Folding (and Unfolding):
A Site-Responsive Strategy for Reusing Construction & Demolition Waste

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MLA Candidate 2024
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Bricks 4 Glass
The formerly industrial waterfront in Greenpoint, Brooklyn is undergoing intensive redevelopment, thanks in part to the 2005 rezoning of the Greenpoint-Williamsburg neighborhoods. The rezoning has faciliated the transformation of brick mill buidlings into lux high rises. Photo by author, January 2024.

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A thesis submitted in partial fulfillment of the requirements for the Master of Landscape Architecture Degree in the Department of Landscape Architecture of the Rhode Island School of Design, Providence, Rhode Island.

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Abstract

Discarding—in its most reductive formulation— is a sorting operation that makes distinctions between materials (as well as objects, people, communities, and landscapes) based on perceived value. In her book *Waste of the World*, Nicky Gregson, therefore, argues for a more careful collection-curation strategy that revalues and re-signifies "waste" to make it available for repair and reuse. Gregson, however, points to limited space and infrastructural capacity as a potential barrier to the development of new material handling strategies.

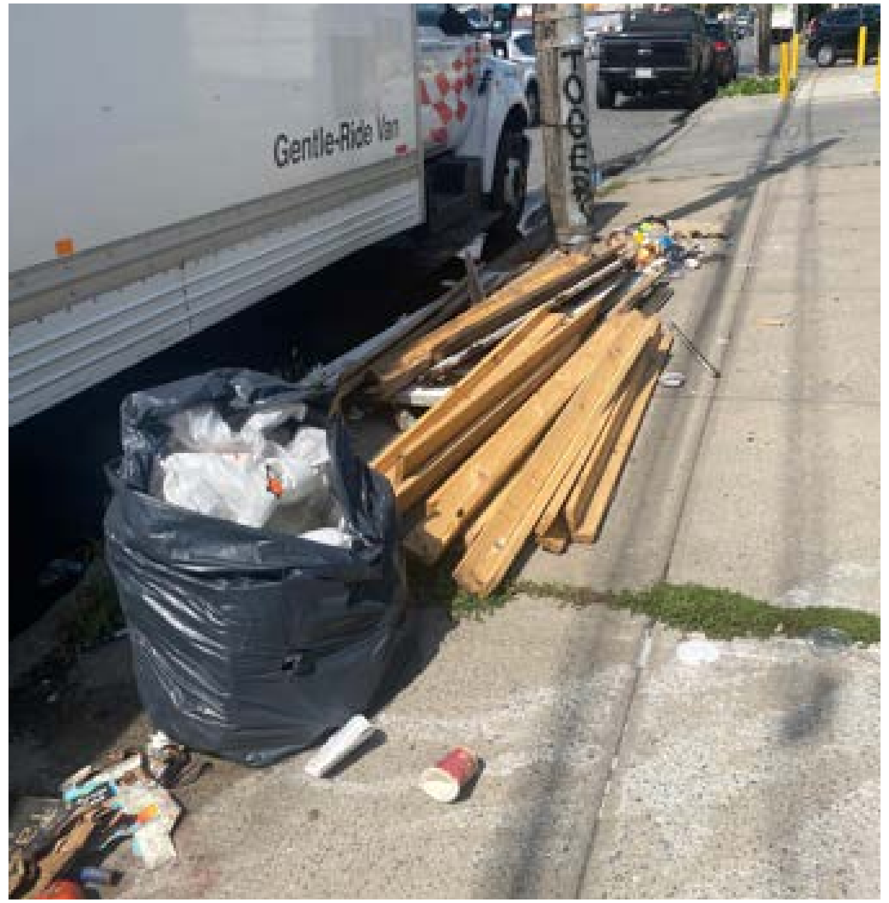
My design responds by proposing a network of walls and paths that operate in each of the sites I've identified as an on-site waste collection-curation strategy while simultaneously articulating the historical and material processes that have produced each of these sites in their current conditions via processes of construction, demolition, and redevelopment that have destroyed communities alongside buildings and landscapes. These processes are articulated through *the fold* as both a concept and formal design strategy that harnesses the waste on site and subsumes it into new forms. Meanwhile, my design works to articulate a staging process for the disassembly of these buildings that makes more material available for collection and reuse, even in a densely developed urban metropolis, like New York City, allowing the history of the built environment to be incorporated into the city's economic, cultural, and ecological transformation.

Brick Rubble at Kingston Point Beach
Photo by author, October 2023.

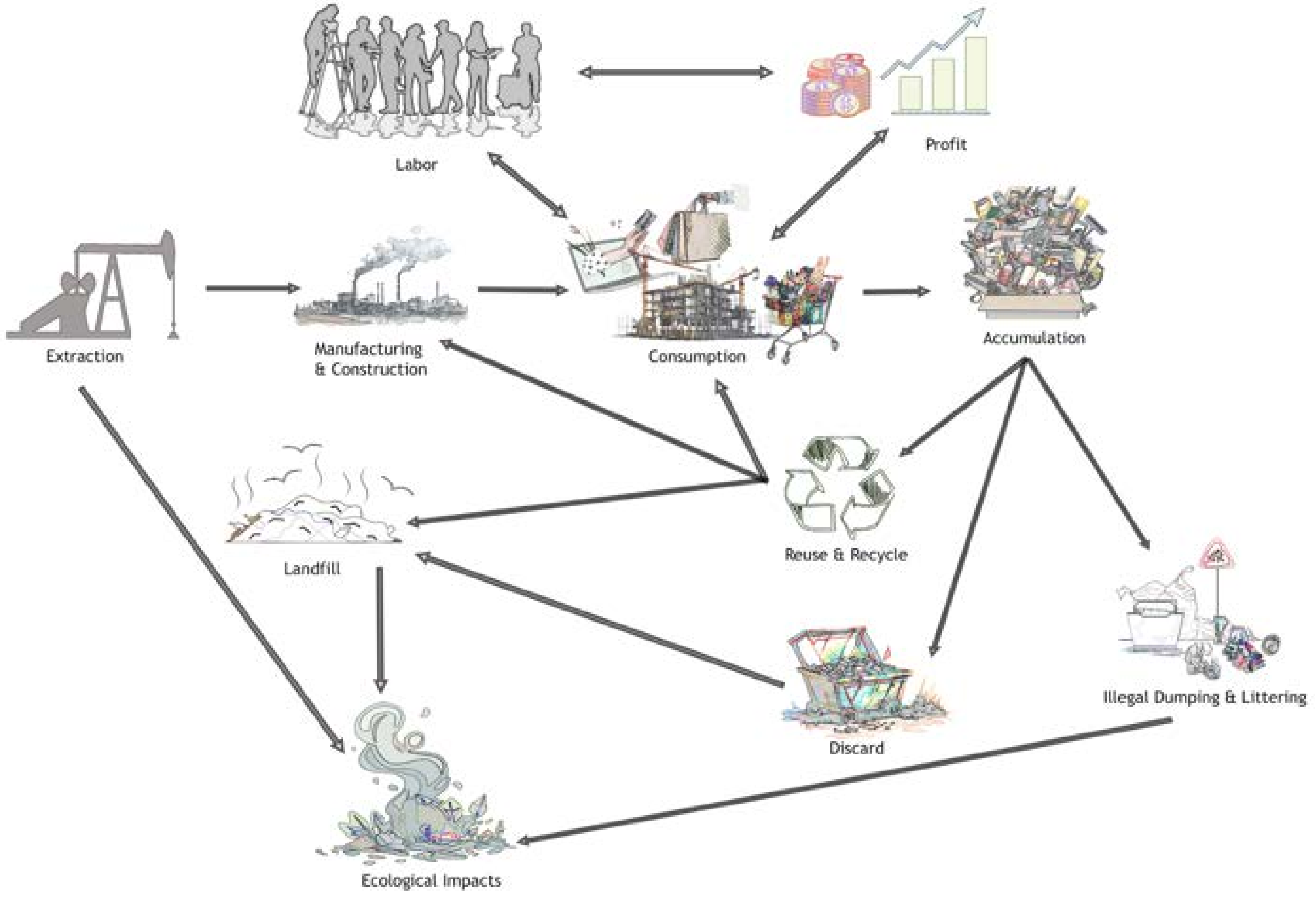
Introduction: Leaky Systems

In the introduction to *Material Culture: Assembling and Disassembling Landscapes*, Jane Hutton describes the authors in the anthology as interested in the "layers of 'externalities,' which are, in fact, intrinsic to material practice" (17). In Discard Studies, the concept of "externalities" (inherited from economics) describes the positive and negative costs and consequences that occur as the result of any systems' effort to maintain itself. In economic terms, these "externalities" are often seen as anomalous and necessary, rather than forms of normalized, ongoing harm that are required for the system to maintain itself (Liboiron and Lepawsky 22). Hutton's impulse to put "externalities" in quotation marks implicitly acknowledges my own concerns about the crucial assumption built into waste management systems—namely that our waste goes "away," helping—in the process—to maintain consumption and resource accumulation under capitalism, even as that which we've deemed "waste" produces ecological harms, the exploitation of workers, and the dispossession of vulnerable communities. Our waste, in fact, emerges as layers of material and meaning that help to construct the social and ecological fabric of the built environment.

The most obvious example of this emerges in the constructed layers of landfills themselves. I'd argue that Kristi Cheramie's "Spies in the Making," in fact, offers a more useful way of thinking about the circulation of materials and the production of so-called "waste" through the example of Monte Testaccio, an ancient landfill made entirely of discarded amphora and a geological expression of Rome's early consumer-based economy (Cheramie astutely compares the amphora to today's single-use plastics). She writes: "Through the firing process, clay inherits a geological persistence that allows it to accumulate complex exchanges that are literally baked into the substrate" (13). In other words, our landscapes exist as a byproduct and archive of material culture, informed by



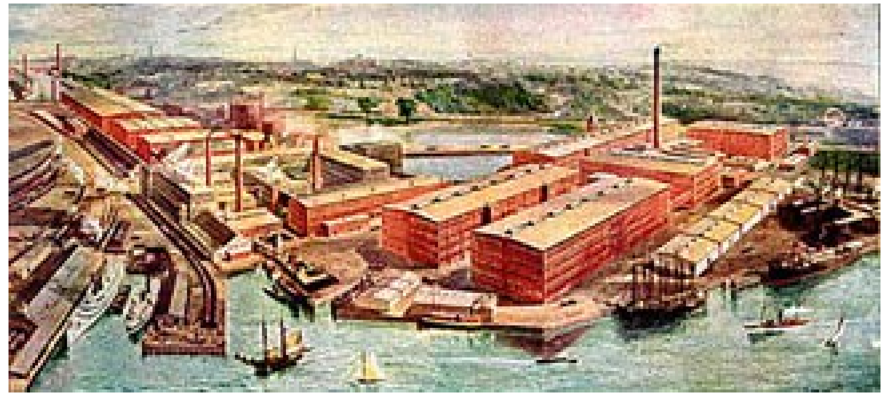
This page: Illegal Dumping in the Bronx
One example of the externalities produced by this system is produced by the illegal dumping that is prevalent in low-income communities like the Bronx. Photo by author, July 2023.
Opposite page: Section of Seneca Meadows Landfill
Seneca Meadows is the largest recipient of waste from New York City, including over 300,000 tons of C&D waste per year, much of which is used in the capping and ongoing construction of the the landfill.



economic systems and associated material flows and processes; we see this not only in the construction of landfills, but in the less visible chemical composition of soil and water; broader patterns of land use; and the living and working conditions of communities. Indeed, the collection, sorting, containment, and segregation of "discards" are, in essence, operations of power that allow consumption and accumulation to persist, but as Max Liboiron and Josh Lepawsky importantly remind us, waste also "always overflows it's official meanings and the technical systems designed to manage and contain it," and it's these inevitable "leaks" in the system that have that have and continue to shape our environments well beyond the site of the landfill (2).

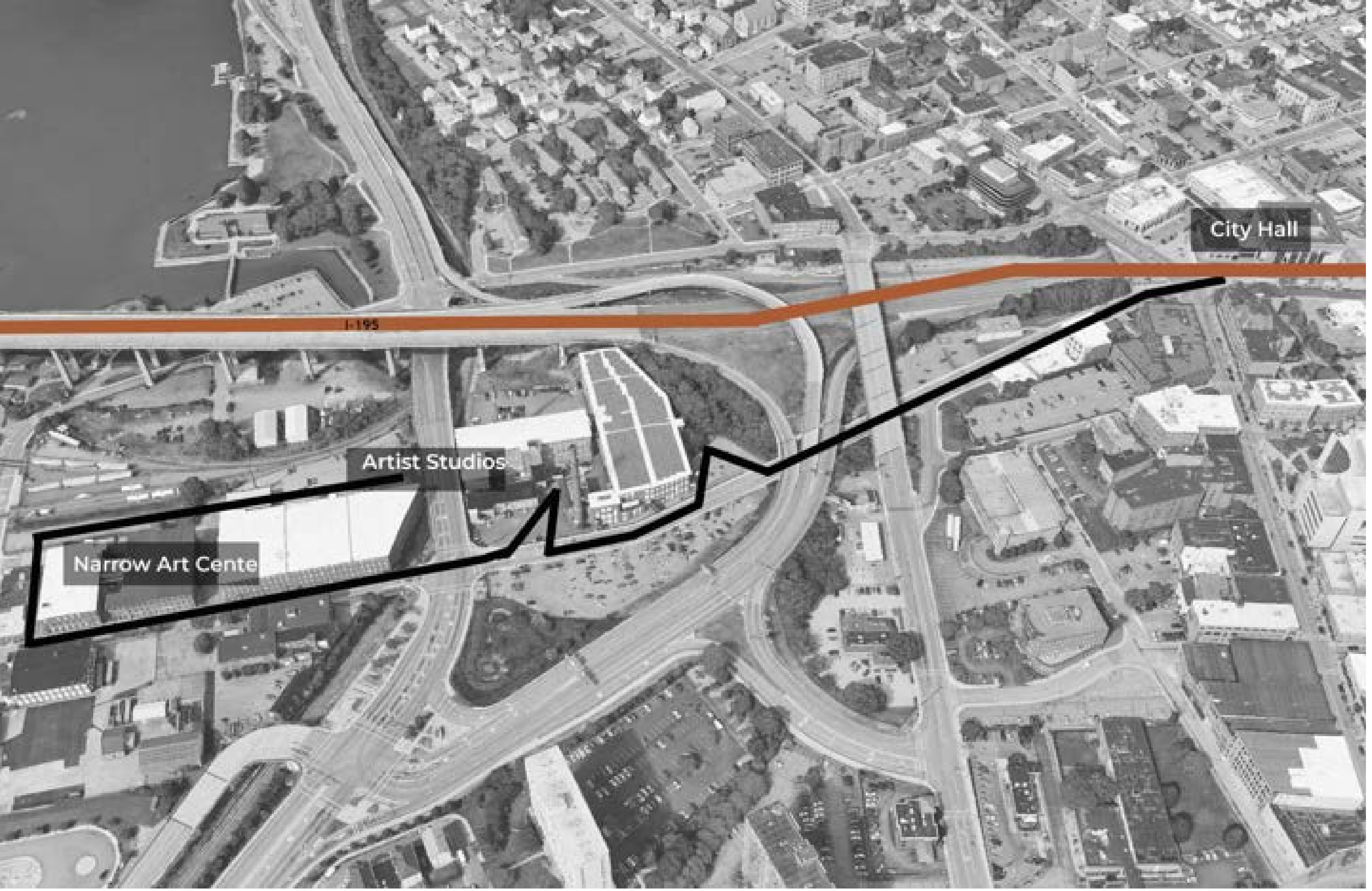
On a site visit to Fall River, Massachusetts in fall 2023, I was struck, for example, by how C&D waste had become literally and figuratively sedimented in the foundation of the built environment. For context: Fall River emerged in the 19th century as a leading center of textile manufacturing in the Northeast, powered by the eight "falls" of the Quequechan River. The American Printing Company, which was established a campus of brick textile mills, emerged as the largest producer of cotton cloth in the United States, and drove the rise of Fall River. The subsequent decline of the garment industry in the

This page: American Printing Company, 1910
In 1910, the American Printing Company was Fall Rivers' larWgest employer, but by 1923, the post-war economy had slowed and began to negatively impact Fall River, which was dominated by the textile industry.
Opposite page: Extraction/ Consumption/ Discard
A diagram of our "leaky" contemporary waste system.



United States, as well as a series of historic fires--including one in 1928 that destroyed most of Downtown—left the city economically devastated. As the city has attempted to bounce back, it's sought to maximize its historic and geographic position as a transportation hub, including the construction of a new transportation center and the expansion of MBTA commuter rail service, still under construction. Meanwhile the American Printing Company complex, as well as the adjacent Metacomet Mill, have gradually become occupied by a few small businesses; studio spaces; and cultural organizations, such as the Narrow Center for the Arts.

Our walking path through the city took us from City Hall, which is constructed over the 195 Freeway; down between layers of freeway and railroad tracks; to the waterfalls that once powered the historic waterfront mills; and into the mill complex itself. We traveled—in other words—through vertical layers of historical, economic, and material relationships mediated by both geologic and man-made methods of moving material that ended—quite stunningly—in the basement of the Narrow Art Center, where the rubble of the historical material processes that have shaped Fall River had come to settle. There, we witness clay as both literally and figuratively baked into the substrate even as efforts to redevelop the city are underway above ground, speaking to at least one way



This page: Aerial view of Fall River's Formarly Industriial Waterfront
Opposite page, top left: Narrow Arts Center *NAC is a non-profit performance venue and cultural center, housed in the former American Printing Factory. Photo by Marc N Belanger.*
Opposite page, top right: NAC Basement Rubble
Photo by author, October 2023.

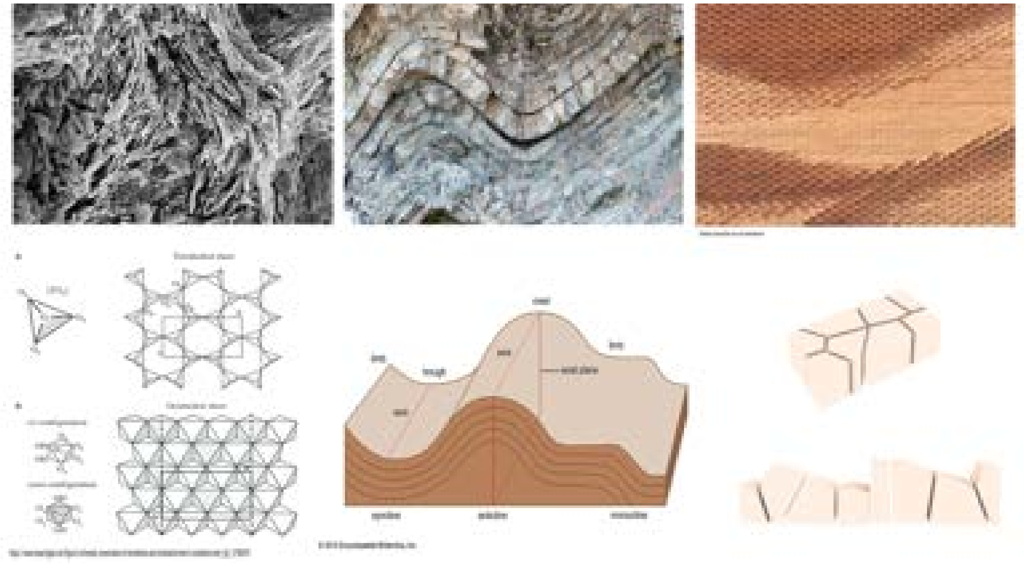
in which the byproducts of urban economic growth are spatialized through the design and construction of a seeming "away" that helps to maintain systems of power that depend on continued production, accumulation, and uneven distribution of resources, despite their ecological and social consequences. What we see in Fall River, however, is that there is no genuine "away." It's all here and in fact, the material and economic history of the place has been folded into and forever altered the very foundations of the city.

I'm interested—here and in my adjacent project, *Trash Atlas*—both in how design functions in service of this system as well as in what escapes it, and where the leaks in the system offer opportunities to reimagine "waste" as a source of existing material abundance. In her book *Mapping Abundance for a Planetary Future*, Candace Fujikane argues for "abundant mindedness as a radical refusal of capitalist economies" that depend on the illusion of scarcity (6). How can we find opportunities to reincorporate the abundance of construction and demolition waste we produce into the tranformation of our built environment, particularly as we consider how to respond to climate change? And how can we draw attention to material and ecological histories and processes, rather than remaining complicit in the social and ecological harms that result from our attempts to conceal them via conventional methods of discard and containment?

To engage in an analysis of waste systems and formulate a design response to these questions, it's methodologically important to me to identify ways of thinking across scales, not only because a shift in scale inevitably shifts our understanding of the problem, but also because the material interactions that shape our built environment and it's relationship to ecological processes reverberate across scales from the cellular to the regional. In this regard, the concept of the fold has emerged in my work as an important method for understanding and expressing material relationships.

This page: Layers of Fall River
All photos by author, October 2023.
Opposite page, top left: Illustrations of geologic folds (Encyclopedia) and the molecular structure of clay molecules (Christidis)
Opposite page, top right: The Fold
Conceptual model of the topography at Brickyard Pond in Barrington, RI.W

The Fold



The fold functions in my work as a formal expression of material processes that produce historical, ecological, and cultural layers of significance, while also operating as a design strategy: Folding works in the form of the walls and paths I've designed to harness the entropy (the leakiness) inherent in modern waste management systems and subsume it into new forms.

The fold appears both formally and conceptually across scales, from the cellular composition of the clay body to the architectural form, and from the regional to the geologic flow of material, also helping me to understand how systems of extraction, production, consumption, and discard work together to produce the sedimentation of material and meaning.

