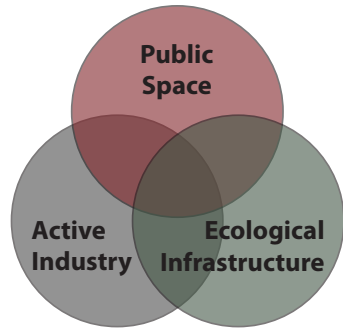
My design proposal for Harbor Island rests on a few fundamental themes that were articulated in my “Critical Stance” and “Conceptual Foundation” sections. I will briefly summarize these themes again here. One general guiding principle will be to effectively integrate ecological infrastructure and public space into an active industrial landscape. The goal here is to produce a diverse, resilient, and synergetic system of ecological, social, and industrial processes that evolve together through shared space and time. I have adopted the themes of pioneering and succession as the conceptual foundation for my design approach. These ideas were critical for substantiating the type of interventions to initiate in the landscape (pioneering) and for the development of a temporal framework under which the design could adapt and evolve over time (succession). A major point here is that the goal for my proposal is not to produce some final, predetermined, static site design, but rather to suggest a successional environment where a series of interrelated ecological, social, and industrial interventions are expected to respond to and change with dynamic environmental conditions.

The themes of pioneering and succession ultimately led to the idea of leveraging experimentation as the primary mode of site operations. Experimentation is directly connected to pioneering and succession – an initial physical experiment in the landscape becomes the pioneering intervention and the change that manifests in this experiment over time represents succession. A landscape of experimentation is being promoted as a way to effectively investigate innovative responses to =a novel ecological paradigm that has evolved along the Lower Duwamish River and in other industrial areas around the world. The native ecosystems associated with these industrial centers have been so drastically transformed that restoration of native conditions may not even function as

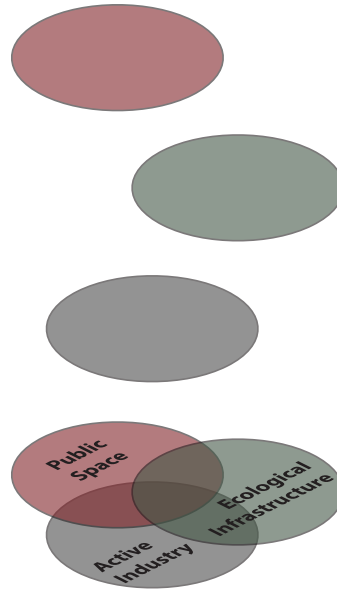
“Drosscapes require design to be implemented as an activity that is capable of adapting to changing circumstances while at the same time avoiding being too open-ended as to succumb to future schemes that are better organized” (Berger 2006).



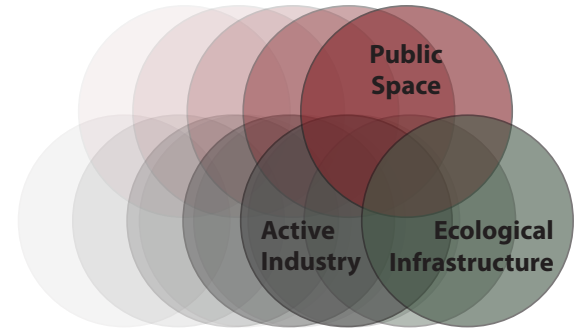
Industrial Monoculture



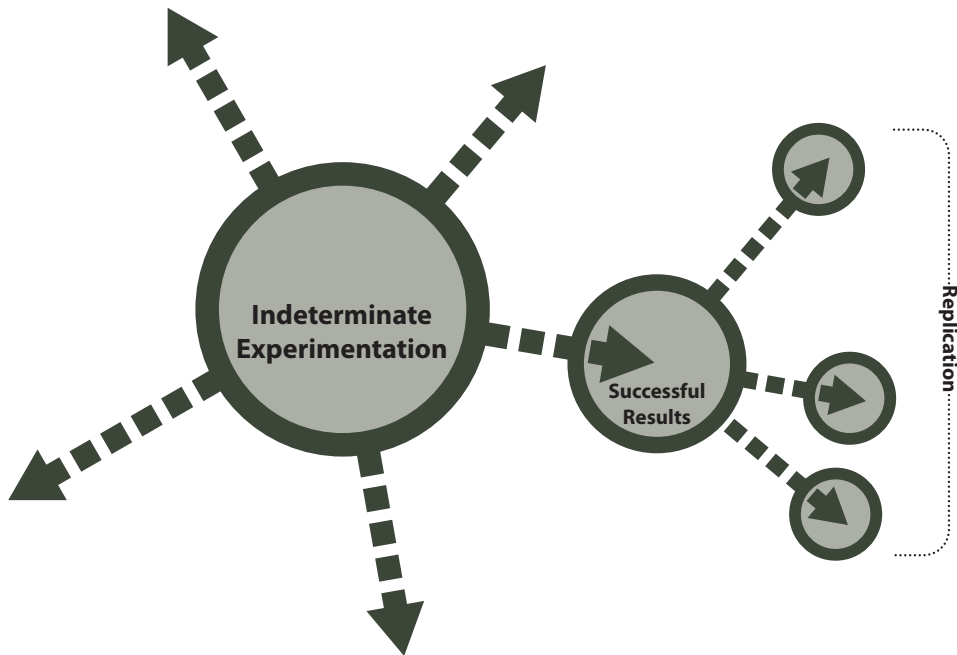
Integration/Hybridization



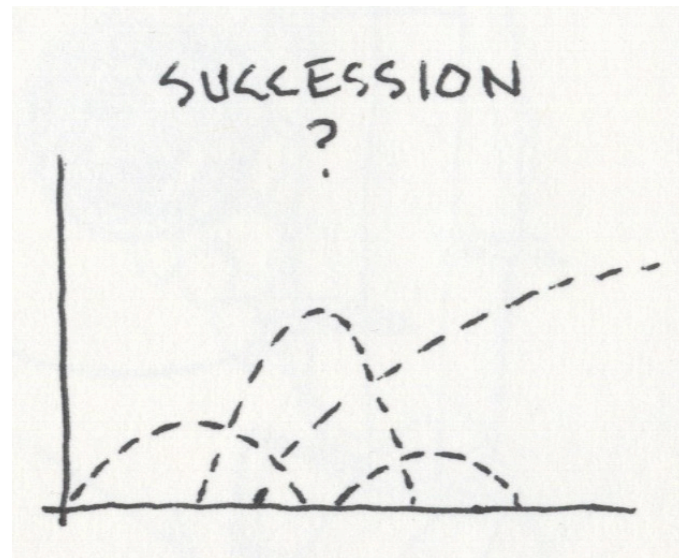
Layered Programs



Successional Landscape



“The field condition implies an architecture that admits change, accident, and improvisation. It is an architecture not invested in durability, stability, and certainty, but an architecture that leaves space for the uncertainty of the real” (Allen 1999).



intended. New ecological frameworks have evolved in these industrial centers, necessitating new ecological responses. In the case of the Lower Duwamish River, intensive dredging and armoring of the river channel has produced a completely different hydrological system at Harbor Island than the system associated with a shallow river delta and tidal mudflats that once existed prior to development. Significant changes in the river system’s physicality mean that native ecological conditions (e.g. intertidal mudflats and salt marshes) may not be able to self organize as they once did. Experimentation becomes the method of pioneering new strategies of ecological regeneration through testing novel infrastructural responses in this degraded and industrialized context. The theme of experimentation also applies to testing how new typologies of public space will function within an industrial landscape context and how innovative industrial processes will perform in a landscape shared with other environmental and social programs.

Through initiating experimental procedures and promoting successional processes, it will be critical for my design proposal to embrace indeterminacy. Any form of experimentation brings with it a certain degree of indeterminacy. Although hypotheses can be made and experiments can be run in a strategic fashion, the outcomes of the experiment are ultimately indeterminate. My design proposal suggests that new responses to contaminated, degraded, and underutilized industrial sites need to be piloted in order to determine unprecedented successful solutions that can be replicated elsewhere. While indeterminacy is embedded in the experimentation that will take place on my site, there is also a factor of indeterminacy associated with larger scale outside influences on the site and the potential evolutionary trajectories of the urban ecosystem in which the site is located. Urban systems are dynamic. There are a wide array of social, political, economic, and environmental influences that will ultimately determine the future of Harbor Island. At the same time, urban systems require the establishment of diverse ecological, social, and economic resources in order to remain resilient as indeterminate systemic changes occur. The goal then for my design is to generate diversity in the urban realm, to catalyze ecological, social, and industrial processes that will promote resiliency, and to be responsive and adaptable to potential changes that could occur on the site.

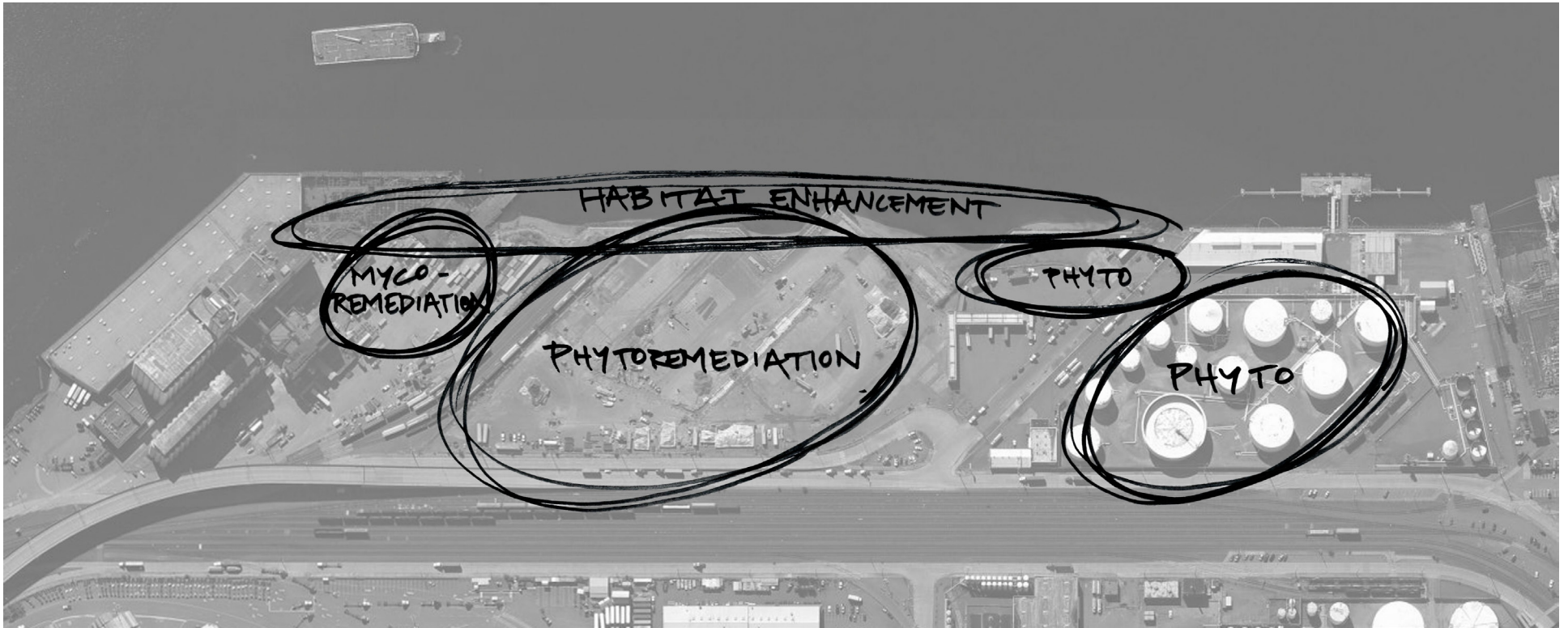
PROGRAMMING THE SITE

The most important design consideration for my site will be how to effectively address the remaining contamination and degraded shoreline. The application of an infrastructural framework for the ecological regeneration of the site is the spine of my design proposal. This ecological infrastructure program is the most critical priority. Remediation of the contamination will be completed through the implementation of phytoremediation on the upland areas of Terminal 10 and the BP tank farm. The creosote pilings located south of Terminal 10 will be moved upland and treated on site through mycoremediation (the process of using fungi to degrade or sequester contaminants). Contaminated sediment from the East Waterway will also be moved upland to the area north of Terminal 10 adjacent to the fueling station for phytoremediation treatment. In an effort to address the limited nearshore habitat at the site, various habitat enhancement strategies will be applied along the shoreline edge, extending from the Fisher Flour Mill to the BP tank farm.

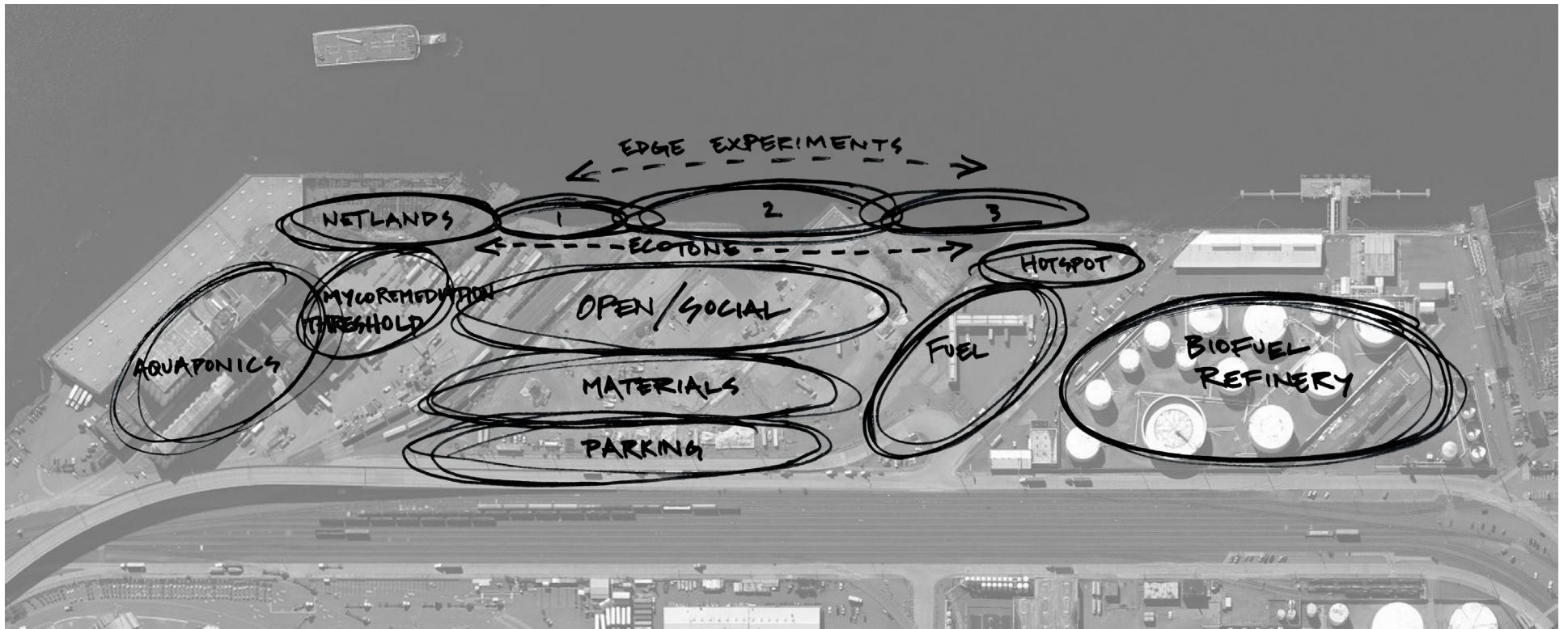
The programming of my site will continue to facilitate some existing industrial uses while also activating a new industrial operation. The Terminal 10 site will maintain its provision of space for Port of Seattle parking and storage along the eastern edge. A material yard will be opened adjacent to this parking/storage area, providing capacity for staging construction materials and storing salvaged waste and demolition materials from Harbor Island and beyond. The fueling station will maintain its function on the site and will eventually connect to an industrial reconfiguration of the BP tank farm. My design proposes the adaptive reuse and conversion of the BP tank farm complex into a demonstration biofuel refinery that would convert woody biomass into ethanol fuel, thereby promoting a theme of industrial ecology on site. On the other side of my site to the south, a separate design proposal for the Fisher Flour Mill involves the adaptive reuse and conversion of these buildings into an aquaponics facility/vertical farming operation.

