

ABSTRACT

Title of Document: SYMBIOSIS: AN INTERCONNECTED REGION FOR 2050

Jacob Walter Bialek, Master of Architecture, 2013

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For the first time in history, the majority of the world's population is residing in its cities. Expended resources and climatic concerns are prompting a shift from traditional patterns of growth, predicated on the burning of fossil fuels, in favor of innovative, sustainable strategies. This thesis demonstrates the implications of this trend in the DC | Baltimore area, in the proposal of a closed-loop symbiotic-network city that will be linked both by alternative means of transit but more importantly by a lifeblood of inter-relational sustainable systems. The project's design develops at three scales; [xL] regional – through the establishment of an infrastructural and transit network between developable brownfield and greenfield sites in and around Baltimore and Washington DC, [L] district – in the development of one site into a mixed-use neighborhood, and [s] building – by the design of a civic edifice that serves as a pronounced model for the whole.

Symbiosis: An Interconnected Region For 2050

By

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Thesis submitted to the Faculty of the Graduate School of the
University of Maryland, College Park, in partial fulfillment
of the requirements for the degree of
Master of Architecture
2013

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Acknowledgements

Thank you to my committee for their continual design advice and inspiration

A special thank you to my parents for their unending love and support throughout my collegiate endeavors

I want to recognize the following individuals for their mentorship, moral support, and guidance throughout this thesis process

Chris Harvey, AIA

Zachary Klipstein

Kiley Wilfong

Justin Cullen

Julian Goldman

Nicholas Tomaszewski

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AN INTERCONNECTED REGION FOR 2050

ymbiosis

Chapter 1: Concept Strategy

With the enhanced viability of city living, for the first time in history, the majority of the world's population is living in cities. By the middle of the century, two – thirds of its inhabitants will call a city home. Expended resources and climatic concerns are prompting a shift from traditional patterns of growth, predicated on the burning of fossil fuels, in favor of innovative, sustainable strategies.

This thesis will demonstrate the implications of this trend in the DC | Baltimore area, in the proposal of a closed-loop symbiotic-network city that will be linked both by alternative means of transit but more importantly by a lifeblood of inter-relational sustainable systems.

The project's design will develop at three scales; regional (extra-large [xL]) – through the establishment of an infrastructural and transit network between developable brownfield and greenfield sites in and around Baltimore and Washington DC, district (large [L]) – in the

development of one site into a mixed-use neighborhood, and building (small [s]) – by the design of a civic edifice that serves as a tangible, visible model for the whole.

The exploration of these three scales of development-dimension will culminate to form a system of interdependencies that will establish the framework for a Baltimore | Washington regional master plan for the year 2050. Although the thesis will focus on this immediate region, its underlying principles are not exclusive to this context. *Symbiosis* presents these conceptual building blocks in an insertable manner, which could theoretically be applied at many locations and

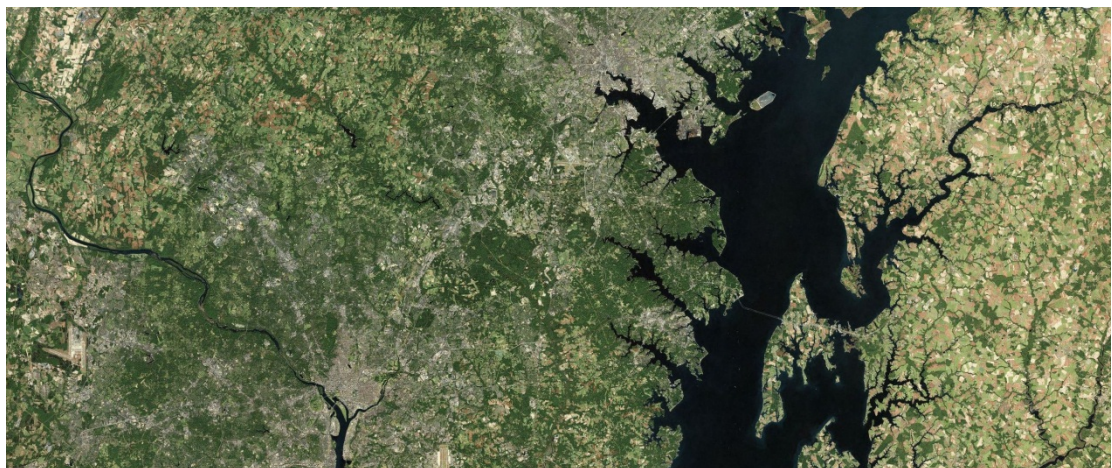


Figure 1.01 Regional Area
<http://www.bing.com/maps>

dimensions.

At the [xL] scale, the dichotomy between the movement of people, facilitated by way of the interstate system, and the movement of goods, via the railroad, will be extricated. Each, in its individualized pattern of growth, produced a series of remnant spaces that will become the focus areas for design and development. The automotive car-culture predicated on the ideals of the American Dream presents vast seas of parking lots covering sometimes up to two-third of a town center's developed area.

Conversely, the railroad, which expedited the movement of goods between industrial sites, leaves behind miles of unused track and brownfield sites where past industry once operated. While the industrial functionality of these sites has passed, what remains is a succession of open spaces that retain their linkage to the system. Rather than planning a new formal transit system, the xL scale of the thesis proposes the adaptive reuse of the found conditions, with the brownfield and greenfield sites developing as new town centers. The existing rail

will then be augmented to support a light rail transit spine introducing new station points which will serve as the seeds for new urban growth.



Figure 1.02 Concept at Three Scales
Graphic by Author

The xL scale will evolve beyond transit into the ways that this spine can serve a greater capacity, through the linking of a series of sustainable district systems. Connected to and through the major cities, this network will link to existing renewable sources, meeting the energy, heating, and waste management demands of the scheme. The establishment of these linkages will sponsor the development sites' capacity to co-exist

and generate processes and products that will permit them to endure as a symbiotic whole.

At the district [L] scale, the thesis will zoom



Figure 1.03 Spine as a Conduit for District Systems
Diagram by Author

in to focus on the development of one of the brownfield sites, W, as a case study. It will follow its transformation into a sustainable mixed-use neighborhood, tied back to the connections provided by the spine to establish the capacity for growth.

The concept of the interconnected network will also follow the scale shift from xL to L, as the

delineation of district systems breaks off of the transit spine, and forms cyclical relationships between the processes in the development. To facilitate this, a variety of planning schemes will be tested to allow for an efficient spread of density as well as adjacencies that allow the byproducts of certain systems to be able to be recycled and reused in others. Once distilled to the building scale [S], the infrastructural systems that co-exist throughout the city merge with the site, manifesting a building that exhibits their interplay in a new civic entity.

Chapter 2: Concept Precedents

To begin to distill the conceptual forces at play in the symbiotic network and synthesize the three scales which they embody, a series of precedents will be studied. Through the comparing and contrasting of their constituent parts, a series of principles will be extracted.

These principles will generate a set of typologies which will set up a theoretical basis to

inform development decisions. This typology-directed model of design will be particularly strategic in the analysis of the Baltimore-Washington corridor as the prototypical sites will be of diverse sizes and forms. To grapple with the inherent challenges of typology application, precedents have been selected that have a variety of approaches to transit oriented development.

XL *La Ciudad Lineal:* Arturo Soria y Mata

Arturo Soria y Mata's *La Ciudad Lineal* in Madrid represents one of the first iterations of linear city planning. Conceived in 1882, Soria's proposal originally outlined a transit-based development applicable for an indeterminate length. Running along the interior of the linear city

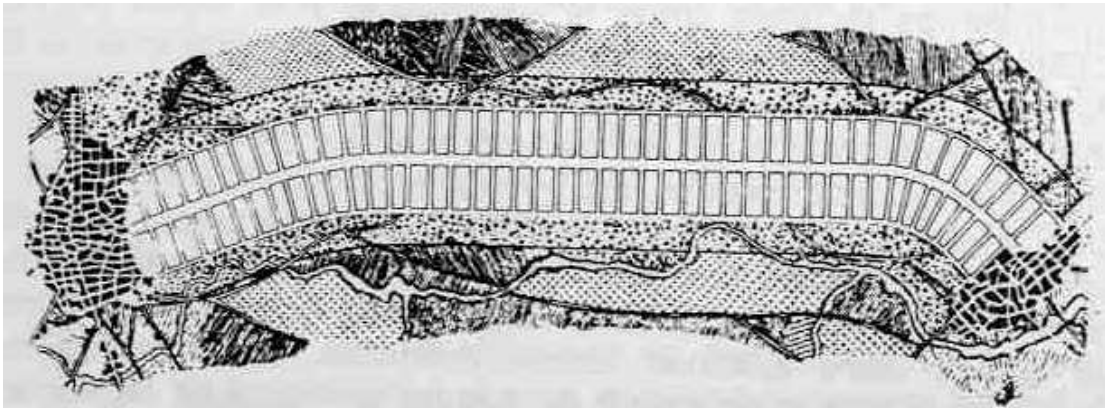


Figure 2.01 *La Ciudad Lineal*, Madrid
http://www.commonswiki.org/wiki/File:Ciudad_lineal_de_Arturo_Soria.jpg

scheme, a central transit corridor bifurcates the developable area into two linear plots of land predicated on a five-minute walk to the center. Secondary streets, running perpendicular to the center, organize the city into regular block sizes.

Soria's vision for the corridor was a single street of 500 meters width . . . such will be the city of the future whose extremities could be Cadiz and St. Petersburg, or Peking and Brussels. In the center of this immense belt trains and trams, conduits for water, gas and electricity, reservoirs, gardens and, at intervals, buildings for different municipal services – fire, sanitation, health, police, etc. – and there would be resolved at once almost all the complex problems that are produced by the massive populations of our urban life. The projected city unites the hygienic conditions of country life to the great capital cities.¹

To either side of the central thoroughfare, Soria proposed the equivalent of contemporary live-work units interspersed with open space for recreation, organized and connected to the spine

¹ Collins, George R. *Arturo Soria Y La Ciudad Lineal*. Ed. Carlos Flores. (Madrid: Revista De Occidente) 1968, 35.

with secondary streets. The housing itself is of a relatively low density, designed as single family detached homes, designed to occupy, independently, one-fifth of each allotted portion of residential land.²

Underlying the transit development, Arturo Soria y Mata planned for the right of way to organize utility systems, a service that was not commonplace at the time. In the cities of the present; electricity, water mains, sewage systems, and subways use street networks to connect to buildings. At the time, this marked a major innovative improvement.

While only ten percent of the original scheme was constructed, the underlying principles of the scheme have been reinterpreted into many new applications. Soria himself imagined three alternative versions of *La Ciudad Lineal's* principles. He regarded the scheme as universally applicable in any one of three forms; a ring around an existing city, a ribbon running through an

² Choay, Françoise, and Marguerite Hugo. *The Modern City: Planning in the 19th Century*. Ed. George R. Collins (New York: Braziller) 1969, 98.

unpopulated area and connecting two cities, or an entirely new town in an urbanized region.³

XL Ørestad: Copenhagen

Located just south of the Copenhagen's city core and nestled within the Kalvebod Fælled protected natural area is the up and coming district of Ørestad. Just a short metro ride from the city, the district bears significant resemblance to *La Ciudad Lineal*. In its infancy, it likely closely resembles the beginnings of Soria's realization of his planned linear development.

Figure 1.03 explains this graphically. In Madrid, Soria's linear city connected from one developed area to the next passing through farmland and natural vegetation. In a similar dichotomy, Ørestad's relationship with its environs consists of contemporary examples of architecture juxtaposed against cow pasture and wetlands.

Also borrowed from Soria's model is the 500 meter dimensioned development. However, Ørestad diverges from the model in its placement

³ Choay, 99.

of the spine. Rather than running it down the center of the development belt, it is placed along the eastern edge. Accordingly, the lot sizes and the resultant buildings that infill the development err on the grand scale to diminish the perception of the 10-minute walk between home and transit.

The central spine in Ørestad possesses a multi-modal capacity analogous to that of Soria's model as well. It includes a computer-driven elevated light rail, a two-lane vehicular avenue, a commuter bus route, and a walking / biking trail



Figure 2.02 Central Spine of Ørestad
<http://www.commons.wikimedia.org>

built along a manmade vegetated canal. The pedestrian trail extends from the center of the city all the way south to the Øresund, the strait that connects the Atlantic Ocean to the Baltic Sea, separating Denmark and Sweden. Additionally, the spine acts as a conduit from Copenhagen's waste to energy plant in Prøvesten, just to the northeast of the city core. The connection supplies district energy as well as heating in the form of steam as a byproduct of the plant's cogeneration process.

Varying densities and uses populate the developed area with the major concentrations of retail and commercial activity located at the three transportation hubs; Bella Center, Ørestad, and the terminal station at Vestamager. Bella Center boasts Copenhagen's as well as Scandinavia's premiere convention and congress center, complete with the iconic twin slanted hotel towers designed by local architects, 3xn. Ørestad features a four-story mall and the highest concentration of office buildings in the district.

The last station point along the spine is Vestmager, which is still in its early stages of development. With the completion of the 8-Tallet project by Bjarke Ingels Group., it received its first commercial and retail space along with a unique reinterpretation of traditional housing typologies. The architectural style of the district, on the whole, represents the styles of many of the new, up and coming local architecture firms.

This has created an ad hoc form of development where the blocks are defined, but the architecture that fills them is not dictated by strict regulations, resulting in a similar realization to the growth patterns of housing within the established grid of Philadelphia, PA. This has manifested a rich architectural formal idiosyncrasy that presents novel alternatives to traditionally accepted typologies.



Figure 2.03 8 Tallet – Architecture Juxtaposed to Pasture
Photograph by Author

L *Bo01 Sustainable Housing Exhibition:* Västra Hamnen

On the northern point of the city of Malmo, in Sweden's southernmost province of Skane, the Bo01 housing exhibition demonstrates a new paradigm for sustainable development. Built upon the artificial island of Västra Hamnen, the Bo01 ecological housing district reconnects the area to the water, reclaiming the site of a polluted industrial ruin.