As glacial ice retreated across the northeast, exerting tectonic stress on the earth's crust, it produced a series of anticlines and synclines; in other words, arching forms that end in inverse folds, forming an adjacent depression. This geology of the fold helps to illustrate Deleuze's influential argument that unfolding is not contrary to folding, but rather, a process by which a fold merely changes its path and in doing so, produces a new fold; in other words, folding-unfolding does not simply mean "tension-release, contraction-dilation, but enveloping-developing, involution-evolution" (Deleuze 6,8).

Meanwhile, in the cellular composition of clay itself, the fold is a source of both structural integrity and pliancy. Consisting of sheets of silicate arranged in a tetrahedral or octahedral lattice structure with a net-negative ionic charge, clay can bind with water molecules that give the material plasticity when wet and—at the same time—enough strength to allow it to maintain its form and cohesion as it dries. As Greg Lynn argues in his essay in *Folding Architecture*, titled "Architectural Curvilinearity: The Folded, the Pliant, and

The Fold at Kingston
In this sculptural form, I was interested in how the fold mediated relation-shipsbetween different typologies of brick rubble at Kingston Point Beach.

the Supple": "The nature of pliant forms is that they're sticky and flexible. As pliant forms are manipulated and deformed, the things that stick to their surfaces become incorporated into their interiors" (25). In this way folding becomes a formal and conceptual process of material change over time, speaking to clay as a conceptually meaningful and ecologically important material in the production of sustainable, site-responsive architectural forms. Among other capacities, it can filter stormwater, neutralize heavy metals, and capture suspended particles, making it commonly used in landfill construction, wastewater treatment, and air purification systems. As Lynn notes, "the manifestation of the fold is the incorporation of differences," resulting not just in a representation of difference but forms that change in response to their environment (30).

The network of brick walls that I'm proposing employ the logic and form of the fold, producing a form that is structural and yet modular and pliant in its response to site as I assemble and disassemble, fold and unfold, and otherwise rearrange it in different contexts, folding the byproducts produced by urban economic transformation in the form of construction and demolition waste into an eight-piece modular form. As I'll elaborate on in the following sections, this form was the result of extensive prototyping that began with a series of conceptual drawings and clay models, where for me, the fold also helps to articulate important material tensions and dynamics. In these conceptual explorations, the relationship between layers of material produced voids in some places, while gathering and producing density and weight in others. In the process, I became interested in how I might form a wall that spoke to these material relationships, beginning in Kingston, New York.

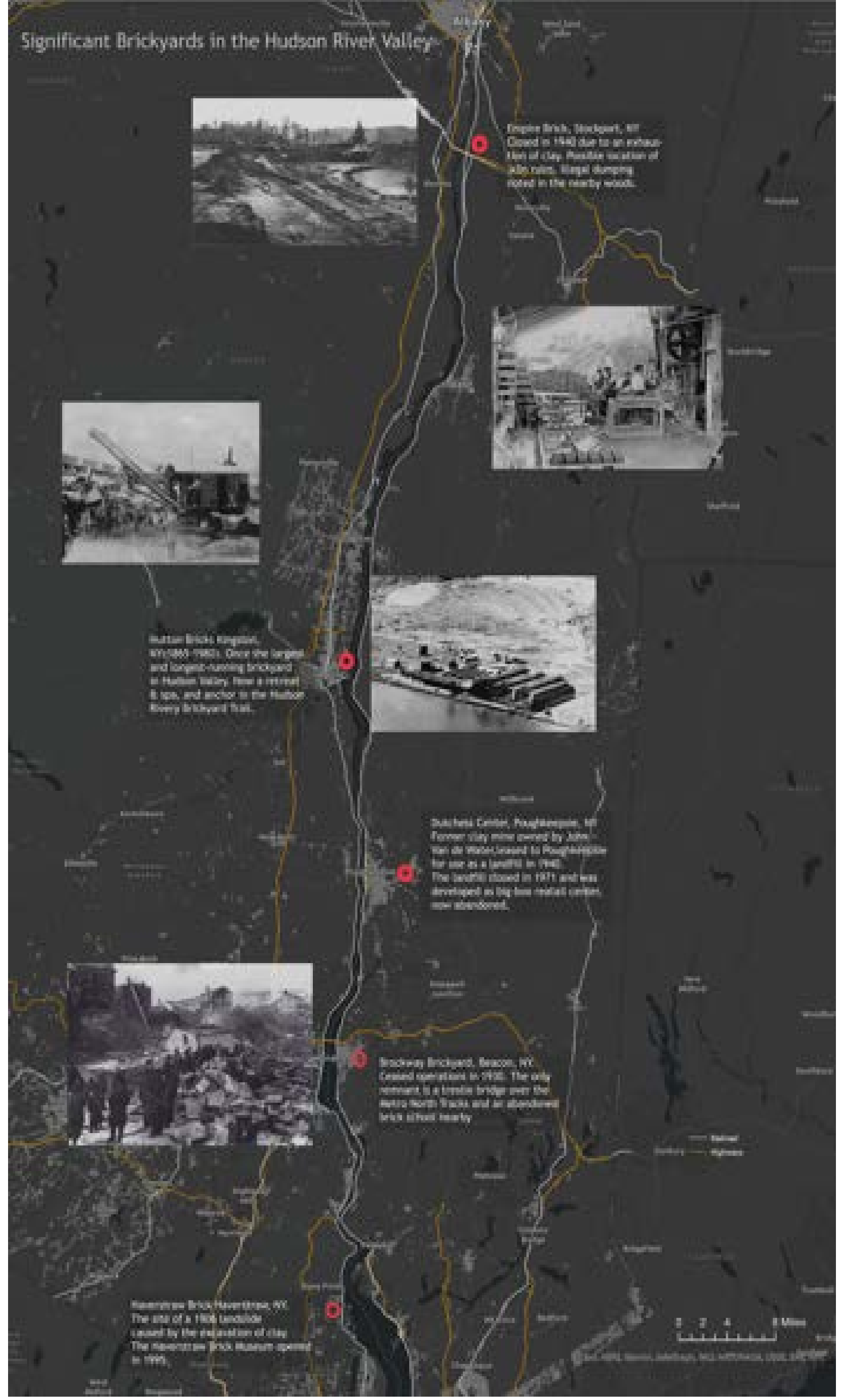
Top: The Fold, Density, and Porosity
This conceptual explored how the fold produced relationships between density and porosity.

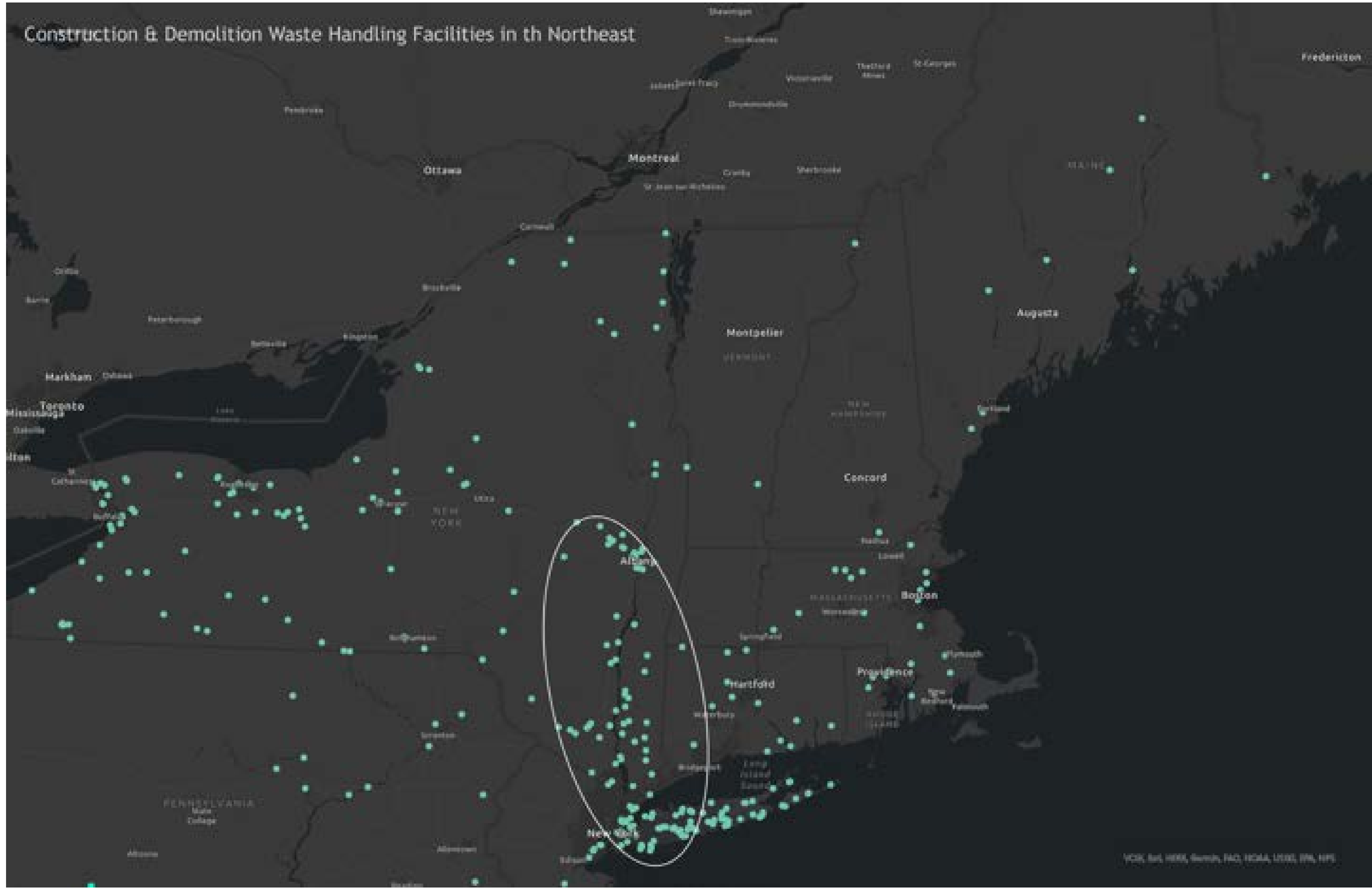
Bottom: The Fold, Light, and Shadow
A study of Saarininen's MIT Chapel that examined how the fold shapes expriences of light and shadow in the built environment.

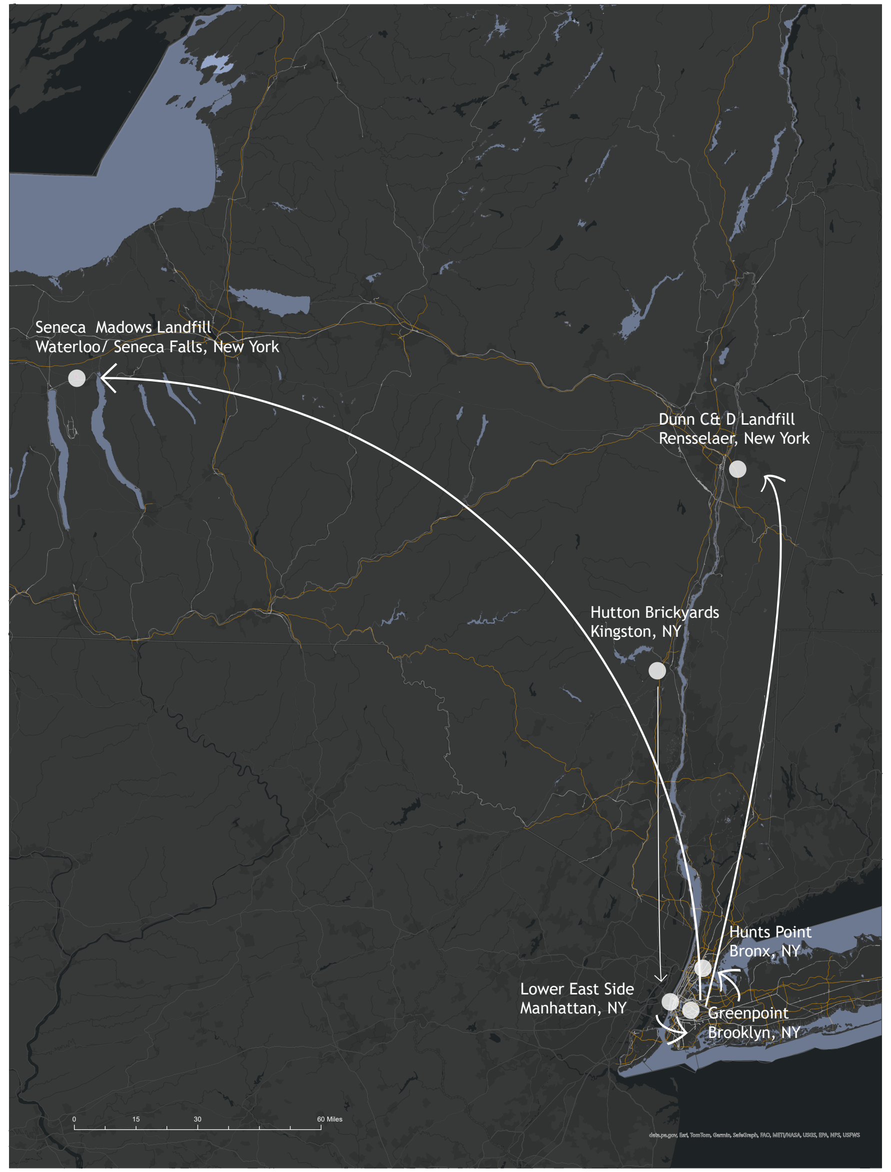
Response to Site

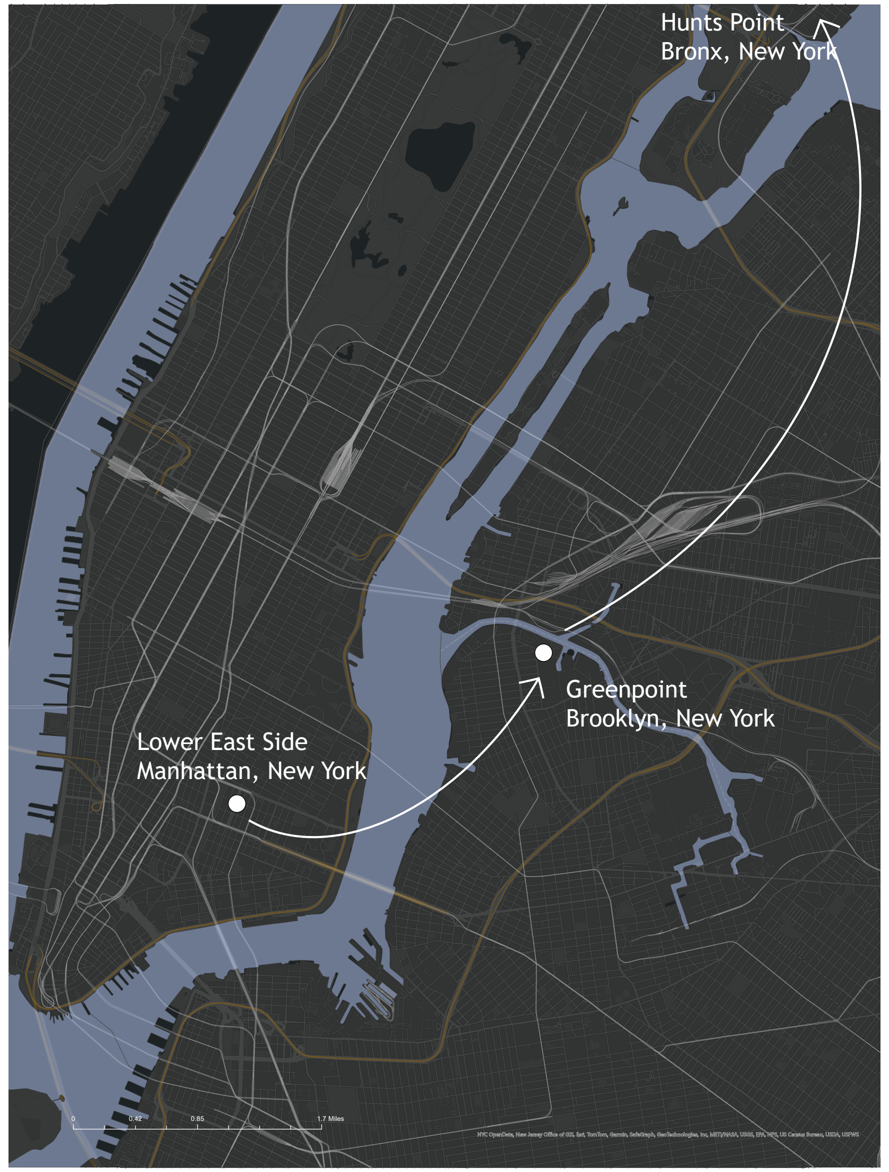
The regional network of sites that my wall is responding to track the historical flow of brick and its transformation into construction waste in order to articulate how the fold works as a way of registering the material history of both individual sites and their relationship to each other. In the 19th century, the Hudson River Valley was the largest producer of brick in the Northeast with over 135 brickyards operating along the Hudson River's banks. Production was driven in large part by demand from New York City, where a rapidly densifying urban environment and a prohibition on wood-frame construction led to an expansion in brick construction, particularly in the form of brick tenements that housed primarily immigrant workers (Lev-Tov). Clay, in other words, provided the foundation for extraction-based urban development in the Northeast, and the material flows set in motion by this period of industrialization and urbanization continue to shape both the urban fabric of New York City and its economic relationship to the Hudson River Valley. As concrete and steel emerged as more affordable building materials and industrial production moved first to the outer boroughs and then overseas, it left vacant land—both along the Hudson River Valley and along the waterfronts of North Brooklyn and the South Bronx—that is now sited for waste handling.

This page: Mapping the Historic Brickyards of the Hudson River Valley
Several of these former brickyards went on to operate as landfills and/or illegal dumping sites
Opposite Page: Construction and Demolition Waste Handling Facilities in the Northeast *Today, this area is dominated by C&D processing facilities, many of which operate in conjuction with quarries that combine waste with aggregate for use in hardscaping.*









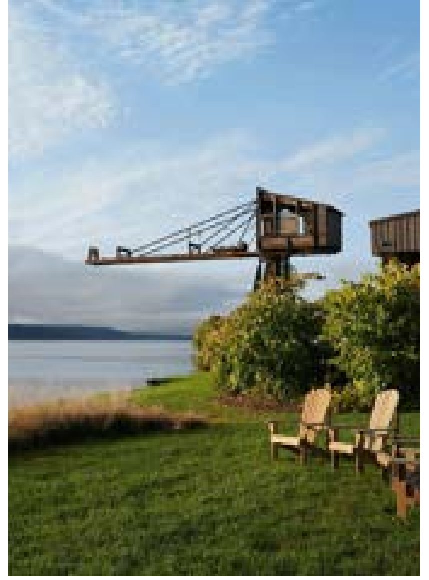
Kingston, New York

In Kingston, New York, my wall incorporates rubble from the former site of Hutton Bricks, which closed in 1980, after a hundred years in operation. Since 1980, the former brickyard has been transformed into resort and event center built around the remaining steel-framed kiln sheds, the Lidgerwood crane that once transferred bricks onto barges destined for New York City, a sunken barge, and a general aesthetic of decay that invokes nostalgia for a bygone industrial area. While the adjacent Kingston Point Beach is accessible to the public, the brick on site makes the beach difficult to inhabit and its connection to the nearby Hudson Brickyard Trail (which connects to the Empire State Trail to the north) is obscured by wire fencing and dense forest. An indirect pathway that crosses the lawn and cuts through the adjacent neighborhood provides the only connection. The adjacent neighborhood is primarily made up of 19th-century wood-framed structures in various states of repair, and likely originated as worker housing. Meanwhile, vehicle access to the resort is restricted by a gated entrance, allowing pedestrian access only via the Brickyard Trail. The areas west of the trail, which include the former clay pit on the hill above the site, are in further development by the resort owners.