The social interventions at the site are the subtlest part of the overall program and are intentionally meant to be light-handed. While most areas of the site will be accessible through an extensive circulation network, the main social node encompasses the western side of Terminal 10 adjacent to the material yard. The





REMEDIATION PROGRAM



SITE PROGRAM



Source: Jonathan Pagan



desire to activate a public space that functions as a 'loose space' influenced the decision to maintain the residual character of the local environment, accentuate the existing experiential qualities derived from the industrial landscape context of Harbor Island, and promote a sense of place that encourages insurgent appropriation of the site. In order to meet these objectives, the social program was integrated into the site as an overlay on top of the ecological infrastructure and industrial activity programs. By prioritizing the ecological and industrial programs and keeping the public space design relatively minimal, the site is expected to retain the experiential qualities and general character that is conducive to more transgressive uses of space.

The social program for the site is intended to follow the lead of the existing user groups (homeless people, graffiti artists, skateboarders, and other explorative and creative types). Simple shelters will be provided to support a multitude of uses and open space will offer a venue for building and creating. Homeless people will be given a place to sleep, graffiti artists will be given a place to paint, and skateboarders will be given a place to skate. The site is envisioned to become a place of exploration – where ecological, industrial, and social dynamics are experienced in their raw forms. The programmatic outcome of the public space is somewhat indeterminate and the simple design moves that are being proposed should be viewed as experiments in their own right. This loose space would be expected to exist in a dynamic equilibrium – moving through ebbs and flows of steady use and neglect. It is doubtful that the social appropriation of this space would evolve in a purely linear fashion. Ultimately, the innovative ecological and industrial processes that will take place on the site may draw visitors as part of a more formal program of research and education.

THE SITE DESIGN

MATERIALITY

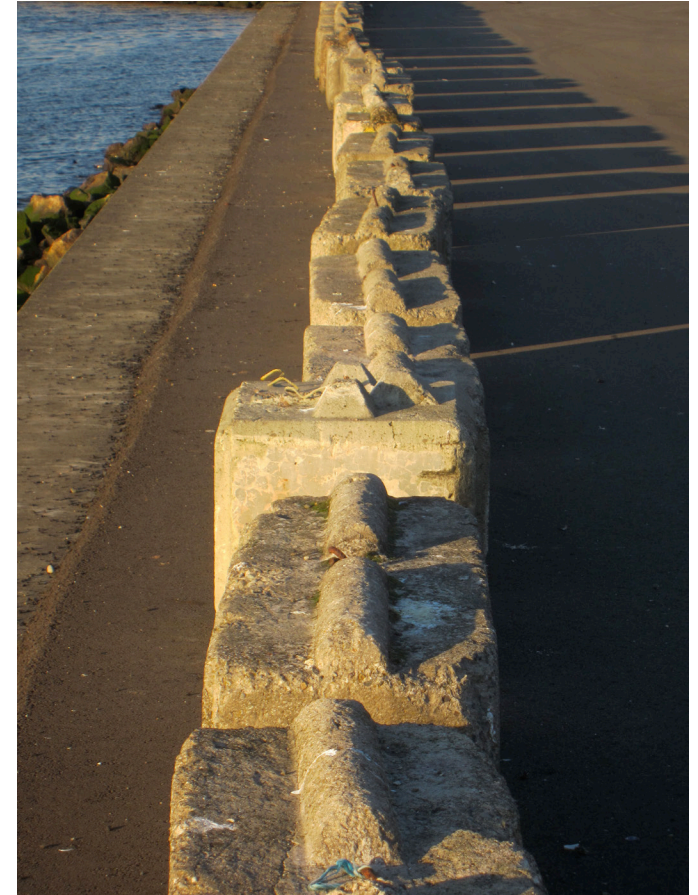
One of the first matters of concern in my design approach was the materiality that would be introduced to the site. Strategic material selection is critical in terms functional, aesthetic, and experiential implications and is connected to all aspects of the site design. It is essential that the materials used at the site provide the

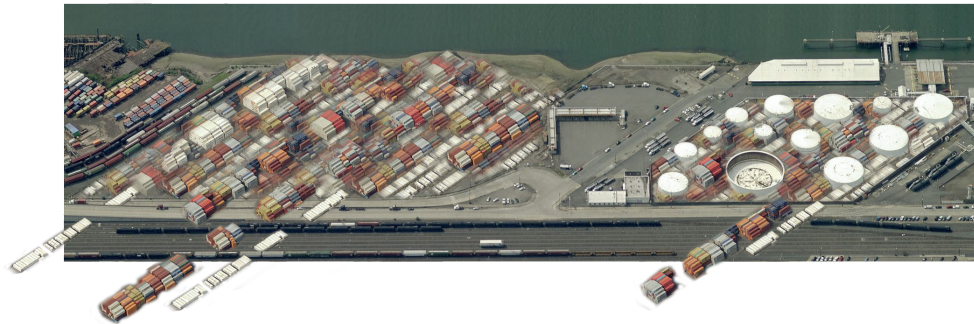
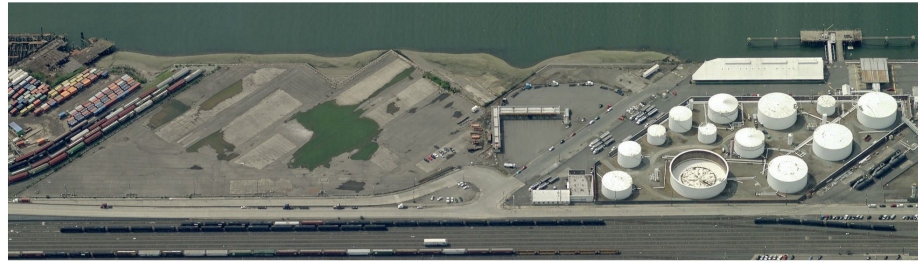
necessary infrastructural capabilities while reinforcing the existing industrial aesthetic of the landscape and promoting a definitive sense of place. Rather than import an array of materials to the site from distant locations, materials were selected based on their local availability and potential to be salvaged from respective waste streams, thereby effectively supporting efficient resource use. An important design goal was to use simple, readily available materials in innovative ways – using minimal forms to generate multiple functions.

The primary material palette for the site design includes ecology blocks, shipping containers, and concrete rubble from the impending Alaskan Way Viaduct demolition in Seattle. Each of these materials are used in multiple ways on the site to provide distinct functions, as shown in the “Material Applications” diagram. Ecology blocks are commonly found in most industrial areas and are currently used extensively on the site as a perimeter barrier around Terminal 10. The modularity of these concrete blocks will make them easy to use for material storage bins, seating, large stairs, and for the construction of a shoreline shelf system supporting nearshore habitat enhancement (discussed in greater detail later). Although it could be argued that shipping containers are overused in contemporary architectural design, the site’s location on Harbor Island adjacent to the Port of Seattle’s largest shipping terminal makes the use of shipping containers a logical choice. Containers will be modified in simple ways to create large planter boxes that serve ecological and remedial functions and shelters that provide social functions. Crushed concrete will be salvaged from the nearby demolition of the Alaskan Way Viaduct and brought to the site for a variety of uses. While some of the rubble can be stockpiled in the material yard in its raw form, much of it will be used to create gabion blocks and artificial rocky islands for the nearshore habitat enhancement design. Crushed concrete can also be used as a fill material to achieve desired elevations along the shoreline if necessary.

OPERATIVE GRID

An important preliminary design move for the site was the application of an ‘operative grid.’ This 20ft. x 20ft. grid was laid over the Terminal 10 site at a 45-degree angle in order to align with existing site features (e.g. roadways and shoreline edges). The operative grid provides an easily measurable guiding framework for organizing the layout of phytoremediation plots at Terminal 10





CONCEPTUAL SITE STUDIES



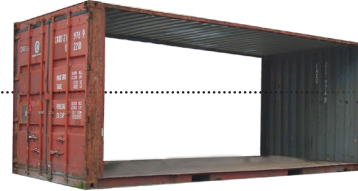
Ecology Blocks



Shoreline Habitat Shelf System



Shipping Containers



Modular Shelters



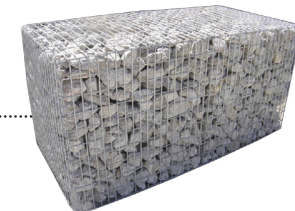
Planter Boxes



Alaskan Way Viaduct

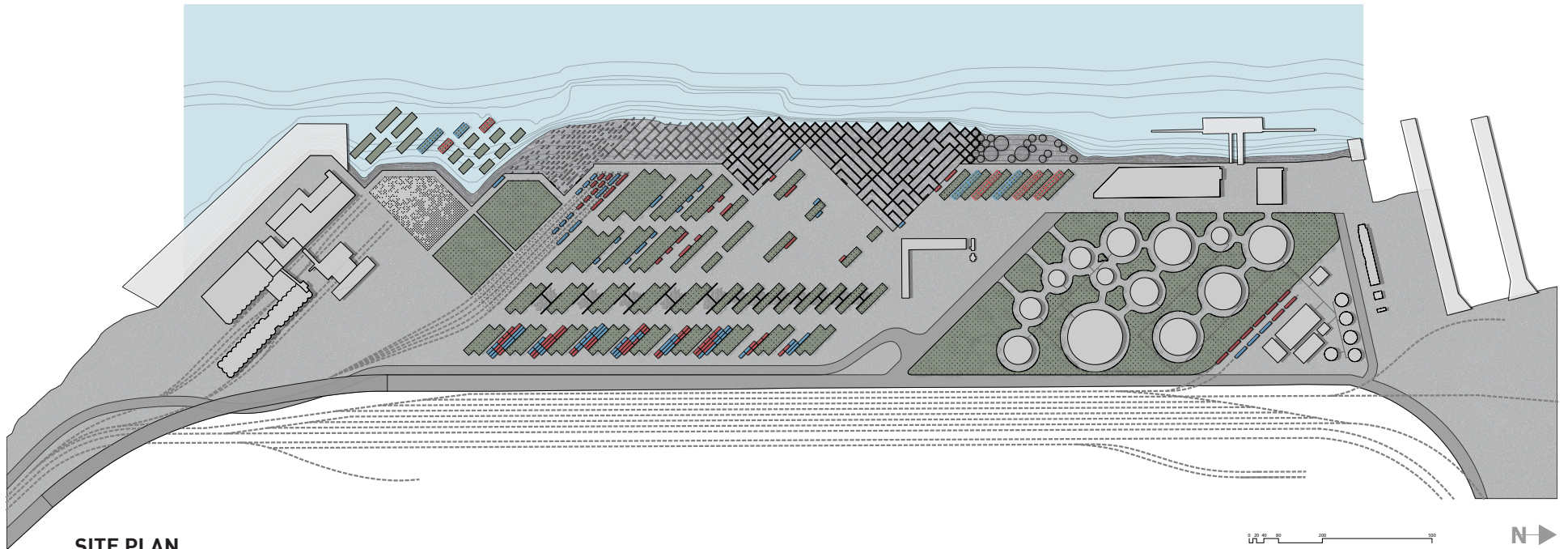


Crushed Concrete



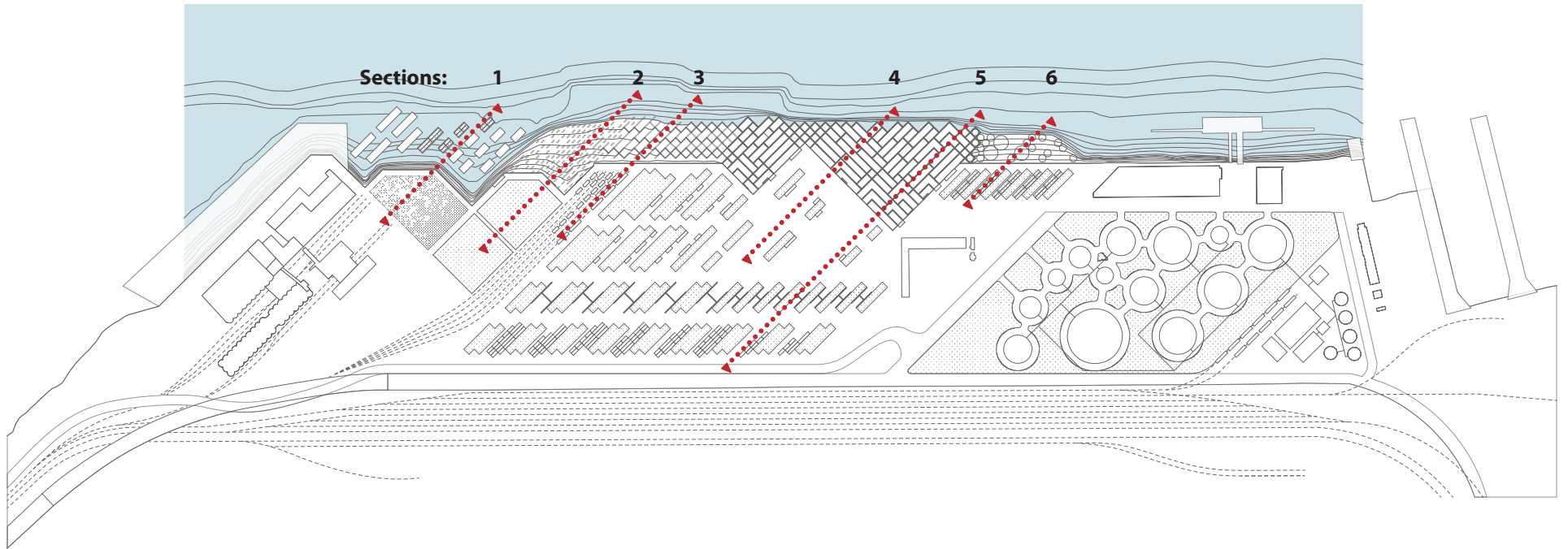
Shoreline Gabion Reef

MATERIAL TACTICS: Strategic material selection is critical in terms functional, aesthetic, and experiential implications and is connected to all aspects of the site design. An important design goal was to use simple, readily available materials in innovative ways – using minimal forms to generate multiple functions.

