

## ABSTRACT

Title of Thesis: THE ARCHITECTURE OF WHARVES:  
REIMAGINING PORTLAND'S WORKING  
WATERFRONT FOR THE FUTURE

Ryan Joseph Banger, Master of Architecture,  
2018

Thesis Directed By: Professor, Brian Kelly, School of Architecture,  
Planning, and Preservation

A New England city composed of rich history, a strong cultural identity, and diverse groups of people; Portland, Maine is acknowledged as a city for the people. The wharves along the harbor's edge of the city create an important symbolic reminder within the city of the centuries of fishing and trading that supported the state of Maine. As the population of the city grew over time, the wharves became disconnected with the expansion of vehicular infrastructure. This thesis explores the cultural identity of Portland's waterfront edge and the possibility of reconnecting the flourishing waterfront industries with the urban fabric through sustainability, master planning techniques and technological advancements that will address current environmental issues. This thesis further explores the pedestrian experience in the city by proposing an architecture that will enhance these experiences through stronger connections with local culture and communities.

THE ARCHITECTURE OF WHARVES: REIMAGINING PORTLAND'S  
WATERFRONT FOR THE FUTURE

by

Ryan Joseph Banger

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of the requirements for the degree of  
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Advisory Committee:  
Professor Brian Kelly, AIA, Chair  
Clinical Associate Professor James Tilghman  
Professor Steven Hurtt

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## Chapter 1: Creating the Cultural Image

The State of Maine illustrates a unique story celebrating its diverse inhabitants, local community traditions, and natural resources. The historical narrative is the key influencer of Portland's culture. Portland is the largest city in Maine and is credited with supporting much of the state with its working waterfront that was established in the 1600s. The cultural identity of Portland is embedded in these working wharves, and represents a constant within an ever-changing city. Commercial Street, located along the wharves is a crucial link from these wharves to regional destination points. This chapter will explore the creation of Portland and how Commercial Street evolved from a prominent rail line to a disconnecting factor for Portland's working waterfront.

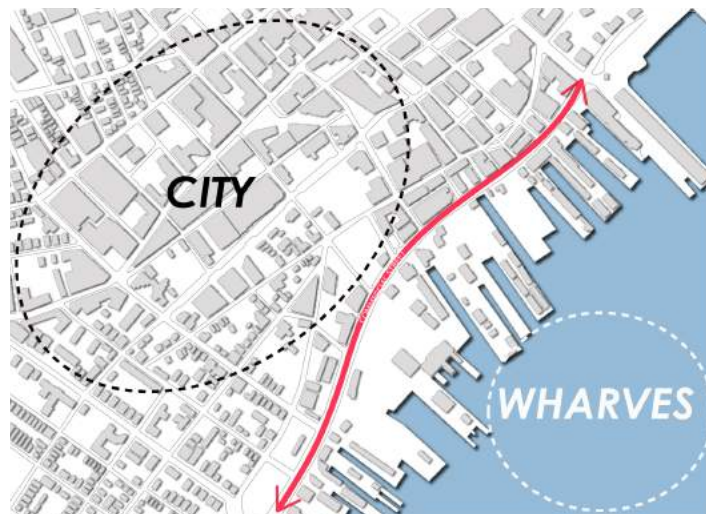




Figure 1a: The current disconnect of Portland's Waterfront Edge (source by author)

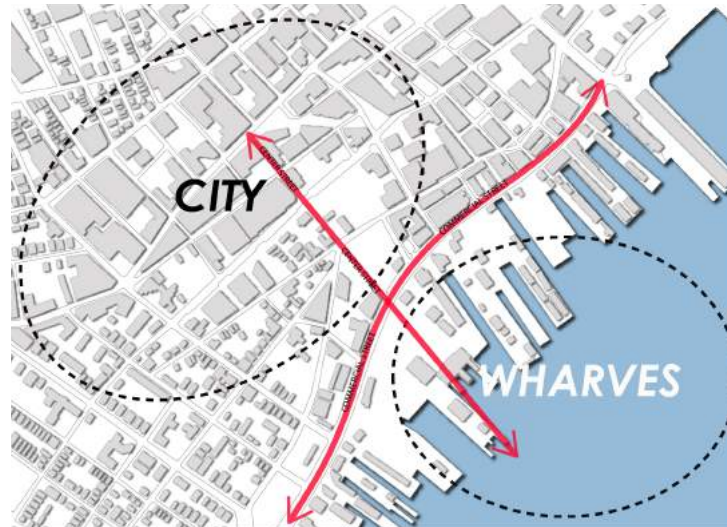


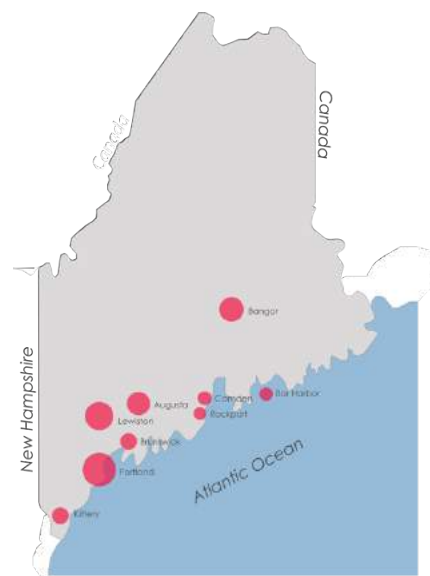
Figure 1b: The proposed reconnect of Portland's Waterfront Edge (source by author)

### Discovery

Maine encompasses the northeastern corner of the United States, located between Canada and the Atlantic Ocean. Originally settled by hunter-gathers and Indian tribes who survived off of the post-glacial land, the geographic area was mainly untouched up until the early 1600s.<sup>1</sup> Three key economic resources that

<sup>1</sup> Richard W.Judd, et al. "Peopling Maine," Maine History Online <https://www.mainememory.net/sitebuilder/site/879/page/1290/display> (Accessed October 2, 2017)

attracted European settlers and savvy merchants when they discovered this vast forested area in the early 1600s; the natural resources, the crucial agrarian land, and profitable geographical proximity across the Atlantic Ocean to Europe. This rural area became a beacon of light for explorers looking for new opportunities and small agriculture-supported settlements formed. These communities were situated along major rivers like the Kennebec and Penobscot rivers, for quick access to the Atlantic Ocean.<sup>2</sup> The fur trade originally defined the business trade and means of survival. The initial discovery and colonization of Maine represented a time of coming to an understanding with the local area.



*Figure 2: The Rivers of Maine (source by author)*  
*Figure 3: Major Cities/Towns of Maine (source by author)*

Settlers and local community people relied heavily on goods for survival means. The primary goods sold and bartered were exports of livestock, cut timber

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<sup>2</sup> Richard W. Judd. “Reshaping Maine’s Landscape: Rural Culture, Tourism, and Conservation, 1890-1929.” *Journal of Forest History* 32, no. 4 (1988): 180–190.

boards, local crops, processed fish, and manufactured goods.<sup>3</sup> Ample sources of these goods led to more establishments of fishing settlements and trading posts. A “ribbon” of settlements was formed as communities settled southward towards the ocean. Portland, originally called Casco and then Falmouth Neck, was established as part of this movement.<sup>4</sup> Portland was essential to the trading industry for the East Coast because it was the closest port for transatlantic trading with Europe, 100 miles closer than that of Boston.<sup>5</sup> The small and rural settlements and ports eventually transitioned towards more flourishing towns and cities that increased standards of living as a result of the bustling waterfront trading.



Figure 4: *The Original Goods of Rural Maine Settlements* (source by author)

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<sup>3</sup> Richard W. Judd, et al. “1500-1667 Contact & Conflict.” *Maine History Online*. Accessed October 21, 2017.

<https://www.mainememory.net/sitebuilder/site/895/page/1306/display>.

<sup>4</sup> “History of Portland, Maine.” *United States History*. Accessed November 2, 2017. <http://www.u-s-history.com/pages/h2212.html>.

<sup>5</sup> Richard W. Judd, et al. “1820-1850 A New State & Prosperity.” *Maine History Online*. Accessed October 1, 2017.

<https://www.mainememory.net/sitebuilder/site/901/page/1312/display>.