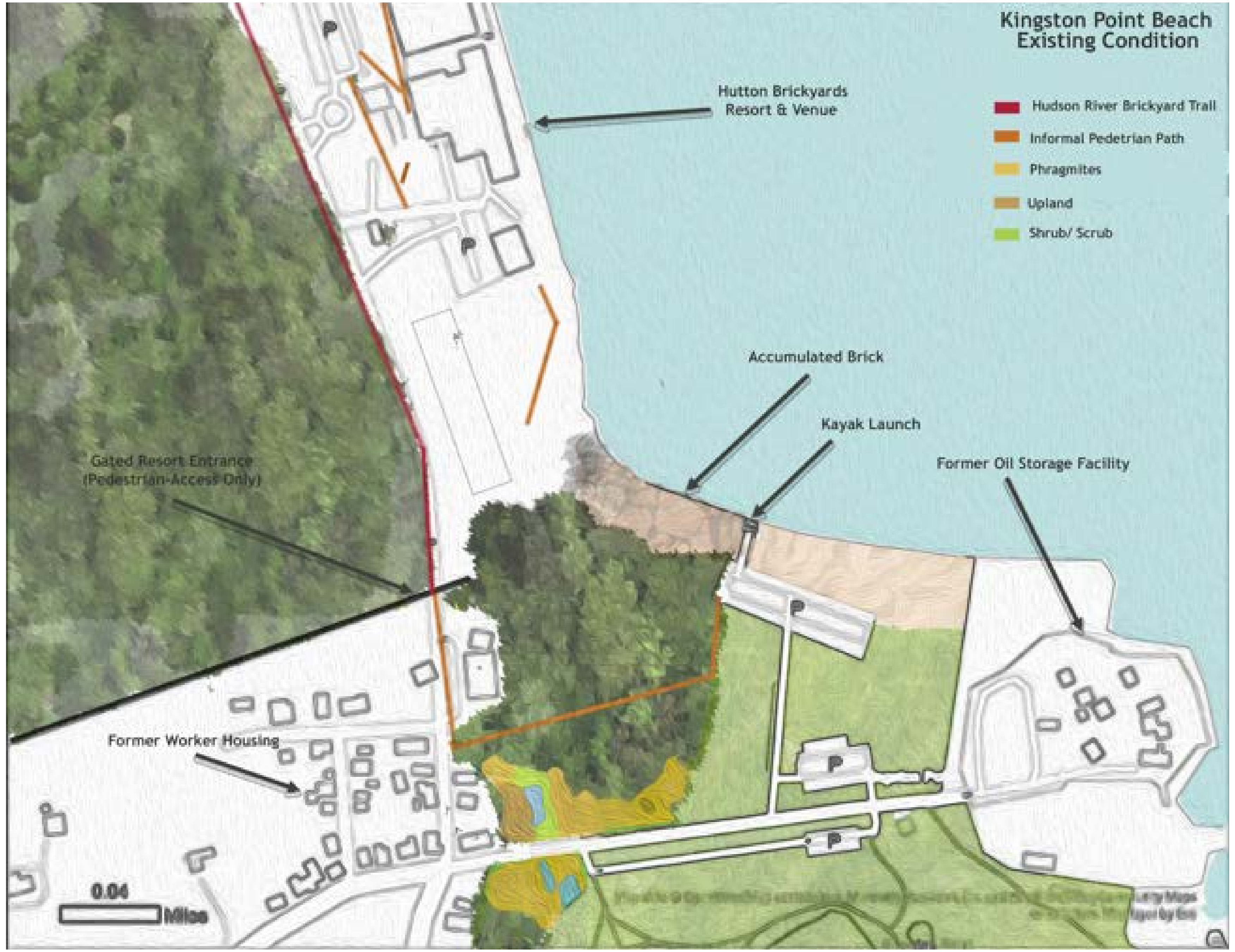
This page, top: Kingston Point Beach *The beach is densely piled with brick rubble, including significant quantities of clinker, some of which has been washed by smoothed by the tide and incorporated into the sand. Photo by author, January 2024*
This page, bottom: Kiln Sheds *The remains of the kiln sheds still stand on the resort property. Photo by author, January 2024*
Opposite Page: Waste Flows *These maps show the dominant flows of waste in and out of New York City with most waste traveling from Manhattan to transfer stations in the outer boroughs. From there, it's sent upstate or out of state.*

The resort itself makes use of the discarded brick on site, incorporating it into gabion columns, walls, and room dividers that organize the event space; crumbling brick walls act as garden arches that provide wedding photo opportunities; and full bricks with the "Hutton" frog fully intact serve as a branding opportunity. The intention of my design is not to participate in this aesthetic or the transformation of the site, it's infrastructure, or brick itself into an "object of heritage" (to use Caitlin DeSilvey's phrase) that relies on fixed and oversimplified understanding of the past in relationship to the present, but to both understand and call attention to the material changes that are occurring on site as it emerges in a new state of being (2). As Christopher Dameron asks: "Can we make reuse more than aesthetic?"

In his recent article for *Urban Omnibus*, "A Wall Made of Bricks," Dameron reflects on his own efforts to build a brick wall in Bushwick that preserved the historic brick and stone on site without indulging in the aesthetic impulse of a gentrifying Brooklyn to establish its authenticity by creating an "antiqued commercial world of shops and restaurants" that invoke little more than nostalgia for bygone era that operates more as an industrial fantasy than a reflection of historical reality. Like me, Dameron was more interested in the material processes and embodied labor signified by the flaws in the material



This page: Marketing photos from huttonbrickyards.com
The resort is a popular wedding and summer concert venue, invoking an industrial aesthetic that became popular in the U.S. in the late 2000's.
Opposite page: Existing Conditions at Kingston Point Beach
Notably, there is no trail access from the beach to the resort



he encountered— patches and infill, plaster residue, terracotta tile, chipped and broken brick, paint from the wall's past as everything from an ice cream factory to a distribution center, layers of graffiti that he anticipated continuing to accumulate, stone rubble, and schist from the quarries that were first mined to build Manhattan—and despite the challenges, he worked to incorporate and highlight these materials as part of the wall's past and future, rather than to grind and smooth out the imperfections. Indeed, I encountered a similar challenge at Kingston Point Beach where the coastline is piled with an array of irregular, "damaged" material that most builders would never consider for reuse unless they could first grind it into unrecognizable dust. But in Dameron's work and my own, I'm reminded of Douglas Murphy's reflections on the work of Cedric Price, for whom "architecture was a set of processes, not objects."

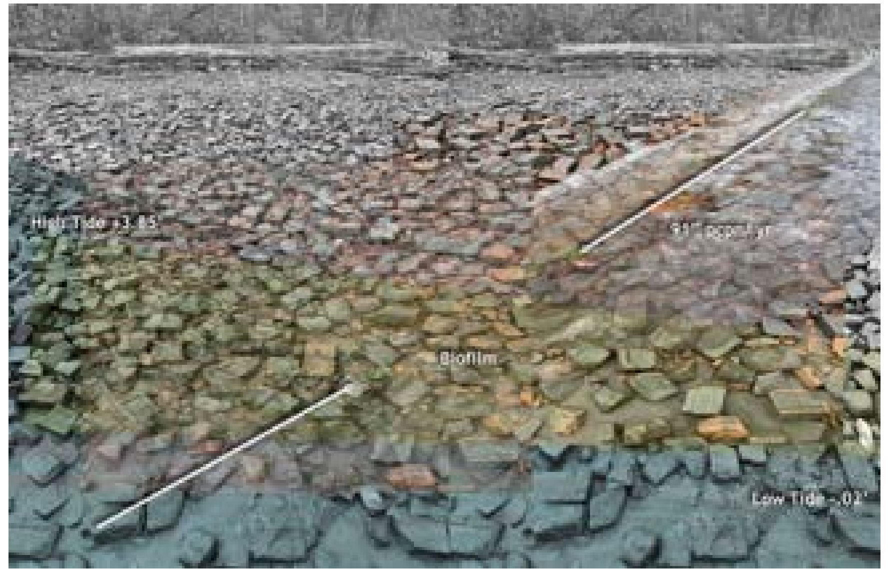
In the context of climate change, I'd argue that we're called on to also consider the impacts of these material processes on ecological systems in ways that have rendered the "natural" virtually inseparable from the built or "constructed." In the introduction to *Reactivating Elements*, edited by Dimitris Papadopoulos, Maria Puig de la Bellacasa, and Natasha Meyers, they argue for an understanding of material and chemical elements as "relational

This page: A Brick Wall by Dameron Architects (2019)
Photos featured at dameronarch.com, where Dameron describes the wall as a "time machine."
Opposite page, left: From "Thinking through Soil" by Seth Denizen
Opposite page, right: Charcoal Soil Section
A section based on my observations of the soil at Hutton Brickyards

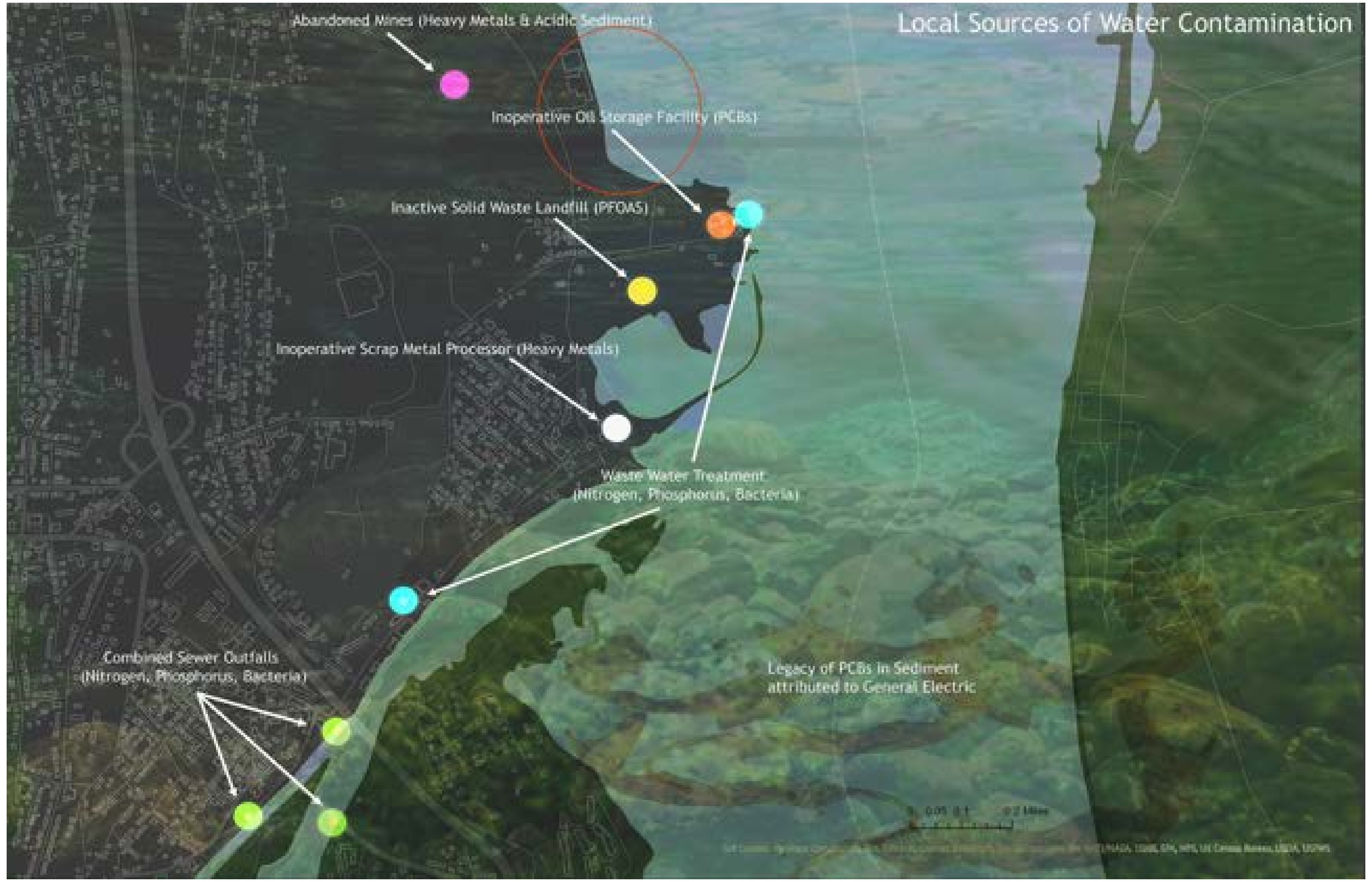
substances" whose intra-actions and after-lives have been shaped by the cultural forces of colonial conquest, the industrial revolution, extractive capitalism, and late industrialism. As an example, I'm reminded of Seth Denizen's early work, titled "The Eighth Approximation" in which he generated a new taxonomy of soils, which included "COMMODIFIED SUBSTANTIALLY DEMOLISHED ROBERT MOSES" and "CITIFIED EXTREMELY CHEMICALLY ENHANCED REAGANOMICS," among others. In this taxonomy, Denizen recognizes the built environment and its material afterlives as inseparable from the composition of

soils, which are both chemically and culturally constructed. More than a decade later, as Denizen himself has recently reflected on via his Instagram account, "Thinking Through Soils," the USDA is on the verge of finalizing a new soil taxonomy, last updated in 1999, which includes, for example, PORTIFACTART, or soil that is significantly composed of building debris, such as brick.

Indeed, at Hutton Brickyards, where the soil is dense with discarded brick, I'm particularly interested in the adjacent Kingston Point Beach as a site for my work, in part because of the material and ecological processes that the brick there are already an integral part of, not only as a product of extraction, but in the new role it's taken in its transformation into discarded, fired brick rubble. The brick rubble piled on the beach has, in fact, produced a novel ecosystem, protecting against coastal erosion in the context of rising sea levels. Recent studies that have evaluated clay brick in terms of its capacity to filter pollutants have shown that bricks can remove pollutants from even highly polluted storm water at a rainfall intensity of 12.5mm/ hour. The bricks were most efficient at removing suspended solids and reducing acidity and oxygen demand in the water. Nutrient removal was more moderate at 30-40%, but not insignificant. Meanwhile, heavy metal removal had the highest variation—from 6.7 to 94 percent—which I presume is due to the variation in ionic charge among heavy metals with positively charged elements binding more effectively to fired clay, which has a net negative charge. Indeed, studies show that there are higher removal rates for iron, manganese, selenium, and lead (Shafiquzzaman, et al). These findings are consistent with ceramic filter technology developed by Fernando Mazriegos in 1989 and subsequent studies have found that the filtration capacity is substantially increased when clay is mixed with sawdust or other combustibles (Efeovbokhan).



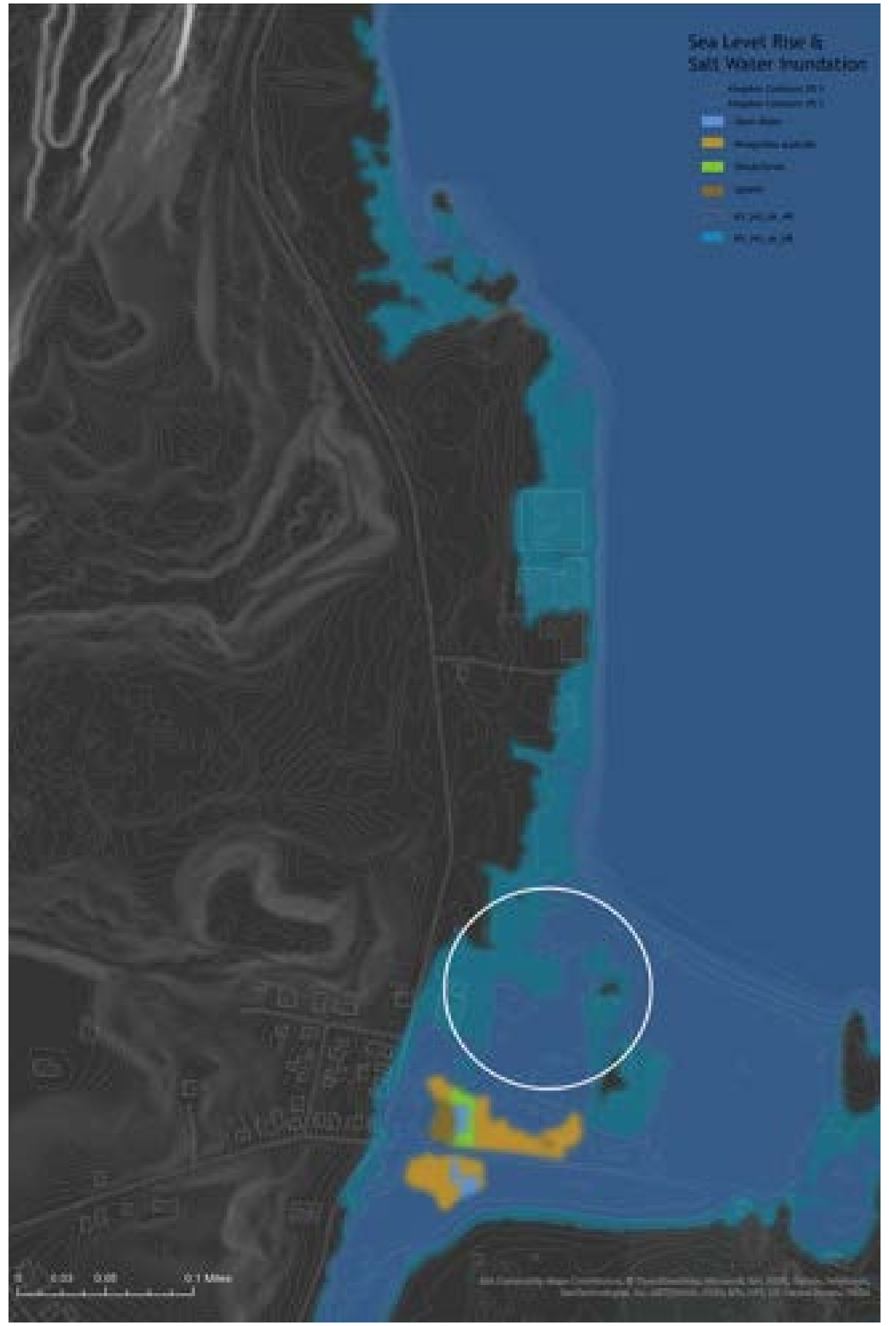
Top: Filtration Capacity of Brick *Positively charged heavy metals in this area include cadmium, copper, arsenic, cobalt, and zinc.*
Bottom: Brick Biofilm *The brick's capture of suspended solids from stormwater runoff contributes to the production of a novel ecology.*

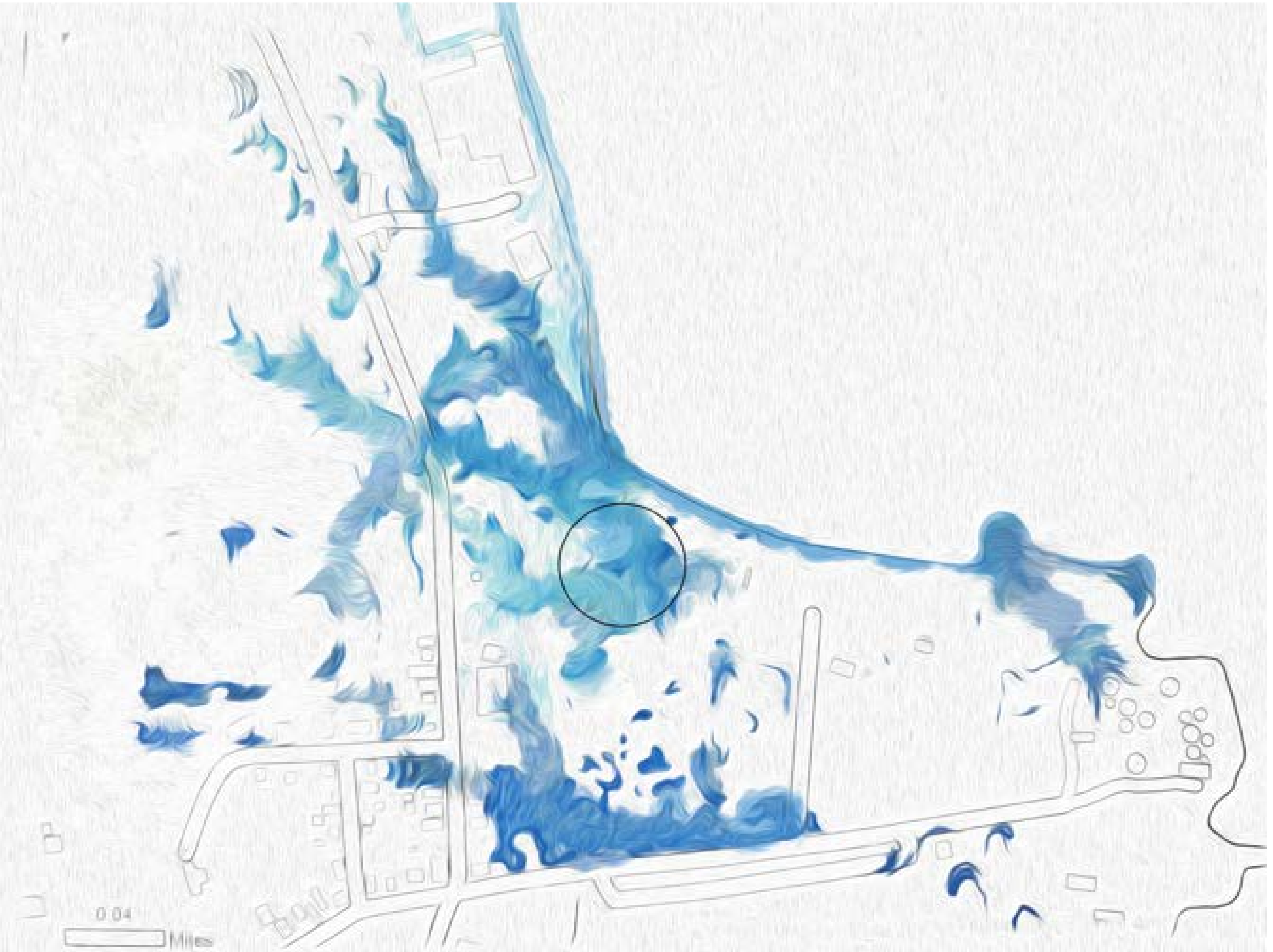


Local Sources of Water Pollution *Sources of contamination in the area include abandoned mines and scrap metal processing facilities likely to contribute to heavy metal contamination.*

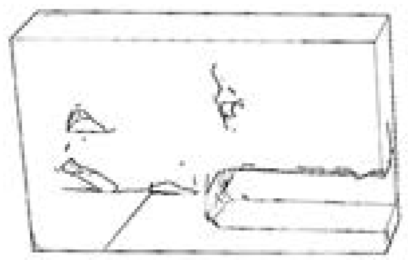
The capacity of brick to filter heavy metals is obviously significant in urban contexts with higher levels of soil contamination and an over-abundance of impermeable surface area, but also becomes meaningful on sites like this one, where the Hudson River—named a superfund site in 2002—produces tidal fluctuations that increase the possibility of inundation. The Hudson River–which featured so heavily in American landscape painting of the 19th century that it inspired an art movement known as the Hudson River School–historically served as a major shipping route connecting Manhattan to the northern interior of the country, providing connection to the New York State Canal System, the Great Lakes, and an emergent railroad network (Harmon). According to Daniel Harmon, its role in the industrial growth of the United States set the stage for its subsequent role in the environmental movement, with a particular focus on General Electric's discharge of PCBs, which contaminated over 200 miles of the waterway.

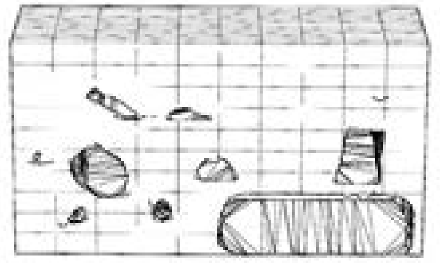
Given this ecological context, I asked: How can I construct a wall that increases accessibility to the beach at Kingston Point while not only acknowledging the material history of the site, but supporting the role that the material had come to play in the site's ecological and hydrological systems?