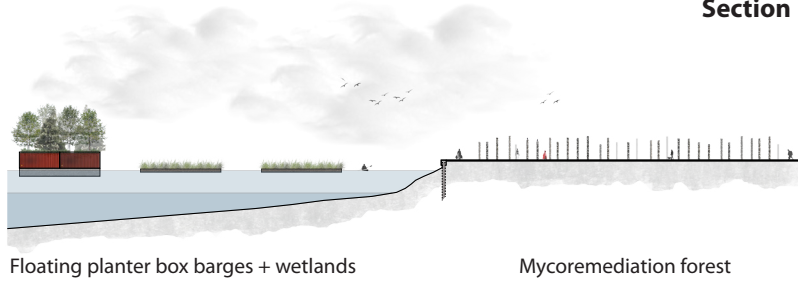


SITE PLAN





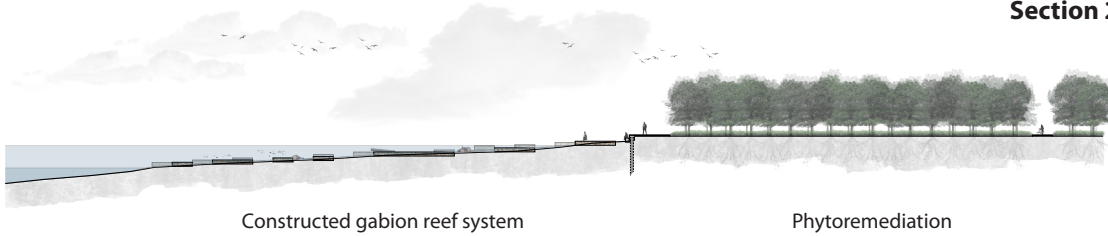
Section 1



Floating planter box barges + wetlands

Mycoremediation forest

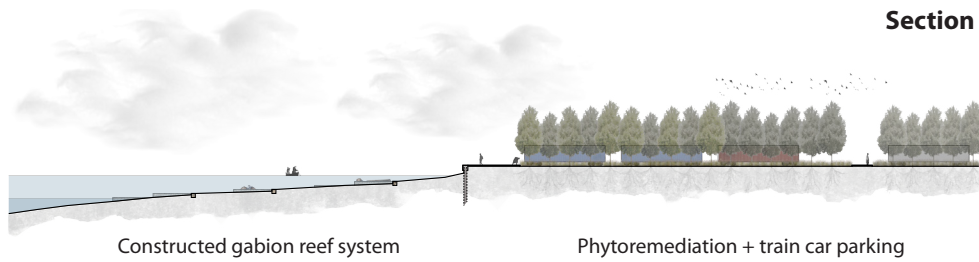
Section 2



Constructed gabion reef system

Phytoremediation

Section 3

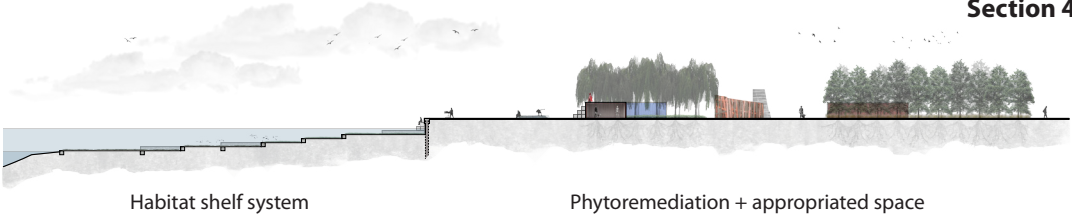


Constructed gabion reef system

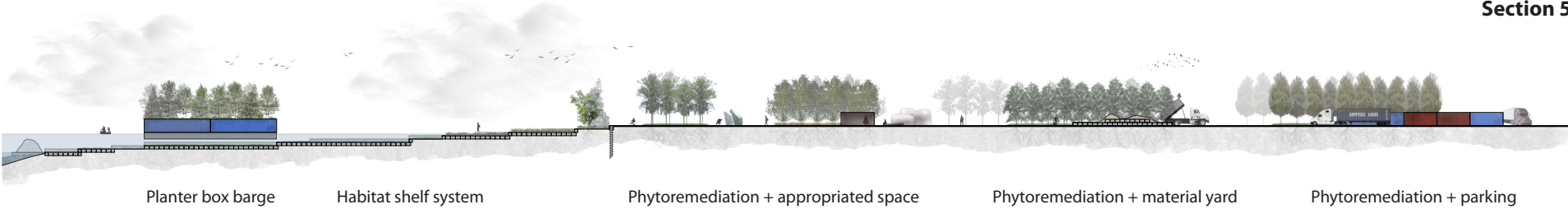
Phytoremediation + train car parking



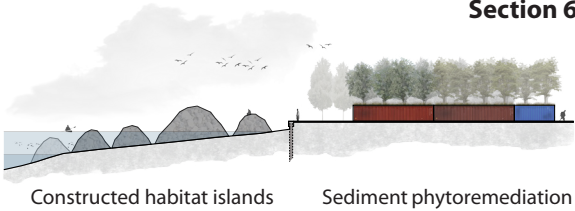
Section 4

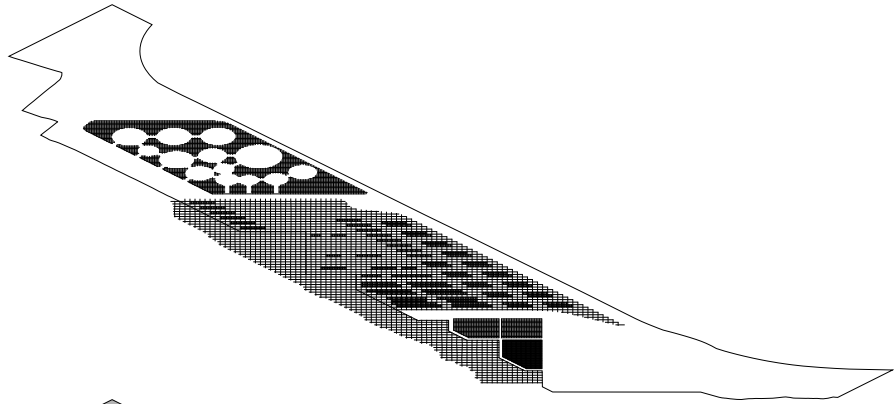


Section 5

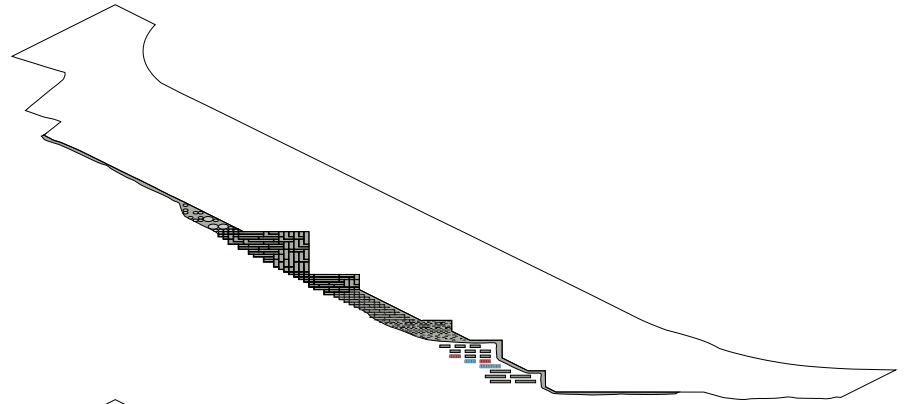


Section 6

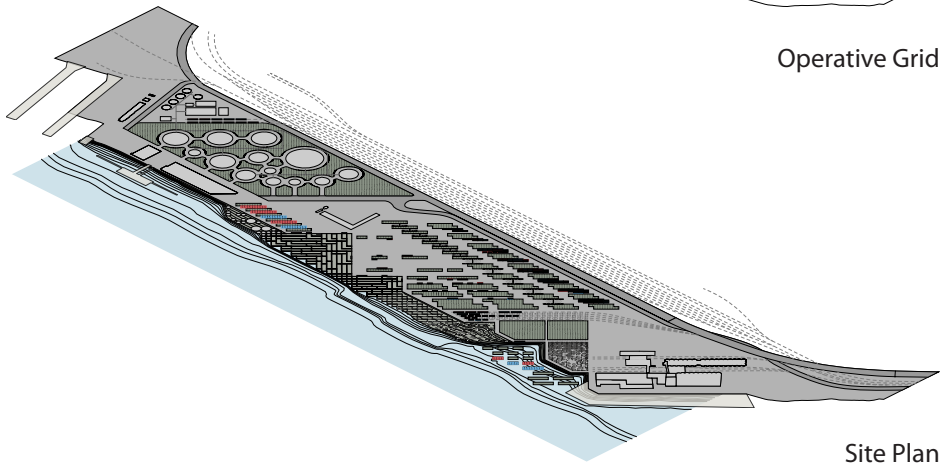




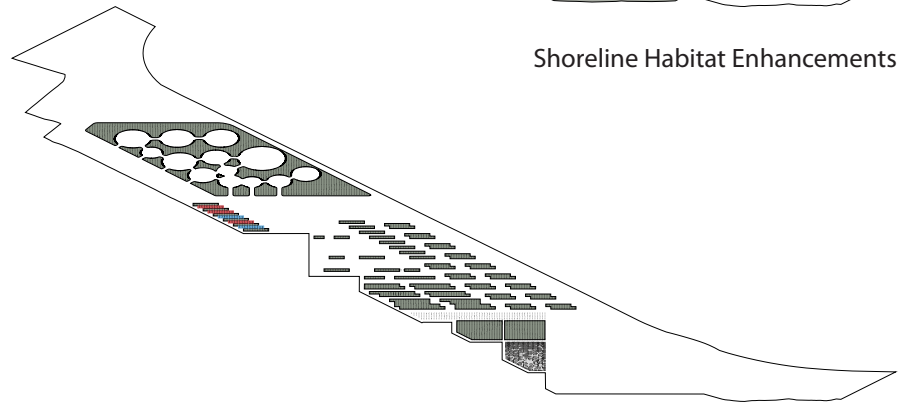
Operative Grid



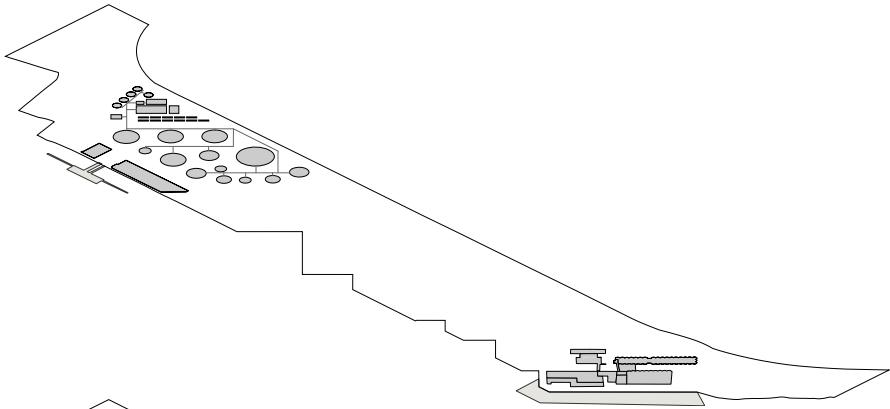
Shoreline Habitat Enhancements



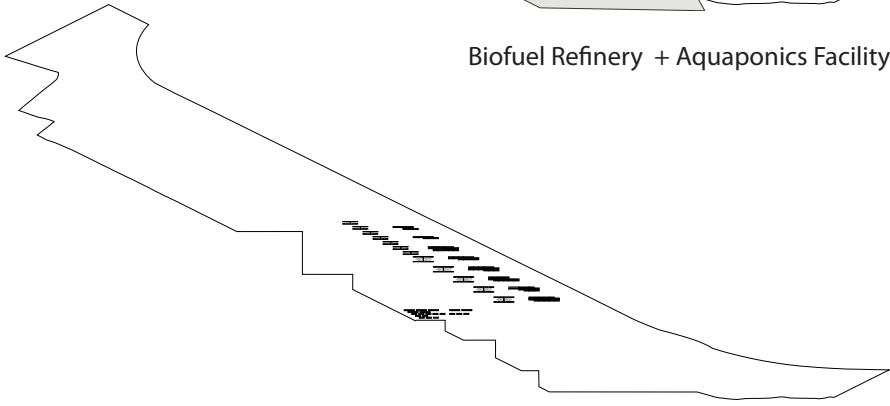
Site Plan



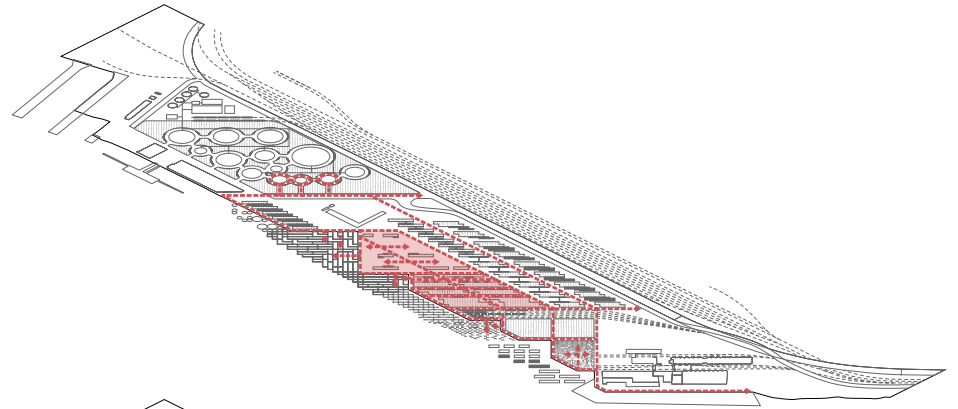
Phytoremediation + Mycoremediation



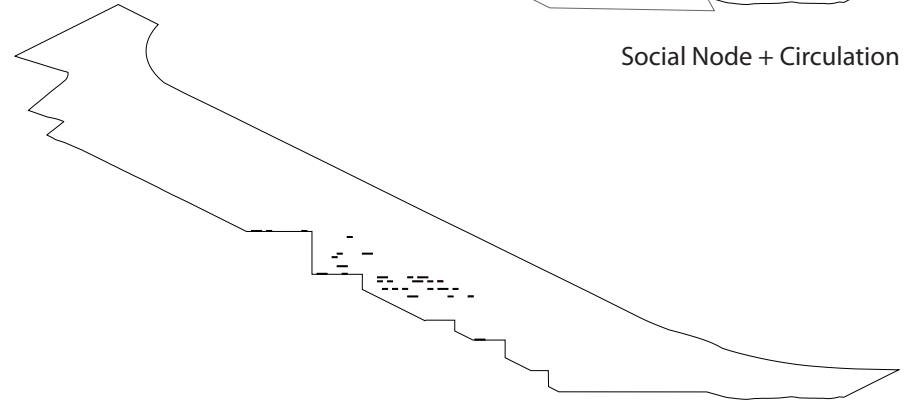
Biofuel Refinery + Aquaponics Facility



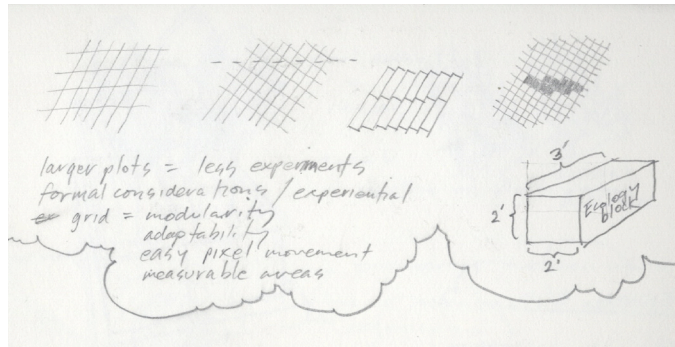
Industrial Parking + Material Yard



Social Node + Circulation

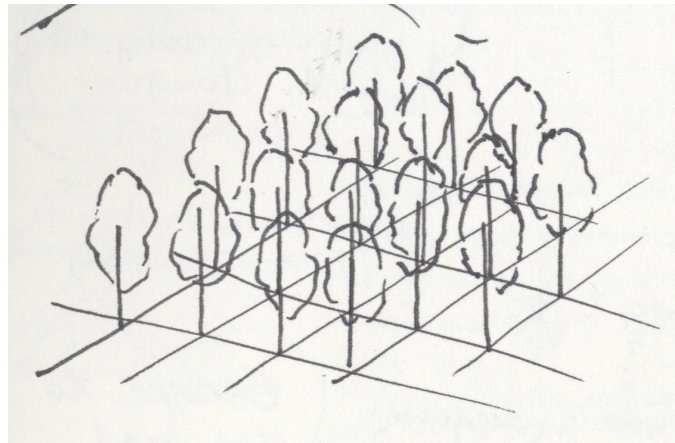


Shipping Container Shelters

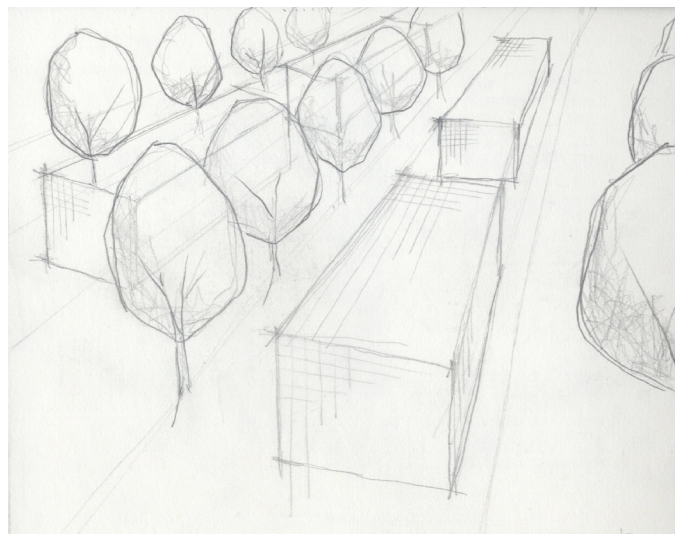


and the entire extent of shoreline enhancement infrastructure. All of the trees used for phytoremediation, the pilings moved upland for mycoremediation treatment, and other site furnishings also adhere to the alignment of the grid. The grid is both operative and formal, guiding the procession of experimental reconfigurations in the landscape and producing a strong experiential identity at the site (these factors will be discussed in more detail in later sections).