The development consists of a mixture of



Figure 2.04 Bo01 Housing Exhibition at Västra hamnen
<http://www.commonswikimedia.org>, photo taken by Francois Polito

housing, offices, shops and recreational areas. The architecture of the buildings themselves is active in their dialogue, creating a variety of urban spaces that act to foster community amongst Bo01's inhabitants. Furthermore, great attention was paid to promote the mixing of different social and economic classes to prevent segregation of people and subcultures within the district. Bo01's concept of diversity extends beyond its residents. According to the Sustainable City Development of Västra Hamnen, several different steps have been taken to ensure that [Bo01] will be a green district with plenty of different biotopes for flora and fauna.⁴

The district supplies all of the electricity and heating it uses by wind and solar energy coupled with Malmö's district cooling and heating, creating a closed-loop system. Transportation, which is dominated by pedestrian and bicycle traffic, is incorporated into the loop as well. The buses and vehicles that are used run on

⁴ *Visions for Tomorrow in Västra Hamnen. Western Harbour.* Malmö Stad, n.d. (14 Dec. 2012).

alternative fuels produced in the district as a by-product of recycled organic waste.



In order to maintain the closed-loop system, residents have the ability to monitor their own consumption, and are presented alternatives to adjust and adapt to more sustainable practices. Through this effort, the city uses only half the energy and resources of other similar residential districts in Malmö.⁵

Figure 2.05 Engineered Wetlands
Photograph by Author



Figure 2.06 Superblock Interior
Photograph by Author

⁵ *Ecological Sustainability*. Malmö Stad. Vastra Hamnen Sustainable City Development. (30 May 2012).

L *Hammarby Sjöstad:* Stockholm

Located just south of downtown Stockholm, on the beautiful Hammarby Sjö (Lake) is the district development of Hammarby Sjöstad. Throughout the past seventeen years it has undergone a dramatic transformation from a polluting industrial site to a vibrant, prosperous sustainable urban neighborhood. The vision was to create a model for sustainable development using green systems, technologies and processes that were planned for use throughout the city. Through the implementation and use of these systems, the City of Stockholm sought to produce an urban district able to sustain daily life using half the energy of a typical development.

The costs of remediation of the soil contamination were covered by the more than 40 individual developers involved in the project. Upon the receipt of their contribution, they were able to purchase plots of land at a reduced, lower than market rate cost. The general building massing and an assigned materials palette were

outlined in the master plan to instill an overall continuity. However, each developer and associated architect was given discretion as to how to interpret these guidelines into their designs.

At the backbone of the development, a public transit route acts as a major artery, organizing Hammarby's ecological-cycle model. In a similar manner as in the past examples, the metro line doubles as a conduit for the neighborhood's connection to its energy and heating sources.



Figure 2.07 Organizing Transit Avenue
Photograph by Author

However, in this case, Hammarby's model adds a touch of personal interaction. This is realized in its innovative process of waste, recyclables, and compost collection. Rather than putting refuse bins on the curb for trash trucks to collect, each residential block is given its own recycling facilities. At each of these depositing locations, a series of vacuum tubes is provided connected to an underground network that uses the transit spine as a direct link to its respective processing plant.

Combustible waste is sent to the local waste to energy plant, returning steam heat and electrical energy to the development. Other forms



Figure 2.08 ENVAC Collection Point
Photograph by Author

of solid refuse, including compost and human waste are sent to the sewage treatment center which using innovative methods, extracts nutrients for use on agricultural land. As a byproduct of this anaerobic digestion process, methane is captured and reconstituted as biogas, which fuels all of the district's busses and shared vehicles.

At the heart of the community, Glasshaus Ett, the town hall building of the project, doubles as an education center. It showcases the environmental technologies that the neighborhood utilizes through a variety of cutaways and interactive displays as well as allowing residents to



visualize their collective energy consumption. This

Figure 2.09 Waterfront Development with Waste to Energy Plant in Background
Photograph by Author

heightened awareness allows residents to save energy and live more sustainably.

Chapter 3: Site Selection System

The selection of sites for the XL category of the thesis follows a comprehensive inventory of the existing heavy rail inherent to the region. This

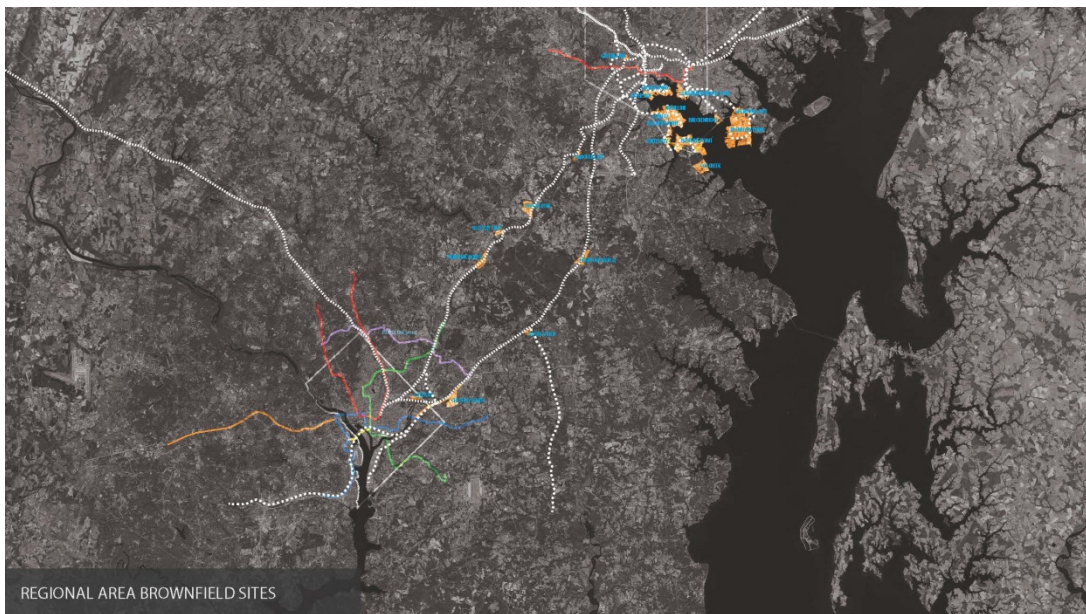


includes the rail lines of CSX freight which are shared by the MARC commuter train, Amtrak, and

Figure 3.01 Brownfield Site Catalog
Catalog by Author, images from www.bing.com/maps

the Acela high-speed train that runs between Washington DC and Boston. Following the lengths of their respective corridors; brownfields, greenfields, expansive or abandoned parking lots, etc. are highlighted and catalogued as plausible sites for development. Within the context of the thesis proposal, the rail corridor of the CSX line will be adapted as the organizational spine for the collective series of transformations of brownfield sites into the new centers of urban development.

In order to secure the energy, heating, and



cooling provisions for the selected sites, an

inventory of the existing renewable energy plants

Figure 3.02 Regional Brownfield Rail Adjacencies
Diagram by Author

is taken. As part of this investigation, studies of the viability, and sites for the installation of new energy production stations as well as the adjacencies of the sources required to operate them will be included. In support of the thesis, the Baltimore Washington region currently boasts five waste-to-energy plants. One of these acts as an iconic element of arrival to the city of Baltimore from the South to commuters travelling along Interstate 95. In each instance, the plant's available, unutilized capacity will be extracted, and then compared against local household usage



Figure 3.03 Baltimore Waste to Energy Plant
www.bing.com/maps

data from the US census to serve as a basis for establishing a supportable density.

If the results determine that an additional waste to energy plant is necessary to sustain

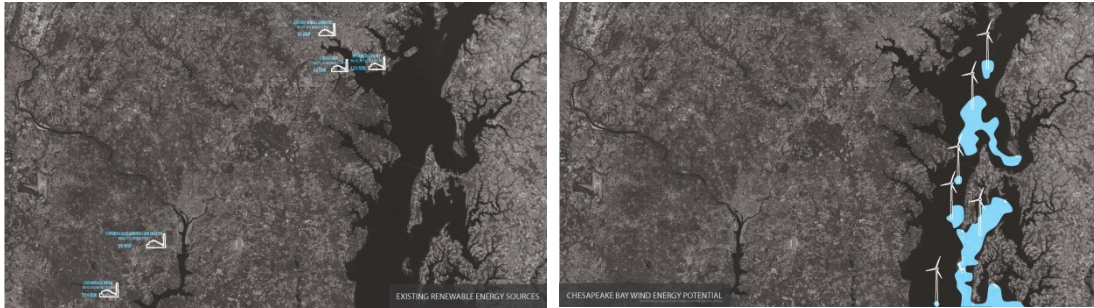


Figure 3.04 Renewable Energy Inventory
Diagrams by Author

said density, the proposal will be for an environmentally conscious pyrolysis-driven plant. Pyrolysis progresses beyond the traditional waste to energy model by removing the practice of the incineration of the refuse, thus cutting out many of the resultant toxins. Instead of being burned, the waste is superheated in an oxygen starved oven, effectively breaking down the materials, producing only methane and carbon dioxide as byproducts. Rather than being released, however these derivative components are reconstituted into a product termed 'Syngas' which has applications as a biofuel that can be used to power vehicles. In the precedent examples, biofuels were reprocessed as a fuel source for commuter buses, car-share and personal vehicles, and streetcars.

In the proposal of the thesis, the pyrolysis waste to energy plant will serve the cogeneration requirements of the individual urban developments; however the electricity production of its process will be utilized as the primary source of energy for the propulsion of the light rail, permitting it to operate at carbon neutrality. The pyrolysis plant could have two conceivable alternative realizations. Either it could be designed (by others) as a completely new plant operating solely for the *Symbiosis* city proposal, or it could be implemented as an expansion of capacity for an existing plant.

Shifting the focus back to site selection, it will be wise to examine the hindsight of light rail implementations elsewhere in the United States. One pertinent take away from past examples is that in order to establish an early realization in the ridership of the system, modifications will need to be made to its trajectory. This entails the organization of the system's network to include not only brownfield sites which will develop as the new nodal urban nuclei, but to existing town centers as

well. The town centers that have been chosen are specimens whose supported populations use Interstates 95 and 895 as their primary means of daily commuter travel. At least half of these areas currently have an existing public transit connection or are slated to have one in the coming years.

The interesting caveat in the current state

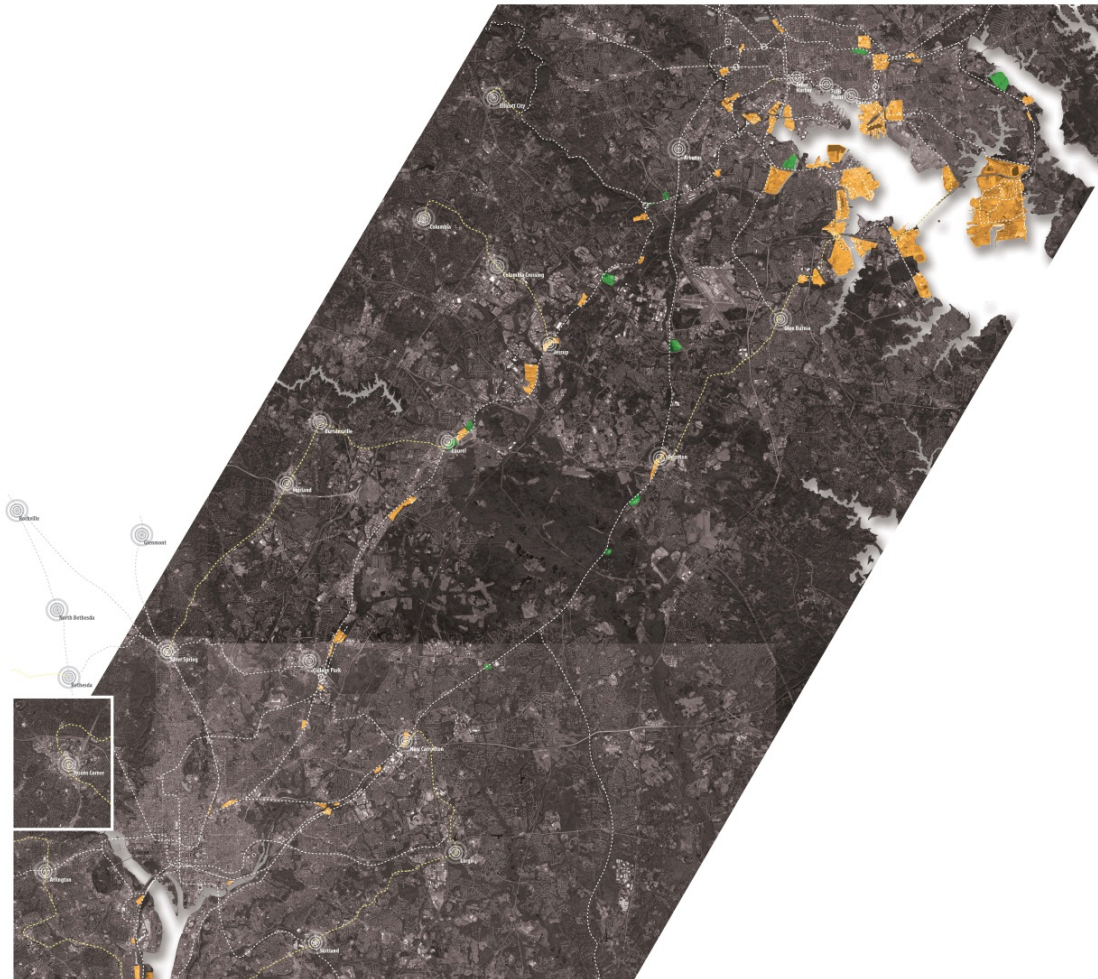


Figure 3.05 Regional Transit Network with Site Callouts
Graphic by Author

of affairs is that most of the rail infrastructure that will support the connections inherent to the thesis already exist. In many cases however, because of the nature of city metro jurisdictions, the singular networks lack connection. Baltimore has its own transit system and Washington DC likewise, and MARC and AMTRAK service connects the two.

However, utilizing the three in the effort of the daily commute is largely inefficient, and as a result the majority of the commuter population would rather drive than risk inconvenience. An additional factor is the realization that due to the lack of integrated planning of transit into development, users still need to use a personal vehicle to drive and park at metro station locations. To accommodate the space required for surface parking, stations end up on the outskirts of towns surrounded in non-descript settings. As a result of their peripheral location, security at the stations is diminished, adding another rationale for commuters to circumvent public transportation in favor of personal vehicles.