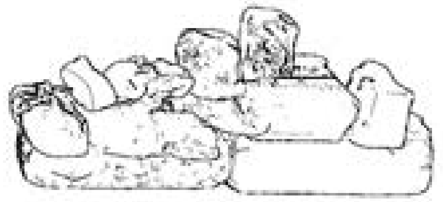




This page: Sea Level Rise & Saltwater Inundation
Opposite page: Stormwater Runoff
The highest rates of both inundation and run-off meet at Kingston Point Beach where increasingly salinity and contamination in the soil supporting the spread of phragmites in the area.

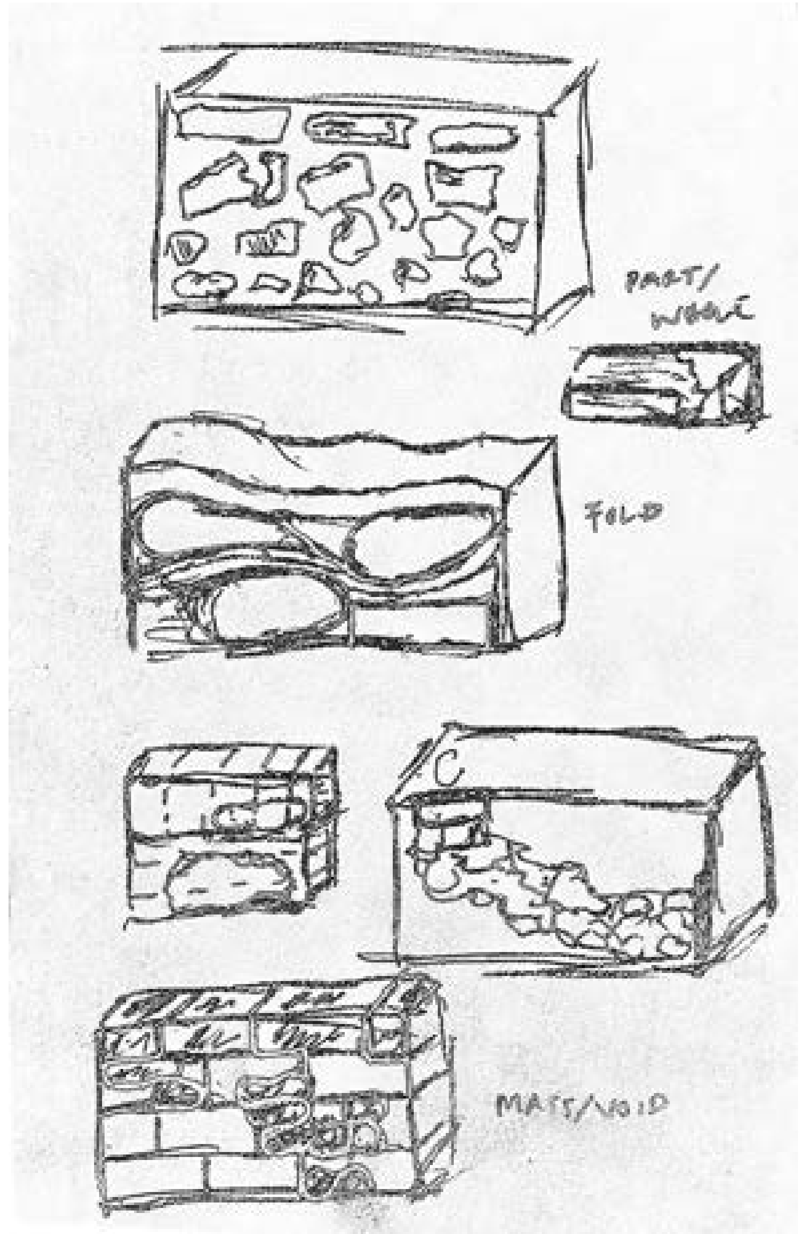




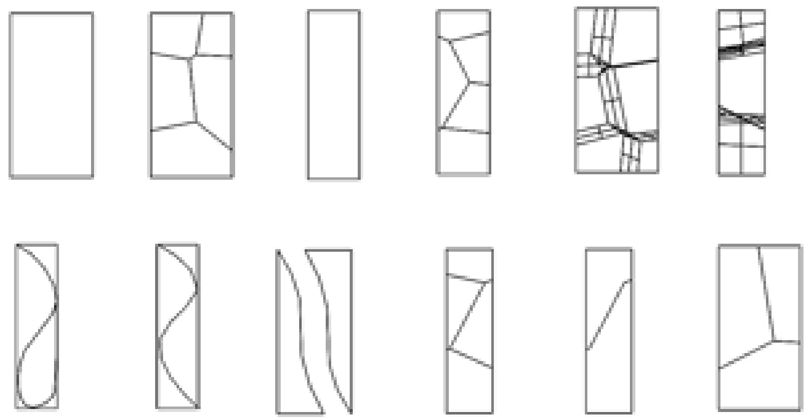


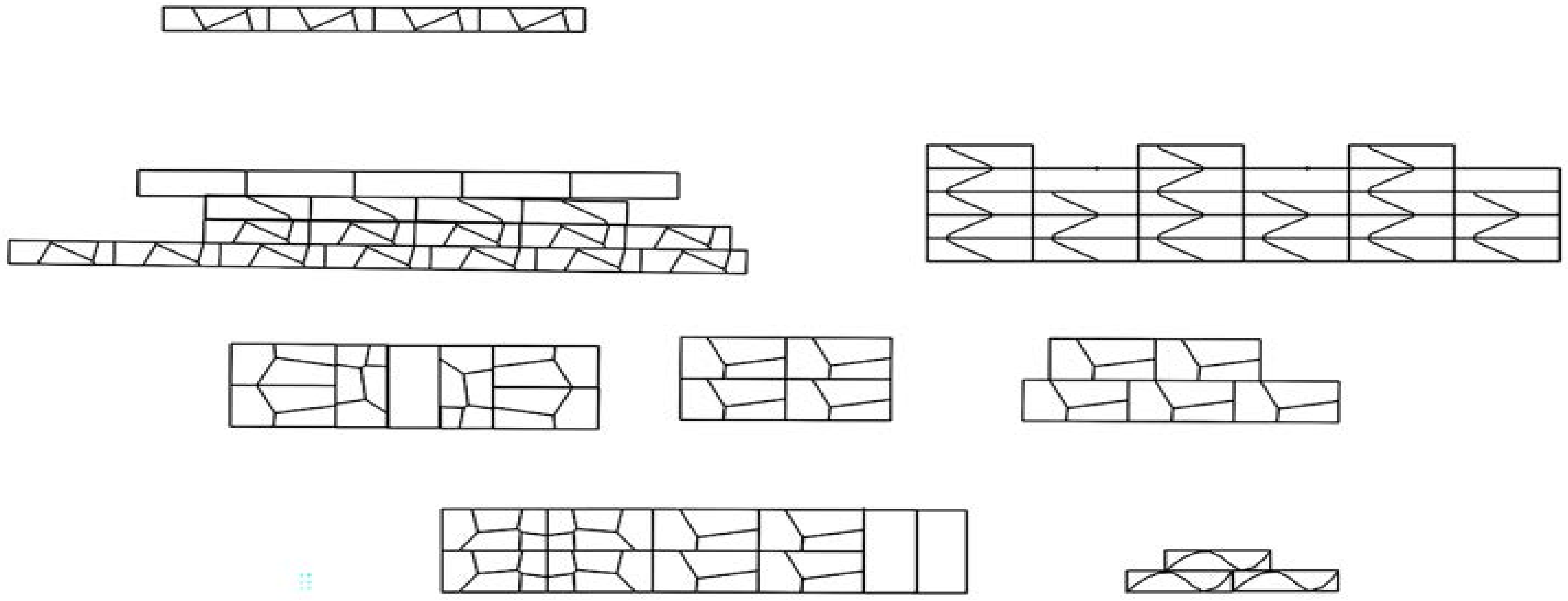
After my initial conceptual models, I began by taking 3D scans of the rubble I used at Kingston and using Boolean operations to imagine how they might interact with the form of a wall, which led to my understanding of each piece of rubble as part of an absent whole, deformed or discolored by the heat of the kiln, broken in transport, worn by time and tide. I imagined that the material would be folded through the wall in ways that reflected this change over time and that those pieces that had been worn and subject to transformation by the tide over a long period would remain close to the base of the wall, where their porosity also meant they had higher filtration capacity. Meanwhile, those that appeared less changed would appear higher in the wall, helping to reinforce the change over time reflected across the wall as operating in relationship to the river.

This page: Wall Sketches
Here I sketched out different ways the rubble (or the voids left by the rubble) might fold across the wall in order to reflect the relationship between part and whole.
Opposite page: Typologies of Brick Rubble
The rubble as Kingston includes everything from full-sized bricks, some of which have been washed by the tide to partially washed clinker.



After experimenting with more organic shapes that might provide a brick "frame" that could hold the rubble, I turned to Grasshopper and the application of the Voronoi, which appealed both functionally and conceptually in its ability to break each brick into a series of compartments, maintaining the structural integrity of the form while also providing a legible series of folds that would emerge across the form of the wall. The coursing and mortar of the bricks would then provide another system of folds that would touch and respond to the folds of voronoi and the rubble itself, articulating multiple systems of material intra-action. Here, I'm thinking of Karen Barad's definition of "intra-

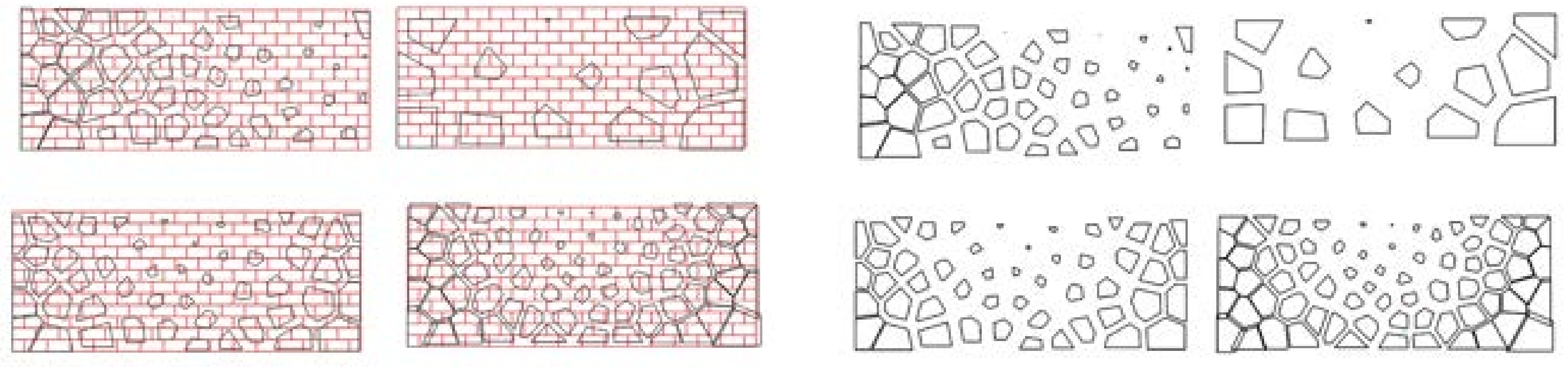


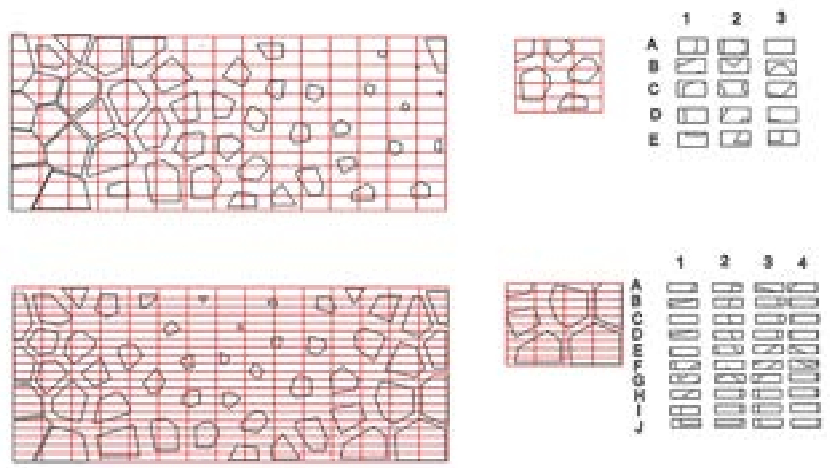


This page: 3D Ceramic Prints of Voronoi Bricks *In these initial tests, I printed both 2.25" x 8" bricks and 4" x 8" bricks, using different numbers of points. This was an opportunity to consider which combination would give me the most compressive strength.*
Opposite page: Voronoi Courses *I was also interested in which courses of the voronoi would establish the strongest and most provocative series of folds across the wall.*

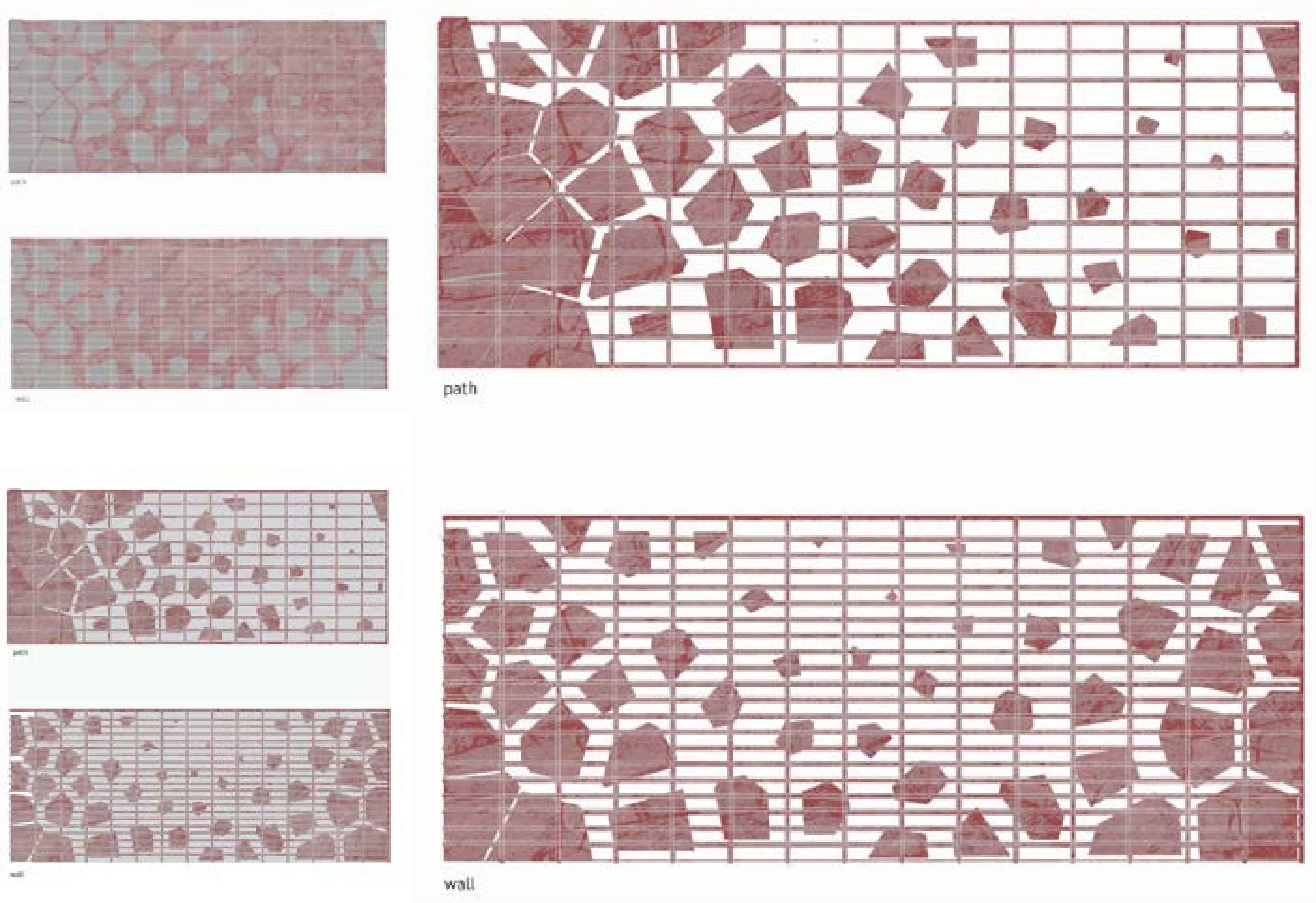
action," which she describes as "non-arbitrary, nondeterministic casual enactments through matter-in-the-process-of-becoming is iteratively enfolded into its ongoing differential materialization" (179). In other words, the folds themselves become points of material change--envelopment-development—that illustrates its role in the ongoing material transformations occurring on site.

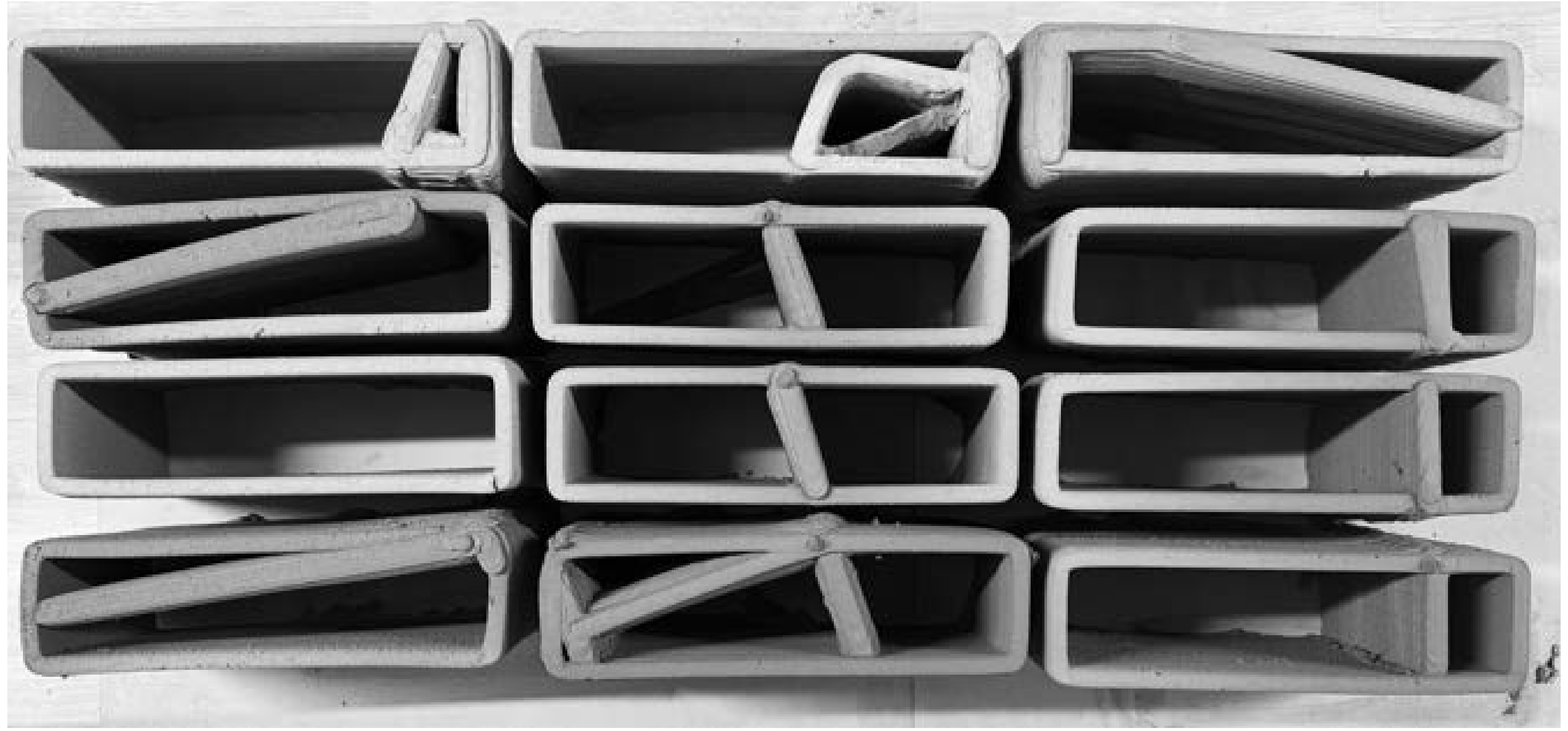
As a form, the voronoi is named for the Russian mathematician, Gregory Voronoy, and has been deployed in architectural contexts for form-finding; structural optimization; and achieving tessellated, organic forms akin to those found in nature. In their research on the voronoi as a tool for structural optimization, Eva Frederiech et al write: "Spatially as well as a structurally, the form moves from a simple modular repetitive system towards a more complex adaptive one, with interconnected parts which cannot stand alone but rather form an organic whole" (1). The voronoi, in other words, also offered me the opportunity to find a formal expression of interconnected, complex historical and material processes in the shape of the fold, while maintaining a level of modularity that is crucial to the form and function of brick itself.