PHYTOREMEDIATION



The phytoremediation strategy for Terminal 10 is to space out and orient the plots in such a way that the other site programs are able to fill in the negative space. This way, the planted zones function as an organizing armature for the industrial and social uses of the landscape. Parking, material stockpiling, open public space, and public site furnishings will all be grounded in between the phytoremediation plots, allowing complete physical integration of the ecological, industrial, and social functions taking place on the site. The phytoremediation plots themselves will function as individual test sites in which different plant species can be introduced and monitored for their remedial abilities. The creosote pilings will be pulled upland, arranged vertically, and inoculated with different fungi species, thereby creating a 'mycoremediation forest.' This demonstration in mycoremediation will function as a threshold between Terminal 10 and the proposed aquaponics facility, with pilings clustered more densely (5ft. spacing) adjacent to Terminal 10 and spaced more openly toward the aquaponics buildings. The phytoremediation strategy for the BP tank farm/future biofuel refinery is to first ensure access to the facility infrastructure by creating a circulation buffer around all of the storage tanks and then to initiate phytoremediation in all remaining areas. Since there is one defined industrial program at this site and open public space is not being proposed here, the idea is to simply maintain facility management access and maximize the space dedicated to phytoremediation. Contaminated sediment from the East Waterway will eventually be dredged and relocated to the area north of Terminal 10 adjacent to the fueling station. The sediment will be placed in a series of shipping container planters for phytoremediation treatment, which will be interspersed between ground level phytoremediation plots.

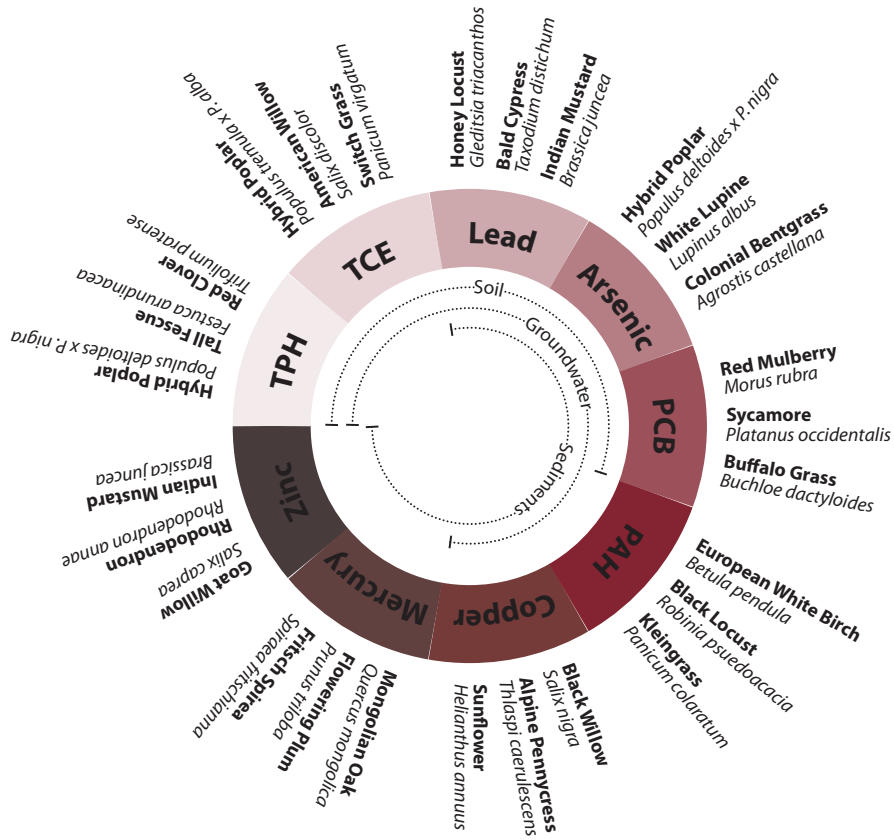


There are a number of different plant species that have been documented to successfully phytoremediate the types of contaminants found on Harbor Island and there are many species that await testing. A variety of phytoremediation processes will be employed at the site, including phytoextraction (accumulation and storage of contaminants through roots and into plant tissues), phytodegradation (contaminants broken down through various metabolic processes and release of enzymes from plants), phytovolatilization (accumulation and degradation of contaminants followed by the release of less toxic compounds through transpiration), and phytostabilization (contaminants sequestered or immobilized through absorption into root system and release of chemicals that convert contaminants into less toxic state) (You Are the City 2011). The “Contaminants and Potential Phytoremediators” diagram shows where the primary contaminants are located on the site and provides examples of plant species that are commonly known to effectively phytoremediate them. Creosote is not considered one of the primary site contaminants as it is localized in the pilings. Recent research has identified different species of fungi that are able to degrade and sequester creosote (NCMFC 2012).

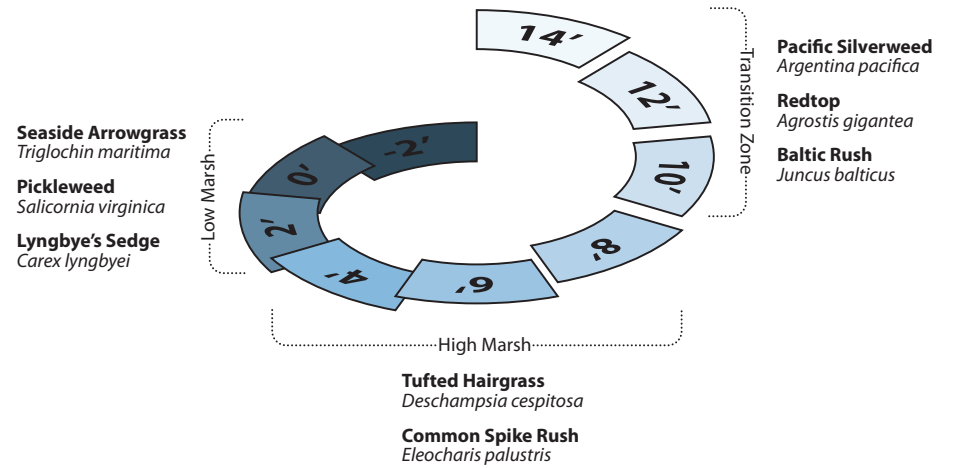
SHORELINE HABITAT ENHANCEMENT

Just as the contaminated upland areas will be used for running various phytoremediation experiments, the site’s shoreline will become an experimental domain for testing unique habitat enhancement methods. Starting at the south end of the shoreline, the intertidal area where the creosote pilings were removed will become the base point for a series of floating wetlands and planter box barges. A variety of species will be planted in these floating systems as an opportunity for testing diverse over water and under water (through root growth on the floating wetlands) habitats. This habitat enhancement strategy is particularly important to test along abrupt armored shoreline edges as a way of determining viable ecological regeneration strategies where it is not possible to provide shallow intertidal habitat.

Moving north along the shoreline, the abrupt edge gives way to a beach-like character. As discussed, much of the shoreline area at Terminal 10 has been partially restored through the construction of a shelf that caps pre-existing contaminated sediment and is amended with a habitat friendly substrate. A major



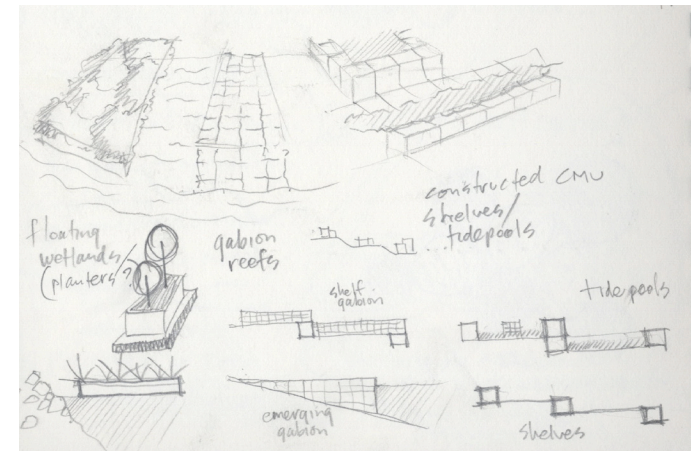
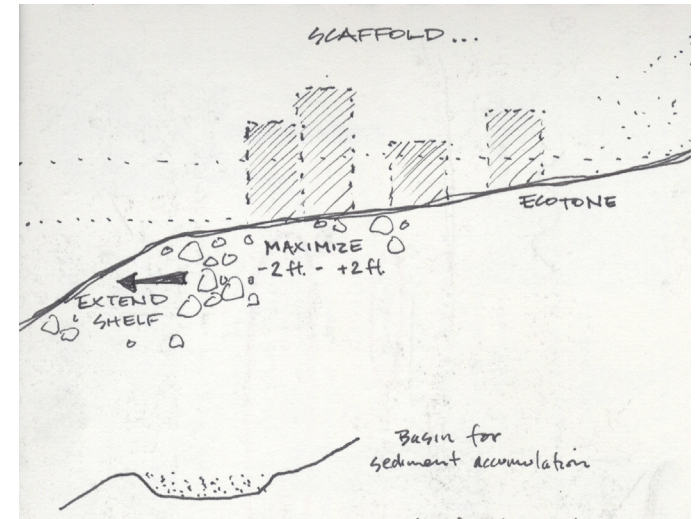
CONTAMINANTS AND POTENTIAL PHYTOREMEDIATORS: There are a number of different plant species that have been documented to successfully phytoremediate the types of contaminants found on Harbor Island and there are many species that await testing. This diagram shows where the primary contaminants are located on the site and provides examples of plant species that are known to effectively phytoremediate them.



SHORELINE PLANT SPECIES: The habitat shelf system will provide the necessary infrastructure and substrate to promote the colonization of a number of different intertidal species. This diagram shows examples of plant species that are indicative of the respective tidal elevations and therefore would be expected to flourish at the site.

difficulty in achieving biotic growth in this intertidal area characteristic of native conditions (e.g. tidal mudflats and salt marshes) is that the dredged, channelized, and armored Lower Duwamish River now has a significantly greater force of flow, resulting in less deposition of sediment and the swift stripping and removal of other organic matter on the shoreline that would spur growth of pioneering biota. The previously constructed nearshore shelf will serve as the physical foundation for additional shoreline enhancements that will support the general goal of retaining organic matter and sediment substrates in different ways. These shoreline enhancements will effectively function as a series of experimental scaffolds – constructed infrastructural elements that will catalyze biotic growth and subsequent habitat development. When developing nearshore habitat enhancement strategies, it is important to consider the overall tidal character of the site and more specifically, the critical intertidal habitat elevations. The high tide (Mean Higher-High Water level) at the site is 9ft. and the low tide (Mean Lower-Low Water level) is -2.3ft. The intertidal habitat elevations that are most important for anadromous fish fall between -2ft. and +2ft. [Cordell 2013]. This is the elevation range at the site where nearshore habitat enhancement strategies will be focused in order to have the most impact.

One of the strategies is to use gabion structures to create an artificial reef system that roughens the surface of the intertidal area, encouraging accumulation of sediment and finer organic matter within the matrix of the bound up gabion material and build-up of larger organic matter exterior to the structures. Using salvaged crushed concrete, gabion blocks will be constructed and installed along the southern shoreline of Terminal 10. The gabion blocks will start out as a staggered formation of smaller units, eventually transitioning into enclosed areas formed by a more extensive use of the structures. Continuing north along the Terminal 10 shoreline, the gabion reef system merges with an extensive shelf system constructed with ecology blocks. The goal of the shelf system is to create many basins at varying elevations that can then be filled with different sediment and substrate types (e.g. rough vs. coarse vs. fine) and other organic materials. Like the phytoremediation plots, each of these basins have the opportunity to become individual testing sites where sediment and substrate residence times and biotic growth can be monitored. As the ecology blocks are 2ft. tall, the shelf elevations are separated by 2ft. lifts. The upland elevation of the site at the shoreline edge (top of the bulkhead) is approximately 14ft. The shelf



system works its way down to a bottom elevation of -2ft. The surface area of the shelves are maximized at the -2, 0, and +2ft. elevations in order create as much space as possible within the critical intertidal habitat elevation range. While the gabion structures create a relatively permeable infrastructure, the solid ecology blocks will produce a tighter seal. This difference in physical character could result in longer residence times for sediment and other organic matter as well as the production of tide pool systems. The last shoreline habitat enhancement experiment will be initiated north of the shelf system adjacent to the BP tank farm site. This strategy proposes using salvaged concrete rubble to construct a system of artificial rocky islands, essentially producing a scaled up version the gabion reef system implemented at the southern end of the shoreline. Even though these islands will be constructed from the same material as the gabion blocks and may function similarly in accumulating sediment and other organic matter, their large size is of interest for experimenting with the production of calm water areas and unique microclimates along the shoreline.