## Growth

Growth of cities like Portland in Maine represents prospering economic markets from the fishing and trading industries. As more people settled in Maine in the late 1700s, the waterfront edge of Portland grew to support major trading and shipping routes established to Europe and the West Indies.<sup>6</sup> The forests provided Maine with timber for sawn lumber to transport goods out of the city and support the prominent shipbuilding industry at the time.<sup>7</sup> In the 1850s three major railways were introduced to the Old Port district that established city-wide economic growth. Commercial Street became the location that linked these rail lines and ground transportation with other towns and states.<sup>8</sup> By the 1870s, wharves, warehouses, and businesses developed along Commercial Street to create a diverse community.<sup>9</sup> Over time, Commercial Street grew as a node of interaction between commercial water and rail transportation and local businesses on the waterfront and provided future generations of Portland with a distinct cultural identity that is still seen today.

## Stabilization

Stabilization in Portland represents working industries utilizing natural resources to maintain a stable economy. Industrial expansion occurred and

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<sup>6</sup> Judd, et al, "1820-1850 A New State & Prosperity."

<https://www.mainememory.net/sitebuilder/site/901/page/1312/display>.

<sup>7</sup> "Timeline of Maine History 02: Exploration and Early European Settlement."  
*Maine: An Encyclopedia*, May 3, 2017.

<sup>8</sup> "Commercial Street: Portland, Maine." *American Planning Association*.  
<https://www.planning.org/greatplaces/streets/2008/commercialstreet.htm> (accessed October 2, 2017)

<sup>9</sup> Joseph A. Conforti. *Creating Portland: History and Place in Northern New England*. University of New Hampshire press, 2005.

transformed the once small and rural agricultural settlements into cities and waterfront ports. Local riverside industrial centers were introduced with mills and factories that shipped goods to ports.<sup>10</sup> As these centers began to grow, the natural appeal of the state became present; introducing the tourism industry into Maine. The tourism industry in Maine formed in the late 1800s when people from out of states began to realize the natural beauty and pristine quality Maine possessed. Easy accessibility by rail made it possible for tourists to reach secluded destinations away from the unhealthy conditions of city environments.<sup>11</sup> More people and businesses, locally and regionally, realized the potential and the beauty of Portland, influencing the stabilization of the city.

Stabilization in Portland and other areas of Maine is represented by the power of natural resources, building a strong base for industries, and capitalizing on the image of the state through tourism. This time period in history eventually led to the existing conditions of Portland.

### *Current Conditions of the City*

#### Neighborhoods

The growth of the city transformed Portland to what it is today. Composed of twenty districts, the city of Portland combined covers approximately 70 square miles, surrounded by Casco Bay on the East and the Portland Metropolitan area on the

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<sup>10</sup> Judd, Richard W. "Reshaping Maine's Landscape: Rural Culture, Tourism, and Conservation, 1890-1929." *Journal of Forest History* 32, no. 4 (1988): 180-190.

<sup>11</sup> Judd, Richard W. "Reshaping Maine's Landscape: Rural Culture, Tourism, and Conservation, 1890-1929." *Journal of Forest History* 32, no. 4 (1988): 180-190.

West.<sup>12</sup> This thesis focuses on the Downtown district of Portland, where the wharves are located. The Downtown district of Portland is a central connection point for the city through transportation, neighborhoods and culture. From ferry access to Peaks Island for island residents to the West End and the East End neighborhoods, there are many layers of zones that define Portland.



Figure 5: The Current Districts of Portland, Maine (source by author)

## Demographics

The demographic composition of Portland, Maine is defined through population growth over time, age ratio and population dispersion. There has been a spike of interest in development in the city with the increase of the city's population and these projects are pushing the boundaries of the urban context. Figure 6 displays the downtown area of Portland and how a majority of the city's population is

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<sup>12</sup> "Portland, Maine." *Wikipedia*, October 20, 2017. Accessed October 21, 2017. [https://en.wikipedia.org/w/index.php?title=Portland,\\_Maine&oldid=806224913](https://en.wikipedia.org/w/index.php?title=Portland,_Maine&oldid=806224913).



concentrated around the edges of the Downtown district; suggesting the future possibilities of mixed-use and residential developments moving towards the Downtown and Old Port districts of the city.<sup>13</sup> Overall, it is important to understand the demographic breakdown of Portland to formulate a clear view of how the city is composed up of by age, race, and income levels.

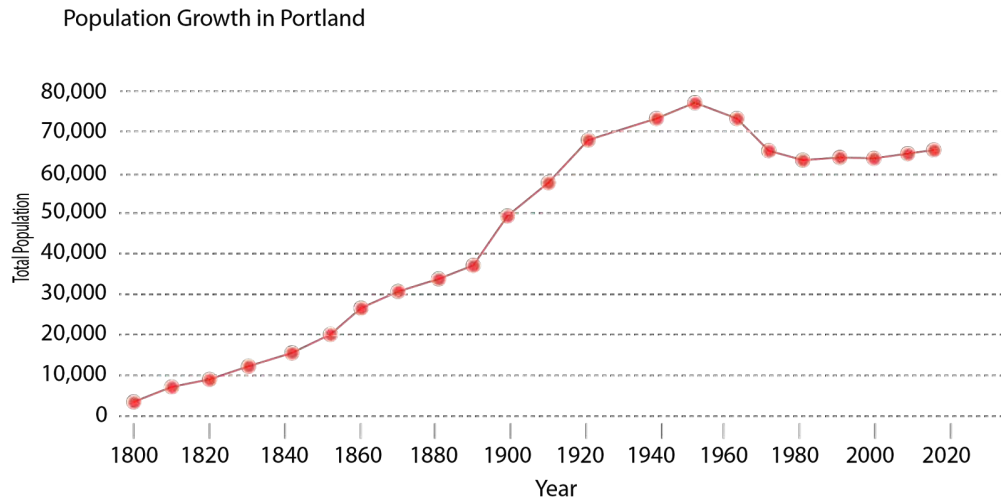


Figure 6: Population growth in Portland (source by portlandmaine.gov)

<sup>13</sup> “Portland, ME,” <http://www.portlandmaine.gov/>. (accessed October 2, 2017)

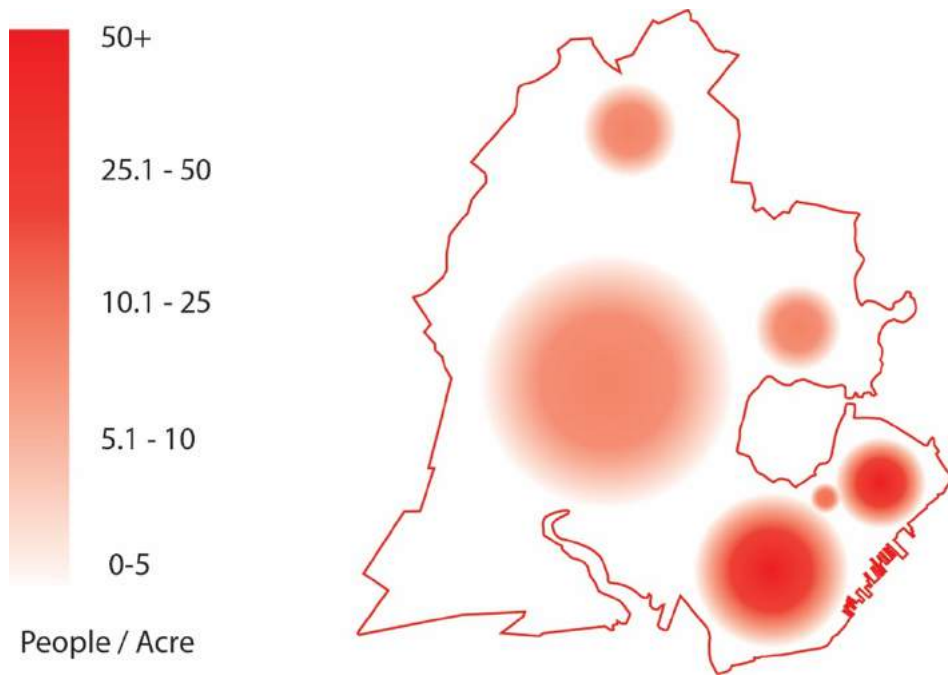


Figure 7: Central residential hubs of Portland (source by author)