This page: Voronoi Wall *Here, I used the voronoi in combination with the point-attract command and expirimented with breaking the result apart into different potential courses of brick. I eventually settled on a set of 12 to 3D print and test.*
Opposite page: Brick vs. Mortar *These drawing imagine different possible dynamics between mortar, rubble, and void.*

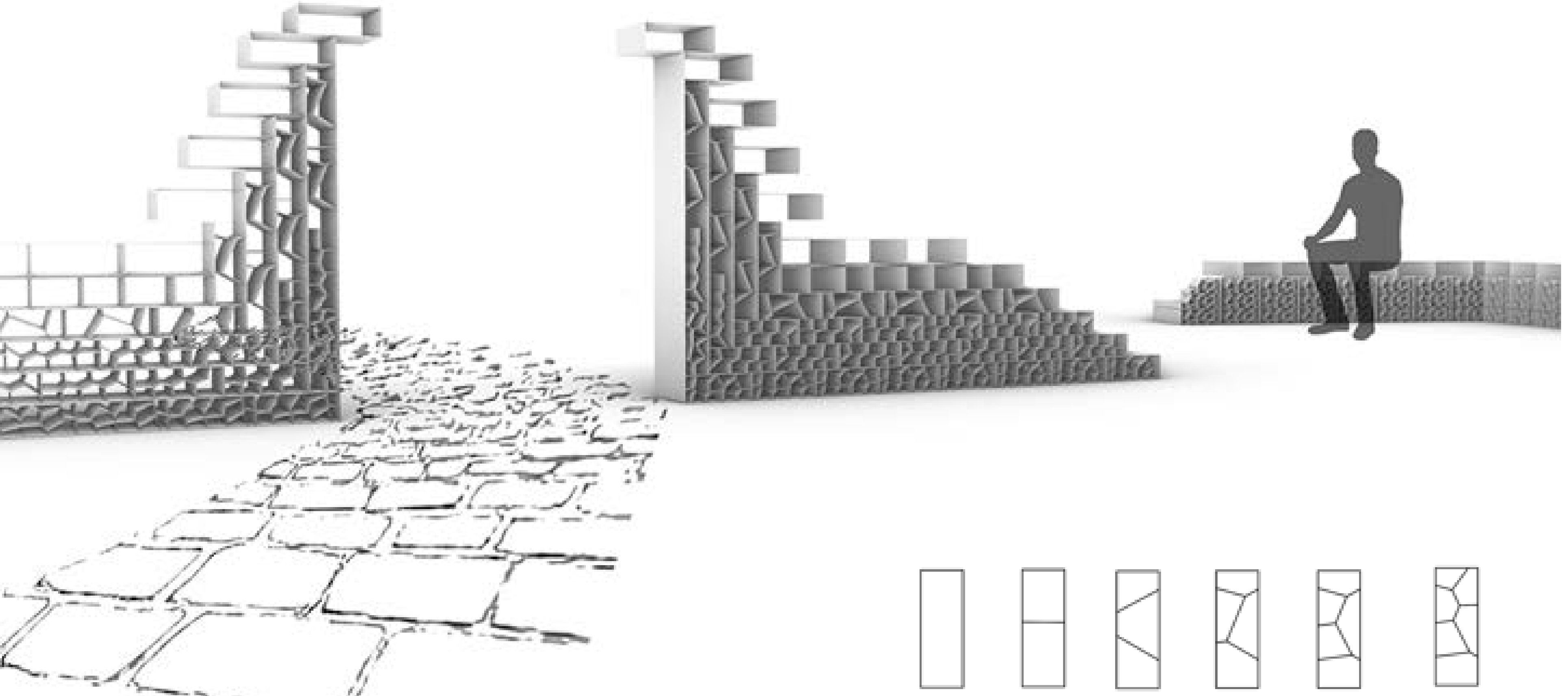


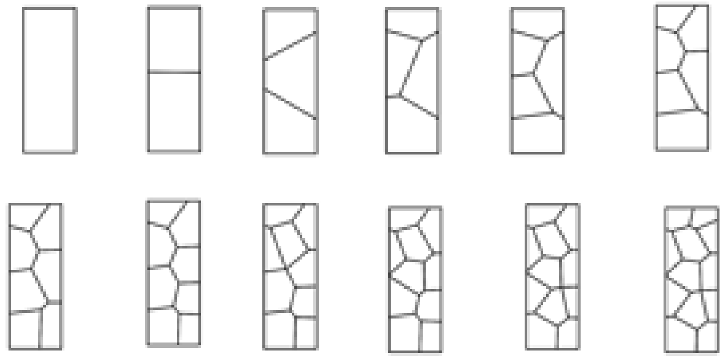


In these initial tests, I experimented both with applying the voronoi to a 2D form and then extruding it, and with applying the Voronoi to a full wall (roughly 4' x 10') and then breaking the wall into "bricks." I ultimately chose to stage the assembly of a portion of the 4' x 10' wall at Kingston Point Beach. In this staging, I incorporated the rubble using a mix of 1part cement, 3-5 parts lime, and 5-7 parts sand and brick particle from the beach at Kingston. Although my drawings explored various possibilities regarding the potential relationship between mortar, rubble, and void, I initially chose to leave large portions of the stack-bonded wall void as a way of gesturing at the absent brick. Ultimately, this approach produced too many large voids across the expanse of the wall to sufficiently support the weight of the rubble and mortar, and was ultimately limited in the level of modularity it allowed, which also led to questions about how this system would translate to other contexts in the regional network of material flows that I was working within, and so I chose to return to the application of the Voronoi to individual brick forms.

In experimenting with both 2D and 3D applications of the Voronoi, I found that when I applied the Voronoi to a 3D brick-sized cube, it produced non-manifold edges that made it difficult to fabricate, and while that problem could be resolved by breaking the brick into pieces, the angular faces limited the number of ways the pieces might fit together across the wall. That said, by breaking the brick apart, I achieved a new level of modularity

This page: Voronoi Tests at Kingston: *These tests also incorporated sand from the beach at Kingston into the rubble. This sand included various sizes of small brick rubble that--along with the unfired brick--probably contributed to the instability of the form.*
Opposite page: Mortar Tests *While lime mortar tends to be more flexible than cement, making it less vulnerable to freeze thaw, it is also low in compressive strength, so I decided to include a small amount of portland cement in order to strengthen the bond.*



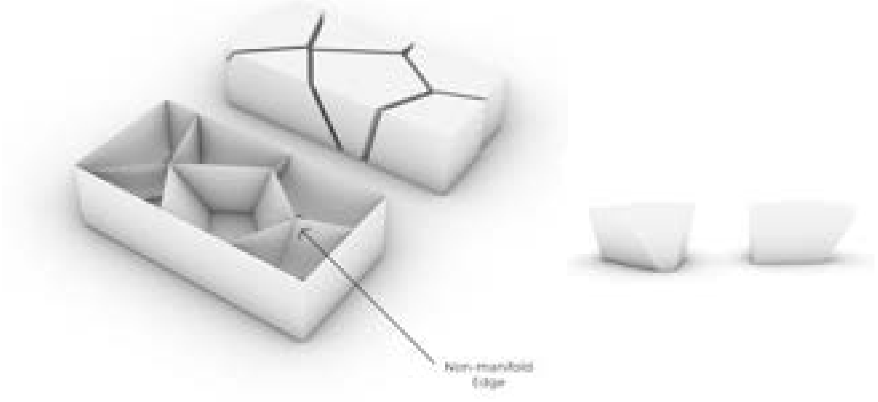


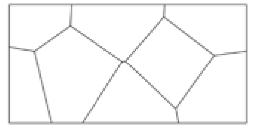
that I hadn't in previous prototypes, and so I returned to the 2D application of the voronoi, using 8 points to create an 8-piece brick.

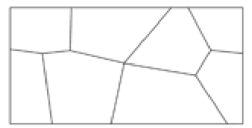
What the 8-point voronoi offered me is: 1) and an interesting level of modularity that allowed the wall to grow in multiple directions; 2) an even number that allowed me to adjust the form so that the side of each piece measures in ½" intervals, allowing the pieces to fit together in even proportions as the wall grows; and 3) a brick capable of holding shape even prior to the application of mortar, which suggested heightened stability. I was especially interested in these initial forms in the idea that each brick could itself fold and unfold, changing the trajectory of the wall or path in the process, and imagined that the form would be made up of a combination of solids (for additional stability) and voids that the rubble could fit within.

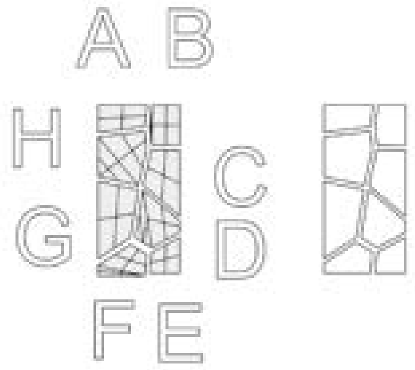
I was still left with the question, however, of precisely how the brick rubble would be incorporated into the form of the wall. In the 3D models, I started to reorganize the relationship between the voids and the solids so that the rubble could be incorporated, in a way that folds through the shape of the wall. In order to make the fold even more legible and to create larger voids for the rubble to fit within, I experimented with removing the lines that separated the smaller pieces from each other, but then soon became concerned that I was losing the form of the brick that all these pieces are

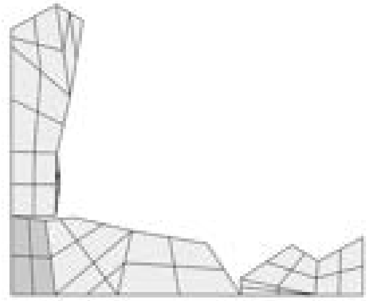
Opposite page: Working Set of 12
I concluded the winter with a working set of 12, broken into increasing numbers of compartments that I formed into a model that reflected increasing density moving from the top of the wall to the ground.
This page: 8-point Voronoi
I ultimately settled on one brick broken into 8 component parts.

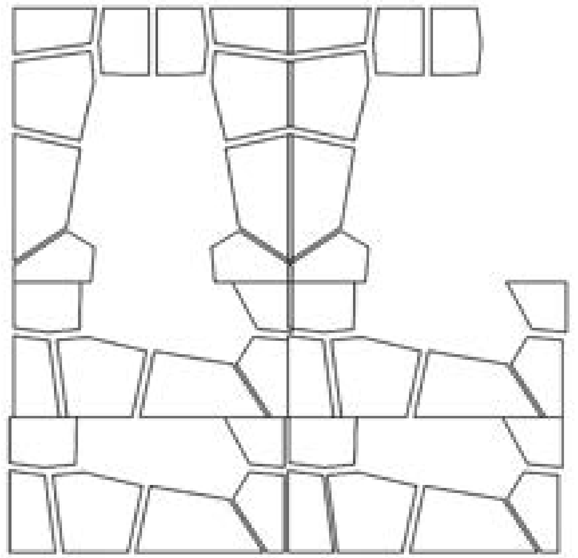


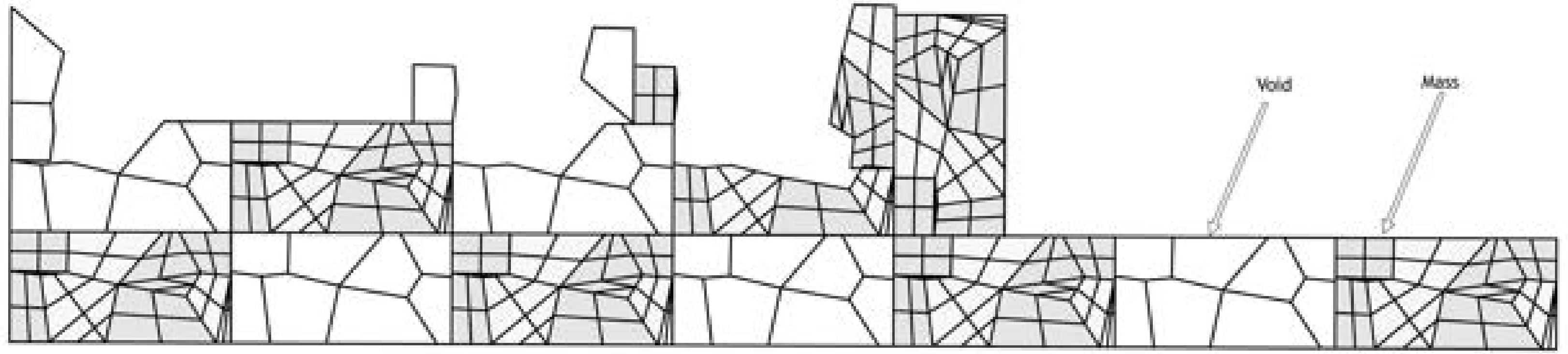




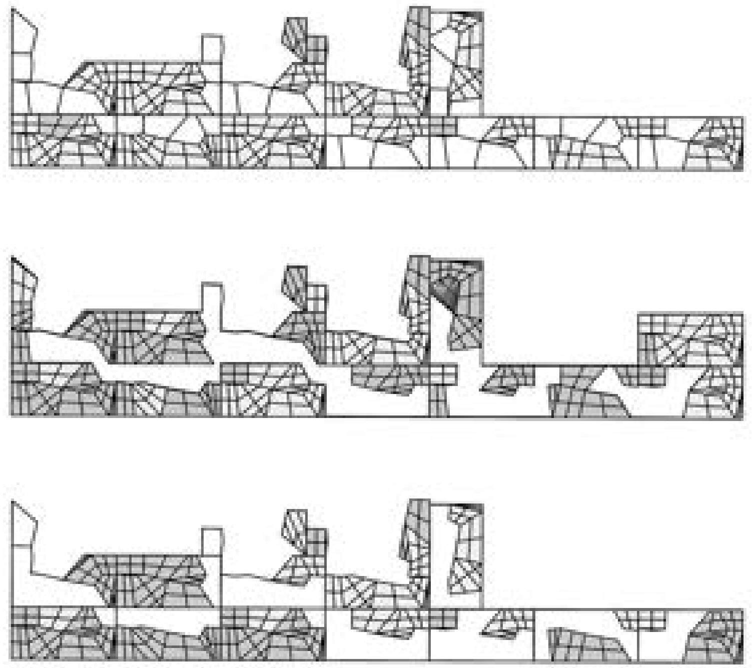


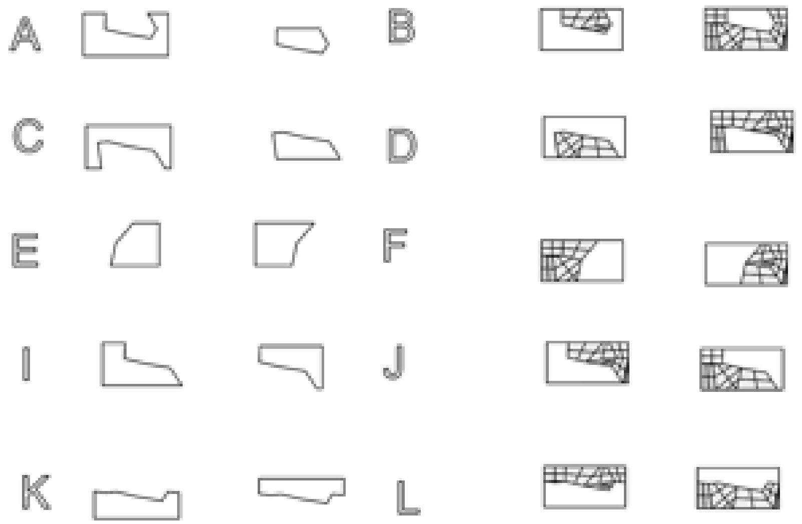






This page: Folding and unfolding the 8-point voronoi
I 3D printed the 8 blocks of my new "brick" and began to imagine the different modular possibilities.
Opposite page: Firing the Voronoi
Firing the blocks gave me the opporotunity to fully understand how each of the components was working in support of the others, pior to mortaring.



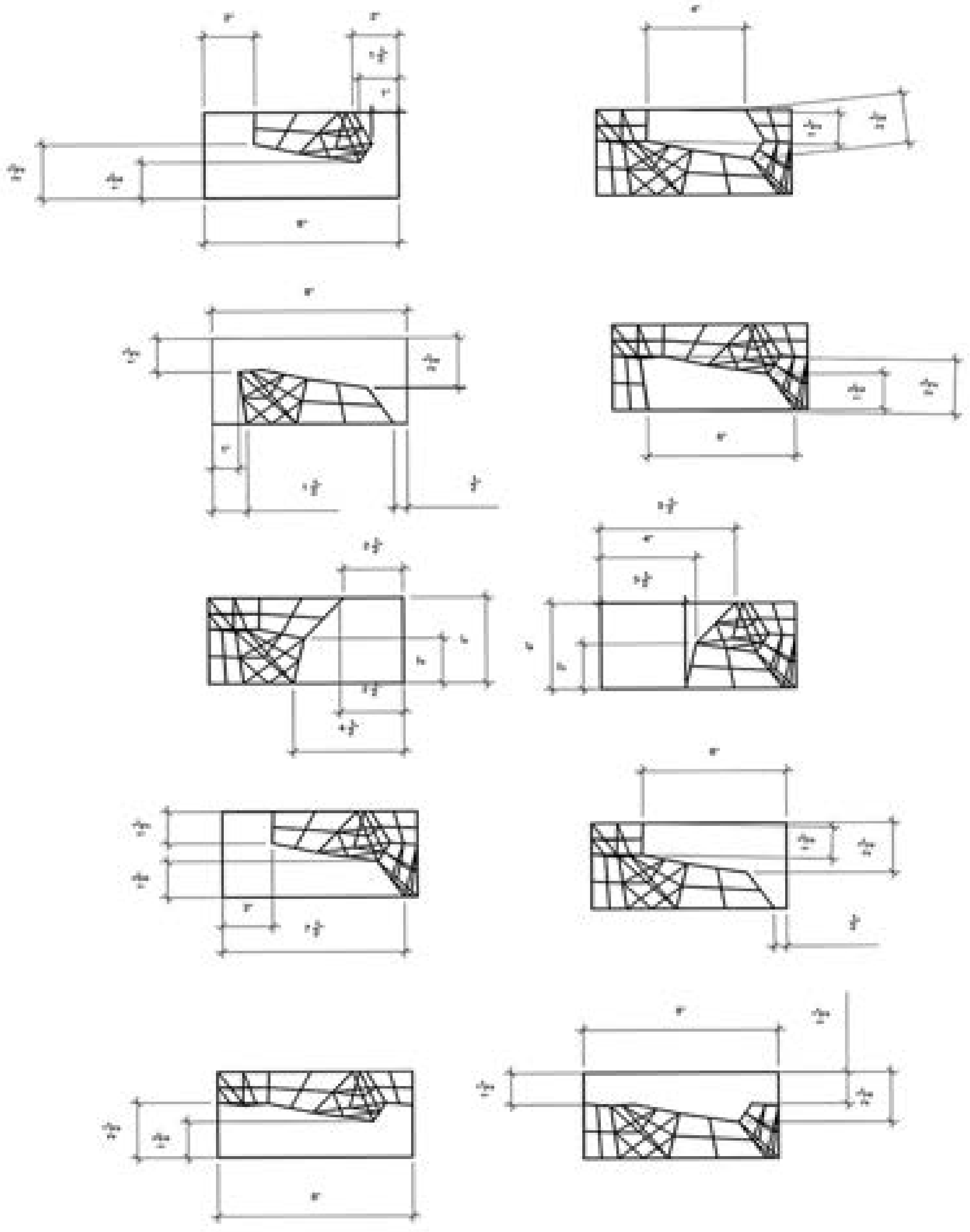


meant to represent a portion of, so I added back in what would be the boundary of the brick form, and developed a series of 10 shapes–the second 5, being the mirror shape of the first 5–and filled in the remainder of each of those shapes with my original 8 pieces, which resulted in 10 bricks that were (in different proportions) void and solid, but which any of these smaller pieces could break from in order to change the shape and directionality of the wall.

I then moved to developing a strategy for sorting and incorporating the rubble, based in part on the rules that guide dry-stacked stone construction. I initially determined the brick waste at Kingston would be sorted into four categories that roughly correspond to boulders (6 inches), cobbles (3 inches), pebbles (1 inch), and sand (<1 inch), but after dimensioning the voids that resulted from my prototyping process, adjusted the system to 4" (half klinker), 2" (small klinker), 1" (washed brick pebbles), and sand.

In conventional dry stacked stone construction, the wall is constructed in a series of lifts with larger stones making up the first lift of the wall and smaller stones making up the second. Throughstones help to stabilize by connecting the two sides of the wall and are incorporated every meter or so up to the half-way point in the wall, while "hearting" refers to the smaller stones that fill in the gaps between the larger facing stones, and again, larger stones tend to be incorporated in the first half as opposed to the second. By organizing the rubble in the voids according to the logic of dry-stacked stone, I was able to offer the wall more stability while ensuring that the rubble itself would stay in place within the voids (The Stone Trust).

My strategy was also informed in part, by Gordon Matta Clark's amphitheater seat wall at La Plaza Community Garden at E 9th street and Avenue C in Manhattan, which was established by CHARAS in 1977 amid a city-wide fiscal crisis that led to widespread vacancy, building deterioration, and demolition on the Lower East Side (La Plaza). Matta Clark's amphitheater wall is constructed of materials reclaimed from many of these former buildings, including brick, stone chimney caps, slate, granite block, and shards of decorative tile, and like more traditional dry stacked stone move from larger, more consistently shaped pieces at the bottom



to smaller at the top with flatter slabs acting as seats and coping stones. The over-all structure was then stabilized with railroad ties.

As I started to imagine how the made-components of this system and the incorporated brick waste would come together as a wall, folding and unfolding in response to specific site conditions, I adjusted my working-set of "bricks" slightly so that there are more options for the voids in each block to line up in a way that would not only allow me to incorporate construction waste, but allow for the possibility of water to run through the length of the wall in various directions. Despite innumerable modular possibilities, the mockup for my exhibition shows how the wall operates as a wall, path, patio, possible seat, waste management strategy, water filtration device, and potential breeze block.