Proposals such as the Purple and Red Lines of Washington DC and Baltimore respectively are beginning to tackle the subject of augmenting individual connectivity. However it will not be until the disparate systems work together that efficiency of the entire public transit network will improve.

The application of an alternative means of transit in each of the town contexts will provide the provision for up zoning based on the added capacity of public transportation. Increased access will then attract more lucrative restaurant and retail entities and as a result will lead to the densification of housing in the vicinity of the station locations. The selected sites were picked based on the consideration of their quantity of open space, defined in this instance as coverage by surface parking lots and internal brownfields. The integration of certain examples of these town center sites will be less intensive as they already possess a CSX freight line adjacency. Others have an existing public transit connection or are slated to have one in the coming years.

Once these urban nodes are cataloged and connected by a cohesive rail proposal, the thesis will begin its transition to the *L* category. The select sites; including brownfields, greenfields, and extant town centers, will then be organized in a taxonomy, which through a composed set of parameters based on adjacencies and inherent



Figure 3.06 Town Centers for Urban Densification
 Catalog by Author, images from www.bing.com/maps

qualities, will commence a comparative analysis of the site characteristics. Site components including; heavy rail connection, light rail connection, metro connection, waterfront location, existing retail, vicinity to city center, vicinity to a co / trigeneration plant capable of supplying

electricity, heating, and cooling, amount of 'there' there, and opportunity for site regeneration as part of a larger socially-responsible agenda, will collectively distill the plethora of plausible site locations for master plan production.

From its inception, it is the goal of the thesis to take on a substantial challenge, which holds the potential to enact a grand transformation of site and of ecological consciousness. Drawing reference to the precedent of Hammarby Sjöstad, in which a polluting brownfield location was converted into one of the most internationally renowned examples of sustainable neighborhood development, the course of this thesis will confront comparable site situations. The three contexts designated for further prototype design development and ultimately distillation to one site are that of Wagner's Point, Westport, and Breckenridge.

Wagner's Point is located at the mouth of the Patuxent River, just south of downtown Baltimore. Its current industrial location is a remnant condition of its historic port situation, as



Figure 3.08 Wagner's Point
www.google.com/maps

the establishment of the railroad system provided a more efficient means to transport its chemical products. Although the site is partly still industrially-active, environmental concerns for the Chesapeake Bay and the current shrinking condition of Baltimore's industrial condition will predictably mark the end of its operation. Following soil remediation, its prime waterfront condition will serve as a catalyst for development for the growing urban population.

Westport presents its own unique site opportunities. Presently a vacant a post-industrial brownfield, it is located immediately to the south of M & T Bank Stadium and Camden Yards. Recent

demolitions on the site have left behind a blank slate of impervious surface with an existing connection to the Baltimore Light Rail towards the southern extent of the site. As a resultant situation of these conditions, not only would it be a site that would be easily connected, but conceptually, it could be conceived as an extension to the downtown fabric of Baltimore.



Figure 3.09 Westport
www.google.com/maps

In addition to its waterfront locale, it also includes on site, the waste to energy plant visible from I-95. This provides not only a precedent for the site's innate capacity for visual awareness, but

more importantly, the plant itself will be able to be tied into the new development, localizing the source of its cogeneration of electricity and heating.

While its waterfront presence is comparable to that of the Inner Harbor; the barrier condition of I-95 which bisects the site through the middle, thus altering the connection between the two halves. The site is then separated once more from its connection to the City by the overpass of the off-ramp to Martin Luther King Jr. Boulevard which bifurcates the parking lot of the two stadiums. These conditions will present unique design challenges, particularly in the ways that the application of the linear nature of the system could act as a virtual fabric to knit the disparate halves of the city back together.

The third potential brownfield site for selection; Breckenridge is located the furthest from the city core of the three sites studied. It is nestled between the Port of Dundalk to the north and the former site of Bethlehem Steel, Sparrows Point. The southeastern edge of the site is bounded by

the Baltimore Beltway just prior to its ramping up to traverse the Francis Scott Key Bridge.

Due to its industrial surrounds, and adjacent port opportunity it is possible that rather than dedicating it wholly to a residential and retail master plan, it could be developed as a movement towards the re-introduction of industry in Baltimore. Instead of heavy, polluting industry, the thesis proposal would investigate the

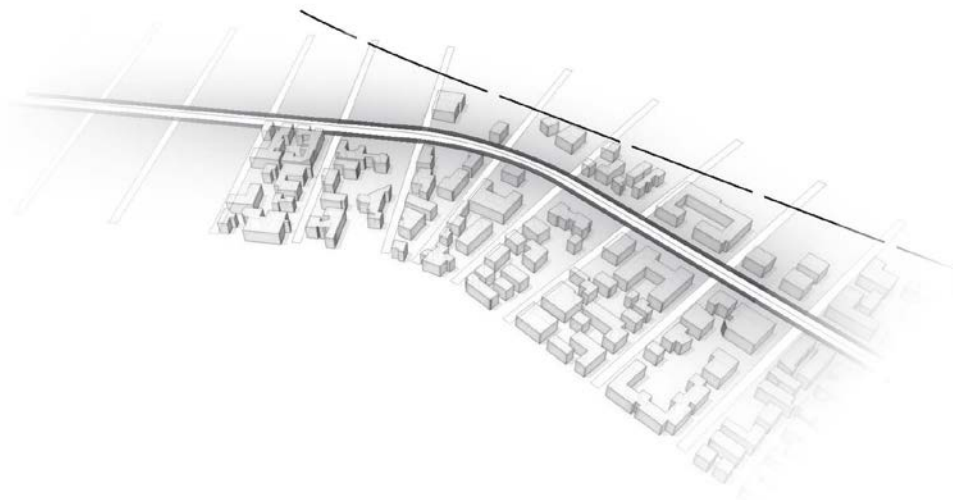


Figure 3.10 Breckenridge
www.google.com/maps

implementation of sustainable industries, such as factories that specialize in the fabrication of solar panels or fuel cells. The added industry would effectively bring jobs back to the city, improving the conditions of the adjacent neighborhoods.

Chapter 4: Typology Tectonics

To begin the master plan design process, the distinct transit oriented development (TOD) models of the precedents will be extracted and distilled to their most basic elements. This process will establish typographical models, which can then be tested on site. In certain circumstances, a site's inherent form and existing rail conditions will dictate which model to apply; however in other cases, multiple typologies or combinations thereof may be plausible.



LA CIUDAD LINEAL | MADRID

Figure 4.01 La Ciudad Lineal Typology Model
Graphic by Author

The model of La Ciudad Lineal generates the first precedent TOD typology. This variety features a central multi-modal avenue with



Figure 4.02 Perpendicular Streets based on Walkability
Graphic by Author

often increases with adjacency to the centerline. The secondary streets nearly adhere to the five-minute, quarter-mile walkable dimension. In the case of Arturo Soria's linear city, the dimension is



Figure 4.03 500 Meter Dimension
Graphic by Author

actually a little less, as the 500-meter measurement that was established as the ideal width results in a 0.15 mile dimension on either side. Given its uniform and consistent formal structure, this typology possesses the ability to easily absorb extrinsic conditions ranging from major thoroughfares and right-of-ways to important sites and topographic features.

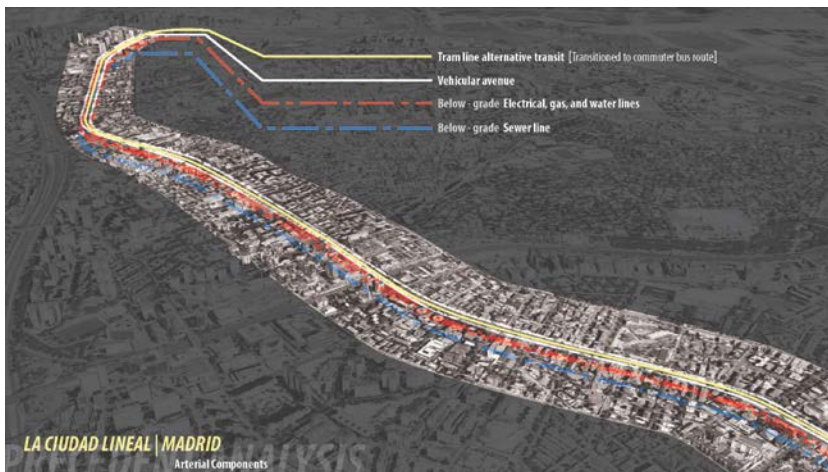


Figure 4.04 Catalog of Linear Systems
Graphic by Author

Common to all three typologies is the organizing avenue or spine that doubly serves to carry the development's transportation loads as well as its necessary infrastructures of electricity, heating, cooling, drinking water, and sewer. The point of divergence happens in each model's placement of this element in relation to the developed area.

The second precedent typology is based on Ørestad. It shares many of the same characteristics as the previous example; however its planned placement of the multi-modal thoroughfare along its edge differentiates it from the latter. This sets up opportunities for sites whose characteristics or outside variables may not support symmetrical development.

Another deviation from Soria's precedent is in the concentration of density. La Ciudad Lineal's regular diffusion of density is made possible by the consistency of secondary streets

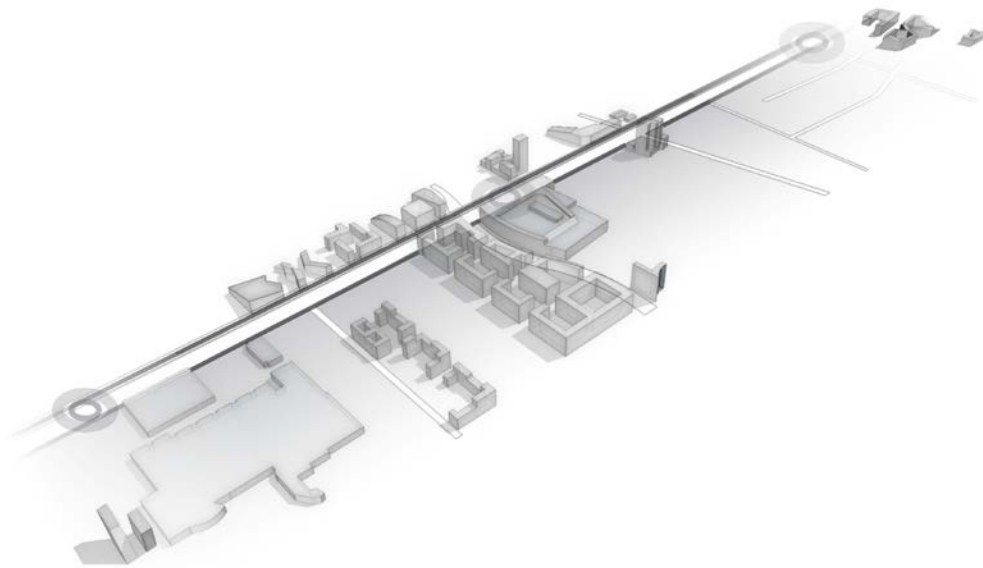


Figure 4.05 Ørestad Typology Model
Graphic by Author

that each have connection to the mode of public transportation. Ørestad's development only includes three of these connection points, so as expected the built-form concentration is greater with closer proximity to the stations.

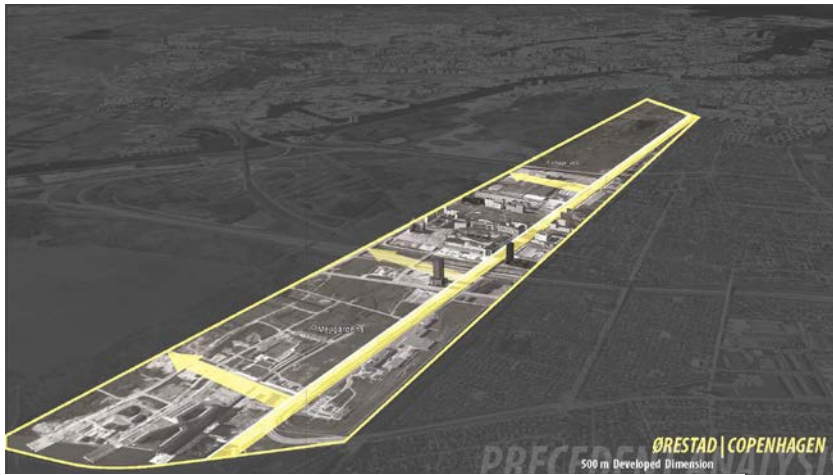


Figure 4.06 Single-Loaded 500 Meter Dimension
Graphic by Author

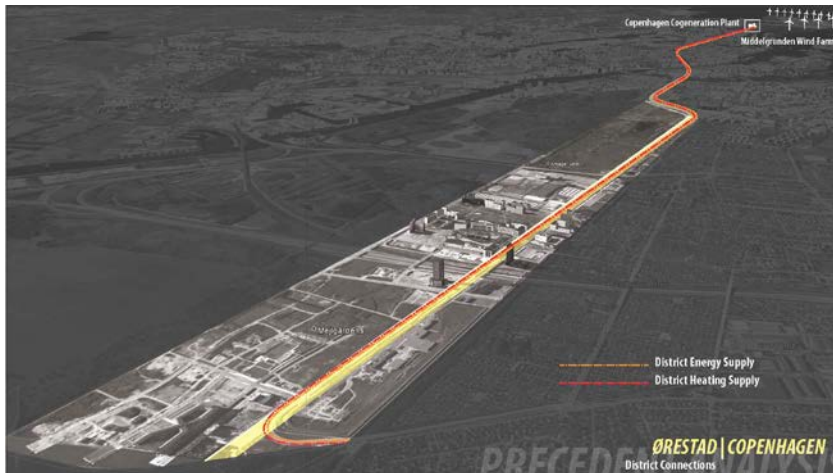


Figure 4.07 Connection to District Systems
Graphic by Author

As a result, Ørestad's typological model presents greater flexibility in the placement of subservient streets, granting the capacity to connect to neighboring roads, and establishing local identities along the length of the spine. This

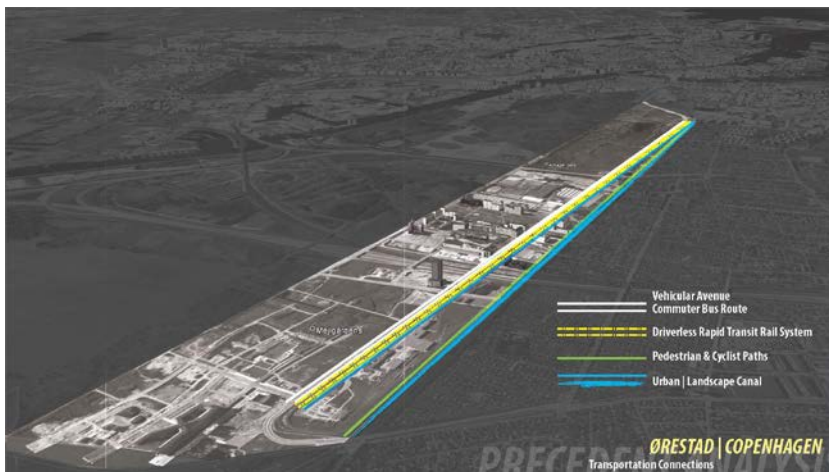


Figure 4.08 Multi-modal Connections
Graphic by Author

also facilitates the efficiency of the light rail metro that connects the development to the city. Less stops equals reduced travel time for commuters going into work, increasing ridership and decreasing the perceived necessity for personal transportation. To augment this, Ørestad's avenue offers transit redundancy, adding local bus routes that operate between the stations and

neighboring developments thus permitting connectivity of the supported spread of density.