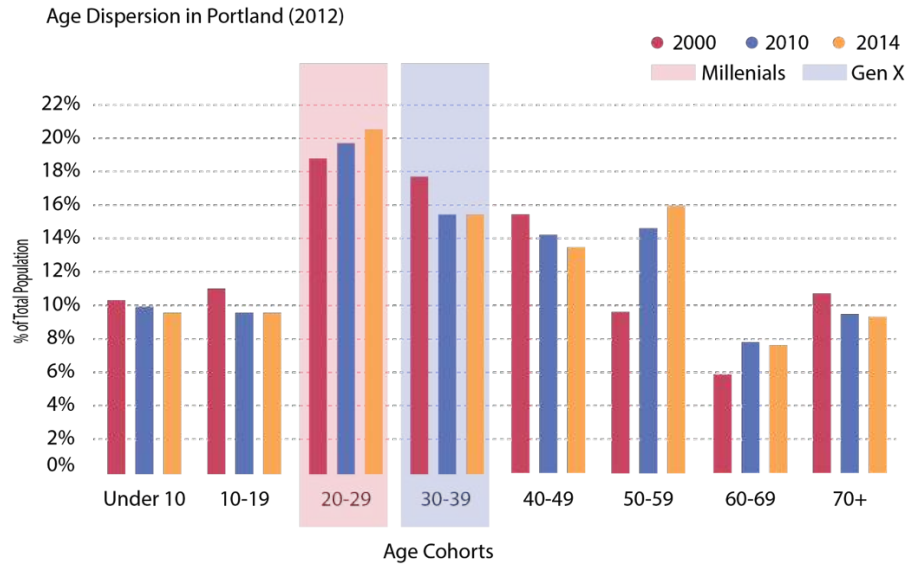


Figure 8: Age dispersion in Portland (2012) (source by City of Portland)

Portland Population by Race (2015)

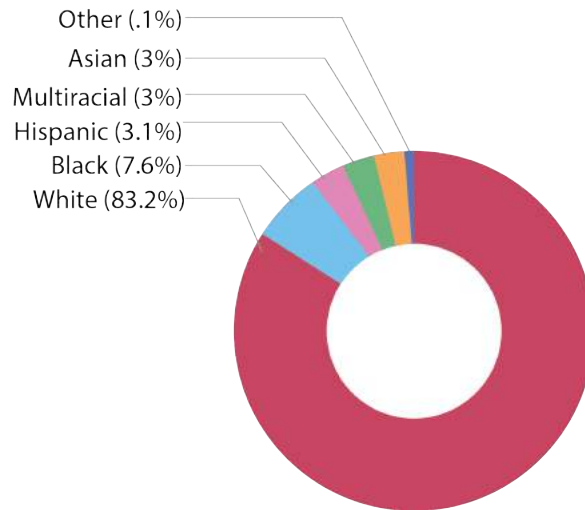


Figure 9: Portland's population by race (2015) (source by DataUsa)

### Connectivity

Portland has layers of transport links that provide connections locally and regionally. Figure 9 highlights the vehicular routes that provide access through the city and ferry routes that connect the city with the islands. These ferries are used by residents of Peaks Islands and visitors to Diamond Island and Cushing's Island. There was a recent establishment of a cruise line that comes into the deep harbor and takes advantage of the unique quality that Old Port has to provide. Commercial Street provides the peninsula with access to Interstate 295. There is also an Amtrak rail system that is located west of the Downtown and Old Port districts and Portland International Jetport that is located south in the city of South Portland.<sup>14</sup> There are four main public bus routes that connect the Downtown district locally and outwards to the residential neighborhoods of Portland.<sup>15</sup> There are currently bike trails that are

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<sup>14</sup> "Portland, ME," <http://www.portlandmaine.gov/> (accessed October 2, 2017)

located mainly around Back Cove and through the Eastern Promenade, ending near the Maine State Pier, but there is potential to continue that bike trail along Commercial Street and towards the West End for improved connectivity and active living. The connectivity of Portland is crucial to understanding how residents and visitors move around and providing potential improvements through master planning and architecture that will bring the city into the future.

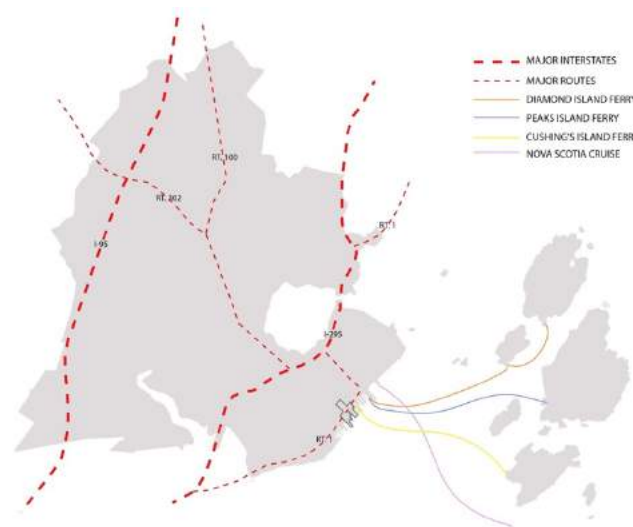


Figure 10: Major transportation routes through Portland (source by author)



Figure 11: Local public transportation routes and bike paths (source by author)



Figure 12: The four driving factors of Portland's cultural image (source by author)

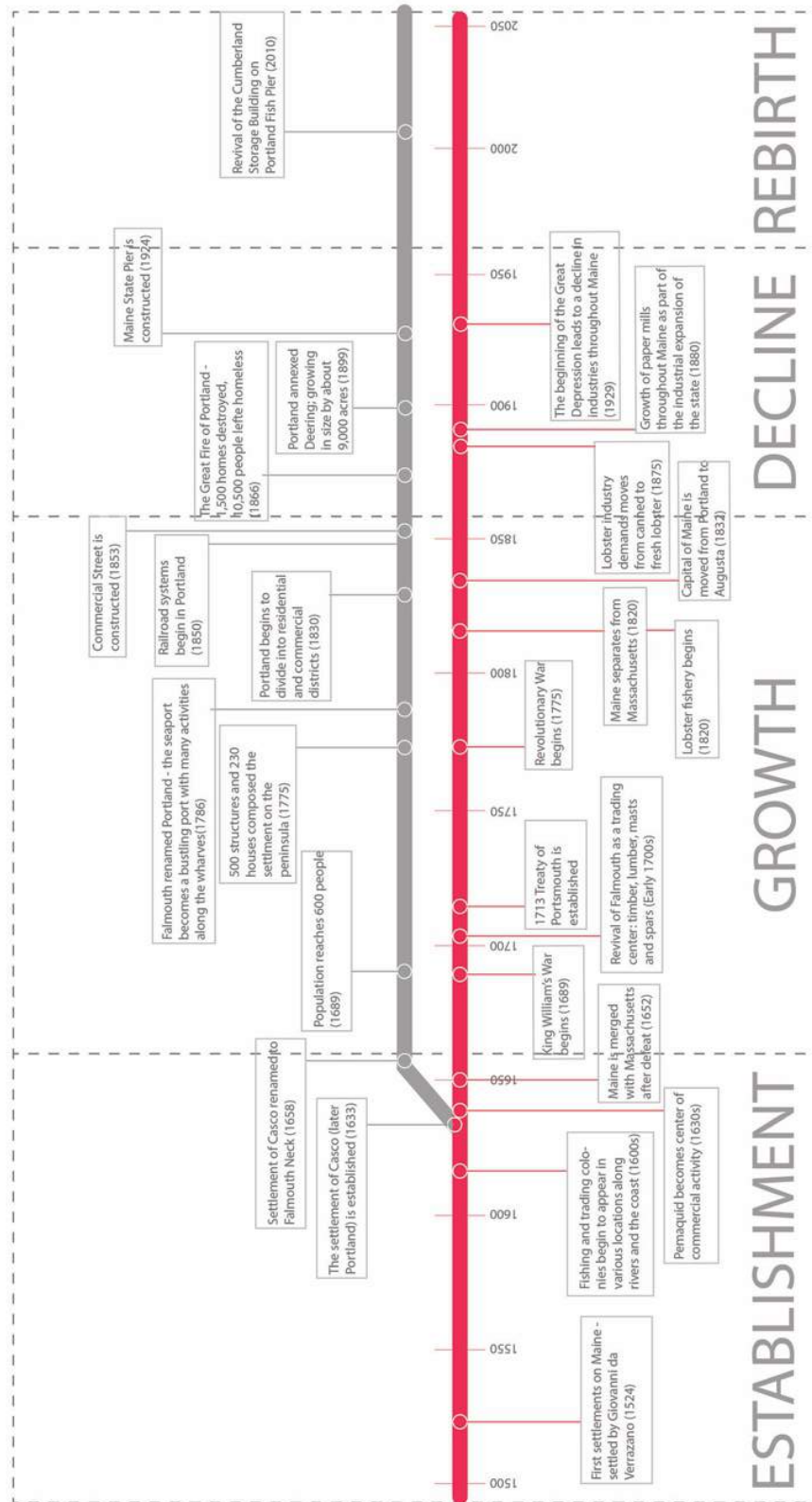


Figure 13: Timeline of Portland's History (source by author)

## Chapter 2: Forming the Industries of Portland

### History of the Fishing Industry

Fishing created a symbolic image of Maine permanently embedded in the its history. The working wharves of Old Port have been preserved since fishing evolved into a profitable business venture back in the 1800s.<sup>16</sup> In order to create a successful waterfront business, a chain of management was established to manage, store, and sell the fish and lobster that follow a set of regulations that was determined based on previous experiences. This section explores the fishing industry of Portland and how it functions in coastal Maine.