The pieces of the wall are mortared using natural cement, which is derived from a type of limestone known as clayey marl—first discovered in upstate New York in 1818 (Rosendale). Natural ement is distinct from Portland Cement in that Portland uses an energy-intensive process that includes heating limestone, silicates, clay, shale, and other material at a high temperature to produce cement clinker that is ground to a fine dust and mixed with gypsum. Unlike hydraulic lime, natural cement can better withstand wet, coastal environments like those found in the northeast, while requiring less processing and producing fewer carbon emissions than Portland cement. Although Portland cement is stronger

This page: Stone stack precedents
As part of my precedent study, I looked at not only New England dry-stacked stone (top), but also Mallorcan Stone walls (bottom), and Gregory Matta Clark's ampitheater wall at La Plaza Community Garden (center).
Opposite page: Dry-stacked rubble
Prototype of how the rubble could be sorted and incorporated into the voids of my modules.



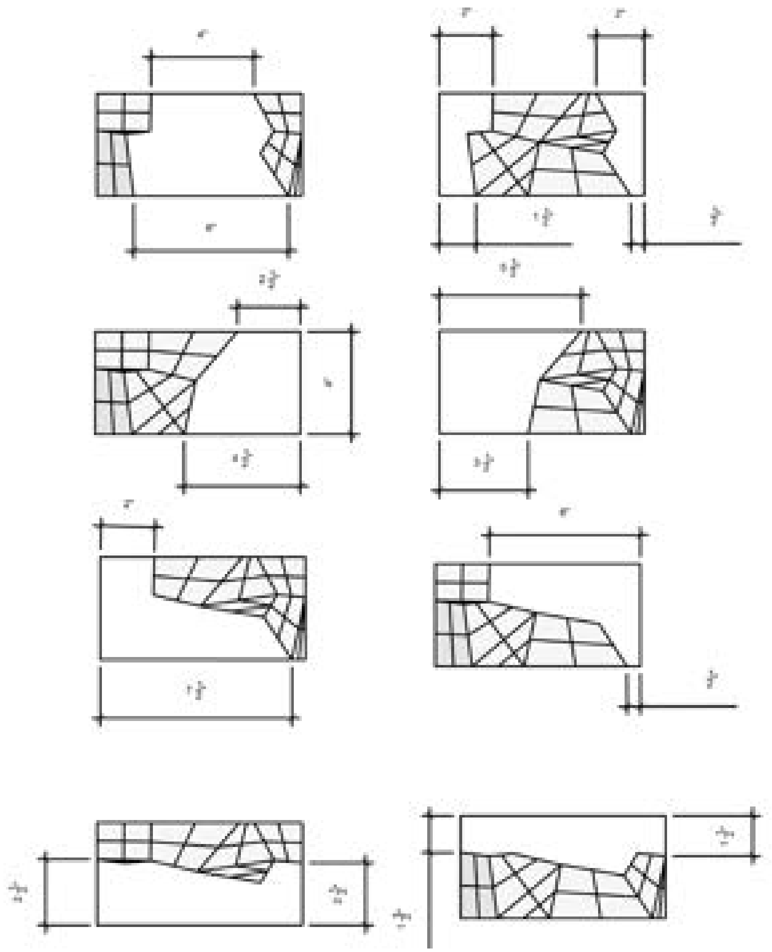
Press Molds vs 3D Prints
At this stage, I tested whether I would use press-molded clay or 3D prints for the smaller blocks. Although press molds take longer to dry, they ultimately offereed a better geometric fit with the 3D-printed pieces.



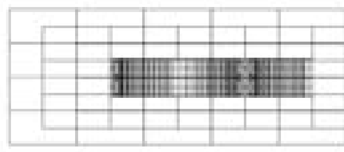
Combustibles
Based on my previous research regarding the ability of combustibles to increase the filtration capacity of the brick, I also tested the incorporation of fibers including reed (phragmites), oat hulls, and flaxseed.

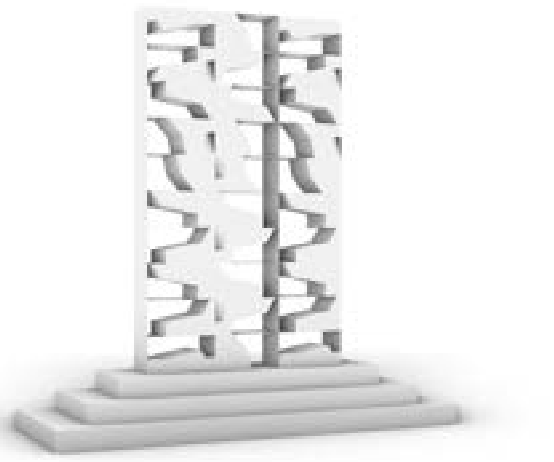
and cures more quickly than natural cement, it is less brittle and more permeable, and so less vulnerable to cracking during freeze-thaw cycles, and for this reason, is often used in the repair and preservation of historic masonry, where Portland cement is likely to cause damage due to differing porosity and expansion potential that exists between the cement and historic brick.. Given the use of worn, historic brick rubble; the wet, cold conditions of the Northeast; my interest in reflecting the material history of the Northeast; and my desire to produce a stable, but lower-impact structure, the choice of natural cement seemed the most appropriate.

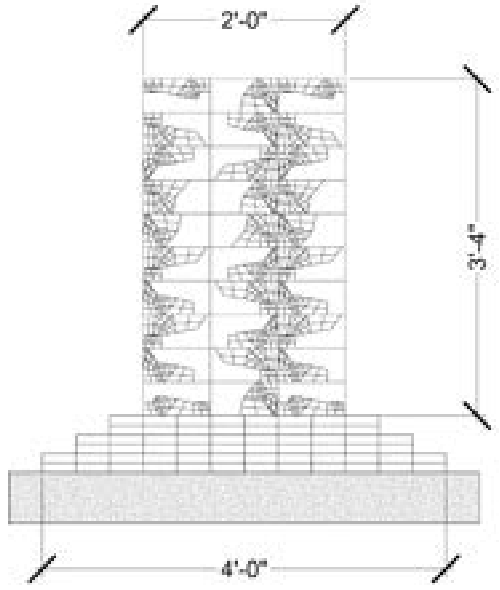
Ultimately, the configuration of the system operates as part of a more comprehensive landscape strategy that is also designed to improve trail connectivity between the beach, resort, and Hudson Brickyard Trail; increase beach access; and provide a public seating area adjacent to the beach, all of which are currently lacking. Meanwhile, the adjacent planting plan would work in concert with the brick rubble and my wall system to support stormwater filtration and phytoremediation on site with a particular focus on heavy metal accumulators.

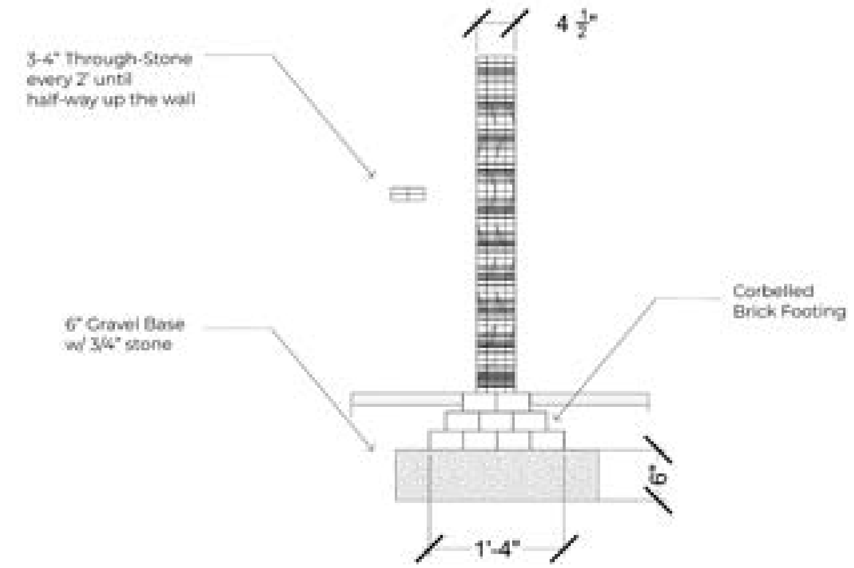


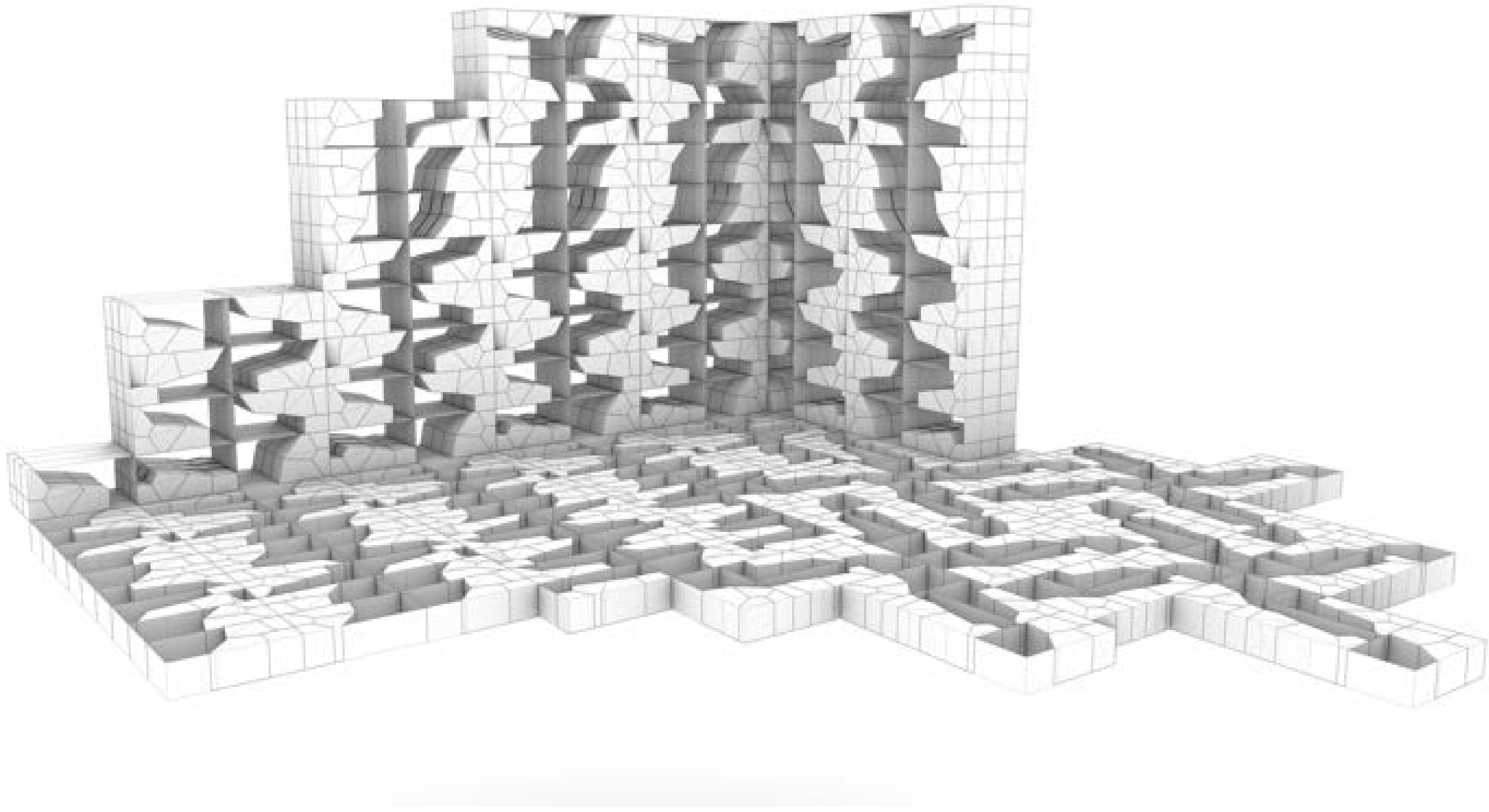
This page, Final Working Set of 8.
I made one final adjustment to my working set of bricks in order to allow them to fit together porportionally in ways that would allow wall to percolate through the system.
Opposite page, Corbelled Footing with a Gravel Base
In these initial construction details, I imagined a footing for the wall that would avoid the use of a concrete base.





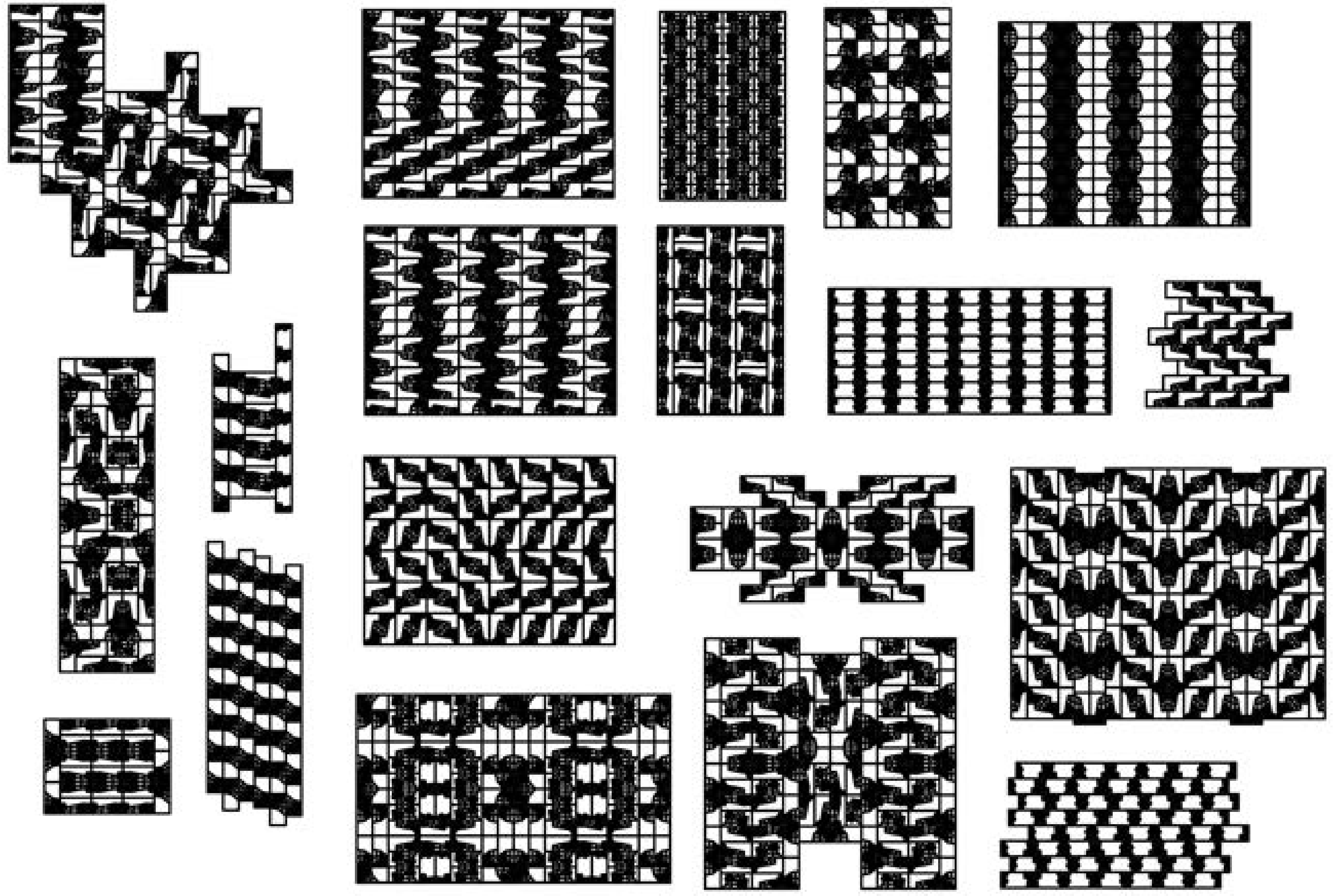






***This page: Installation Mockup**. This mockup of my installation illustrates how the module works as part of a wall, seat, path, and patio, while also working as a breeze block, waste management strategy, and water filtration system.*

Opposite page: Other Modular Possibilities



Viburnum acerifolium L.
Maple Leaf Arrowwood
Low Shrub, 4-6' h x 3-4' w
Distinctive fall foliage, flowers in late summer before fruiting.

Appropriate for upland, shady areas within the canopy..

Typha angustifolia L.
Narrowleaf Cattail

Commonly found in brackish conditions. Though to be introduced to North America from Europe, but operates as an efficient heavy metal accumulator.

Cornus amomum
Swamp Dogwood

Irregularly-branched shrub native to swamp boarders and floodplains with trong erosion control properties.

Attracts butterflies, birds, and bees.

Uniola paniculata
Sea Oats

Common to the Atlantic coast, expanding northward.

Well-suited to salty conditions and helpful in p reventing coastal erosion.

Rhododendron viscosum
Swamp Azalea

Native decidious shrub, tolerant of moist environments. Appropriate as an understory plant in woodland environments.

Spartina alterniflora
Salt Marsh Cordgrass

Intertidal brackish plant that is tolerant of a wide range of soil conditions and levels of salinity.

Helps to reduce coastal erosion and trap suspended sediments. Provides habitat for a range of coastal species.

Planting Palette
The planting pallet includes plants that can tolerate varying levels of salt water inundation and contaminatd soils, while also acting as accumualtors.

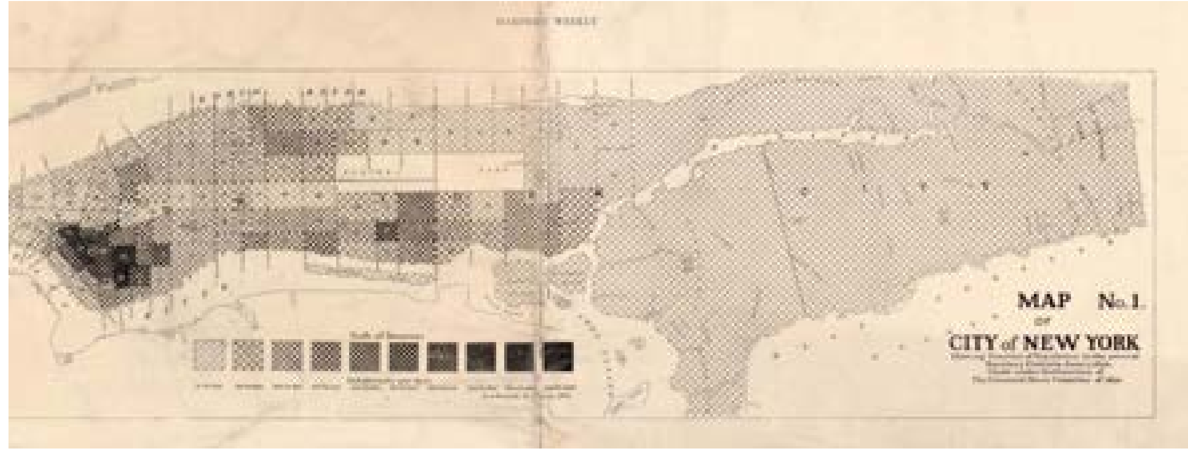

High Tide
Low Tide
0
8'
16'

Lower East Side, Manhattan

Fired brick—although dating back to 4000 B.C.—emerged as a mass-produced modular building component in the context of industrialization. Mechanization of the process can be characterized as a prolonged era of trial-and-error beginning with various compression technologies that failed to translate from work with one clay body to another. Therefore, mechanization of brickmaking didn't become significantly scalable until the invention of the extruder in 1797, used in combination with a horizontal pug mill (Holley). By the end of the 19th century this was the dominant way of producing brick, allowing brick makers to meet demand from emergent metropolitan centers like New York, where it was predominantly being used to build tenements to accommodate a rapidly expanding immigrant workforce.

The design and construction of these early tenements were guided more by norms and conventions than design standards and building codes. The vast majority were 3-6 stories tall and sat on 25 x 100-foot lots with 18 rooms per floor. Only the front and back rooms received sunlight. The Tenement Housing Act of 1866 required fire escapes and resulted in some increasing attention to spacing between buildings, but it wasn't until 1879 ("Old Law") that the housing code began to stipulate minimum requirements for light and air, made available through the addition of a window in each room and the introduction of an air shaft between buildings. These requirements became further standardized and regulated after the Tenement Housing Act of 1901 with "New Law" buildings constructed on wider corner lots, often with a courtyard, indoor plumbing, and a ban on windowless interior rooms (Marcum).

This area of the city has since seen multiple waves of demolition motivated by "slum clearance" efforts. The first followed the Great Depression, when clearance coincided with the creation of the New York City Housing Authority (NYCHA). The second occurred in



This page, top: Tenement Housing Committe Maps, *published by Harper & Brothers in 1895, illustrate the population density of the tenement districts on the Lower East Side. Source: Library of Congress. https://www.loc.gov/resource/g3804n.ct001463r*
This page, right: Slum Clearance
These archival photos illustrate not only the multiple waves of "slum clearance" efforts that have impacted the Lower East Side, but also evolving approaches to demolition and preservation of building material.
This page, bottom left: Typologies of Tenements
This image from the NYC Municipal Library and Anna Marcum at the Greenwich Village Society of Historical Preservation shows the evolution from pre-regulation to "new law" tenements.
Opposite page: Avenue C & 3rd
This building at Avenue C & 3rd is a contemporary example of a pre-regulation tenement building. One of it's side walls has been exposed by an adjacent building demolitions, making it more vulnerable to possible structural failure. Photo by author, Jan 2024.

1937 demolitions performed by the WPA
Source: The Living New Deal

1970 building demolition
Source: LISC

the 1970's in the context of a city-wide fiscal crisis. Property was left vacant, became vulnerable to arson, and/or fell into disrepair. Many of these buildings and lots were claimed by the neighborhood and converted to squats and community gardens, some of which have since been reclaimed by developers, but many of which remain after years of a struggle with the city over rights to the property.

Meanwhile, as recently as 2021, the Department of Buildings identified 13,000 corner-lot and end-wall tenement buildings (i.e. three exposed walls with the long wall acting as the bearing wall) built before 1900 that are at risk of structural deficiencies, some of which have resulted from the demolition and/or foundation work on adjacent buildings (Lynch).