The third and final current extracted typology is derived from Hammarby Sjöstad. In this model, the defining multi-modal thoroughfare is designed to optimize the found site geometry into effective TOD dimensions. This results in a more organic realization of its form in contrast to the largely straight-line previous examples. Due to the non-uniformity of the avenue, the dimension between the centerline and the extent of



Figure 4.09 Hammarby Sjöstad Typology Model
Graphic by Author

HAMMARBY SJÖSTAD | SWEDEN

development oscillates. In this example, the dimension more closely adheres to the quarter-mile walk in the zone between the avenue and the waterfront, setting up both center and edge relationships.

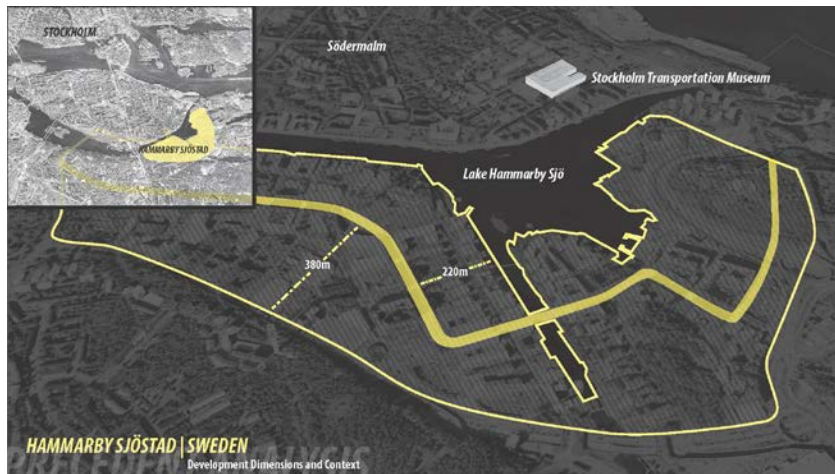


Figure 4.10 Placement of Avenue to Achieve TOD
Graphic by Author

Another digression is in the way that it self-contains the provisions for heating, cooling, water treatment, and electricity production.

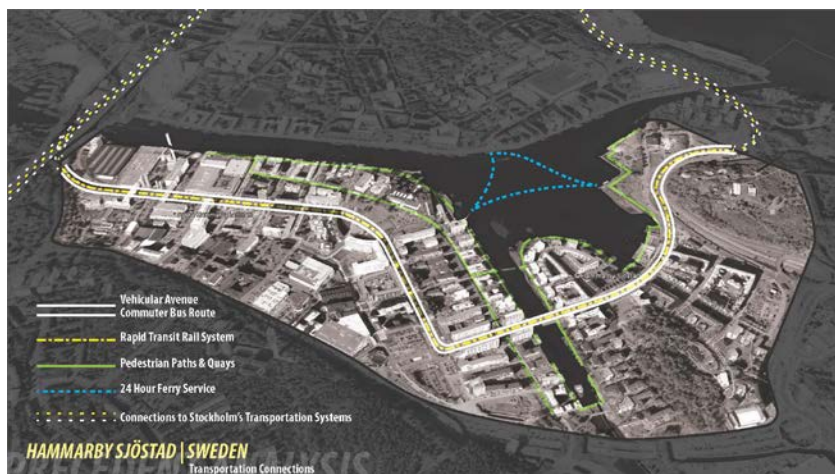


Figure 4.11 Transit Spine Components
Graphic by Author

The internal district systems have redundancy however, as they are still connected back to the Stockholm grid. This buttresses the natural fluctuations in electricity supply and demand inherent to any closed-loop system as delineated by the first law of thermodynamics. As waste production rises and falls, so does the capacity for waste-to-energy electricity generation. This model does possess the overlap found in the Ørestad model in the availability of transit options. An even spread of rail rapid transit metro stations are complimented by a bus route that follows the same path but offering more stopping points.



Figure 4.12 In-House Energy / Heat / Waste Treatment
Graphic by Author



Figure 4.13 Integrated Waste Collection
Graphic by Author

Chapter 5: Typological Parti Generation

In the parti production phase, the three sites of Westport, Breckenridge, and Wagner's Point are test-fitted through the juxtaposition of the preceding typologies in their individual contexts. This is first approached in the process of the thesis by the literal translation of the precedents onto the sites. This study will daylight possible site opportunities as well as provide a basis for the further understanding of each site's scale. This will also shed light onto the inherent capacity of

each location to engage the established walkable dimensions of transit-oriented developments.

As each of the three waterfront sites possesses differing configurations of developable space, these overlays will begin to demarcate and distill the most effectual areas for development based on the location of existing rail infrastructure. Land area remaining in the periphery could then be programmed for alternative uses ranging from waterfront amenities to bioremediation wetlands and natural edges.

In addition to observing each potential site through the lens of TOD, it will additionally be prudent to examine them as they relate to their waterfront location. The daily cycle of the currents, seasonal severe weather events, and the inevitable rise of the sea level over the next century will prompt special considerations in both the design of the architecture and in each site's inherent relationship with the water's edge. Typical waterfront development in Baltimore characteristically shored up its edges, lifting itself many feet above the water's edge. However, this

rarely offers increased connection to, or respect of, the water in relation to the site.

One such proposal for the latter was realized as a competition entry by New York architecture firm, Lewis Tsurumaki Lewis (LTL) for the New York Museum of Modern Art's *Rising Currents* exhibition. Their design for the competition's predetermined brownfield site involved extensive earthwork which both provided a capping method for the contaminated soil on site

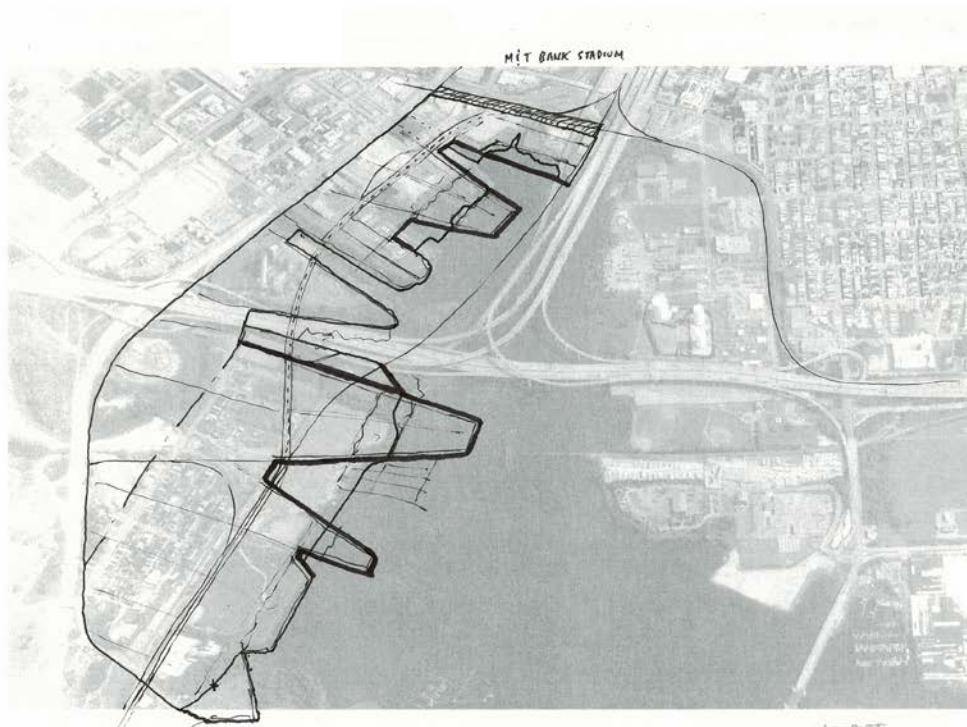


Figure 5.01 Westport Parti
Graphic by Author

as well as a basis for the augmentation of the length of the developable shoreline area.

The resulting landforms represent a series of fingers which drew precedent from the shipping ports on and around the site. Essentially, it was a borrowing and repurposing of features rather than a new concept for the site. The proposal provided an adaptive reuse, or an adaptive reimagining, so to speak, of the dock typology; transforming what was once a symbol of industrial prosperity into a new paradigm of opportunity.

This precedent and its land-shaping strategies are particularly relevant to the sites in Baltimore, as the selected post-industrial brownfields each contain existing port features, or physical remnants thereof. The implementation of this precedent site-shaping method has the application potential to occur on a variety scales depending on the individual geometry of each site. On the two narrow sites of Westport and Breckenridge, the finger-cutting approach could adapt in a similar fashion to the precedent, as an effective method to increase the amount of

developable waterfront property, as shown in the Westport Parti, figure 5.01. Applied to Wagner's Point however, it possesses the potential to be used as a tool to redefine the site's character entirely.

To demonstrate the implications of the latter realization, a to-scale drape of the plan of Hammarby Sjöstad has been overlaid onto the satellite view of Wagner's Point and Shoreline, as shown in figure 5.02. This method of establishing

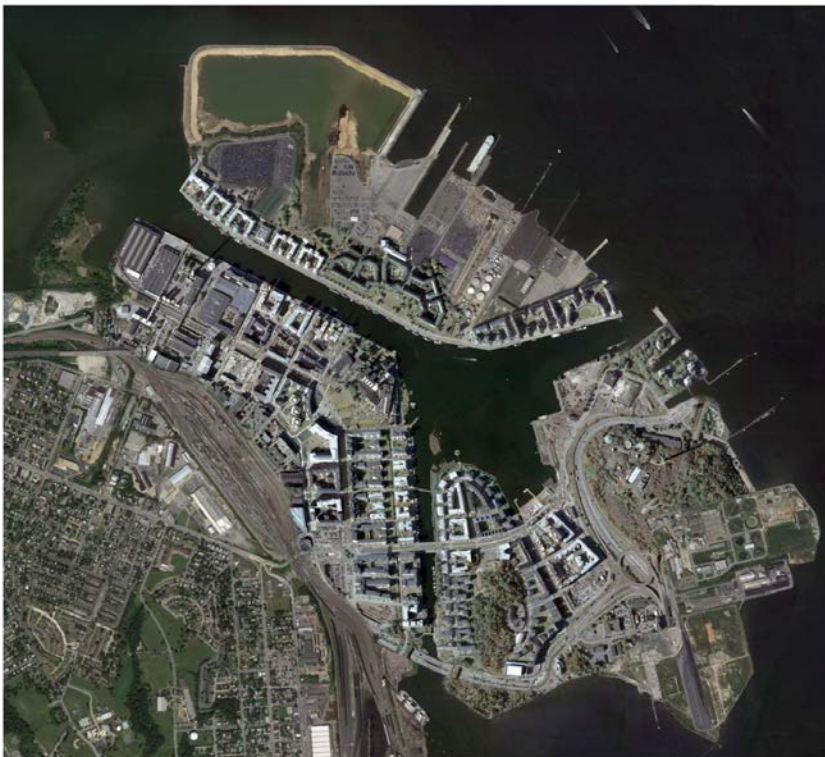


Figure 5.02 Hammarby Sjöstad | Wagner's Point Overlay Study
Graphic by Author, Images from www.bing.com/maps

the grounds for a parti, while rudimentary, begins to present the framework for new understandings of the site, both in scale, and in the formation of new speculative models for its future development potentials.

It initiates a thought process that proposes approaches for the division of the site into areas for differing land uses, ranging from housing and commercial functions to opportunities



Figure 5.03 Wagner's Point Cut and Fill Parti
Graphic by Author

for open space and wetland creation. The delineation between the two is further called out in figure 5.03, which abstracts this union of sites into

its basic massing. The responsiveness of the built typology in Hammarby Sjöstad to its topographical condition suggests similar deferences in Wagner's Point to site elements such as the Patapsco Wastewater Treatment Plant, the Curtis Bay train yard, and the BMW of North America yards in Shoreline.