#### Establishment of the Commercial Industry

Prior to the 1800s, fishing was conducted to serve small and rural settlements as a source of food. There were limited forms of transportation and technology was not available to properly handle the catch over long distances from the ports. The commercial activity for fishing formed with the invention of the smack and made it possible to transport live lobster to other coastal port cities like Boston and New York.<sup>17</sup> These smacks were lobster boats that contained open holding wells on deck that protected and maintained the live lobsters as they were being transported long distances.<sup>18</sup> Growing interest in this particular market and the innovation of

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<sup>16</sup> James M. Acheson. "The Politics of Managing the Maine Lobster Industry - 1860 to the Present." *Human Ecology* 25, no. 1 (1997): 3–27.

<sup>17</sup> Acheson, 3–27

<sup>18</sup> "Lobstering Basics – History," The University of Maine. *Lobster Institute*, <http://umaine.edu/lobsterinstitute/education/lobstering-basics/history/> (accessed October 18, 2017).

technology, lobster canneries around Maine began to appear and define the market in the 1800s and the 1900s. The introduction of rail system as a commercial mode of transportation in the 1870s made it possible for live lobster to be transported to inland commercial markets, transitioning from canning market to a live lobster market.<sup>19</sup> The establishment of the commercial industry of fishing is represented by a process of realizing technological advancements and adapting techniques to best serve this industry and its consumers.

#### Introduction of Fishing Regulations and Laws

Formal regulations and laws were formed in the Maine lobstering industry. These regulations and laws addressed health concerns, diminishing population levels of lobsters and business tactics conducted by fishermen. These regulations strived to protect egg-bearing female lobsters and small lobsters that were not fully developed from being caught and sold to avoid extinction of the lobster population. They also attempted to protect against the illegal “short lobster” trade that was present. Additional lobster conservation laws formed to protect against this illegal activity and evolved with the changing fish. Illegal trade became so severe in the 1920s that the entire central U.S. coast fishery markets were closed as a warning that drastic measures must be taken to protect the fish and lobster.<sup>20</sup> It was only a matter of time before the market reopened in the late 1920s that the lobster market had to adjust to the Great Depression.

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<sup>19</sup> Thoman, Richard S. “Portland, Maine - An Economic-Urban Appraisal.” *Economic Geography* 27, no. 4 (1951): 348–367.

<sup>20</sup> James M. Acheson. “The Politics of Managing the Maine Lobster Industry - 1860 to the Present.” *Human Ecology* 25, no. 1 (1997): 3–27.



The Great Depression was difficult for all industries in the United States nationally. During this time market prices for the lobster and catch/supply levels of lobster dropped, creating a decline in business and revenue.<sup>21</sup> With the loss of profits, many fishermen were not able to support themselves and their families during this time. “Lobsters are very scarce and the price so low that together with the weather a fisherman can’t earn enough for a living not to mention keeping up their gear.”<sup>22</sup> There were attempts were made to grow the industry through advertising and revising conservation laws to overcome the financial disaster. Through trial and error the double gauge law was introduced, stating a 3 1/16” minimum length and a 4 3/4” maximum; measuring the total backshell length.<sup>23</sup> This law merged the maximum length limit of lobsters with the existing minimum length to not only protect juvenile lobsters, but also the breeding stock provided by larger female lobsters carrying eggs.<sup>24</sup> This double gauge became a pivotal moment in history that helped bring the industry back after the Great Depression and World War II and defined the modern-day lobster and fishing industries of port cities along the coast today.

### Current Day Fishing Industry

Today’s fishing and shipping industries of Portland have retained the historic character. Commercial fishing and lobstering activities occur mainly on Union Wharf

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<sup>21</sup> Acheson. “The Politics of Managing the Maine Lobster Industry - 1860 to the Present.” 10.

<sup>22</sup> Acheson, 10

<sup>23</sup> Scott, Elizabeth C. “Managing the Maine Lobster Fishery - An Evaluation of Alternatives.” *Virginia Environmental Law Journal* 20, no. 4 (2001): 573–603.

<sup>24</sup> James M. Acheson. “The Politics of Managing the Maine Lobster Industry - 1860 to the Present.” *Human Ecology* 25, no. 1 (1997): 3–27.

and Portland Fish Pier in the Old Port district. This section focuses on the management of the fishing and lobstering processes and to understand how these industries work currently.

#### Business Relationships of the Fishing Industry

Waterfront industries rely on the relationship between the catching and selling of these goods. The main fisheries that form this industry are groundfish, halibut, herring, lobsters, shrimp, scallops, soft-shell clam, and tuna; which are all caught in various harbors within the Gulf of Maine at different times of the year. Fishermen travel by boat out to their territorial marine locations in the Gulf of Maine to check traps, set additional traps and reel in legal catch. The legal catch is brought to the wharves to be cleaned and prepared in provided work facilities. Fishermen have business relationships with fish dealers to sell their catch. Fish dealers sell this catch to pound operators, wholesale firms, or other types of buyers. Selling prices of fish and lobsters vary and is determined based on the “going price,” which is the supply and demand levels of the fisheries.<sup>25</sup> The process of selling occurs relatively fast, as the fish and lobster are perishable goods and are expected to remain fresh for customers. These business relationships are crucial to the ongoing industrial process that occur on the wharves.

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<sup>25</sup> Acheson, James M. “The Maine Lobster Market: Between Market and Hierarchy.” *Journal of Law, Economics, & Organization* 1, no. 2 (1985): 385–398.

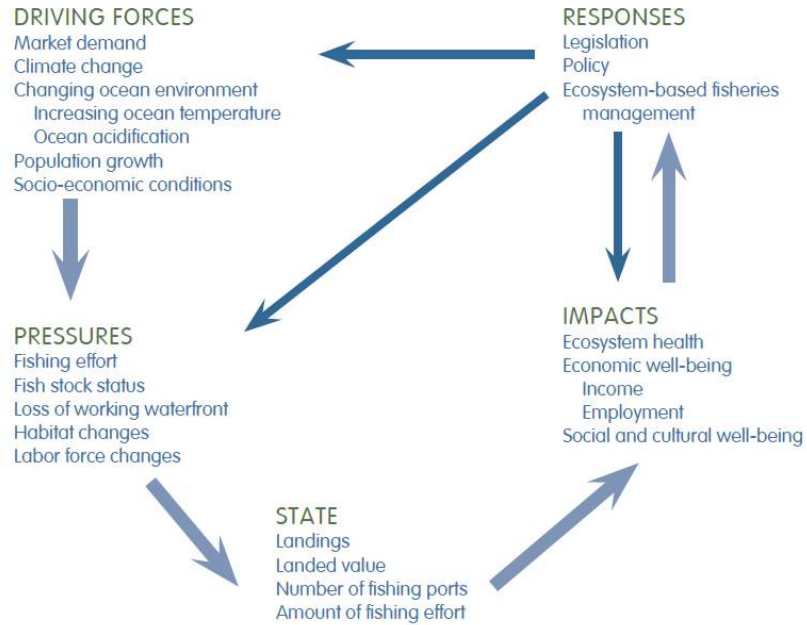


Figure 14: Driving forces, pressures, state, impacts, and responses (DPSIR) for commercial fisheries in the Gulf of Maine. (source by Gulf of Maine journal article)