INSURGENT PUBLIC SPACE

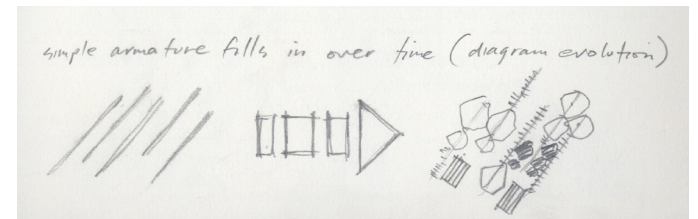
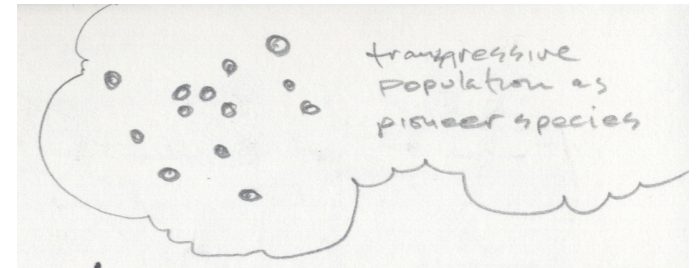
While the design of ecological infrastructure is the priority for the site, some simple yet pivotal design moves were made for the social infrastructure. The main social node is intended to develop on the west side of the Terminal 10 site. One gesture to make this part of the site more enticing for public inhabitation was to strategically place the phytoremediation plots in a way that creates a dynamic spatial configuration. By clustering phytoremediation plots on one side of the site and creating a more enclosed area and leaving the other side more open and expansive, a clear hierarchy of space is created along with a contrasting sense of prospect and refuge. This spatial hierarchy is expected to have a direct influence on the social activities that take place and the insertion of numerous modular shipping container shelters integrates with this design strategy. In the more enclosed area to the south, the idea is that the shipping container shelters could be appropriated by individuals or groups for longer-term purposes (e.g. homeless people looking for a place to sleep and/or store their belongings). The shipping containers located in this part of the site will simply have one or both of their ends opened up as a way to make them accessible while retaining some sense of privacy. As the trees mature over time, the enclosure created by the phytoremediation plots would further elevate a feeling of privacy and degree of

separation from the open space that is expected to become more active. The part of the area that is left more open is intended to become a place of creation and building. Art installations, skate spots, and other experimental engagements with the landscape will all be encouraged. Shipping container shelters will also be placed in this open area but will be made more permeable (i.e. by removing one or both of the side walls) with the expectation that they would provide more passive social functions. The same type of permeable shipping container shelters will also be placed along the main pathway that follows the shoreline, offering intermittent points of resting and viewing. Ecology blocks will be placed in all of the shipping container shelters to provide raw but functional seating. Another integral part of the site's social infrastructure is the material yard, located directly adjacent to the public space. The material yard will be loosely managed and public access to the yard will be uninhibited. This way, a variety of materials that are stockpiled and stored on site will remain available for public use. The material yard will provide a valuable resource for people wanting to build anything from structural additions to a shipping container shelter to improvised skateboarding obstacles.

The site's social infrastructure is similar to the shoreline enhancement infrastructure in the way that it is meant to function as a series of experimental scaffolds. The intention with the social infrastructure is for the associated design elements (shelters, materials, and open space) to catalyze insurgent appropriation of the landscape. In the case of both the shoreline habitat and public space enhancements, the idea is to construct a scaffold and see what pioneer species populate the space.

INDUSTRIAL OPERATIONS

The proposal to convert the BP tank farm into a biofuel refinery is more of a programmatic gesture and promotion of industrial ecology than a conventional form of site design. The activation of this new industrial operation is a way of strategically designing a material flow process and establishing an interconnected system that transcends the boundaries of the site. There is currently a major buzz in the biofuel industry regarding the impending economic viability of converting woody biomass into ethanol fuel. This process will facilitate the transformation of a significant waste stream into a form of energy and will allow ethanol production without having to compete with food crops



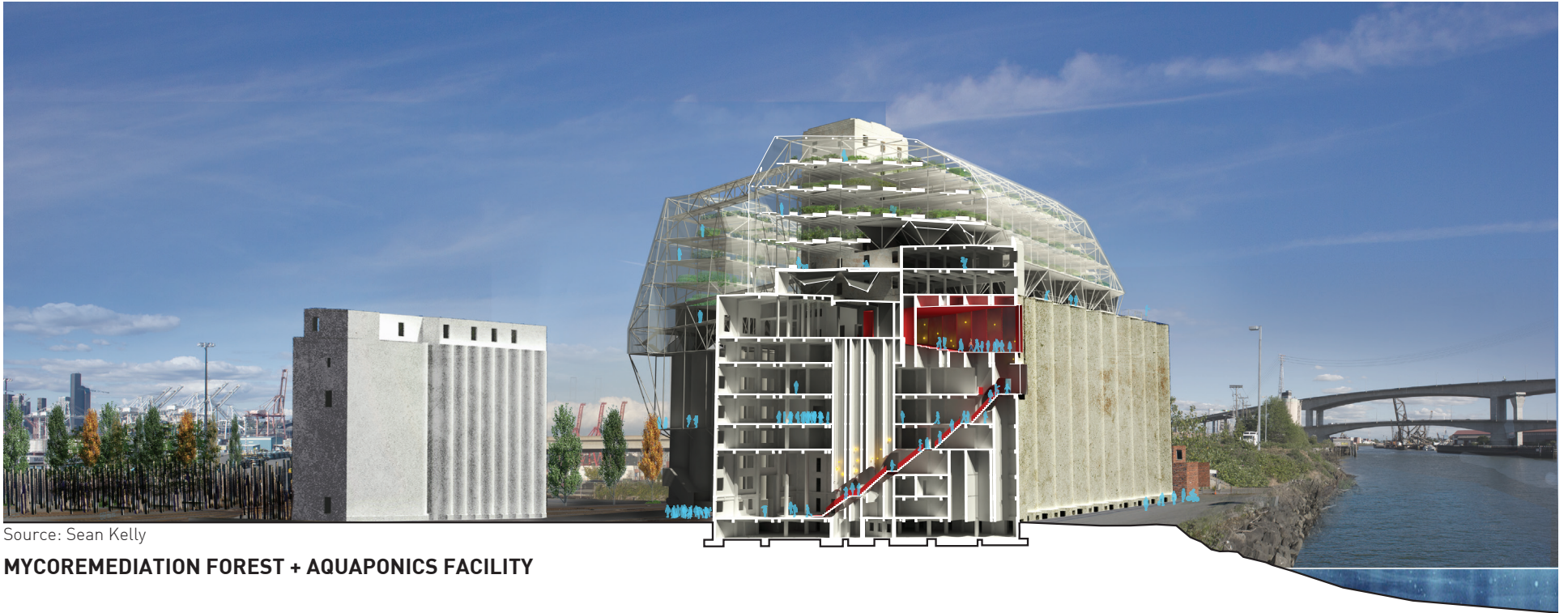
(the food or fuel debate criticizes the ethanol industry for the large quantities of corn crop required for fuel processing). The biofuel refinery will play the role of a demonstration project, applying current cutting edge research on the ground and providing a mechanism to convert waste biomass from completed phytoremediation operations into a fuel source. This proposal essentially updates the role of the petroleum storage facility to more progressive and innovative industrial service while maintaining a focus on fuel production, storage, and transfer. By maintaining similar operational processes as the facility's former use, the proposed biofuel refinery will be able to adaptively reuse much of the infrastructure existing on the site (e.g. storage tanks and piping). Based on other biofuel refinery models, there is sufficient space available in the northeast corner of the site to construct the new infrastructure necessary for processing the woody biomass and managing the fuel refinement process. The economic productivity of this operation depends on an adequate supply of woody biomass, therefore it is suggested that the phytoremediation strategies implemented on Harbor Island be replicated throughout the Lower Duwamish River industrial area and other contaminated landscapes in the region. Locally harvested biomass from the site will be easily transferred to the biofuel refinery for processing. The direct accessibility of the biofuel refinery by shipping and rail transport will allow for an efficient import of regionally harvested biomass as well. While most of the facility would be fenced off from public access for safety purposes, there is potential to allow access to several of the storage tanks at the south end of the site. These tanks could be loosely used as graffiti walls and viewing platforms, effectively augmenting the social program.

The proposed aquaponics facility at the abandoned Fisher Flour Mill complex will generate another adaptive reuse process and innovative eco-industrial operation at the site. The goal for the facility is to promote and demonstrate local food production through a closed-loop, synergetic system that hybridizes vertical farming and aquaculture. The main function of this complex will be food production but it will also serve as a research lab and forum for public education. By initiating the biofuel refinery on the north end of the site and the aquaponics facility on the south, these two distinct industrial programs serve as 'bookends', creating thresholds and providing elevated views to the more loosely programmed ecological, industrial, and social infrastructure in between.



Source: Sean Kelly

AQUAPONICS FACILITY: For the complete adaptive reuse strategy and design proposal for the Fisher Flour Mill, see “Infrastructural Ecologies: Converting the Abandoned Fisher Flour Mill on Seattle’s Harbor Island into an Aquaponics Food Production and Education Facility” - Master of Architecture thesis by Sean Kelly (University of Washington, 2013).



Source: Sean Kelly

MYCOREMEDIATION FOREST + AQUAPONICS FACILITY



Source: Sean Kelly

VERTICAL FARMING OPERATIONS

AESTHETICS AND EXPERIENCE

While the design process for this thesis is primarily concerned with promoting the infrastructural capabilities of the landscape, it is essential to nurture the site's aesthetic and experiential qualities as a means of developing social relationships with this place. The forms that are brought to the site ultimately follow the lead of the prescribed functions (i.e. the desired processes direct the physical forms). It is important to further recognize a dynamic feedback loop that is generated between process and form in the design of this site: as the desired regenerative and experimental processes serve to guide the establishment of form, the formal qualities then return the favor by elucidating the processes. The operative grid is a valuable example and effective method of creating a functional landscape framework with distinct aesthetic implications. By laying out the site's features on this pronounced grid, not only are the infrastructural processes efficiently organized through space and time, but the landscape is imbued with a unique aesthetic identity. The grid informs the transformation of the site's barren scenery into a highly visible constructed ecology. Through the prominent patterning of phytoremediation plantations in the upland asphalt matrix and the distinctive geometrical arrangement of various habitat enhancements along the shoreline, the processes of soil decontamination and habitat regeneration are accentuated. None of this ecological infrastructure appears "natural." Instead, it is represented as a hypernatural social construct, clearly expressing the human management of the landscape. The processes and forms employed at this site will provide a surreal experience for visitors unlike any other public space in the City of Seattle. It is a place where industry, ecology, and social engagement will commingle in poetic ways – where old pier pilings will become mushroom farms, where poplar trees and train cars will extend through the landscape in unison, where artificial reefs will reach out toward massive ships, where tugboats will pull floating wetlands, where constructed habitat islands will find themselves next to a constructed industrial island, where the unloading of shipping container cargo will be observed from shipping container shelters, where improvised art installations will appear from industrial waste. This is the landscape of experimentation.



"Landscape artists can reveal the forces of nature underlying cities, creating a new urban identity from them" (Balmori 2010).



TERMINAL 10: Phytoremediation plots create a hierarchy of spatial configurations which are appropriated in unique ways. Shipping container shelters and an accessible material yard encourage inhabitation and unrestricted building for a variety of purposes (e.g. skate spots and art installations). This social node provides opportunities for activities that are typically discouraged or are unlawful in other public spaces (e.g. homeless encampment, graffiti, and skateboarding).



BIOFUEL REFINERY: While most of the facility would be fenced off from public access for safety purposes, there is potential to allow access to several of the storage tanks at the south end of the site. These tanks could be loosely used as graffiti walls and viewing platforms, effectively augmenting the social program.



SHORELINE HABITAT SHELF SYSTEM: The goal of the shelf system is to create many basins at varying elevations that can be filled with different sediment and substrate types (e.g. rough vs. coarse vs. fine) and other organic materials. Like the phytoremediation plots, each of these basins have the opportunity to become individual testing sites where sediment and substrate residence times and biotic growth can be monitored. The modular sizing of these basins and the floating wetlands/planter box barges allows stacking of these systems to increase experimental capacity.



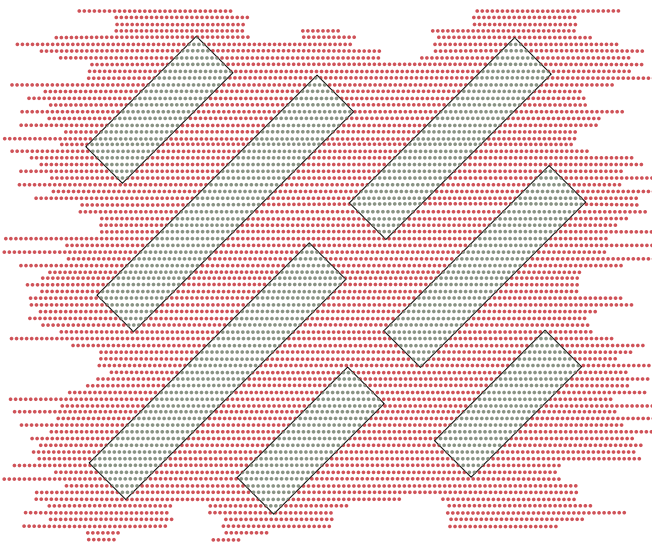
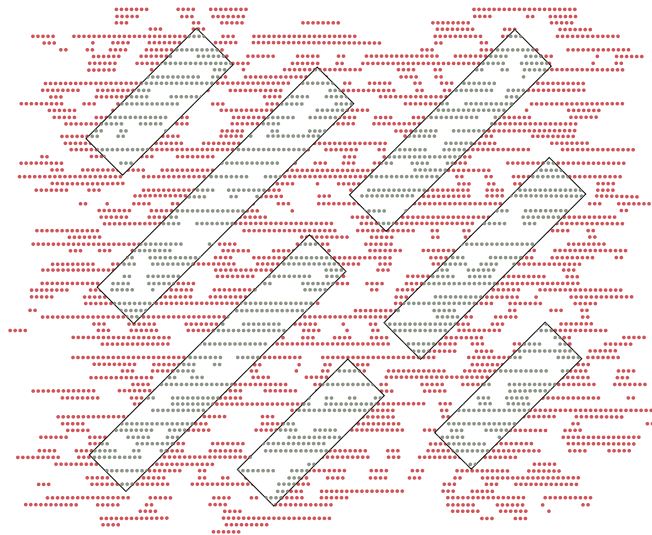
MYCOREMEDIATION FOREST: Creosote pilings will be pulled upland and inoculated with different fungi species to degrade and sequester the embedded contamination. This demonstration in mycoremediation will function as a threshold between Terminal 10 and the proposed aquaponics facility.

DYNAMIC PROCESSES IN THE SUCCESSIONAL LANDSCAPE

The design that is represented in plan and section will not be constructed all at once and its physical framework is intended to be modified over time in response to changing environmental conditions. This is a landscape in flux – a site under perpetual construction that will experience variations in social and biotic appropriation and reconfigurations of experimental structure over time. The manifestation of pioneering and succession on site is represented through nested scales of time, where short-term changes (biotic growth and social appropriation) are nested within the intermediate changes (project phasing and modifications of experimental framework), which are nested within the long-term changes (evolving land uses). The processes of pioneering and succession are dynamic, happening at different rates and exhibiting relatively linear or episodic behavior depending on the scale and type of pioneering and succession that is being discussed.

In the short-term, pioneering and succession will simply occur through the planting and maturation of phytoremediators, the growth of volunteer species in the nearshore habitat enhancement areas, and the appropriation of public space by new site users. This short-term pioneering and succession would be expected to be a standard process in the landscape, characteristic of any experimental regime that shapes the site. At the intermediate time scale, the dynamic nature of the site design is fully expressed. In the first phase of the project, the pioneering site interventions will include the initial sequence of phytoremediation at Terminal 10, mycoremediation of the pilings, the material yard, floating wetlands and planter box barges, nearshore habitat shelf system, and shipping container shelters. The second phase will allow the necessary time to introduce the nearshore gabion reef structures, constructed habitat islands, phytoremediation at the BP tank farm, phytoremediation of East Waterway sediment, and construction of the aquaponics facility. The third phase will initiate construction of the biofuel refinery and begin an ongoing intermittent reconfiguration of the site's experimental framework.