In a similar manner, the internal extension

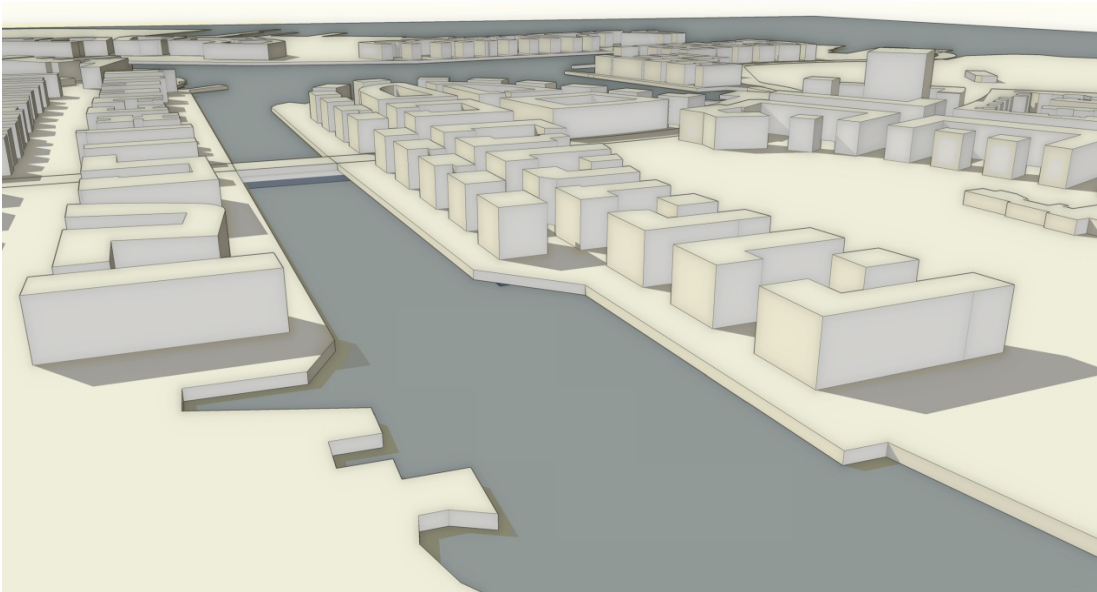


Figure 5.04 New Canal within Wagner's Point

Graphic by Author

of the Patapsco River advocates for the prospect of new canals and an interior bay within the site, building new opportunities for interaction with the water. This interior bay could be envisioned as a

new recreational centerpiece for the development, and/or as a proving ground for clean-up efforts within the Chesapeake Bay and the consequent reintroduction of an abundant diversity of marine wildlife.

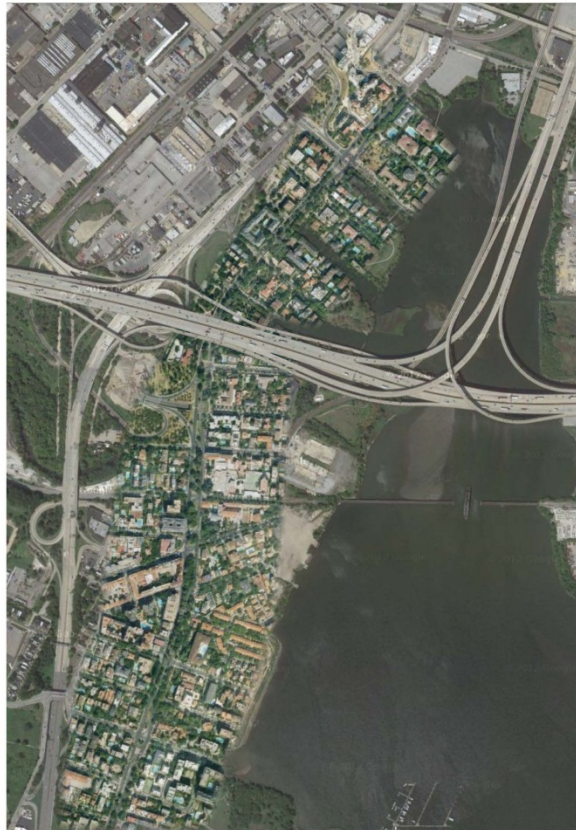


Figure 5.05 La Ciudad Lineal | Westport Overlay Study
Graphic by Author, Images from www.google.com/maps

Returning to Westport, a similar overlay comparison can be made, establishing its linear relationships to La Ciudad Lineal. This

juxtaposition is strengthened by the presence of Westport's existing rail which carries both CSX freight and Baltimore's light rail route. The current trajectory of this line carries it over the Patapsco in the area to the north of the I-95, I-395 interchange. The parti, as well as the overlay, propose the repositioning of this right of way along the centerline of the northern half of the site, offering one solution to the adaptation of the site for TOD potential based on the 500 meter walkability dimension. Similarly to the previous, the blending of the precedent and the found condition of Westport begins to delineate areas for recreational and ecological opportunity outside of the development area

This opportunity for the application of Soria's model is further strengthened by Westport's linear yet bending form and overall slim proportion. Examining this context at an additional layer of detail, the site has similar potential to develop a comparable sustainability model to that of Hammarby Sjöstad. Hammarby's main asset, in the context of this thesis, is its mode of handling

all of its tri-generation, wastewater treatment, and biogas production essentially in-house. It is still connected back to the district infrastructure of the city of Stockholm; however this is only to handle the natural fluxes in the synergetic system's operation. Westport presents a similar opportunity

Baltimore Refuse Energy Systems Company
OPERATIONS OVERVIEW

Year	Total Refuse Processed (tons)	Ferrous Metals Extracted	Total Steam Generated (lbs)	Total Electricity Produced (MWH)
1999	716,274	18,296	4,414,983	284,023
2000	667,004	11,551	4,175,843	302,964
2001	736,192	10,906	4,406,765	296,230
2002	668,669	10,127	4,260,720	260,481
2003	658,002	7,385	4,914,888	270,658
2004	635,655	12,923	4,158,968	279,055
2005	634,335	13,842	4,161,778	336,167
2006	670,989	8,202	4,424,030	345,533
2007	657,404	7,939	4,375,435	333,782
2008	688,800	7,240	4,516,057	365,678

AVERAGES 673,332 10,841 4,380,947 307,457

FULL PLANT CAPACITY

Waste Processing (per day)	(per year)
2,250 tons	821,250 tons
Steam Generation (per hour)	(per year)
500,000 lbs	4,380,000,000 lbs
300,000 lbs per hour to Trigen <small>BALTIMORE'S DISTRICT HEATING SUPPLIER</small>	
Electricity Generation (per hour)	(per year)
60 MW*	525,600 MW
* The equivalent of supplying the electrical needs of 68,000 homes	

Figure 5.06 BRESKO Operations Overview

Charts by Author, Data from www.wheelabratortechologies.com

in the fact that it has, as was touched upon earlier, an existing, functioning waste to energy plant which is active in the engagement of the city's commuters. Perhaps though, one of the interesting finds in the course of research is that this plant is operating at only around 60% of its capacity.

Outlined in Figure 5.06 are the plant's operating numbers from 1999 to 2008 from the Baltimore Refuse Energy Systems Company's (BRESCO) website. Collected in the chart to the left are the averages of some of the key inputs and

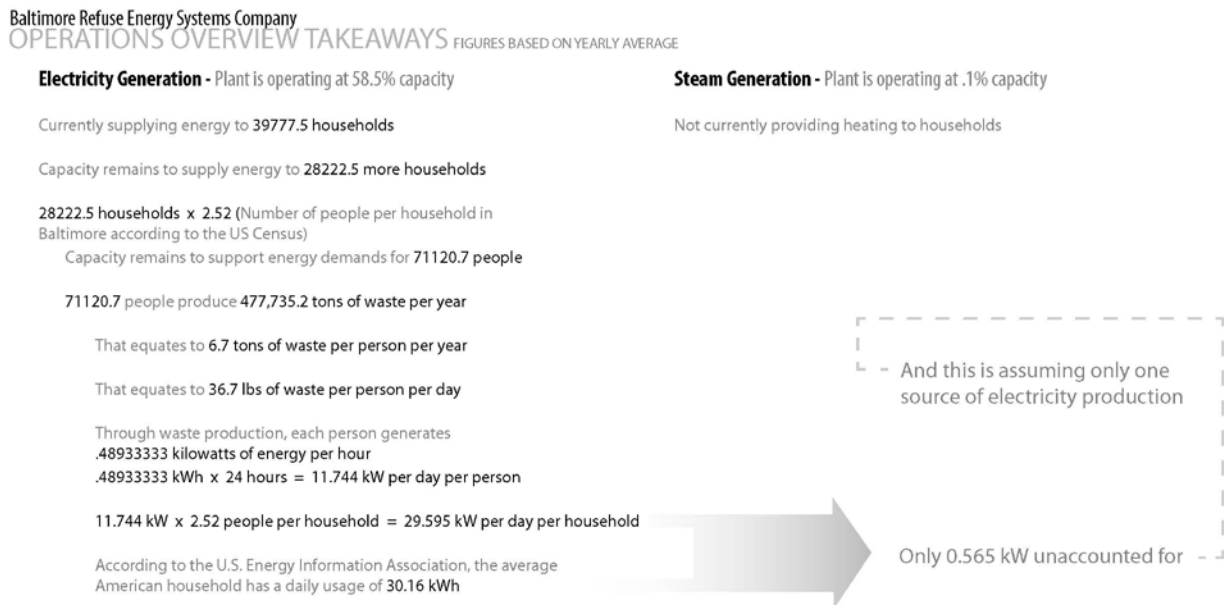


Figure 5.07 BRESCO Operations Takeaways
 Chart by Author, Information from US Census Bureau

outputs inherent to the plant's process, including; the annual quantity of refuse processed, and the production amounts of energy, heating, and recycled metals extracted. The line items on the right of the graphic outline the quantities that could be produced were the plant operating at its designed capacity.

Through a study of the difference between the existing and allowed plant operation figures, it is found that there are just over 40 percent of the plant's potential resources unutilized. Based on these figures, it can be calculated that this waste to energy plant is currently supplying electricity to nearly 40,000 households, leaving the potential to supply an additional 28, 225. This equates to roughly 71,120 people based upon the Baltimore region's census data. This dataset also includes the average amount of waste produced per person per day. One of the most interesting lessons learned from the conclusion of this research is the fact that the average American household nearly generates enough refuse to power itself.

What this means for Westport is, not only is there an active waste to energy production source on site, but due to its available capacity, it provides the necessary potential for the establishment of density. Additionally, its juxtaposition to the right of way of the rail sets up an interesting potential for a dynamic give and

take relationship that is not unlike the condition of Hammarby Sjöstad.

Similarly in this context it could be imagined that the multimodal avenue of the Westport parti proposal could act as the delivery medium between the residents and the plant itself. This could then remove the constraint of having to design Westport's new urban fabric with the trash and recycling truck in mind. This could open up new possibilities for spatial interaction as well as the reduction of litter within the designed development.

Enacting a parallel overlay analysis of the site of Breckenridge introduces the framework for a theoretical parti based on the plan of Ørestad. An existing rail extending south from the Port of Dundalk currently delineates the eastern extent of the site. To its east, the development of Turner Station presents a mixture of duplexes and 2-3 story rowhomes. Respecting the presence of this existing neighborhood, the rail-access right of way sets the stage for a single-loaded condition for the proposed multi-modal transit spine on the site.

Due to the still infantile state of development in Ørestad, two different approaches to density based on this model can be extracted. Graphically represented by figure 5.05, the two conditions are put forth by the urban development

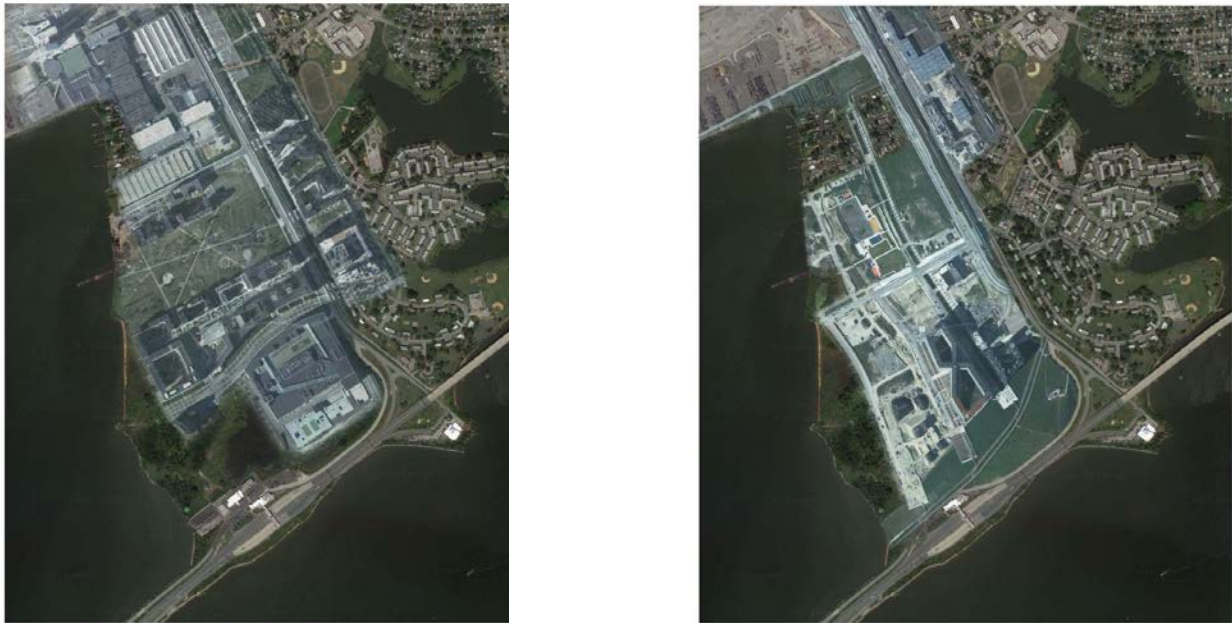


Figure 5.08 Ørestad & Vestamager | Breckenridge Overlay Study

Graphics by Author, Images from www.bing.com/maps

patterns of the Ørestad Center and Vestamager stations. Ørestad Center presents a similar characteristic to the model of La Ciudad Lineal in the fact that it is organized by a series of evenly densified streets oriented perpendicular to its infrastructural datum.

Less than a mile to the south, Vestamager breaks this tradition, organizing development via a superblock mentality in which each block is comprised of a single mixed use commercial and residential entity. For further contrast, the orientation of the superblocks is parallel to the right of way, instead setting up a perpendicular relationship to a manmade lake at the southern end of the development.

The overlay of these two conditions on the brownfield of Breckenridge begins to allocate potential strategies for development in relation to I-695, which resolutely defines the lower edge of the site and sets up a hierarchical site relationship with the Francis Scott Key Bridge. Ørestad Center, in both Breckenridge and the municipality of Ørestad, mediates this condition with a grand public program, unconstrained by the noise levels of the nearby traffic.