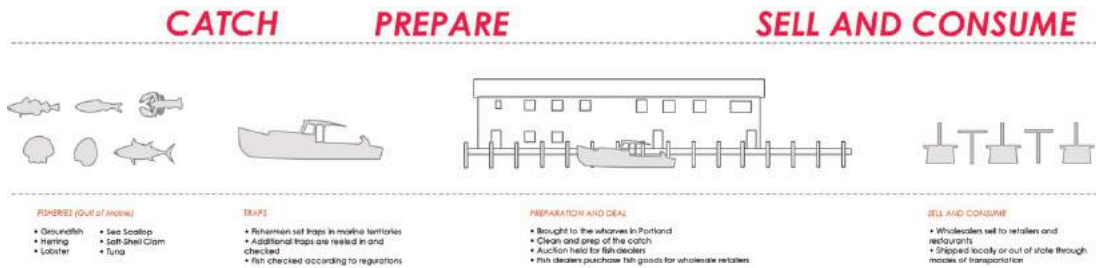


Figure 15: Fishing Process - Relationship between fishing and business (source by author)



Figure 16: Fishing Process – Gulf of Maine and Portland (source by author)

## Current Environmental Conditions

Productivity of the fishing industry relies on environmental conditions. Fishing occurs year-round, with limited activity during the winter months for some fisheries. Climate change affects the fishing industry through increasing ocean temperatures, changing of ocean currents, acidification of the water, and redistribution of plants and animals.<sup>26</sup> The current annual time frame for fishing has an increase of catches between April and mid-November and shifts based on weather conditions during this period.<sup>27</sup> Increasing ocean temperatures are leading to a northward migration of the fish and lobster populations, reconfiguring the existing territories for fishermen. Fishermen, dealers, and wholesalers are dependent on the marine wildlife to make their livings, making climate change a major influence on the fishing industry

## Building Program Spaces of the Fishing Industry

Building spaces and facilities provide the fishermen with safe and effective working spaces. Cleaning and preparation activities occurs in the Portland Fish Exchange building on the Portland Fish pier. This building was constructed in 1986 to introduce efficiency and effectiveness for this commercial form of production.<sup>28</sup> This building consolidates tasks involved in the fishing process, so the process of buying and selling also occurs in this building. Dealers can inspect their catch here before the

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<sup>26</sup> Brawn, Togue. *Portland, Maine - Commercial Fishing Infrastructure Report*. Community Panels, 2004.

<sup>27</sup> Acheson, James M. "The Maine Lobster Market: Between Market and Hierarchy." *Journal of Law, Economics, & Organization* 1, no. 2 (1985): 385–398.

<sup>28</sup> Portland Fish Exchange, "Auction," <http://www.pfex.org/auction/> (accessed October 10, 2017).

purchasing it, which is rare in this fast-paced industry. Portland Fish Exchange works with Vessel Services to obtain fuel, and with the Vessel Services Gear Company for fishing boat gear.<sup>29</sup> Portland Fish Pier also has a working open space to provide workers with places to work on nets and repair other gear and equipment for smooth business operations. Major transportation lines connect Portland Fish Exchange to assure fast movement of these perishable goods. The Guilford Rail System connects Portland with a majority of upstate New York and to Canadian rail lines.<sup>30</sup> Interstate 295 is used for ground transportation modes, linked by Franklin Street. By understanding the wharves, the building programs that contain them and the major connection points, there becomes a sense of layering seen along the waterfront of Portland.

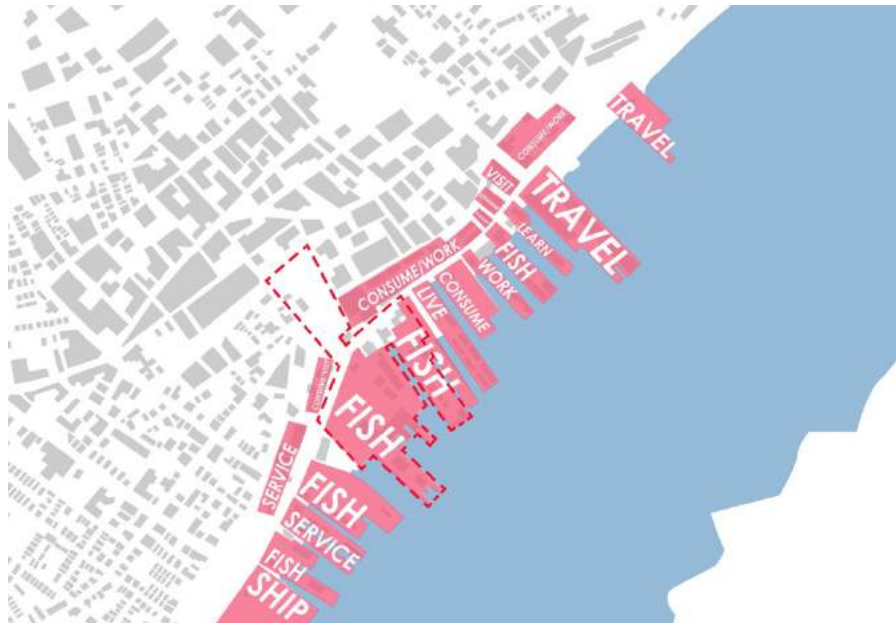


Figure 17: Functions of the Portland's wharves (source by author)

<sup>29</sup> Brawn, Togue. *Portland, Maine - Commercial Fishing Infrastructure Report*. Community Panels, 2004.

<sup>30</sup> "Pan Am Railways, Today's Guilford Rail System." *American-Rails.Com*. Accessed October 12, 2017. <https://www.american-rails.com/par.html>.



Figure 18: *The Functions of Portland Fish Pier and Union Wharf* (source by author)

Revenue generated by this process is an important economic value for Portland. According to Maine Department of Marine Resources, the commercial fishing industry brought in \$721,197,482 as of February of 2017.<sup>31</sup> The staple fishery; lobster is the most economically profitable fishery; representing almost 75% of the entire fishing industry. Lobstering is the primary fishery that will continue to provide Portland and Maine with a stable source of revenue and jobs for many fishermen of

<sup>31</sup> State of Maine Department of Marine Resources, “Most Recent Maine Commercial Landings,” <http://www.maine.gov/dmr/commercial-fishing/landings/index.html> (accessed October 14, 2017).

the state. Preserving and better utilizing the current wharves of Old Port will better serve the industry and continue to adapt to the increased demands for this industry.

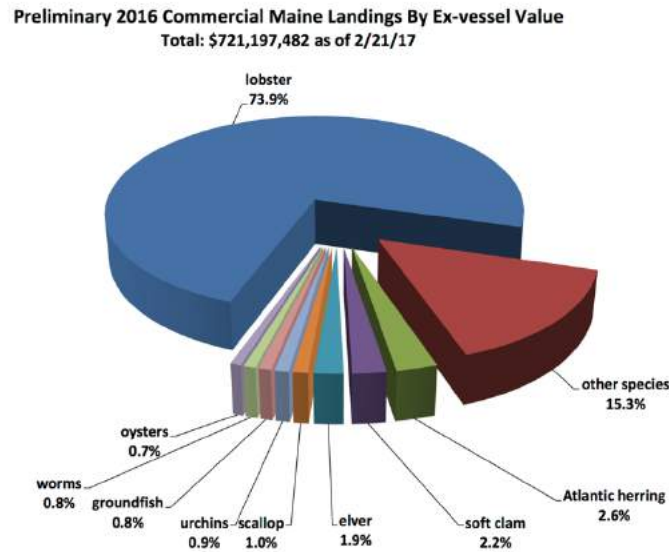


Figure 19: Preliminary 2016 Commercial Maine Landings by Ex-vessel Value (source by Maine Department of Marine Resources)

### History of the Trading Industry

The original trading industry of Portland grew from rural and secluded settlements along the rivers. The historical trading industry of the region consisted of agricultural trading. Portland was relatively small as the time with small cottages that lined along the two main streets of the city leading towards the wharves and bordered by mainly forests and water.<sup>32</sup> This section focuses on the benefits of trading in history and how it's still important today.

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<sup>32</sup> Bauman, John F. *Gateway to Vacationland: The Making of Portland, Maine*. University of Massachusetts Press, 2012.