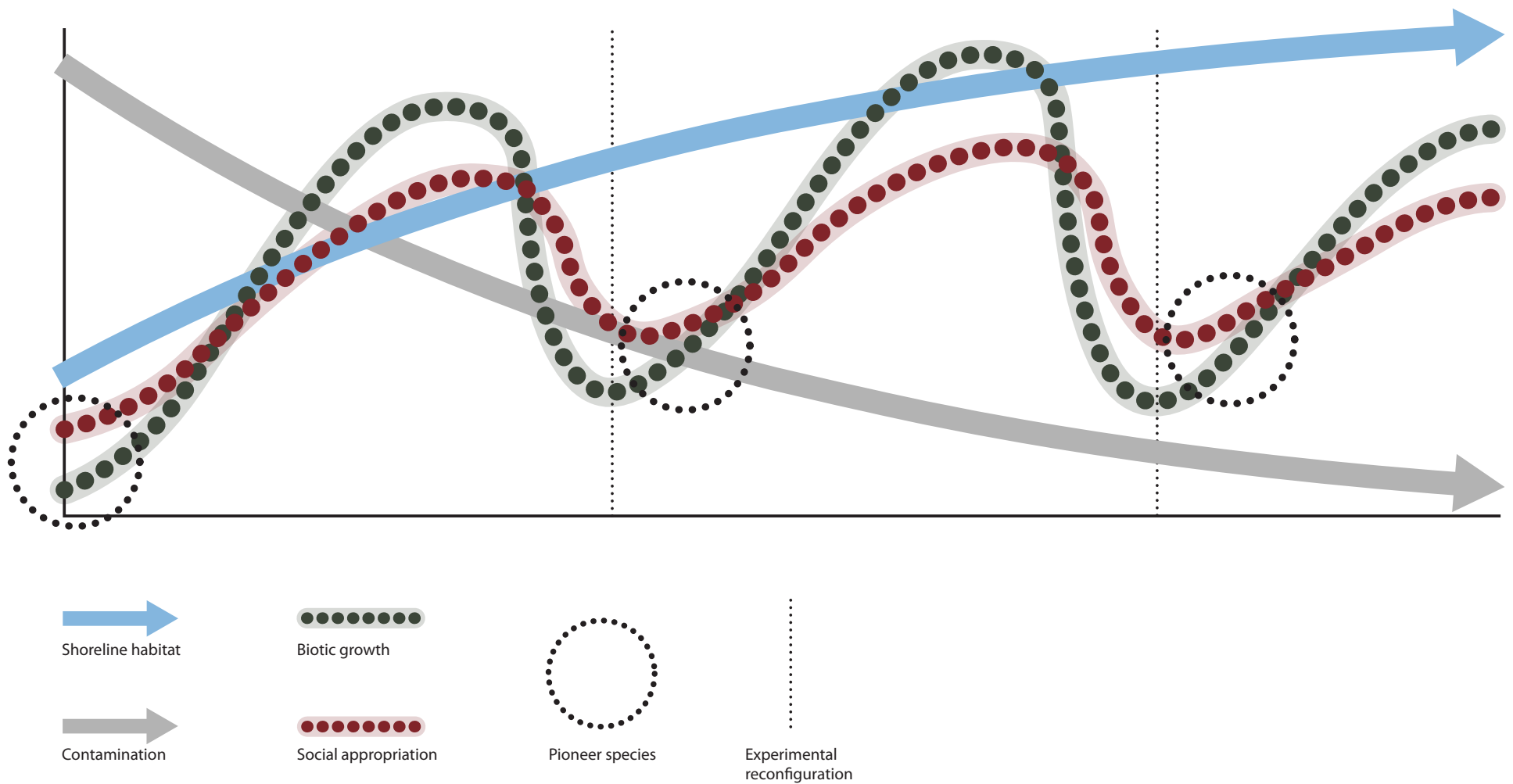
The “Experimental Reconfiguration” diagram shows how the operative grid will guide successional staging of phytoremediation through the landscape. This sequencing becomes particularly dynamic at Terminal 10, as the goal for this



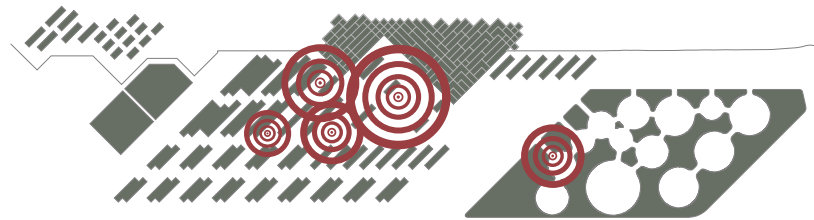
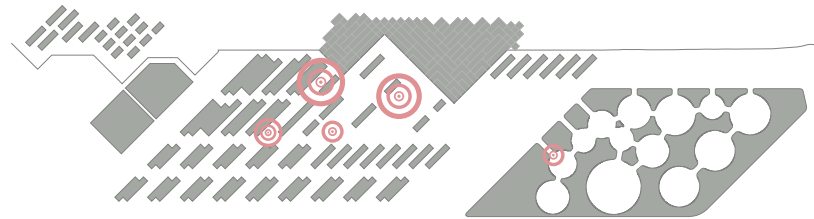
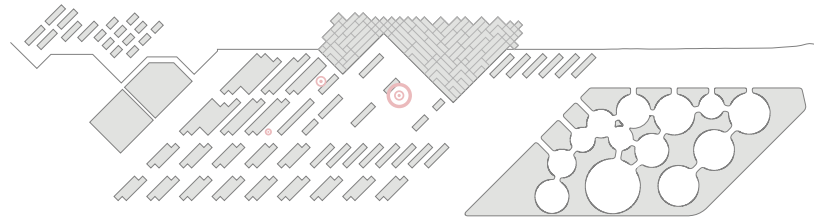
part of the site is to maintain integrated open space for the industrial and social programs in conjunction with the planted phytoremediation plots. Over time, the phytoremediation plots would be shifted around the site like mobile pixels, evenly decontaminating the landscape while sharing the space with the other industrial and social uses. Using the operative grid as a guide, the general process for the phytoremediation sequencing is to cut away the asphalt (to be stockpiled in the material yard for future reuse) and plant the desired species as appropriate for the respective sequence. After a period of years, the planted soils will be decontaminated and the biomass can be harvested for biofuel processing. The treated areas will then be patched with asphalt and a new phytoremediation sequence can begin.

Another way of reconfiguring the site's experimental framework exists in the habitat shelf system. The "Experimental Reconfiguration" diagram shows the shelf system basins and their respective elevations. As discussed, the basins provide an opportunity to test residence times of various sediment and substrate types and their associated biotic growth. These basins can be amended with diverse materials over time to see how the habitat function is affected at different tidal elevations. The experimental environment of the shoreline will be further diversified through the deployment and docking of the floating wetlands and planter box barges within each of the unique nearshore systems. The floating vegetated systems will significantly increase the presence of over water habitat, will augment under water habitat with the floating wetland root systems, and are expected to provide a source of leaf litter and other beneficial organic matter. Deploying these systems along the shoreline offers an effective way of compounding the experimental environment, allowing multiple nearshore habitat enhancement strategies to be tested in one place. The modularity and consistent measurements informed by the operative grid are critical factors here, ensuring that the shoreline systems are laid out in such a way that the modular floating wetlands and planter box barges are able to fit in like Lego blocks (shown in the "Experimental Reconfiguration" diagram). If at some point the trial of new shoreline enhancement strategies is desired, the proposed nearshore habitat enhancements can be easily removed and their materials reused elsewhere.

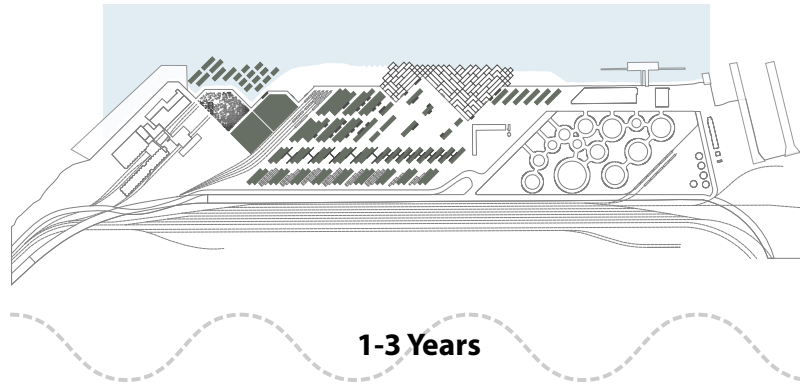
The design of this site will support a dynamic system of symbiotic industrial, ecological, and social processes. These system dynamics are clearly expressed



SUCCESSION THROUGH TIME: This diagram represents the episodic successional patterns of biotic and social systems and general trends of habitat enhancement and decontamination that are expected to occur at the site over time. The plant palettes used to initiate phytoremediation and the visitors that instigate appropriation of the site both function as pioneer species and stimuli for successional processes that will coevolve together through time and space. As the biota matures and soil contamination is treated, public use of the site and various forms of appropriation will proliferate. Reconfiguration of the site's experimental framework causes these successional cycles to start over.

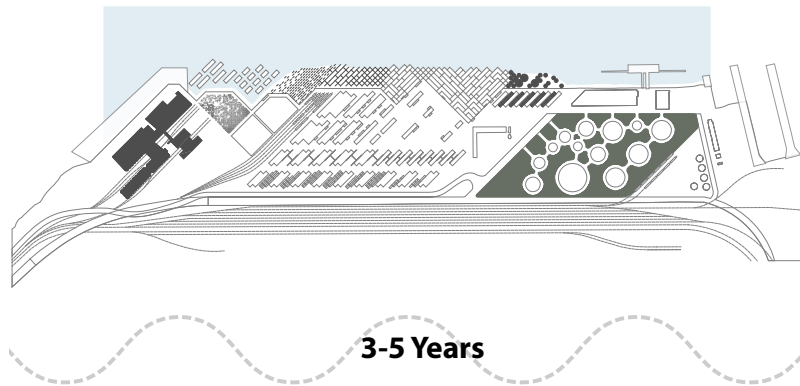


BIOTIC GROWTH AND SOCIAL APPROPRIATION



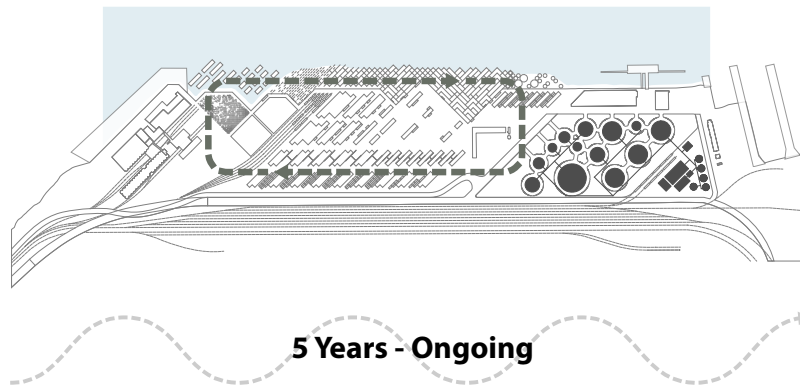
Phase 1:

Initial sequence of phytoremediation at Terminal 10, mycoremediation of pilings, material yard, floating wetlands and planter box barges, nearshore habitat shelf system, shipping container shelters



Phase 2:

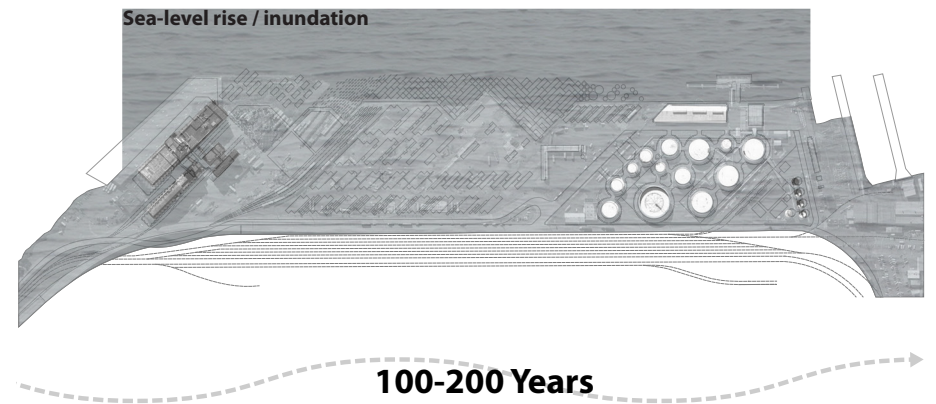
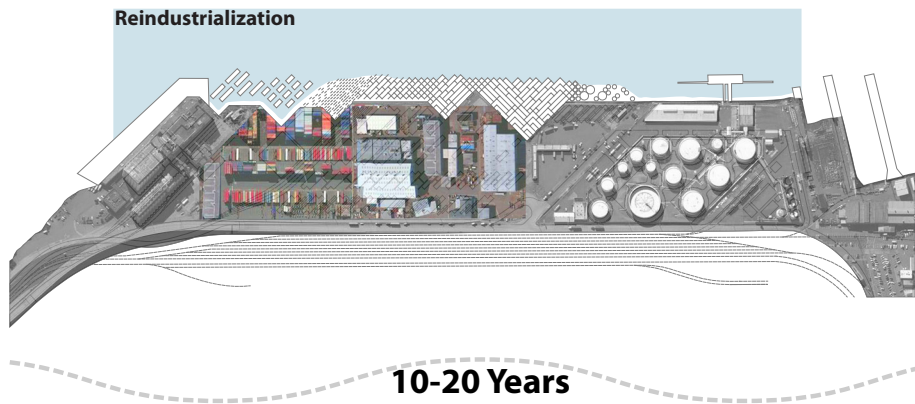
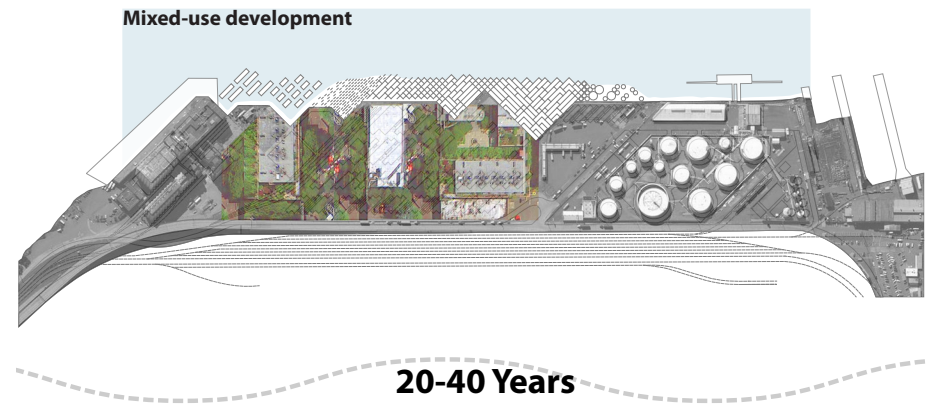
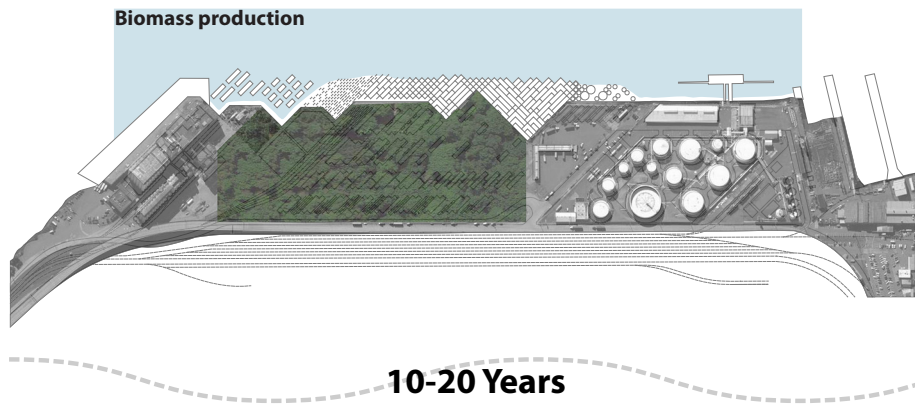
Nearshore gabion reef structures, constructed habitat islands, phytoremediation at the BP tank farm, phytoremediation of East Waterway sediment, aquaponics facility construction