Vestamager takes a more ecological approach, achieving the separation through a vegetated waterfront edge. This could be further conceived as an implementation of the concept of

carving and shaping the existing topography
enacting new interactions between the site, the
water, and the individuals who will work and live
there.

Chapter 6: Program Tabulation

[XL] Regional Masterplan

- Implementation of infrastructural connections adaptively repurposing existing heavy rail right-of-ways as a network of symbiotic veins linking opportunity brownfield and greenfield sites which will serve as the new centers of development.
- Introduction of a rail rapid transit system servicing the region encompassing the metropolitan districts of Washington, DC and Baltimore, MD
- Extension of current rail to existing town centers to establish necessary ridership and reduce dependency on personal transportation
 - Continuation of Washington, DC Purple Line proposal establishing a transit beltway around the city
 - Line connecting Silver Spring MARC and Metro hub to Laurel, including stops in Fairland and Burtonsville
 - Extension off of the MARC Penn Line, diverging at Odenton, connecting to Glen Burnie and a series of brownfields, and crossing the inlet of the Patapsco via the Francis Scott Key Bridge in order to complete the Baltimore transit beltway
 - Connection of Columbia to the MARC Camden Line

[L] Westport Neighborhood District Design Total Land Area: 250 ac.

- Development of a scheme that proposes a medium density mixed use neighborhood, which respects and connects with the existing town of Westport, accommodates for future sea level rise, as well as integrates itself with the multimodal infrastructural spine.

[S] Building Design

- Advancement of the conceptualization of a typology that better responds to and works in tandem with the network synergy of the regional system as well as the TOD strategy

Westport Community Centre	% of Program
- Regional Transit Station	10
- Local Transit Station	5
- Market	35
- Pyrolysis Cogeneration Plant	10
- Pier Side Waterfront Amenity	15
- Exhibition Program Space	15
- Flexible Program Space	10

Chapter 7: Westport Introduction

Of the three sites analyzed in the previous chapters, Westport was selected as the site to develop for the design district [L] scale of the thesis. Westport exhibits the potential for the integration of elements from all three of the precedents analyzed. Relating to La Ciudad Lineal, the given dimension between the shoreline of Westport and the existing transit spine is nearly identical to Soria y Mata's proposal.

At the same time, the site offers correlation to the Ørestad scenario, as one side of the development; the current town of Westport is already constructed. This sets up unique prospects for the proposed urban fabric to act strategically in the dialogue that it has with the existing neighborhood. The found topographical conditions present challenges as well as design opportunities in the ways that the old and the new become a cohesive whole.

The town of Westport exists on a slope, ramping up from the low-lying portions of the brownfield site to +86 feet at the southwestern

edge, adjacent to the I-295 corridor. Between the existing town and the location of the proposed development the topography steps down three times to provide different elevations for the light rail, heavy rail, and Wenburn Street; which provides access to the site from the south. It is interesting to note that even though the site is within two miles of Baltimore's downtown and situated immediately adjacent to interstate 95, it has very few vehicular entry and exit points.

Baltimore's light rail system has a station in the center of Westport, however its inclusion has not had a noticeable effect on the development itself.

Relating to the precedent of Hammarby Sjöstad, the existing BRESCO cogeneration plant and the aforementioned study of its latent capacity set up a unique juxtaposition between the new Westport development and a viable source of district connections. Furthermore, the trajectory of the existing light rail would only require minimal re-aligning to be reinstated as the right-of-way conduit that connects the two.

Delving into the history of the site through reveals many layers of past programmatic uses. Originally a tract of marshy farmland, Westport evolved into a destination location, including waterfront restaurants, pleasure piers, and hotels, for area residents as it provided ample waterfront access in a close vicinity to the downtown. At the same time, its low topography effectively separates the experience of Westport from that of Baltimore, allowing it to be its own unique area. This awareness of the site's independence can still be felt to this day, suggesting that further development on the site be of a different pattern than that of the rest of the city.

The Industrial Revolution greatly reshaped the fabric of the site, transforming the thriving waterfront amenity into an industrial center. At its peak, Westport's waterfront industry boasted Baltimore Gas and Electric's initial coal-fired power plant and substation, the Lowrey Glass Factory, as well as numerous other warehouses and manufacturing sites. During this period of

time, the neighborhood of Westport became a residency for the industrial workers.

After a period of decline in industry, the site was scheduled for TIF - funded redevelopment into a bustling mixed-use development. Phase 1 of the proposal included the removal of the site's industrial buildings, soil remediation, and the implementation of numerous acres of wetlands. Unfortunately, the beginning of the project coincided with the great recession of 2008, and site demolition was the only stage of the project that was realized.

The site today bears no resemblance to the phases of development which preceded it. Decades of physical separation from the city, and the flight of the industry which historically provided jobs to the area's residents, have driven Westport proper into a gradual state of decline. The waterfront site exists now as a blank slate.

site analysis



westport

sybiosis

Figure 7.01 Westport 2002

Graphic by Author, Underlay from Google Earth

site analysis



westport

sybiosis

Figure 7.02 Westport 2013

Graphic by Author, Underlay from Google Earth

Chapter 8: Westport Urbanistic Approach

The approach to the urbanistic intervention in Westport begins with an examination of the cataloging exercise from earlier at the localized scale of the site. From these overlays, it is possible to enact a series of infrastructural design interventions to cohesively connect the found elements on the site into a clear working diagram.

Figures 8.01 to 8.03 depict the first intervention, the re-routing of a portion of Baltimore's Light Rail to set up a TOD dimension of walkability in the area of the site that is north of I-95. This would conceivably offer a new connection to the proposed casino site and transit bus terminal at Warner Street. This adaptation of the transit route would also establish the aforementioned connection to the BRESKO plant that would permit Westport to actively engage the district heating and energy production potential of the plant.

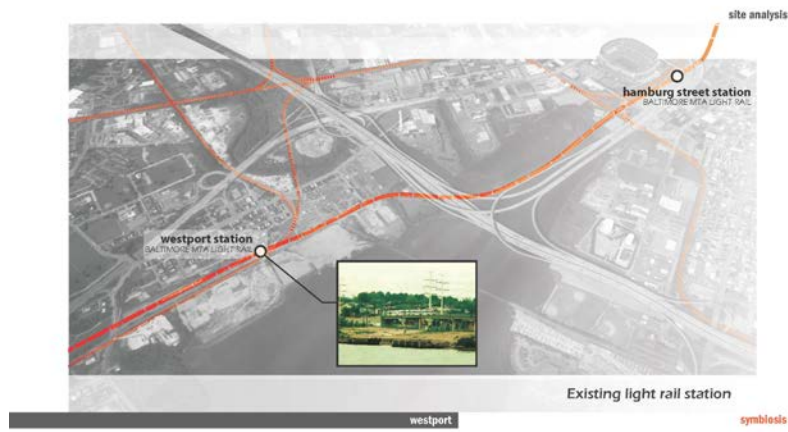


Figure 8.01 Existing Westport Station Callout
 Graphic by Author, Images from Google Earth, Wikimedia Commons

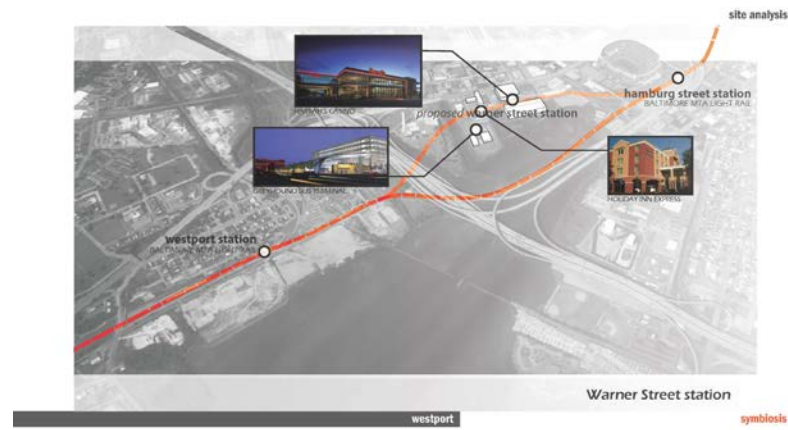


Figure 8.02 Proposed Light Rail Re-routing | Warner Street Station
 Graphic by Author, Image from Google Earth, Wikimedia Commons



Figure 8.03 Waste to Energy Plant Connection to Spine
 Graphic by Author, Images from Google Earth

Given the site's waterfront location, the development will be subject to flooding and also to the inevitable effects of sea level rise. Figures 8.04 and 8.05 graphically depict the amount of shoreline loss that will occur, given the current projections. While the two foot rise expected for 2050 will only minimally affect the site, the four foot projected rise by 2100 begins to have a significant impact on the integrity of the shoreline. The latter graphic depicts the worse-case scenario; based on the hypothesis that global warming will cause the polar ice caps to melt by the beginning of the next century.

One interesting discovery from the course of the analysis of the site is that during hurricanes and other natural flooding events, the Gwynn's Falls River poses more of a threat to the site than the storm surge, causing Westport to flood from the back. This is due in part to the landfilling of the northern part of the site to prepare for the construction of I-95.



Figure 8.04 2050: Projected 2' Sea Level Rise
 Graphic by Author, Underlay from Google Earth



Figure 8.05 2100: Projected 4' Sea Level Rise – Rapid Ice Melt Scenario
 Graphic by Author, Underlay from Google Earth

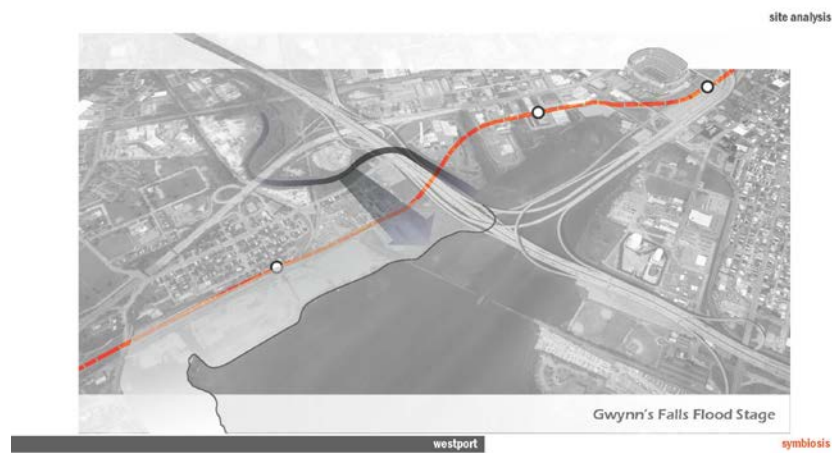


Figure 8.06 Gwynn's Falls Flood Stage
 Graphic by Author, Underlay from Google Earth

In order to mitigate and prepare for the effects of flooding on the site, the existing waterfront site is carved into a series of 'urban piers'. The canals which separate them extend into the site, physically bringing the waterfront to the residents of the existing town of Westport. This move serves multiple purposes. First, it allows for a cut and fill approach to begin the soil remediation of the site. The excavated earth is then used to increase the elevation of the buildable surface, lifting it out of the flood plain.

The augmented length of the shoreline increases the amount of developable waterfront area, while simultaneously acting as a means to knit the new fabric to the old. To further support this new connection, the adjusted proximity of the water would provide an increased land value to the existing town laying the framework for future redevelopment.

The canals are then widened to the east permitting boat parking along the new pier edges. This doubly serves to allow for wetland plantings

along the southern edges of the piers to aid in the mitigation of any storm water runoff from the site. To reconcile the potential for flooding in the northern extent of the site from the Gwynn's Falls River, a spillway is proposed to capture the storm surge and filter it before it reaches the Middle Branch and enters the Bay.

In the southern portion of the site, a plinth is proposed to serve as a mediator between the elevated topography of the current town and the new development. This would allow the new urban fabric to be constructed above the regional connector rail, effectively removing the cliff face that presently divides Westport from its waterfront. The plinth then facilitates the change in elevation from the multimodal spine down to the 13 foot elevation of the pier at the water's edge. The volume beneath the plinth could then be used to satisfy the parking requirements of the new development.

Following the earthworks interventions, a set of orientation setbacks are applied to the piers in order to begin to define the types of activities

that will take place in the new development. Along the southern pier edges, a 40 foot setback is implemented to accommodate outdoor café and restaurant seating, as well as vehicular, bicycle, and pedestrian paths. Along the east facing edges, a 60 foot setback is imposed, allowing for ample public amenity down by the water's edge. The northern edges receive a smaller setback of only 20 feet due to the minimal solar exposure that these areas will receive. The 20 foot dimension covers the lane access requirements for fire trucks and allows for a continuation of the pedestrian waterfront promenade. The manifestation of these principles as designed into an urban scheme is depicted in the Figure 8.19 site aerial.