## Forms of Trading

The basis of trading was determined by the natural resources located in the regional area of Portland and around Maine. One of the primary forms of trading was lumber; provided from the dense forests of the state. Types of timber were oak, maple, birch, beech and elm timber, that were mainly shipped regionally. The timber was sawn into lumber that was also used locally to support the predominant shipbuilding industry.<sup>33</sup> The growth of Maine and its settlements fueled the growth of trade for future generations of Portland.

### Current-Day Trading Industry

#### Overview of the Trading Zones

Portland transformed into a significant trading port that has wholesaling, shipping, and the manufacturing of goods. The trading zone is contained within the downtown commercial core of Portland, along the wharves and harbor and supported by other cities in the Portland Metropolitan Area. The Portland Metropolitan Area are five adjacent urban units that serve one another, consisting of Portland, South Portland, Westbrook, Cape Elizabeth, and Falmouth. As a result of this, Portland, Maine has become one of New England's most livable cities as the local economy and culture of this city flourishes from the support of these diverse industries.<sup>34</sup> By

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<sup>33</sup> Bauman, John F. *Gateway to Vacationland: The Making of Portland, Maine*. University of Massachusetts Press, 2012.

<sup>34</sup> Conforti, Joseph A. *Creating Portland: History and Place in Northern New England*. University of New Hampshire press, 2005.



working with the current trading industry that exists in Portland, it will help to support the effective growth of the city into the future.

#### Goods of the Current-Day Market

The wholesale market of Portland includes fuel, food, and clothing supplied to retailers. One of the most predominant forms of goods that distributed outward from the city is petroleum. The petroleum pipeline was originally established between Portland and Montreal that formed Portland into an oil.<sup>35</sup> Petroleum is important because of increasing demand for this goods grows regionally. Other goods that are included within wholesaling are grain, lumber, automobile accessories, drugs, and electric equipment.<sup>36</sup> These goods represent a market that was established through the recognition of the potential that the natural resources of the state represented.

The trading and shipping markets of Portland is a diverse inventory of goods shipped by a network of regional transport. There are three requirements for a thriving shipping industry; marketable goods, favorable elements (weather, climate, currents, and tides), and hospitable harbors.<sup>37</sup> Portland's trading industries are important to supporting the local economy and livability of Portland. The current-day trading industry of Portland will influence the functions so that it can be applied

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<sup>35</sup> Conforti, Joseph A. *Creating Portland: History and Place in Northern New England*.

<sup>36</sup> Thoman, Richard S. "Portland, Maine - An Economic-Urban Appraisal." *Economic Geography* 27, no. 4 (1951): 348–367.

<sup>37</sup> Judd, Richard W., Karen Kimball, Elizabeth De Wolfe, and Candace Kanes. "Trade & Transport." *Maine History Online*, <https://www.mainememory.net/sitebuilder/site/885/page/1296/display> (accessed October 5, 2017)

effectively to this proposed master plan of Portland understanding of trade routes, nodes of trade, and efficient techniques of movement.

# Chapter 3: Site Analysis

## Site Selection



Figure 20: Site Matrix and Existing Site Images (source by author)



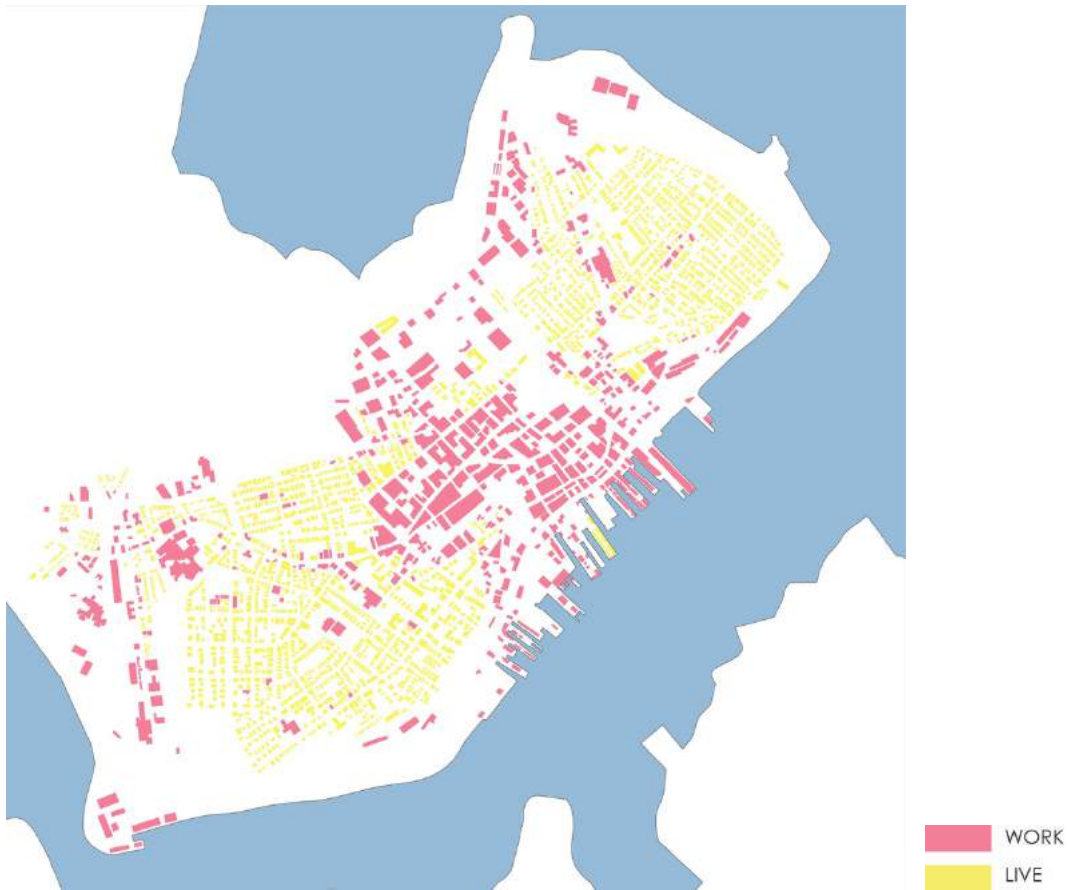
Figure 21: Site Location (source by author)



*Figure 22: Aerial View of the proposed thesis site (source by author)*



*Figure 23: Walking Radius from thesis site (source by author)*



*Figure 24: Existing Live and Work of downtown Portland (source by author)*

### Cultural

#### Main Streets: Linear Nodes of Human Activity

Culture is seen within the four main streets that contain linear nodes of human activities. Commercial Street is recognized as a main street where a mix of retail stores, restaurants and working waterfront industries are situated. While these activities are located along the same street, there is a disconnect caused by the street itself; with four lanes of fast-moving vehicular traffic, it becomes a place of uncertainty and chaos. The north side of Commercial Street is lined with the retail stores and restaurants that attract many local visitors and tourists each year and the

south side of Commercial Street is composed of a more transparent urban edge that opens towards the wharves and the harbor. Fore Street is a main street that acts as a transitional street from the waterfront urban edge mentioned before to the central downtown area of Portland. Congress Street is the central downtown main street that contains landmark buildings like Portland City Hall and Portland Public Library and civic spaces like Monument Square, as seen in *figure 29*. This square hosts many different forms of activities from farmer's markets in the summer to festivals in the fall. The main streets of downtown Portland are important linear nodes of activity for people and create interactions with the historic architecture.