As the neighborhood has become increasingly gentrified, the community-managed land remains vulnerable to development, as does that which potentially becomes available as the city moves to identify aging buildings with structural deficiencies. However, the Trust for Public land has referred to the debate over gardens vs. housing as a "false choice," given the amount of vacant land in the city, and the reality that gardens provide a low-cost resource that produces a myriad of economic and social benefits, including improved health and quality life; educational and work opportunities; and community gathering space.

Furthermore, the community gardens constitute important neighborhood infrastructure, particularly in the context of sea-level rise. Projections by the New York Department of Planning predict that the high tide of the East River will begin to inundate Avenue C by 2080 with the floodplain extending as far west as Thompson Square Park by 2100. The New York City Housing Authority (NYCHA) complexes along the waterfront will be particularly vulnerable to storm surge. In many respects, Hurricane Sandy in 2012 served as a warning.

This page: Structural Failures

These images from the Department of Buildings show common structural failures in tenement buildings built built before 1901. Collapses are common due to a load-bearing soft story and/or an adjacent demolition that leaves a third unrestrained wall, and in buildings constructed before 1901, it's not uncommon to see the 8" bearing wall separate from the joists due to a lack of mechanical ties.

Opposite page: Tenement buildings constructed before 1901 in the vicinity of Avenue C and the Community Garden District

I speculate that fewer pre-regulation tenements exist in this district due to it's previous history of high vacancy rates and successive "slum clearances." Many of the community gardens that exist here are the result of the community's attempts to reclaim vacant lots that were left abandoned during the city's fiscal crisis in the 1970s.

Left: The Flooding of Avenue C

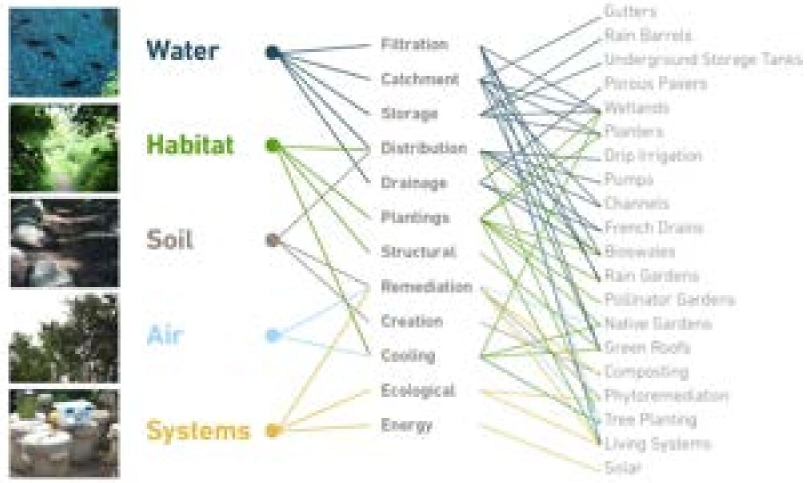
These are widely circulating images of the flooding of Avenue C after Hurricane Sunday

Right: Map of Future High Tide and Floodplain.

These predictions are sourced from NYC Planning Dept.

In 2015—3 years after the hurricane--the New York City Community Garden Coalition, in recognition of the resources they provide--was awarded a $1,500,000 Community Development Block Grant to institute green infrastructure improvements. The award was based on a study headed by the coalition that identified best practices for stormwater capture, and the funding has been intended support the implementation of 40 projects in 40 out of the 46 community gardens in Lower Manhattan, including the installation of bioswales in the public right of way, the installation of rain barrels, the purchase and installation of porous pavers, regrading to direct run-off, the planting of pollinator gardens, the purchase of pre-fab structures for water storage and harvesting, and the installation of solar panels to provide on-site power. The contract included stipulations for creating on-the-job training opportunities for women and people of color, and in cases where those projects required the support of a design team, NYCCGC solicited the services of WE Design, who went on to win an ASLA NY Merit Award for their work which included extensive community engagement.

I would argue, however, that efforts to incorporate the community gardens into green stormwater infrastructure planning should be more ambitious in both scale and imagination, and indeed, there is a broad coalition of community organizations on the Lower East Side and across Manhattan that are working to promote such plans, including Green Guerillas, GrowNYC, Rise Up, GreenThumb, Just Food, East River Park Action, the Newtown Creek Alliance, Bronx Green Up, and More Gardens!, among others (Gittleman, et al). Plans to design a flood protection proposal for Lower Manhattan brought many of these organizations and community members together in 2014 when the Obama administration launched a design competition titled Rebuild by Design to solicit plans. The seven winners included the Big U, a plan proposed by Bjarke Ingles Group



WE Design

These are images from the feasability study that WE Deesign did on behalf of the New York City Community Garden Coalition, which proposed the incorporation of bioswales along the streeet edge of many of the gardens.

(BIG) to redesign East River Park that was specifically aimed at protecting the public housing developments along the coast by building a floodable, grassy berm along the edge of the park to be completed in 2023. In 2018, the DeBlasio administration nixed the plan, citing budgetary concerns and objections from ConEdison, who expressed concern regarding risk to the city's energy systems. The new plan—which turned out, in fact, to be more expensive than the first and is projected to be finished in 2025, rather than 2023—proposed razing East River Park (including a thousand mature trees) and rebuilding it atop a landfill and levee system. Despite the perceived failure of the East River Park Plan, the Big U plan marked for many, a genuine meeting of minds between community members, designers, and planners that is indicative of the kind of organizing and scaled-up creative thinking that's both possible and necessary on the Lower East Side (Kimmelman).

My question: As this neighborhood continues to evolve and the historic architecture calls for disassembly and repair, how can we engage in a process that makes use of this abundance of construction material while planning for future climate impacts, including flood protection?

My design offers both a disassembly plan and staging guide that reserves some of the bricks from these tenements for use in the repair of other buildings, while other weaker bricks would be used, in combination with my modules, to increase the permeable pavement along Avenue C. Concrete sidewalks would be removed and processed into gravel that would fill the voids in my modules. The modules would be oriented on the street edge to allow for the absorption and percolation of water, while the remainder of the sidewalk would be replaced with whole reused bricks. In addition to reusing construction waste in a way that folds the history of the built environment into the city's future, the path that I'm proposing would articulate the community gardens in the neighborhood as a network of spaces that provide green stormwater infrastructure and help to maintain local foodways. Stronger bricks from the buildings could be incorporated into temporary or permanent structures within new and existing gardens (garden beds, water capture systems, etc.), and/or conserved as structural or facing bricks for use in new affordable housing projects and/or the repair of existing NYCHA buildings.

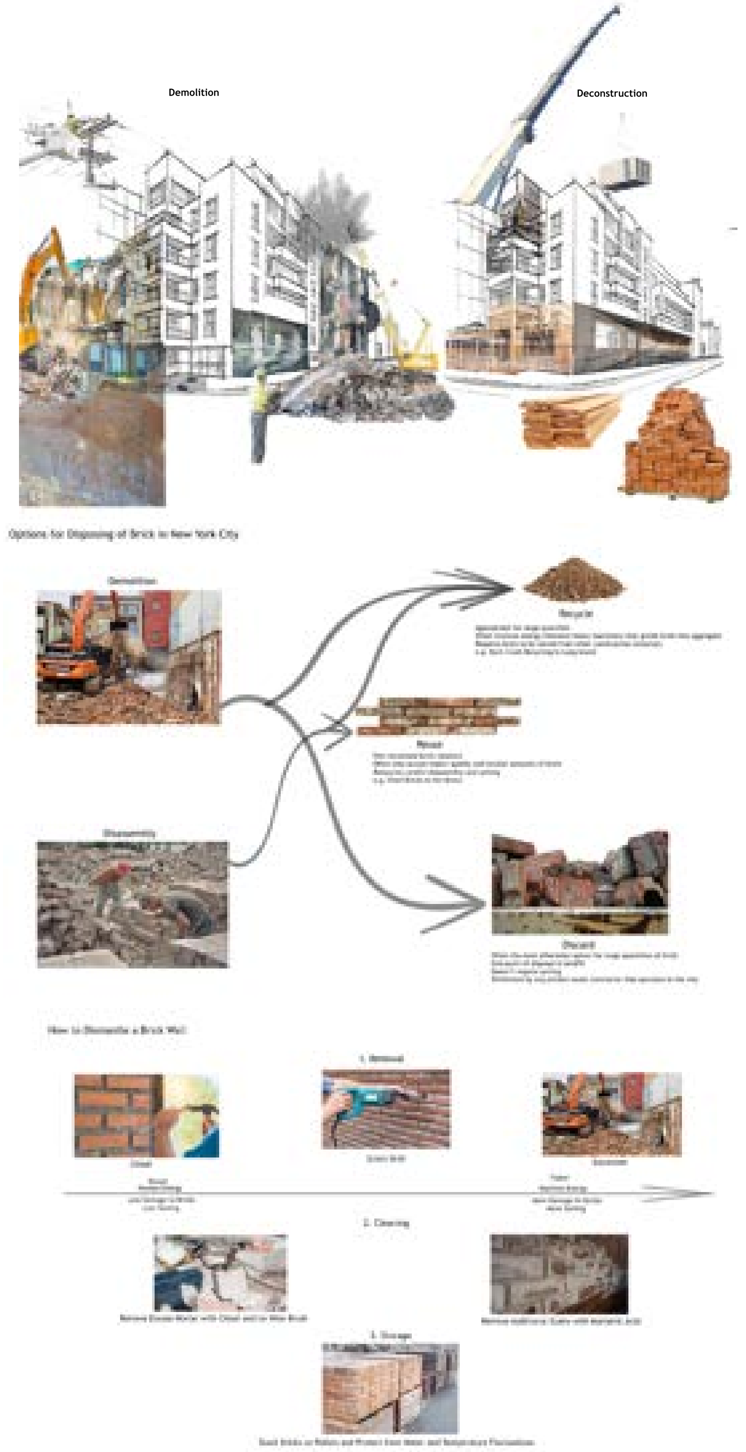
This page: Proposed Street Edge Design
The incorporation of crushed concrete gravel into my system would not only reuse waste on site, making space for permable pavement, but also act to slow the flow of water and increase percolation into the ground beneath. This strategy feels particularly important in this neighborhood due to the high flood risk, but potentially becomes a model for how to approach the retrofit of sidewalks city-wide.
Opposite page: Articulating the Gardens as a Network
The red line shows the proposed path of this retrofit along Avenue C, which would also articulate the gardens as an important part of building green stormwater infrastructure in this neighborhood.

Brick Deconstruction & Disposal

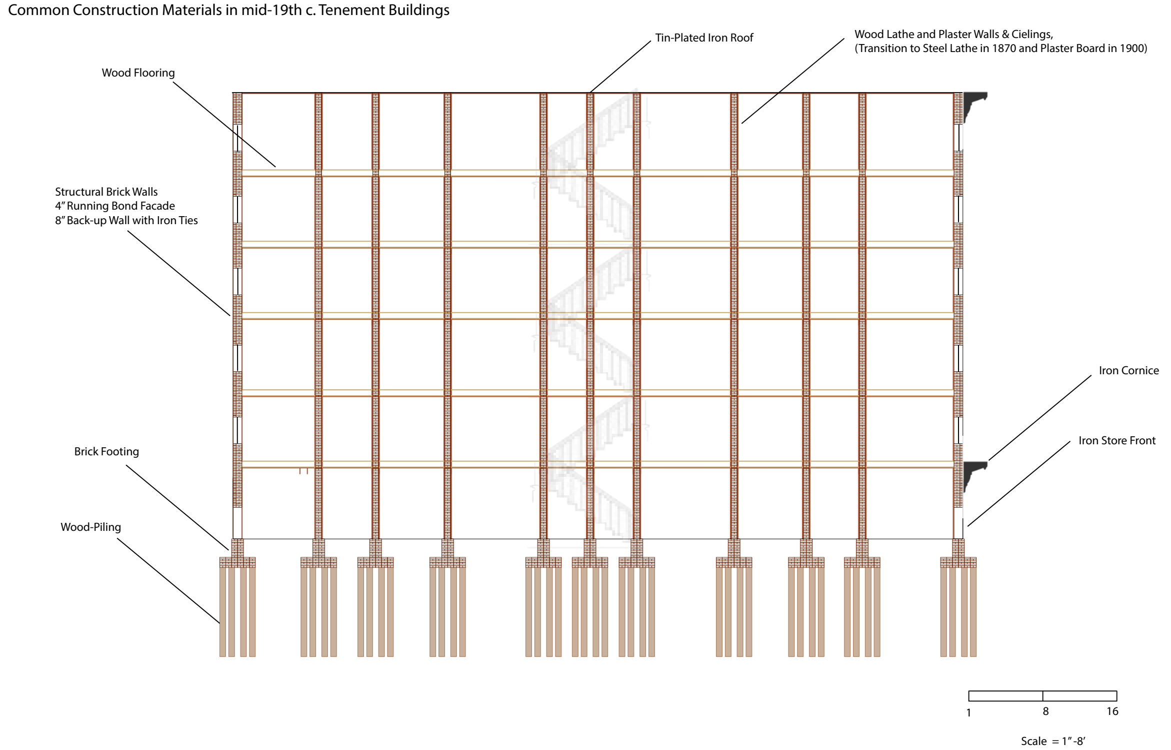
In his history of demolition, *Rubble: Unearthing the History of Demolition*, Jeff Byles quotes a speech given by the publisher William Loring Andrews in 1913 in which Andrews argues that the "wrecker," with his pickaxe, crow bar, and shovel, is "the busiest man in our midst," often described as a skilled laborer, performing construction in reverse and producing cost-savings in the form reusable building material. Indeed, in the early 20th century, second-hand brick could be sold for $50 per load, but as alternative and imported building materials became less expensive, the slow work of carefully dismantling buildings and preparing brick for reuse made less economic sense to wreckers and developers alike, and they were more inclined to "use the brick they get in filling up the Long Island Swamps." As Christopher Dameron has noted, however, materials have embodied labor and that when we build anew, we are not only wasting material but the embodied energy of previous workers.

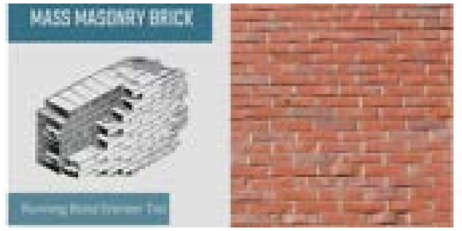
That said, the use of heavy machinery in building demolition became increasingly common throughout the 20th century, first in the form of the wrecking ball and later in the form of the hydraulic excavator with shears and rock-breakers attached. These forms of machinery, as we know, leave little in the form of sorted, reusable material, and that which is sorted is often "recycled" in the form of aggregate. The rest is destined for landfills. And in densely built environments like New York City, these forms of

Top: Demolition vs. Deconstruction *Our ability to reuse construction material begins with our approach to demolition which often leave little reusable material behind.*
Middle: Current Options for Reuse *Options for recycling and reuse are often limited by the need for large quantities, and limited speciality retailers*
Bottom: How to Dismantle a Brick Wall *While dismantling the brick requires higher labor costs, there are potential savings in both material and transportation if re-used on site.*



demolition have often led to the damage of adjacent buildings. Indeed, as recently as April of this year, the *New York Times* reported on the demolition of a jail complex in Chinatown and the subsequent damage to nearby buildings, damage that—according to architect Will Bialosky-- could become more extensive when excavation for the new building begins due to the site's location on top of former pond and the likelihood of shifting soils (Chen et al). The ongoing damage is expected to have the most severe impact on historic tenement buildings, where the cost of repair would be higher than merely demolishing them. This case points to the destructiveness and waste produced by current demolition practices; the fact that the historically high water table of the former marsh that makes up most of Manhattan produces the shifting soils that have the potential to expand that damage even further; and the fact that the city's historic brick buildings are particularly vulnerable to these cycles of demolition and construction.



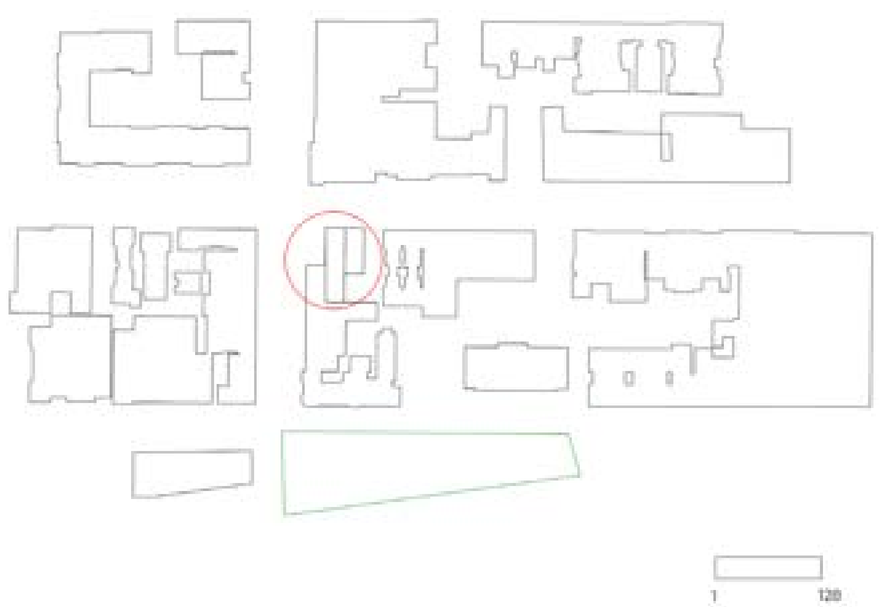


***This page, top right: Typical Mass Masonry Brick Construction**. Source: International Union of Bricklayers and Allied Craftsmen*
This page, bottom right: Tenement Wall Section
This portion of wall in the Tenement Museum shows the interior walls composed of layers of brick and plaster. Photo by author, January 2024.

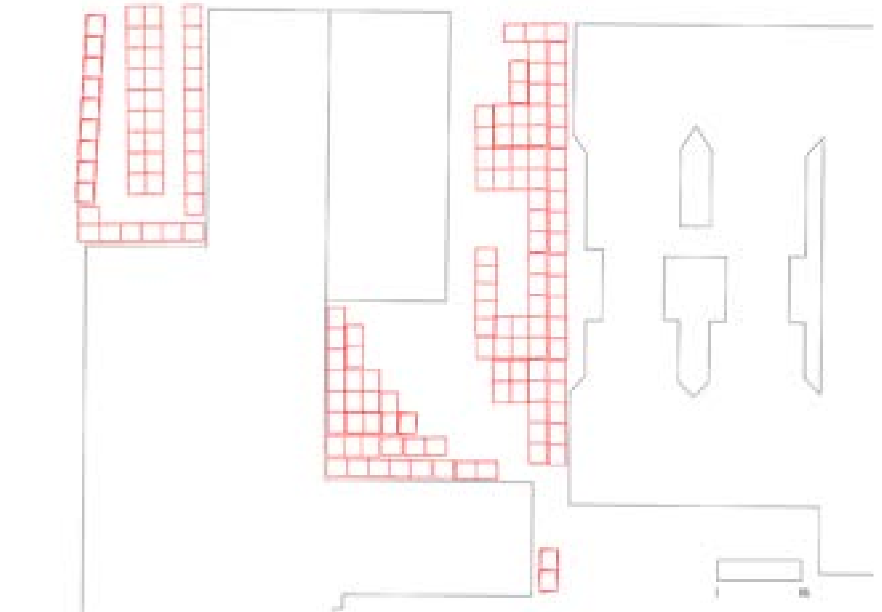
Staging

Given these conditions, what would it look like to disassemble a pre-regulation tenement like the one at Avenue C & 3rd St that begins this section? A 5-story pre-regulation tenement that sits on 25' x 100' lot would likely consist of 4" running bond face with an 8" back-up wall consistent with mass masonry brick construction shown to the right, meaning that the exterior of the building would require 750,000 bricks. Although each building originally consisted of 18 rooms per floor, likely divided by a structural brick wall covered with lathe and plaster, my plan presumes that half that many rooms exist today, given changes in both building code and contemporary preferences for more open living space. The foundation, too, would have been constructed from brick and bolstered by wood piling, and if possible, would stay in place to avoid disturbing adjacent structures. Four interior walls spanning ~25 feet across would add an additional 300,000 bricks.

To disassemble a single building constructed out of an estimated 1,050,000 bricks would then require 1,966 pallets at 48" x 40" a piece, each holding 534 bricks. If we presumed that one of the exterior long walls stayed in place to help reinforce the adjacent building, that would reduce the number to 1,404 pallets. The adjacent diagram shows how much space would be needed for disassembly, presuming that each pallet could be stacked two-high. However, given that the bricks would simultaneously be deployed in the construction of the new permeable pavement system on Avenue C, it's unlikely that all of this space would be needed at once, and ideally, the staging are could operate as publicly inhabitable space.