Figure 8.07 Westport Infrastructural Master Plan
Graphic by Author, Underlay from Google Maps



Figure 8.08 Build-to Boundary
Graphic by Author, Underlay from Google Maps

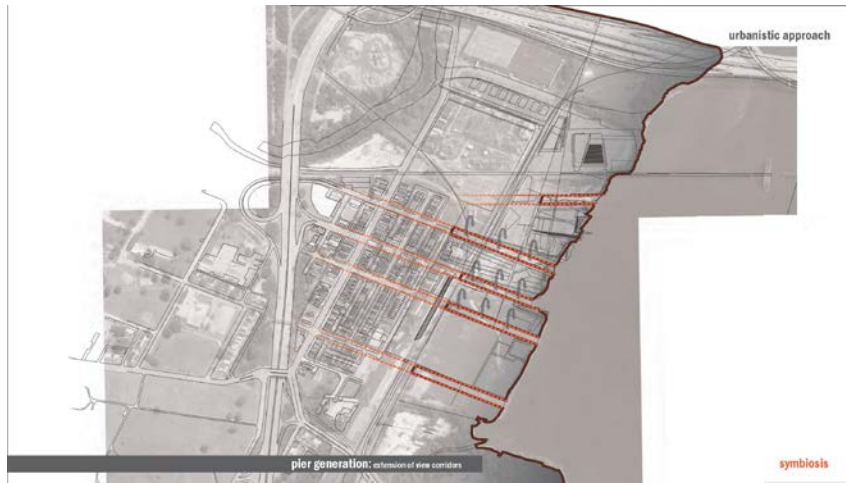


Figure 8.09 Cut & Fill Carving Out of Urban Piers
Graphic by Author, Underlay from Google Maps

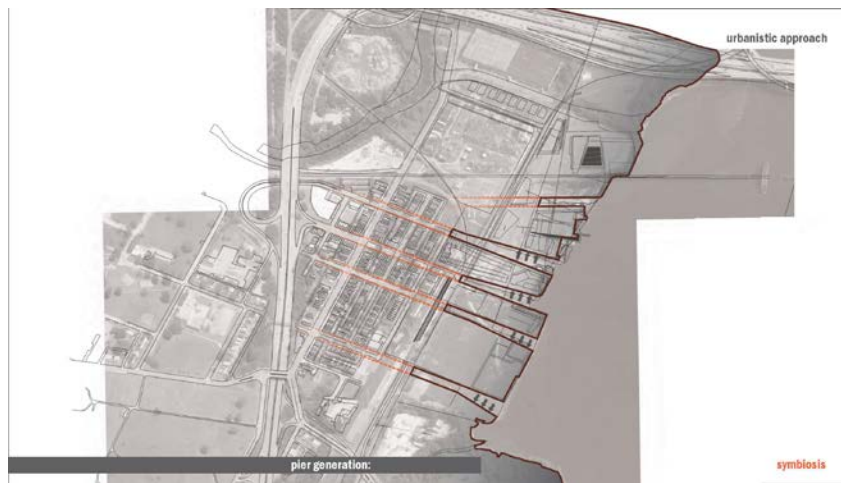


Figure 8.10 Widening of Canals to Accommodate Boat Parking
Graphic by Author, Underlay from Google Maps

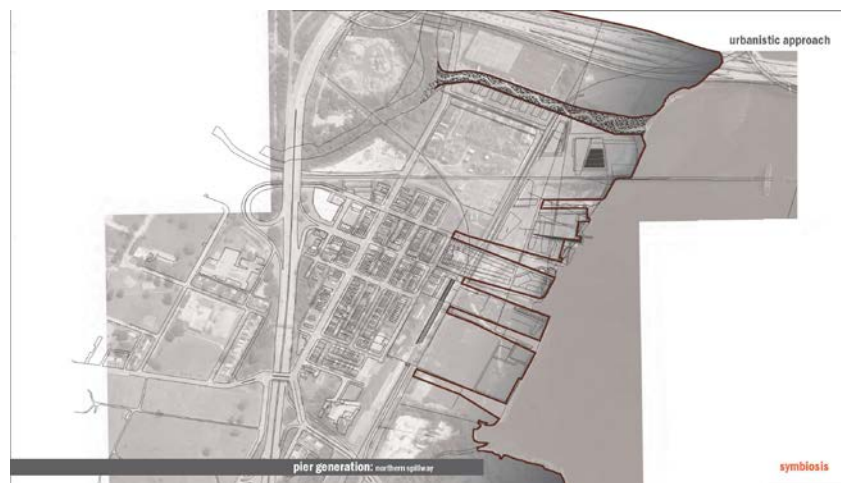


Figure 8.11 Northern Spillway to Control Flooding
Graphic by Author, Underlay from Google Maps

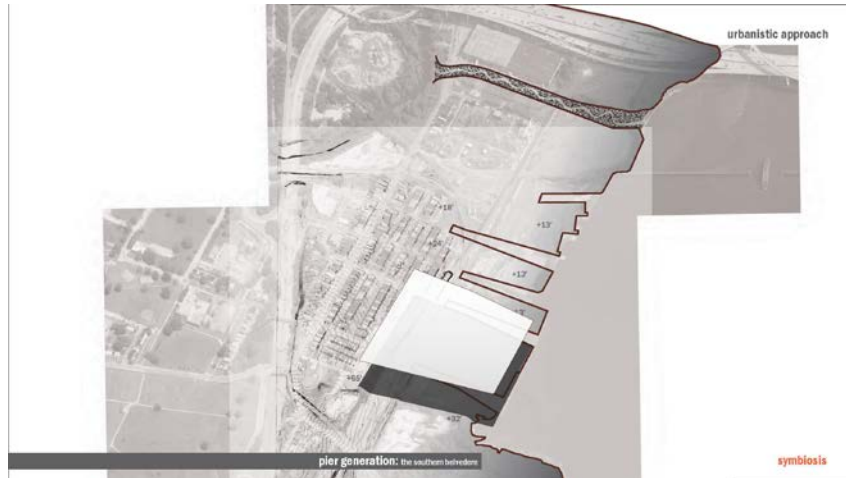


Figure 8.12 Proposed Southern Plinth
Graphic by Author, Underlay from Google Maps

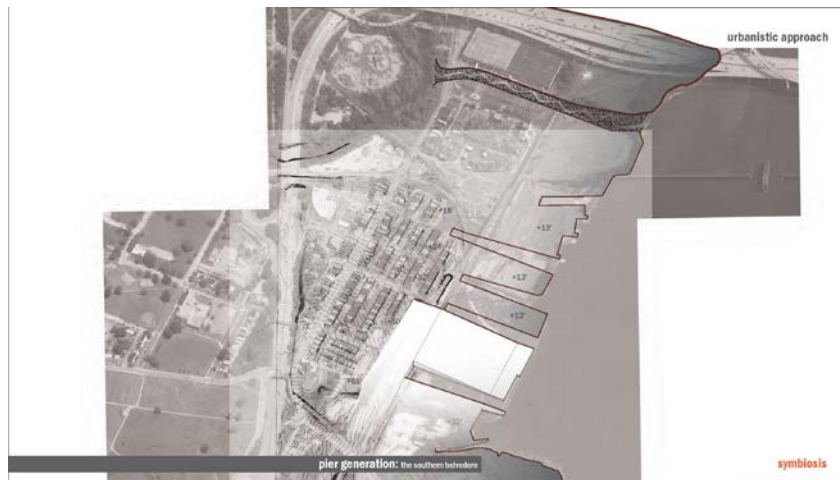


Figure 8.13 Plinth as Mediator of Elevation Between Old and New
Graphic by Author, Underlay from Google Maps



Figure 8.14 Parking Beneath Plinth
Graphic by Author, Underlay from Google Maps

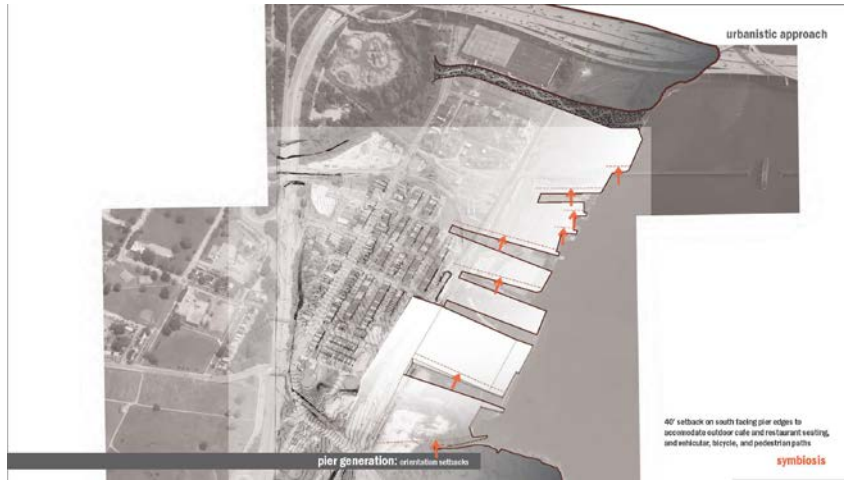


Figure 8.15 40' Setback to South
 Graphic by Author, Underlay from Google Maps

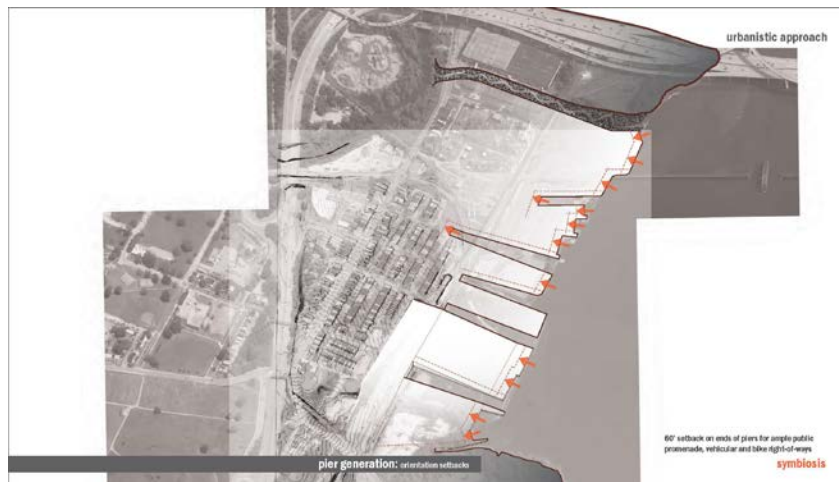


Figure 8.16 60' Setback from Waterfront
 Graphic by Author, Underlay from Google Maps



Figure 8.17 Local Rail at New Ground Plane | Regional Rail Below
 Graphic by Author, Underlay from Google Maps

urbanistic approach



regional site plan

symbiosis

Figure 8.18 Regional Site Plan
Graphic by Author, Underlay from Google Maps

urbanistic approach



site aerial

symbiosis

Figure 8.19 Site Aerial
Graphic by Author, Underlay from Google Earth

Chapter 9: Westport Community Centre

The final constituent of the thesis is the [S] scale, in the form of a building that brings the concepts of the larger system down to a localized demonstrative understanding so that awareness can be spread to all who frequent it. It was also the intent of the building to begin to act as a timeline of the history of the waterfront on which it sits. In doing so, the design seeks to layer in the elements of waterfront amenity, calling back to Westport's past as a destination location, while also implementing a new form of industrial integration that allows the building to play a larger role in the overall system.

Figure 9.01 depicts in a diagrammatic sequence the generation of the form of the building. Beginning with the site pier, the orientation setbacks from the previous chapter are overlaid to establish the buildable area. The site's perpendicular attachment to the multimodal spine then sets up the entrance to the building coincident with the location of the connection between the local and regional rail stations. One

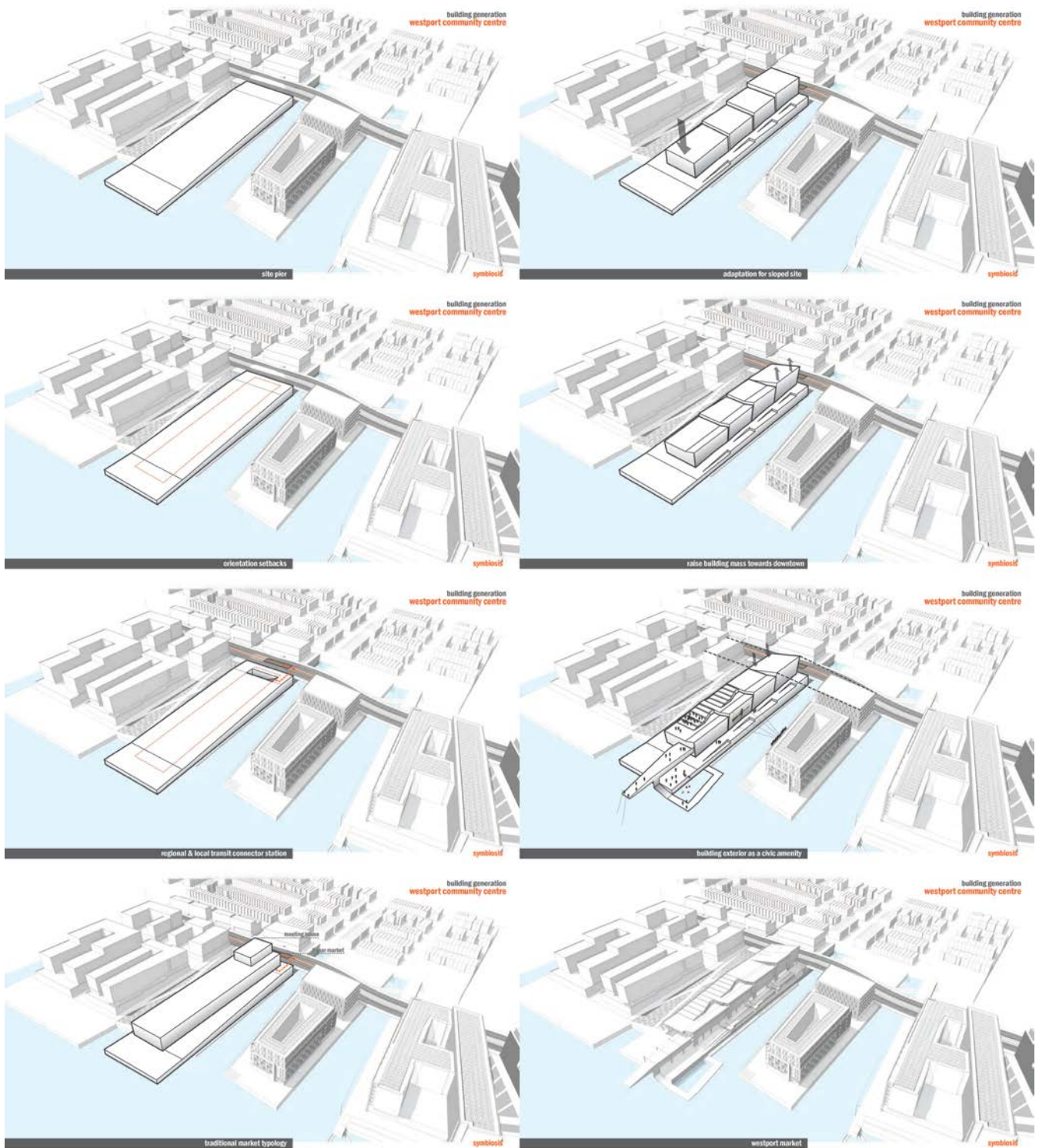


Figure 9.01 Westport Community Centre - Form Generation
 Graphic by Author

of the main constituents of the program is a market which will serve as a new anchor of activity for the development. Superimposing the traditional market typology of a linear market with a meetinghouse onto the gradually sloping site, the building form is segmented into a repetitious series of elements. These elements step down along the length of the pier, transitioning from the height of the neighborhood, down to a cantilevered fishing pier and barge pool at the eastern edge.