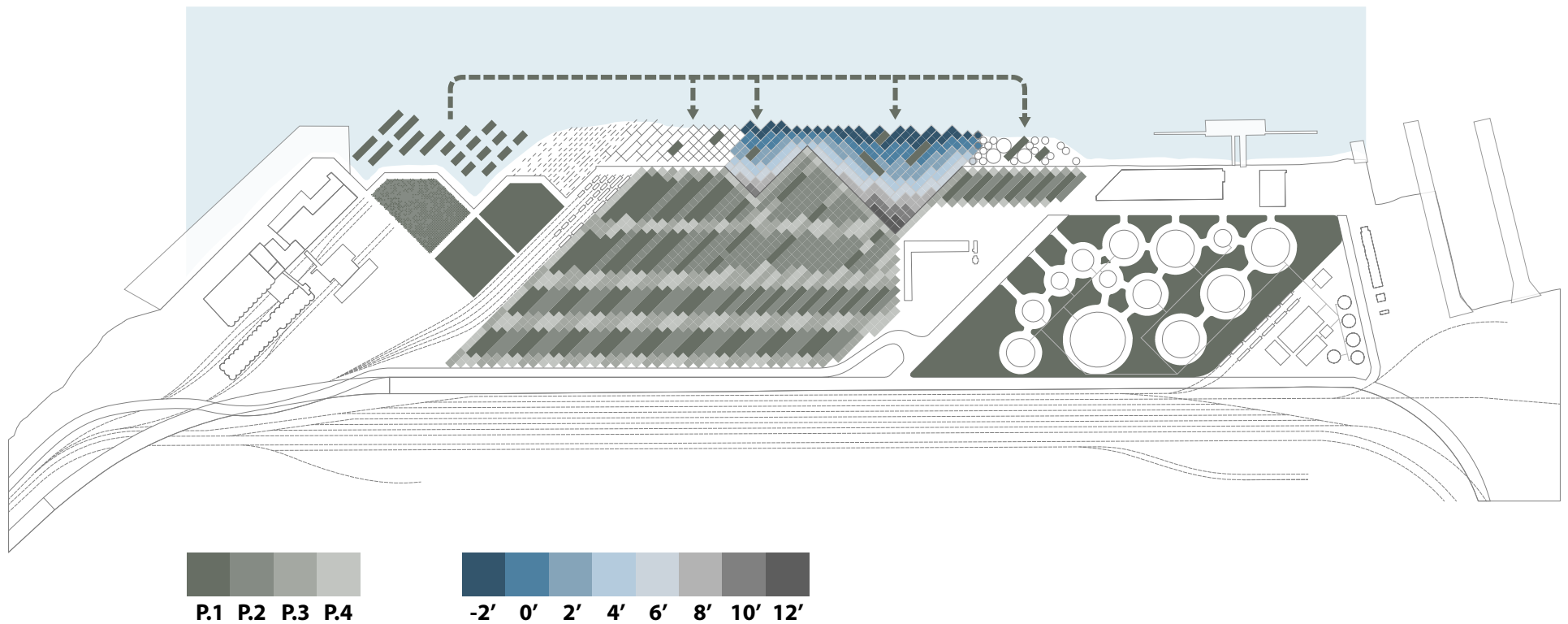
Phase 3:

Biofuel refinery construction, ongoing intermittent reconfiguration of the site's experimental framework

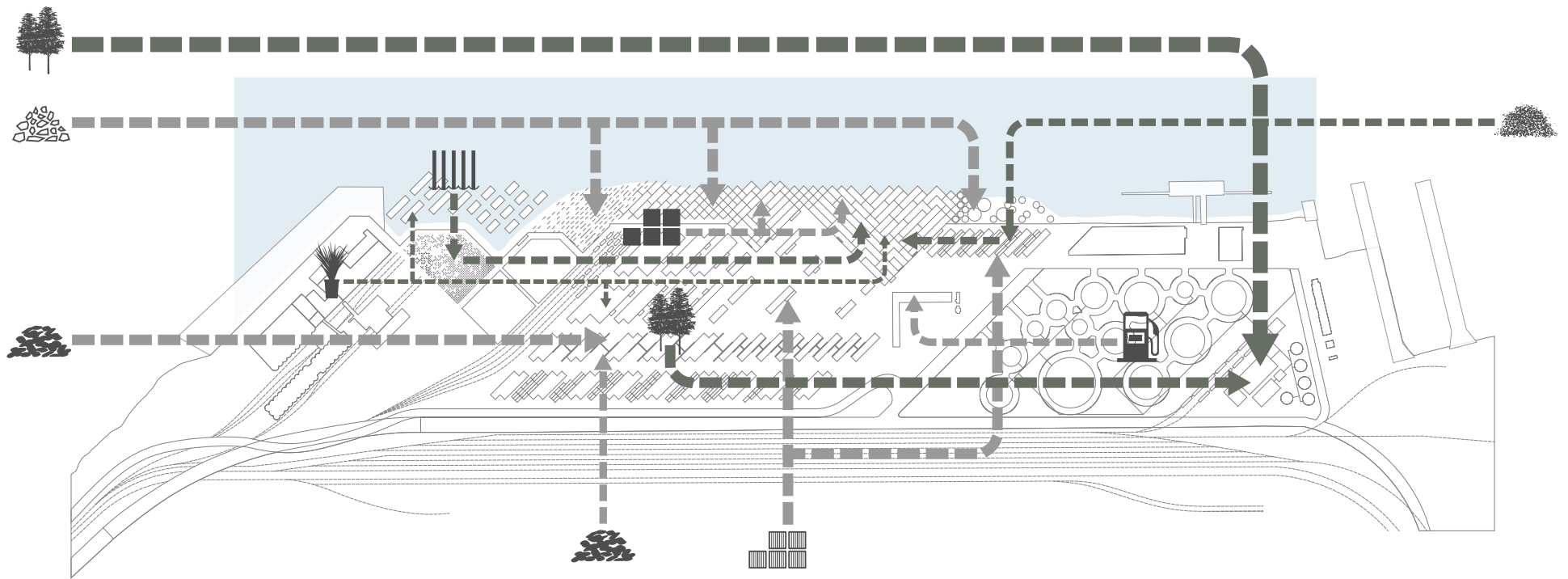
PROJECT PHASING



POTENTIAL LAND USE TRAJECTORIES



EXPERIMENTAL RECONFIGURATION: This diagram shows how the operative grid will guide successional staging of phytoremediation through the landscape (Phases 1-4). In order to maintain integrated open space in conjunction with the phytoremediation, the planted plots will be shifted around the site like mobile pixels, evenly decontaminating the landscape over time while sharing the space with the other industrial and social uses. The habitat shelf system elevations are shown along with the individual basins that provide an opportunity to test residence times of various sediment and substrate types and their associated biotic growth. The deployment of the floating wetlands and planter box barges further enhances the experimental environment.



-----> Biotic material flows

-----> Industrial material flows



Local and regional waste biomass from phytoremediation transferred to biofuel refinery for processing



Phytoremediation and shoreline plant starts supplied by aquaponics facility



Ethanol fuel produced from biomass processing and supplied on-site at existing fueling station



Locally sourced ecology blocks used for construction of habitat shelf system



Locally sourced shipping containers used for modular shelters and planter boxes



Creosote pilings mycoremediated then used as large woody debris in habitat shelf system



East Waterway sediment phytoremediated and then supplied to habitat shelf system

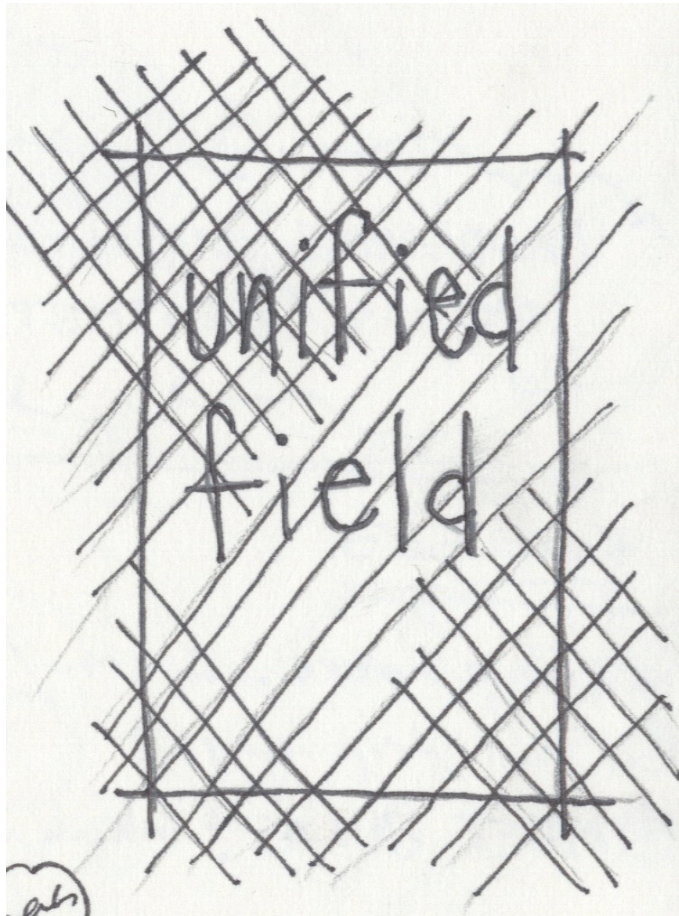
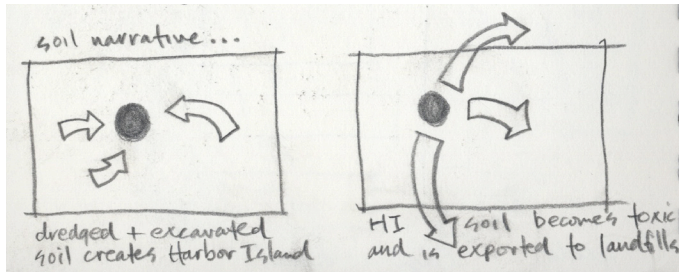


Local and regional industrial waste materials stockpiled at material yard for public use



Waste concrete from viaduct demolition used for construction of gabion reef structures and habitat islands

MATERIAL AND ENERGY FLOWS: An important part of the design proposal is the production of a regenerative cycle of material and energy flows that will transform waste into resources and promote closed-loop, synergetic relationships. This diagram shows how all of the different ecological, industrial, and social design interventions on the site will become truly integrated and interrelated in a robust, overarching system.



in the material and energy flows that will take place throughout the landscape. Harbor Island has a long history as a place of intensive material and energy flows, seen in the movement of mass quantities of fill to construct the island, the deportation of large volumes of contaminated soil to distant landfills, the production and distribution associated with the island's industrial processes, and the day-to-day import and export of cargo managed by the shipping terminal. An important part of the design proposal is to apply systems thinking to stimulate a regenerative cycle of material and energy flows that will transform waste into resources and promote closed-loop, synergetic relationships. The "Material and Energy Flows" diagram shows how all of the different ecological, industrial, and social design interventions on the site will become truly integrated and interrelated in a robust, overarching system.

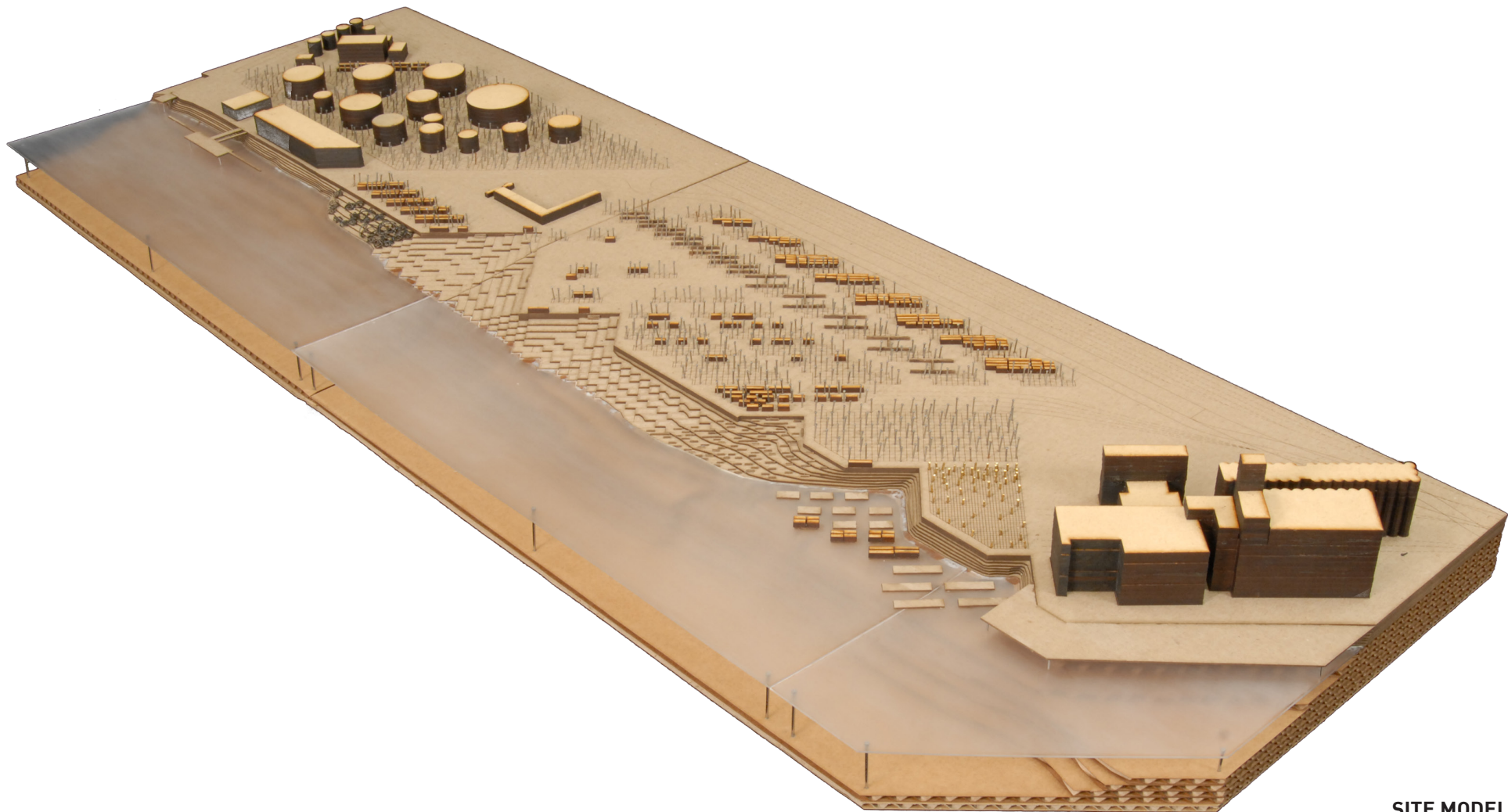
The design of the site does not propose a final formal outcome on Harbor Island, but rather a series of processes that will decontaminate, regenerate, and activate the landscape in new ways. The long-term succession of the site brings a certain level of uncertainty. After the site has been remediated to the greatest extent possible, phytoremediation will no longer be required. At this point, there are numerous potential future trajectories for the site. These potential site futures include use of the space for biomass production to supply the biofuel refinery, development into an additional shipping terminal or other industrial operation, rezoning to become a mixed-use commercial and residential setting, or even inundation by sea-level rise. Ultimately, the long-term future of the site is undetermined.