*Figure 25: Portland's Main Streets: Linear Nodes of Activity (source by author)*

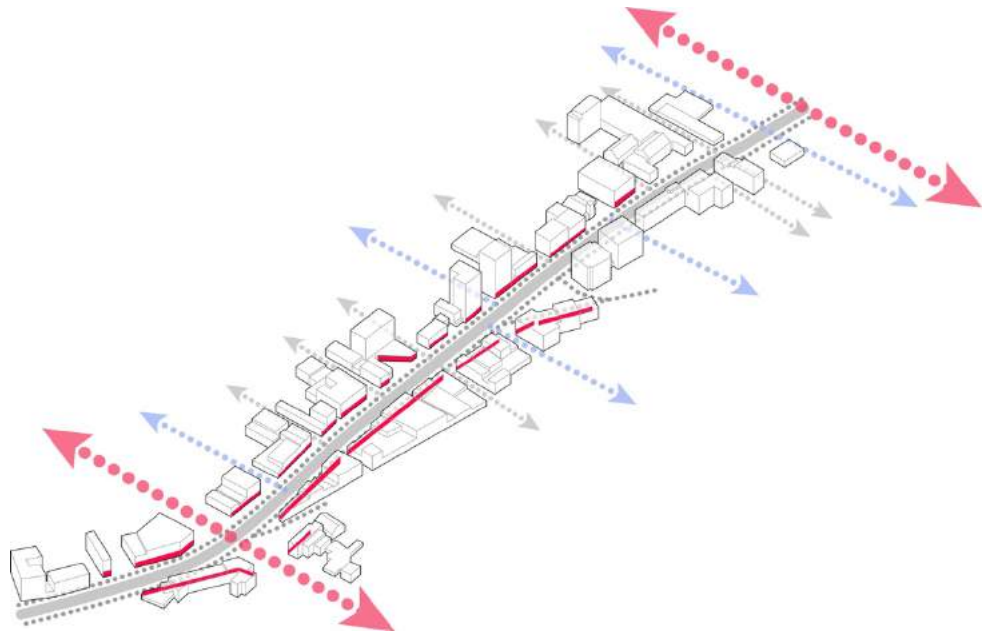


Figure 26: Congress Street: Linear Nodes of Activity (source by author)

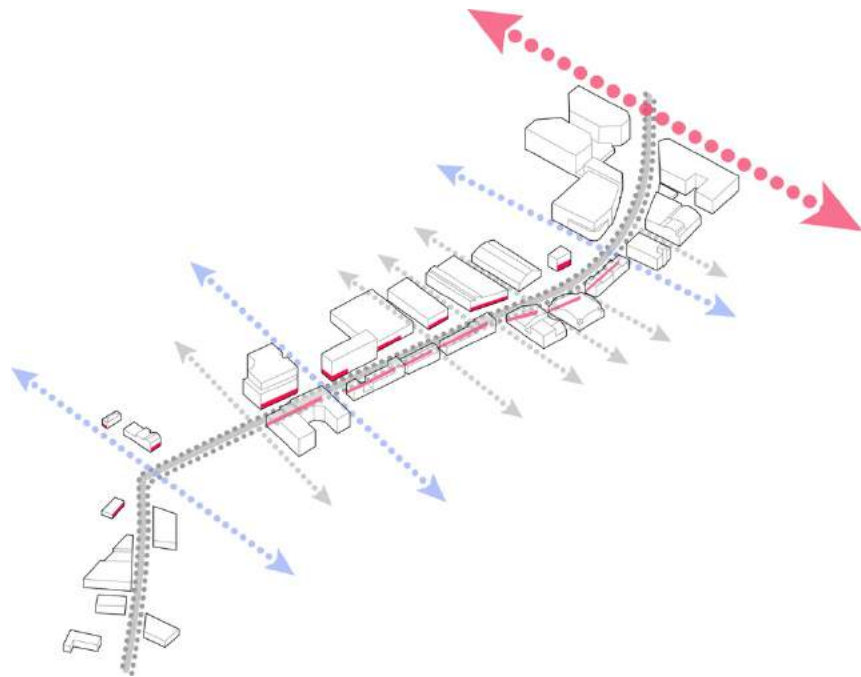


Figure 27: Fore Street: Linear Nodes of Activity (source by author)

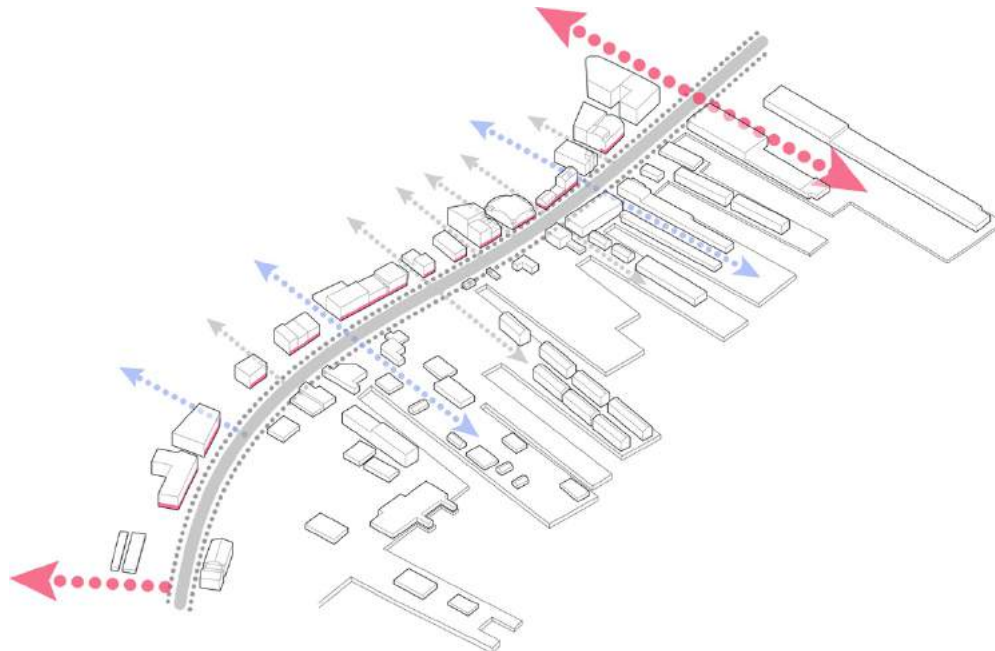


Figure 28: Commercial Street: Linear Nodes of Activity (source by author)

#### Events and Landmarks

Portland has layers of cultural elements that are celebrated predominantly through many different annual events and festivals in the city. Old Port Festival, celebrated every year on a Sunday in June, kicks off the summer with a pedestrian-friendly festival that showcases local businesses, hosts popular music bands, and sells local baked goods and drinks. Many of the streets in downtown Portland are closed down to vehicles and replaced with people roaming the streets and checking out clothing, crafts and accessories being sold by local businesses. Stages are placed throughout the city with live music, a parade route is established, and vendor stands are situated along the main streets that all create an atmosphere of excitement and liveliness. While this festival only spans a day in the whole year; it encompasses a wide range of culture of Portland into one afternoon. There are other festivals and events that occur throughout the year; like the *SchoonerFest "Tall Ships Portland"*



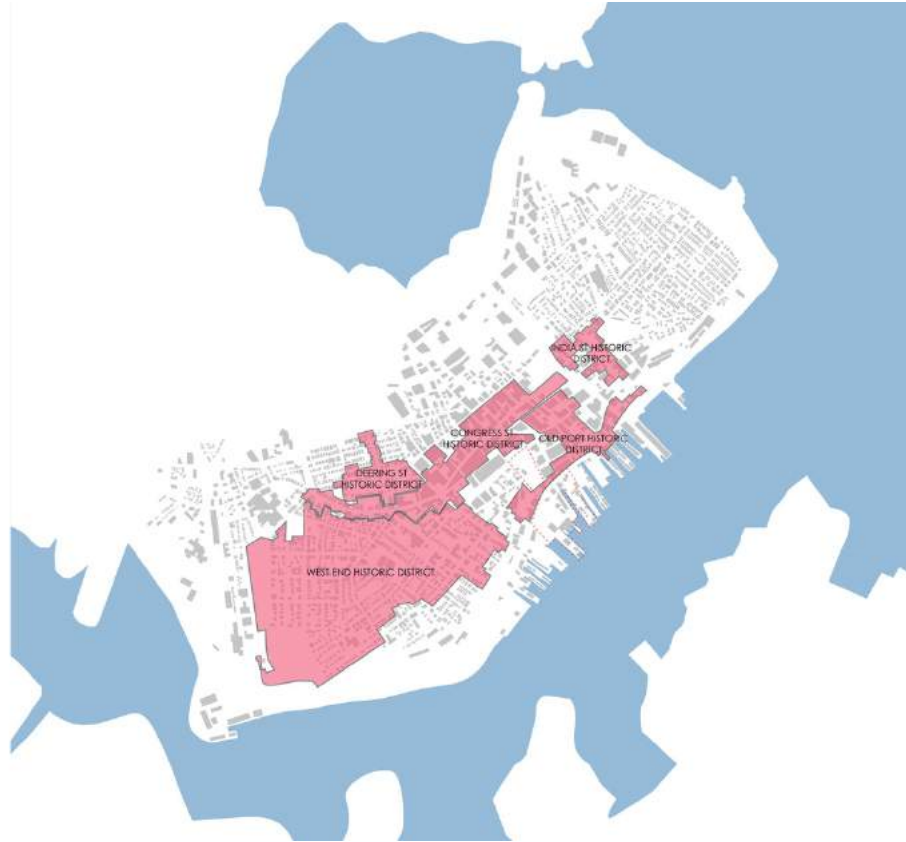
festival along the wharves and *Harvest on the Harbor* that engages local chefs and their food and drink creations. The *SchoonerFest “Tall Ships Portland”* occurs one weekend in June and showcases some of the fastest schooners in the country that race against local schooners within Portland’s Harbor.<sup>38</sup> The *Harvest on the Harbor* festival occurs in October and contains locally grown and sustainable foods, lobster, beer, and restaurants.<sup>39</sup> These events reflect an important cultural aspect to the city about connecting the people with the diverse history of the city.