The elevation of the northern façade of the building is then raised, elevating itself as a nod to the downtown. This also provides the space for solar photovoltaics and solar hot water production on the roof plane. The exterior of the building is envisioned as a civic amenity, providing opportunities for swimming, fishing, façade movie projection, and waterfront dining. The waterfront terminus of the building also boasts a boating centre; providing kayak rentals, sailboat rides, and a station connection to the Baltimore Water Taxi. The roof of the building plays into this dialogue offering a venue for harbor concerts with a

dramatic backdrop of the Hanover Street Bridge and views back to the downtown. Along the southern façade, large bi-fold doors allow the market to open up onto the neighboring park, facilitating areas for outdoor dining and shopping.

Within the building, a new integrated programmatic dialogue unfolds. Annually, markets are responsible for discarding mass quantities of food. While the conscientious solution would be to donate this surplus to charitable organizations, the misdirected fear of legal ramifications as a result of doing so (should the food make someone sick), typically warrants the disposal of the food.

To propose an alternative, the Westport Community Centre market, which acts as the hub of activity in the new neighborhood, is connected to a pyrolysis cogeneration plant. Pyrolysis is an existing process, currently utilized to produce charcoal. Its applications for cogeneration are only recently being discovered. The major improvement comes with the fact that this process doesn't utilize an incinerator, but rather a high temperature oven. By removing the flame from

the equation, much of the off-gassing from the combustion process is removed. The gases that are produced can be further refined into biofuel, and used within Westport as fuel for local transit buses.

In this model, the waste food is burned in exchange for the generation of electricity and heating in the form of steam. This production is then used to meet both the energy and heating demands of the Community Centre. Any surplus is then injected back into the district system, to satisfy the demands of the surrounding neighborhood.

Along the main hall of the market, this symbiotic relationship is on display. The cogeneration plant suspended above the entrance lobby begins the conversation of integration in the program. Vacuum tubes run the length of the center aisle, connecting the program to the pyrolysis machine and allowing visitors to witness the system in action while shopping in the market. This dialogue of system integration then extends outside of the building with a connection to the

local rail station. In this instance, the center three supports of the station pavilion double as the stacks that exhaust the steam from the electricity generation process. Attached to the infrastructural spine, this element serves as a testament to the sustainability of the system and the reduction in greenhouse gasses as a result. Adjacent to it, on the second floor of the Community Centre, an interactive theatre and visual model further the education of the system and teaches the citizens of Westport how they can change their daily habits to live more sustainably.



pier side pavilion - daytime rendering

westport community centre

symbiosis

Figure 9.02 Pier Side Pavilion – Daytime Rendering
Graphic by Author

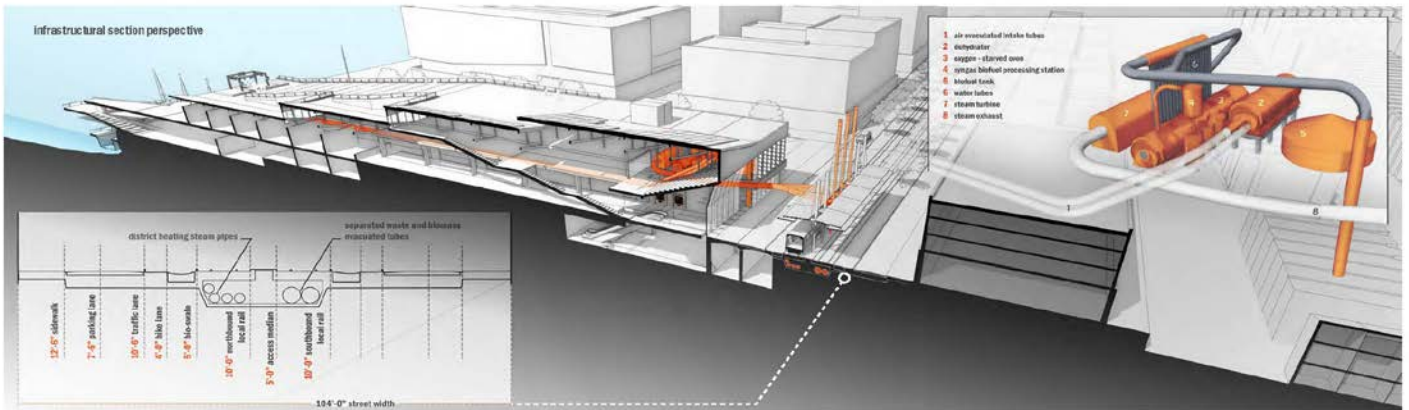


pier side pavilion - night rendering

westport community centre

symbiosis

Figure 9.03 Pier Side Pavilion – Night Rendering
Graphic by Author

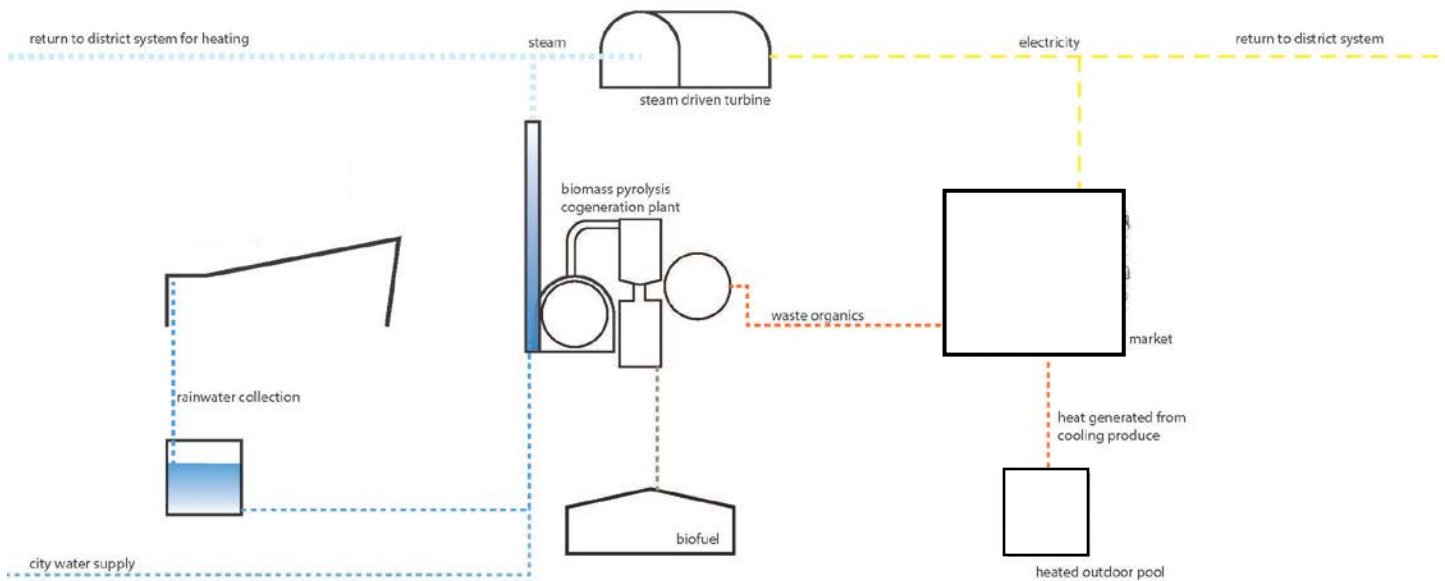


westport community centre

sympiosis

Figure 9.04 Program Integration Section Perspective
Graphic by Author

westport community centre



building systems diagram

sympiosis

Figure 9.05 Building Systems Diagram
Graphic by Author



westport community centre - northwest

westport community centre

symbiosis

Figure 9.06 Northwest Aerial View
Graphic by Author

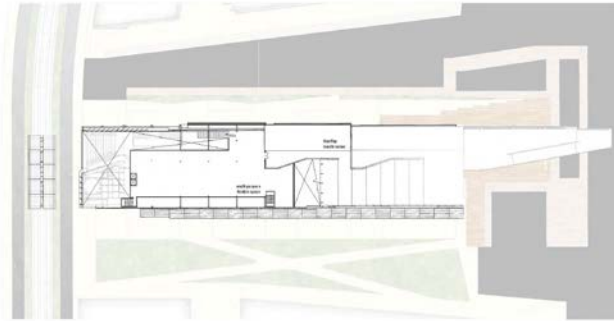


entrance | station connection

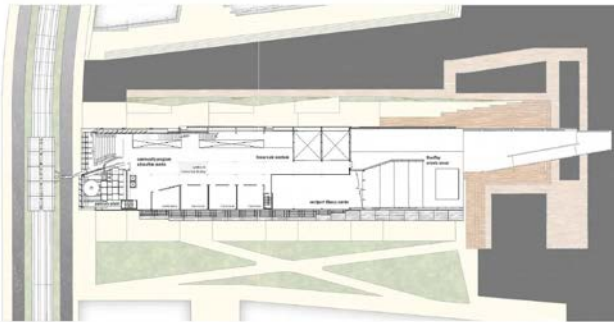
westport community centre

symbiosis

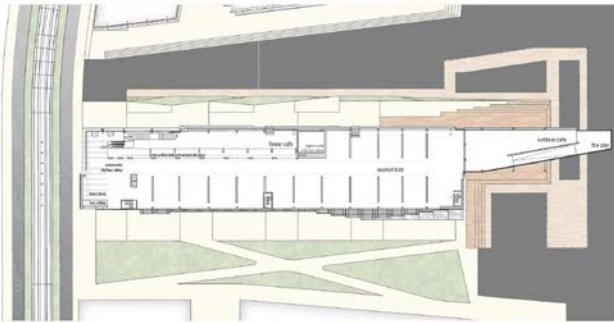
Figure 9.07 Entrance | Station Connection
Graphic by Author



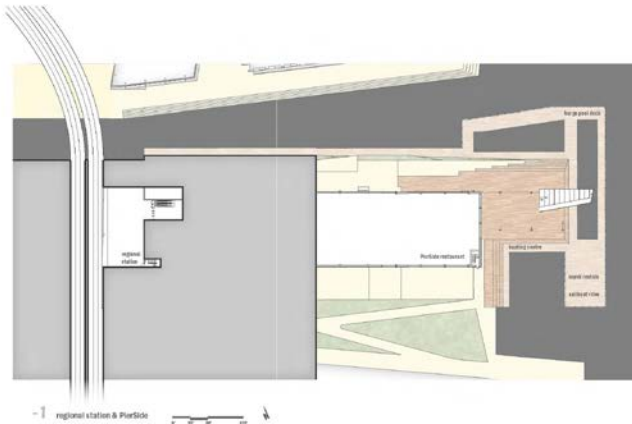
3rd Floor



2nd Floor



**Ground Floor /
Local Rail Station**



**Subgrade Regional
Station Connection**

regional station & PierSide

plans

symbiosis

Figure 9.08 Plans
Graphics by Author



symbiosis interactive exhibition

systems demonstration centre

symbiosis

Figure 9.09 Symbiosis Demonstration Centre
Graphic by Author

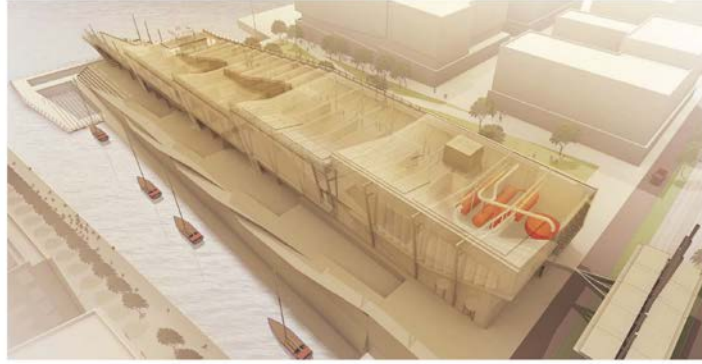


entrance lobby | regional rail station connection

symbiosis

Figure 9.10 Entrance Lobby | Regional Rail Station Connection
Graphic by Author

program integration



tectonic x-ray illustration

symbiosis

Figure 9.11 Tectonic X-ray Illustration
Graphic by Author

program integration



westport community centre - southwest

symbiosis

Figure 9.12 Southeast Aerial Perspective
Graphic by Author

program integration



westport community centre - southeast

symbiosis

Figure 9.13 Pier Side Boating Centre
Graphic by Author

Conclusions

Symbiosis presents the framework for a new interconnection of regional, district, and building design strategies in a proposed master plan for the Baltimore Washington Region. With its roots in linear city planning and the contemporary practices of transit oriented development, it manifests as a massive scale adaptive reuse. Instead of building new, it formulates ways to repurpose and reconnect existing systems to propose a cohesive model for future development; connecting transit, energy production, and infrastructure. Once this groundwork is established, it presents the potential to shape the built environment through localized innovative examples that break down the scale to a manageable understandable dimension.

Although this thesis focuses on the immediate region, its underlying principles are not exclusive to this context. *Symbiosis* presents these conceptual building blocks in an insertable manner, presenting innate solutions that have application on a regional scale.

Notes

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2. Choay, Françoise, and Marguerite Hugo. *The Modern City: Planning in the 19th Century*. Ed. George R. Collins (New York: Braziller) 1969, 98.
3. Choay, 99.
4. *Visions for Tomorrow in Vastra Hamnen. Western Harbour*. Malmo Stad, n.d. <http://www.malmo.se/English/Western-Harbour.html> (14 Dec. 2012).
5. *Ecological Sustainability*. Malmo Stad. Vastra Hamnen Sustainable City Development. <http://www.malmo.se/English/Western-Harbour/Plans-and-on-going-projects/Bo01-expo-area/Ecological-sustainability.html> (30 May 2012).

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