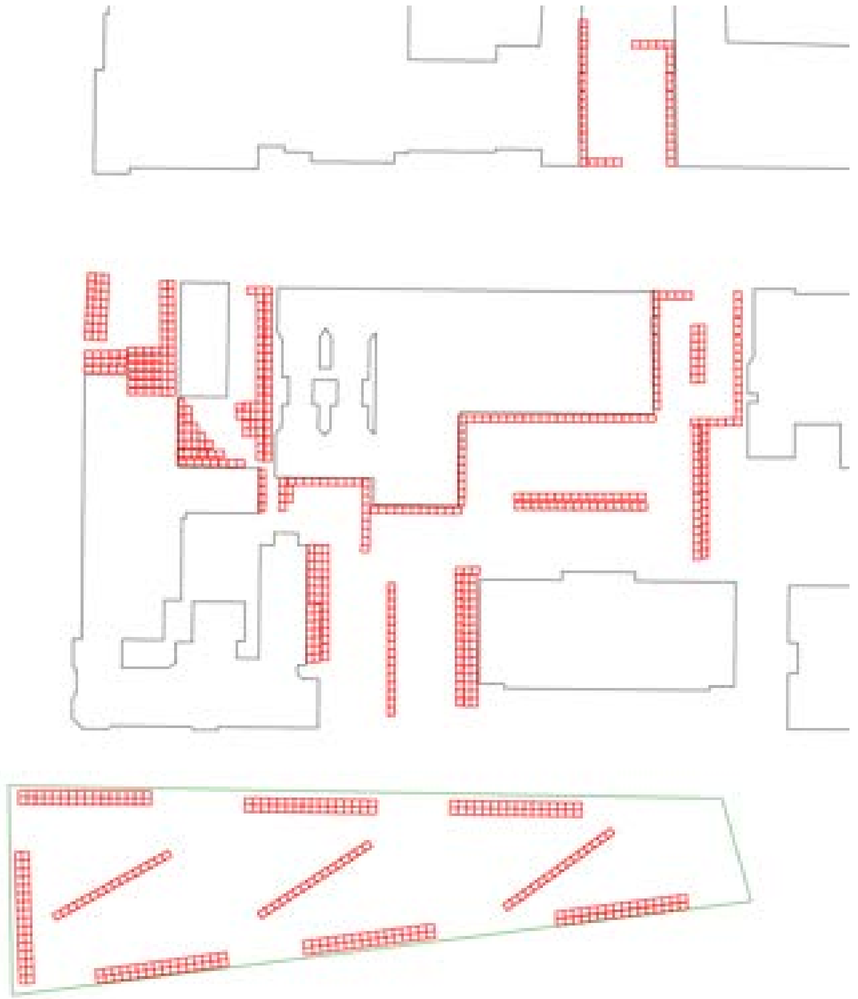


Staging Plan for the Disassembly of Avenue C & 3rd



***Phase 1:** 156,994 Bricks on 294 Pallets, Front & Back Walls*

Phase 2: *536,136 Bricks on 1,004 Pallets, All 3 Exterior Walls*



Phase 3: *762, 552 Bricks on 1,428 Pallets,3 exterior + Interior Walls*
Interior and facing bricks should be prioritized for use in path construction, while structural brick can be preserved for potential used in building repair and construction.

Local Material Flow for the Construction of New Permeable Pathways on Avenue C. *This plan anticipates that gravel will be processed on site.*

For me, METASITU's public art commission, "We Were Building Sandcastles but the Wind Blew them Away" operates as a significant precedent for this kind of intentional place-making through the staging of disassembly. As Mathias Agbo writes, "We Were Building Sandcastles," "reflects on the extractive city-building process" by attempting to return each material to its original state, pulverizing and organizing it into an ephemeral space, no more or less permanent than the built environment more generally. While I'm less interested in conventional demolition practices that depend on pulverization, it stands to reason that this kind of staging could be used as part of an intentionally designed transformation of built space as we prepare for climate change. Rana Ghosn and El Hadi Jazairy have imagined something similar in their project *Geographies of Trash*, by generating a visible, formalized system of local waste management, and I see my project as part of this dialogue about how we might make the material processes of production, consumption, discard, and decay more visible.

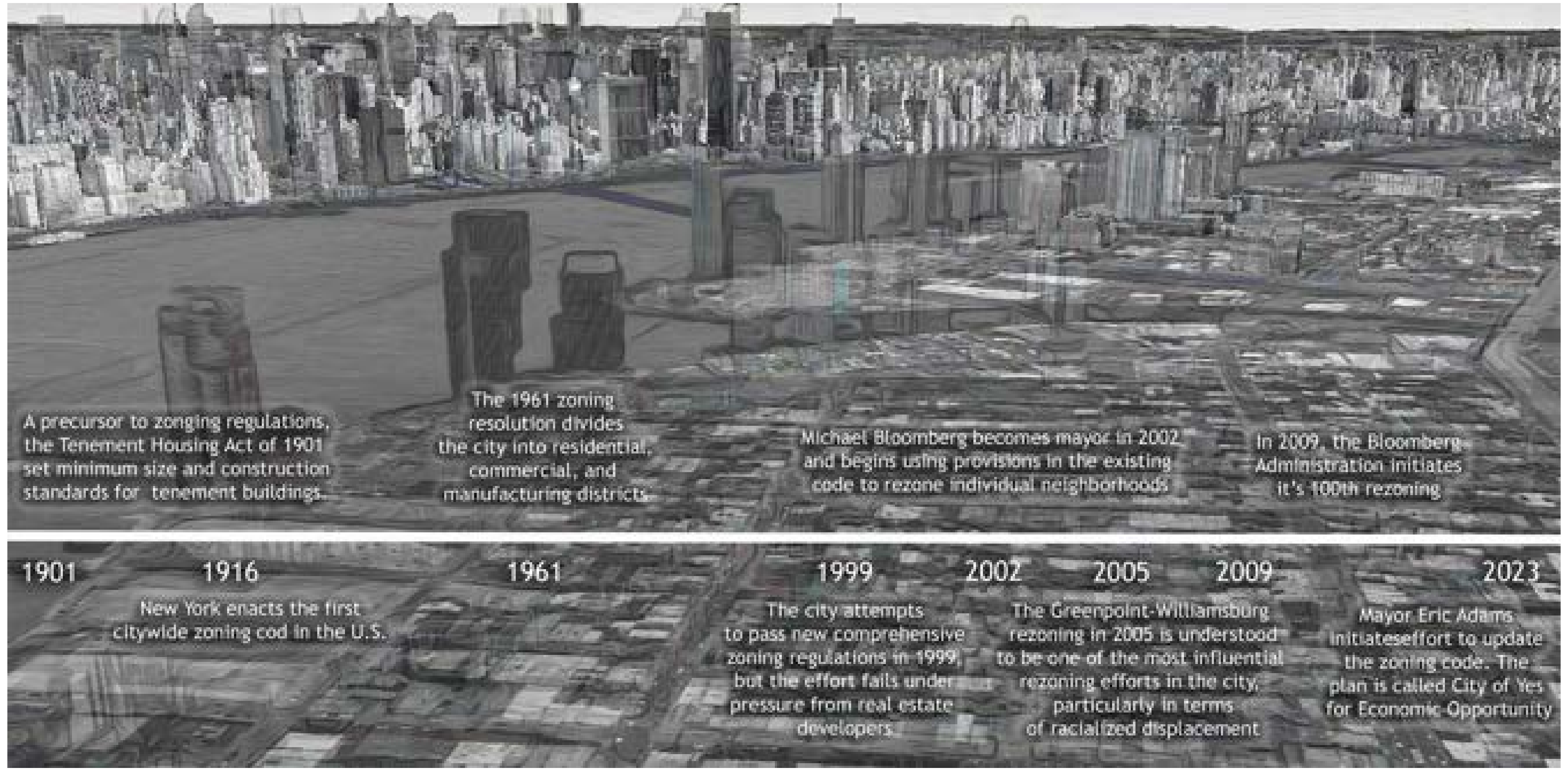
This page: "We Were Building Sandcastles but the Wind Blew them Away," Metasitu (2019)
Opposite page: "Geographies of Trash," Rana Ghosn and El Hadi Jazairy (2014) *These projects differently imagine how we might formalize, spatialize, and make visible the waste that results from processes of extraction, construction, and consumption.*

Greenpoint, Brooklyn

In the absence of rigorous planning for material disassembly and reuse, one of the primary points of transfer for C&D waste out of the city is Newtown Creek. Here in North Brooklyn, the waterways that connect New York City to the inland areas of the country—Newtown Creek to the East River and then back up the Hudson--continue to facilitate the regional flow of materials, now in the form of demolition waste, rather than structural brick.

The waterfront along the creek—which runs between Brooklyn and Queens– emerged as a manufacturing hub in the late 19th century, and Greenpoint, in particular, became a destination for large numbers of German, Irish, and Polish immigrants who came to work in the tanneries, rope and twine factories, glassworks, porcelain works, and refineries that emerged along the shipping route. These industries have had devastating effects on the creek, which like the Hudson River, was named a Superfund site in 2010, and has suffered a wide range of impacts resulting from the Greenpoint Oil Spill, discovered in 1978, which released between 17 and 30 million gallons of petroleum product into the creek; raw sewage from the 22 combined sewer outfalls that exist along the creek; heavy metal contamination from former copper smelting facilities; and the siting of multiple waste transfer facilities along the creek and its tributaries.

This page, top: View of the Newtown Creek from the Polaski Bridge. *New Development is underway on both sides of the creek in Long Island City, Queens on the right and Greenpoint, Brooklyn on the left. Some remaining brick factory buildings can be seen in the foreground.*
This page, bottom: Pallets of old brick sit exposed to the elements in a vacant lot. *To maximize availability for reuse, pallets should be covered.*



Timeline of Zoning and Rezoning Efforts in New York City
The recent effort to rezone specific neighborhoods, rather than push for comprehensive zoning regulations has paved the way for the racialized displacement of communities in North Brooklyn.

Despite this history of contamination, waterfront development on both sides of the creek has rapidly expanded in recent years, most notably in Long Island City, Queens and Greenpoint, Brooklyn. Indeed, the brick manufacturing building that now houses the Greenpoint Manufacturing and Design Center, built in by the Chelsea Fiber Mills Company, is one of many manufacturing buildings that have become indicative, not just of the industrial history of Greenpoint, but the emergent development in the neighborhood occurring under the guise of adaptive reuse. Tens of millions of dollars are being poured into remediating former manufacturing sites (lot-by-lot often according to minimum permit requirements, rather than guided by holistic ecological thinking), while brick manufacturing buildings are being converted to lofts, offices, and film and fabrication studios, and absorbed by glass and steel high rises. Meanwhile—as recently reported by the Gothamist—some sites like that of the NuHart vinyl and plastic manufacturing plant are so deeply contaminated, hopes for sufficiently remediating them are dim (Gass-Poore). And yet, housing prices in Greenpoint continue to rise. According to the NYU Furman Center, both the median rent and the median sale price of a single-family home in Greenpoint has more than doubled since 2010, and as of 2021, stood at $2490/month and $2,327,500, respectively.

This growth has been driven by finance capitalism, aided in part by a combination of rezoning and greenwashing that obscures the realities of the neighborhood's industrial history. Matthew Soules' work *Icebergs, Zombies, and the Ultra-Thin: Architecture and Capitalism in the Twenty-First Century* offers powerful insight into how financialization has driven cycles of construction and demolition, particularly in cities like New York, where despite high rates of vacancy, a housing crisis has been generated by a level of real estate investment that doesn't equate to occupancy. The

Greenpoint-Williamsburg neighborhood has been additionally impacted by a 2005 update to the neighborhood's zoning regulations which led to a dramatic decline in rent-stabilized units, increased rent burden, racialized displacement, and the loss of over 5 million square feet of manufacturing space, described by Urban Planning professor Tom Angotti as "zoning without planning." ("Zoning").

This development along the waterfront in Greenpoint is divided from the remaining industrial waterfront and wastewater treatment facilities by the Polaski bridge. On this adjacent section of waterfront, scrap metal, recyclables, and C&D debris generated by these development pressures are loaded on barges to be sent upriver, where several provocative landscape interventions have also emerged as windows onto the material life of the city. Walking along Paidge Avenue, the first of these that one encounters is

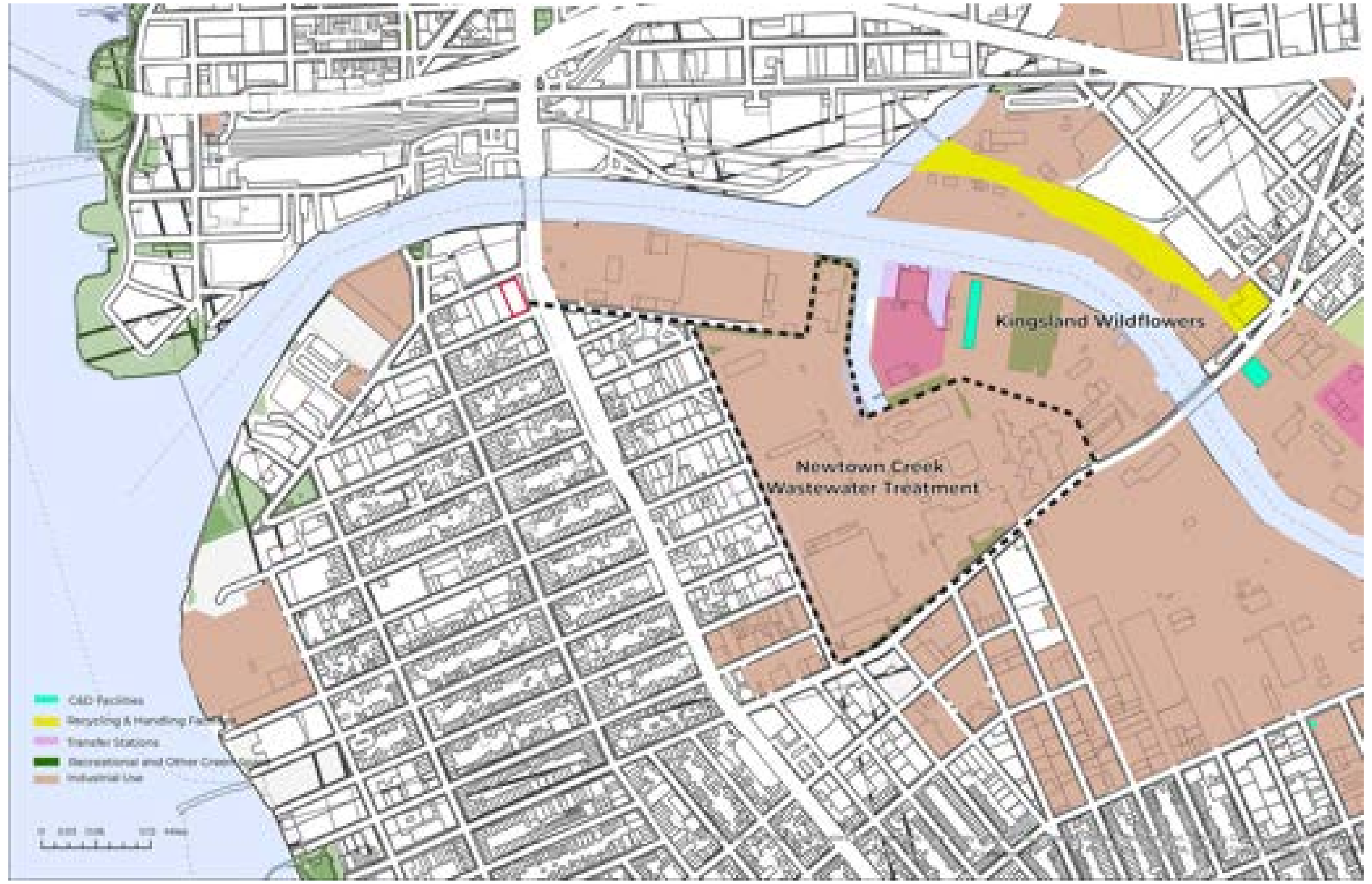
with the Newtown Creek Nature Walk, a path and park space constructed by the Department of Environmental Protection (DEP). Skirting the outer wall of the wastewater treatment facility and looking out across the creek at waste being loaded onto barges, the space features native trees, shrubs, and perennials; a promenade; and a circular precast concrete seating area.

After exiting the park, one finds themselves standing across the street from the offices of the Newtown Creek Alliance–a community-based organization in operation since 2002, working to monitor and restore the creek. In conjunction with other community partners, NCA also operates a green roof known as Kingsland Wildflowers, designed and constructed by Alive Structures, on the top of the brick mill building. In addition to providing habitat and a green corridor for native pollinators and birds, the roof hosts educational workshops and events, an annual wildflower festival, and art installations. The building sits between Alloco Recycling and Metro Oil and has views of the wastewater treatment facility to the South and waste-processing facilities to the North. These spaces, like the basement of the Narrow Arts Center, draw our attention to where the byproducts of economic and historical processes begin to gather to construct an "away" that allows development and economic expansion to continue unabated, even as it it's producing externalities that have devastating impacts on both ecological and social systems.

Newtown Creek Alliance's Kingsland Wildflowers space stands out, for me, as provocative attempt to reclaim public green space in the area while keeping the material processes that are shaping this space within view, and challenging the myth of an "away" in a way that feels resonant with what I'm proposing for the Lower East Side. I think there are opportunities to further highlight the tension that exists here between urban development, waste processing, and the need for publicly-available green space that addresses infrastructural needs, rather than priorities of developers In the space, I imagine my system becoming part of an elevated platform/ seating area that incorporates steel and glass, illustrating the degree to which BRICKS 4 GLASS has indeed become part of the material transformation of this neighborhood.

We can also begin to imagine, however, that if C&D waste could be processed and reused on site in other parts of the city, it might also open up other possibilities for neighborhoods like this one that are bearing the burden of the externalities produced by our current waste-management system.

Opposite page: NuHart Vinyl and Plastic Plant According to the Gothamist *efforts to redevelope this site are being held up by the unanticiapted depth of the soil contamination in the area. Image Source: Brownstoner*
This page: View of the Netown Creek Waste Water Treatment Facility from the Kingsland Wildflowers green roof. *Photo by author, January 2024 (hence the lack of wildflowers)*



Conclusion

My design proposal acknowledges the material and cultural history of clay as laying the foundation for an extraction-based urban economy in the Northeast that continues to be driven by cycles of construction and demolition, while also offering a low-impact strategy for subsuming the existing material abundance that exists in our built environment into new forms capable of responding to climate change impacts.

The fold operates as both and formal and conceptual device that generates a system that is both modular and site-responsive, capable of incorporating materials--from brick and stone rubble to glass and ferrous materials-- in order to minimize C&D waste while simultanourly responding to the needs of various sites, including toxic contamination and sea level rise.

The ability to deploy the system across a range of sites not only makes the system scalable to a range of contexts, but also puts these sites—in the context of the regional, economic transfer of materials—in conversation with each other while interrupting the regional material flows that currently link them. By managing waste more locally and drawing attention to how it can be reincorporated as part of the built environment on site, we also in turn, create an opportunity to shift the burden of waste away from low-income communities who suffer disproportionately from it's social, economic, ecological, and health impacts.

Opposite page, top: My Walking Path through Greenpoint
Opposite page, bottom: Waste Processing Views
Photo by author, January 2024
This page: For Rent
Fall River. Photo by author October 2023.

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Ultimately I learned from all of you not just how to be a scholar, but how to practice generosity, compassion, and care for myself and others in a profession where those values are too rare.

Thank you also to my classmates from that time, who moved me out of one entire apartment and into a new one while (in my memory of it), I stood shell-shocked in the sidewalk, still reeling from my dad's death; sang their hearts out with me late into the night drinking cheap budlight; provided feedback and comradery and company and inspiration: Alexis Lothian, Charlie Shipley, Alex Wescott, Rae Gleason, Amaranth Borsuk, Adrienne Walser, Shayna Kessel, Michael Robinson, Steve Park, Mary Ann Davis, Virginia Solomon, Jay Sibara, Josie Sibara, Amaranth Borsuk, Laura Fugikawa, Evren Savci, Gino Conti, Marshall Green, Trisha Tucker, Colin Dickey, Jonathan Hamrick, and so many others.. Most of all, Michelle Wilson, who knocked on my apartment door most days just to see how I was; nagged me to attend a kitten adoption event where I met Mina, my companion for 16 years; left lemon bars and flowers in my apartment when I had to go home to take care of my grandmother; got me home safe on many evenings; who spent so many evenings sitting quietly with my grief and who I still think of all the time. There are so many years I wouldn't have gotten through without you.

In 2013, I started my job at Duke University, where I had the privilege of working with the most creative, committed, and talented group of faculty, students, and labor organizers that I think I'll ever know. I continue to be inspired by all of you: Jay Summach, Jim Berkey, Eddie Pinuelos, Lindsey Smith, Leslie Maxwell, Sandra Sotelo, Marion Quirici, Nathan Kalman-Lamb, Miranda Welsh, Mike Dimpfl, Adam Boyette,.Alison Klein, Stefania Heim, Peter Pihos, Paolo Bocci, Sachelle Ford, Haleema Welji, Jessica Gohkberg, Laura Jaramillo, Syd Roberts, and all the members of Local 26 SEIU Southern Region and the Durham Workers Assembly. I strongly believe that faculty working conditions are student learning conditions, and I continue to believe that what we built together at Duke was an inspiring example of what it looks like when faculty challenge themselves, each other, and the institution to be better than we are. I knew it was special then, but it became more special in the context of being a student again, and I hope you never doubt the meaningful work you all do.

All of my love to Stefanie Wess, stef shuster, and Matt Whitt. No one has ever seen me the way that the three of you have, and I feel so grateful for the ways you've reflected me back to me in the moments when I've most doubted myself. You've been my anchors through every turn in this weird path, even in the years when our communication has ebbed.

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My time at RISD has been made possible in so many ways by Tiago Torres Campos, who convinced me to bring my whole self to RISD when I presumed that my turn into Landscape Architecture would mean having to leave behind everything that came before. Thank you for not just inviting me, but challenging me in precisely the ways I've needed.

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But as before, it's been my collaborators who've made it all worth it, and I genuinely don't know how anybody gets through a program like this without the company of classmates like Denzel Amoah, Alex Goodenough, Naomi Canino, Corey Watanabe, Jun Shi, and the rest of the class of 2024. You're all going to kill it out ther and when all else fails, just pave it. ;-)

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To my grandmother who isn't here, but who was the kind of person I wanted to be when I grew up. I often think of a specific day toward the end of her life when it was clear that she was having trouble placing me, and in the face of her confusion, I said "You might not recognize me because I cut my hair." She looked at me concerned and said "why would you do that?" to which I shrugged and said, "because I wanted to." Her face immediately lightened and she said, smiling, "well that's a good reason." She believed that teaching was my special calling, as it was hers, and maybe she's not wrong, but I know that me wanting to do this instead would've been good enough reason for her. Thank you for everything you made possible, Grandma.

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