REFLECTIONS AND CONCLUSION

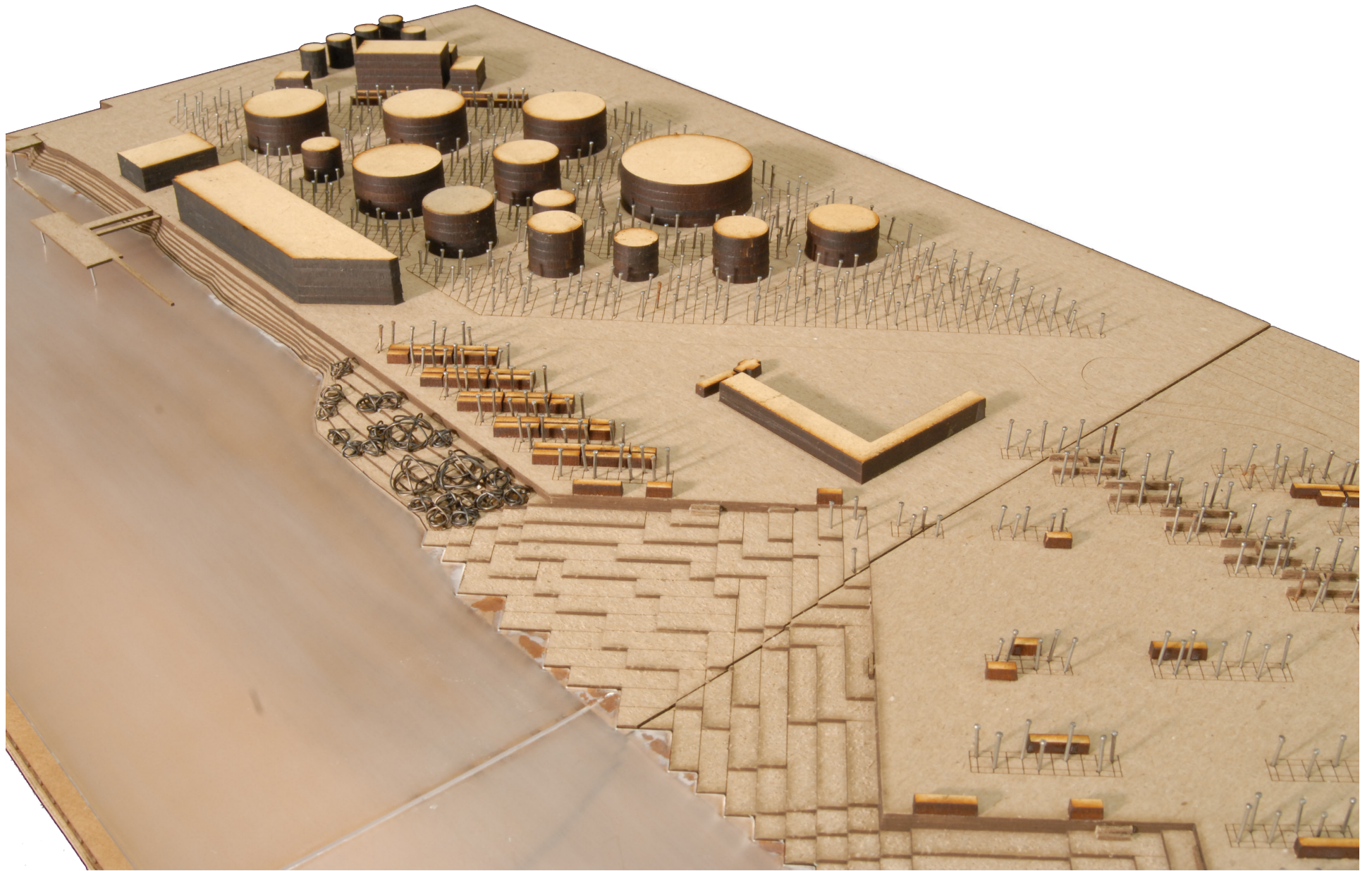


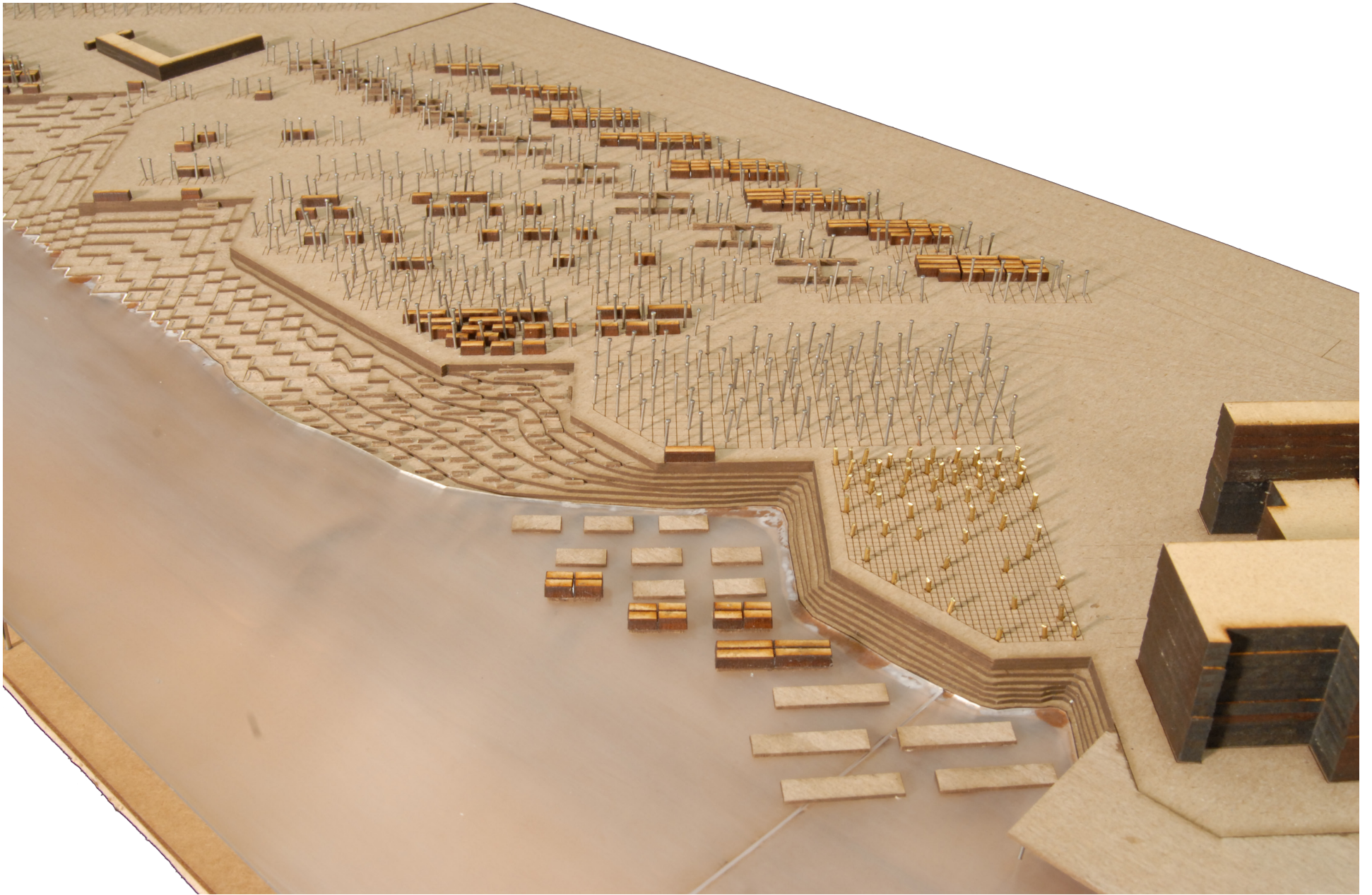
preference of the designer is relatively intangible. In my case, I am very much biased toward the raw and gritty rather than the manicured and sanitized. I grew up spending time in residual and derelict urban spaces and my attraction to these landscapes remains strong. I find the aesthetic and experiential qualities of these environments to be very special. It is the designer's role to make spaces beautiful, but whose beauty are we talking about? It does not surprise me that many people will not understand why I am proposing to maintain a raw and gritty quality at a designed site or why I am even designing a public space on an industrial island in the first place. This approach is not the norm in the field of landscape architecture because this is not the type of space that most people want to engage with. If this project went through a community based participatory design process, it would be expected that the outcome for the site design would be quite different. But since this is my own thesis work, I took the opportunity to project my aesthetic and experiential values in the design in order to realize my personal vision for the site.

An important part of my thesis work was the collaborative process that evolved with Sean Kelly, a Master of Architecture student at the University of Washington who is also developing his thesis project on Harbor Island. Early in the process, Sean and I were able to share our intuitive reactions to the site, island, and context and concurrently develop theoretical approaches for our respective designs. By generating a strong theoretical foundation for the site together, our individual design proposals became more integrated and responsive to one another. Kelly's proposal for the adaptive reuse of the Fisher Flour Mill complex and development of an aquaponics facility introduces an integral component to the system prescribed by my design proposal. Ultimately, our shared design efforts have strengthened each other's individual designs and produced a whole infrastructural and experiential system which is greater than the sum of its parts.



SITE MODEL





BIBLIOGRAPHY

Allen, Stan. *Points + Lines: Diagrams and Projects for the City*. New York: Princeton Architectural Press, 1999.

Balmori, Diana, and Michel Conan. *A Landscape Manifesto*. New Haven: Yale University Press, 2010.

Bargmann, Julie. "D.I.R.T. Studio." Interview by Heather Ring. October 2, 2006. <http://archinect.com/features/article/45200/d-i-r-t-studio>

Bélanger, Pierre. "Landscape as Infrastructure." *Landscape Journal* 28 (2009): 79-95.

Berger, Alan. "Drosscape." In *The Landscape Urbanism Reader*, edited by Charles Waldheim. New York: Princeton Architectural Press, 2006.

Bularca, Brandusa. "Harbor Island Manufacturing Fields: Man-Making and Re-Making of Seattle Metropolitan Industries." Thesis (Master of Architecture), University of Washington, 2009.

Carman, Eric. "From Laboratory to Landscape : A Case History and Possible Future Direction for Phyto-Enhanced Soil Bioremediation." In *Manufactured Sites: Rethinking the Post-Industrial Landscape*, edited by Niall Kirkwood. London: Spon Press, 2001.

Cordell, Jeff. Interview by author. Note taking. Seattle, WA , February 15, 2013.

Corner, James. "Terra Fluxus." In *The Landscape Urbanism Reader*, edited by Charles Waldheim. New York: Princeton Architectural Press, 2006.

Environmental Protection Agency (United States). "Harbor Island - Partial Deletion Data Collection Form." 2013. <http://yosemite.epa.gov/r10/cleanup.nsf/9f3c21896330b4898825687b007a0f33/31db1db75b73482788256bf0007b11e0!OpenDocument>

Environmental Protection Agency (United States). *Third Five-Year Review Report: Harbor Island Superfund Site Seattle, Washington*. 2010.

Franck, Karen A., and Quentin Stevens. *Loose Space: Possibility and Diversity in Urban Life*. London: Routledge, 2007.

Halligan, Victoria E. "Facilitating Flux: Landscape as Coastal Infrastructure." Thesis (Master of Landscape Architecture), University of Washington, 2011.

Hill, Kristina. "Shifting Sites." In *Site Matters: Design Concepts, Histories, and Strategies*, edited by Carol Burns and Andrea Kahn. New York: Routledge, 2005.

Höfer, Wolfram, and Vera Vicenzotti. "Unsightly Sights to See: On the Transformation of Old Industrial Sites Through Post-Industrial Design." *Topos: The International Review of Landscape Architecture and Urban Design* 78 (2012): 56-60.

Hou, Jeffrey. "(Not) Your Everyday Public Space." In *Insurgent Public Space: Guerrilla Urbanism and the Remaking of Contemporary Cities*, edited by Jeffrey Hou. New York: Routledge, 2010.

Hough, Michael. Foreword to *Manufactured Sites: Rethinking the Post-Industrial Landscape*, edited by Niall Kirkwood. London: Spon Press, 2001.

Jackson, Lucinda. "Beyond Clean-Up of Manufactured Sites: Remediation, Restoration and Renewal of Habitat." In *Manufactured Sites: Rethinking the Post-Industrial Landscape*, edited by Niall Kirkwood. London: Spon Press, 2001.

Klinge, Matthew W. *Emerald City: An Environmental History of Seattle*. New Haven: Yale University Press, 2007.

Lewis, Michael. "Found Walking: An Immanent Approach to a Derelict Post Industrial Site." Thesis (Master of Landscape Architecture), University of Washington, 2010.

Meyer, Elizabeth. "Uncertain Parks: Disturbed Sites, Citizens, and Risk Society." In *Large Parks*, edited by Julia Czerniak and George Hargreaves. New York: Princeton Architectural Press, 2007.

Mossop, Elizabeth. "Landscapes of Infrastructure." In *The Landscape Urbanism Reader*, edited by Charles Waldheim. New York: Princeton Architectural Press, 2006.

North Coast Mushroom Farmers Cooperative. "Bioprospecting, who found a creosote eating fungus?" 2012. <http://ncmfcoop.org/public/2012/12/13/bioprospecting-who-found-a-creosote-eating-fungus/>

Poole, Kathy. "Boston's Back Bay Fens: a Sectional Story." 1997. <http://www2.iath.virginia.edu/backbay/fenssite/html/docs/story.html>

Port of Seattle. *Lower Duwamish River Habitat Restoration Plan: An Inventory of Port of Seattle Properties*. 2009.

Reed, Chris. "Public Works Practice." In *The Landscape Urbanism Reader*, edited by Charles Waldheim. New York: Princeton Architectural Press, 2006.

Senatsverwaltung für Stadtentwicklung. *Urban Pioneers: Temporary Use and Urban Development in Berlin*. Berlin: Jovis, 2007.

Sola-Morales, Rubio. "Terrain Vague." In *Anyplace*, edited by Cynthia Davidson. New York: Anyone Corp, 1995.

Stilgenbauer, Judith. "Landschaftspark Duisburg Nord - Duisburg, Germany." 2005. http://designobserver.com/media/pdf/Landschaftspar_405.pdf

Thayer, Jr., Robert L. "Visual Ecology: Revitalizing the Aesthetics of Landscape Architecture." *Landscape* 20 (1976): 37-43.

Van der Ryn, Sim, and Stuart Cowan. *Ecological Design*. Washington, D.C.: Island Press, 1995.

Wilma, David. "Harbor Island, at the time the world's largest artificial island, is completed in 1909." 2001. http://www.historylink.org/index.cfm?DisplayPage=output.cfm&File_Id=3631

You Are the City. *Brownfields to Greenfields: A Field Guide to Phytoremediation*. 2011.