Figure 29: Landmarks/ Significant Views of downtown Portland (source by author)

<sup>38</sup> “Portland SchoonerFest & Regatta.” *Tall Ships Portland*. Accessed November 3, 2017. <http://tallshipsportland.org/portland-schoonerfest/>.

<sup>39</sup> “Harvest on the Harbor | Maine Food and Wine Festival Fit for Foodies.” Accessed December 14, 2017. <https://harvestontheharbor.com/>.



*Figure 30: Historic Districts of downtown Portland (source by author)*

Culture is also represented by historic and contemporary landmarks located through the peninsula. Many of these landmarks are located within walking distance of the proposed thesis site. Cross Insurance Arena is a multi-functional arena that hosts different types of events from concerts to hockey games. The Portland Museum of Art is a prominent influence in the Arts District of Portland. The addition fronting Congress Square, designed by Henry N. Cobb of I.M. Pei & Partners, draws inspiration from the New England seaport architecture and contains local Maine materials and celebrates natural light. These landmarks are a crucial part of using architecture to create a physical representation of what culture is in Portland and around Maine.

## Local Building Materials

Local building materials of Maine are a good example of how the culture is represented. The two primary materials composing these facades are brick and granite. Many of these historical buildings were constructed after much of the city was destroyed during the Great Portland Fire of 1866.<sup>40</sup> From the biotite-muscovite granite of Portland City Hall to the brick of the Wadsworth-Longfellow House to the iron and sandstone of the Centennial Block, the building materials is an important use of the local resources of Maine.



*Figure 31: Granite of City Hall (source by Department of Agriculture, Conservation & Forestry)*

*Figure 32: Brick of the Wadsworth-Longfellow House (source by Department of Agriculture, Conservation & Forestry)*

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<sup>40</sup> Bauman, John F. *Gateway to Vacationland: The Making of Portland, Maine*. University of Massachusetts Press, 2012.



*Figure 33: Local red sandstone of Portland (source by Department of Agriculture, Conservation & Forestry)*

*Figure 34: Detail of Mariner's Church on Fore Street (source by Department of Agriculture, Conservation & Forestry)*

### Environmental

Environmental considerations are an important part of analyzing Portland along the waterfront edge. Portland is a temperamental northern city that experiences a wide range of weather annually. The relationship between land and water is an important consideration to understanding how the city edge can be built up in the future. This section will focus on the topography, weather conditions, the flood zone and rising sea levels of downtown Portland.

## Topography



*Figure 35: Topography/ storm-water runoff of Portland's waterfront edge (source by author)*

Topography determines the stacking relationship of buildings in master planning. Figure 35 highlights the high and low points of the proposed thesis site and how it relates to the 100-year flood plain map. The high is located up by Congress Street, sloping down towards the water. This topography greatly affects storm water runoff, rising sea levels and building forms. The current topographical conditions of the site will create a unique relationship between the proposed buildings that will create a natural interaction with the landscape.



Figure 36: 100 Year Flood Plain of Portland's Waterfront edge (source by author)

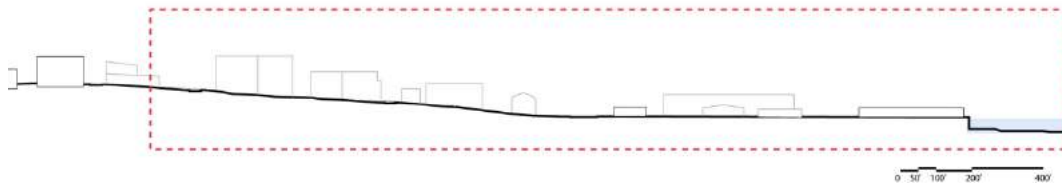


Figure 37: Site section A of the proposed thesis site (source by author)

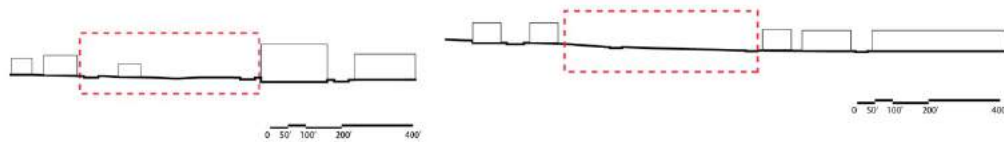


Figure 38: Site section B of the proposed thesis site (source by author)

Figure 39: Site section C of the proposed thesis site (source by author)

## Climate

There are many different components to the annual climate of Portland, Maine. Figure 40 highlights the annual temperatures and precipitation of Portland for 2015. This city experiences all four seasons and the thesis site is surrounded by

buildings so sun directions and shading is an important component of the orientation of proposed buildings. Figure 41 displays the effect of shadows on the site during June and December at all times of the day. Climate should be accounted for in the building design and the design should be interactive and effective with this norther waterfront climate.

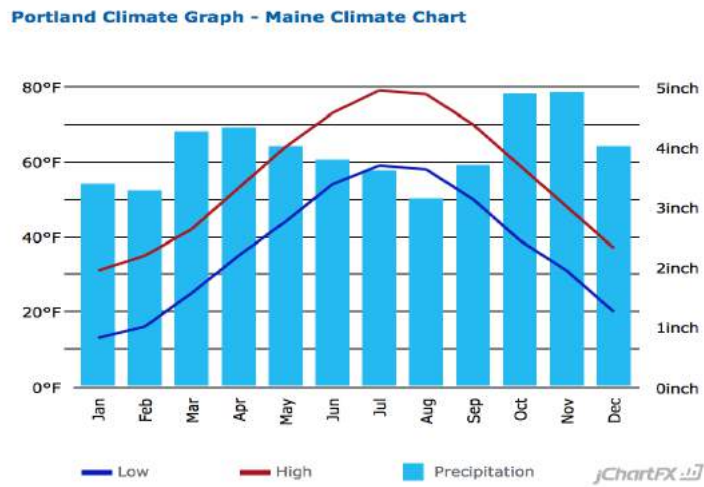


Figure 40: Portland Climate Graph (source by NOAA)



Figure 41: Sun and shadows: June 21st (source by author)

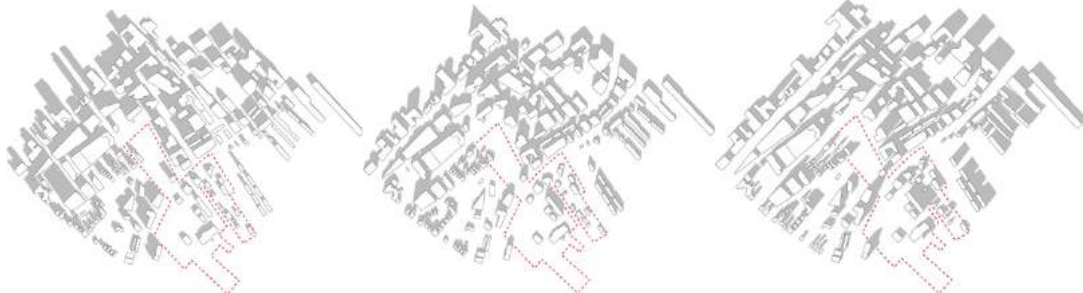


Figure 42: Sun and shadows: December 18th (source by author)

## Accessibility

### Open Spaces

Open spaces are key in the city to create balanced relationship between the built environment and civic spaces. Based on the figure diagram presented, a series of open spaces were located throughout the peninsula of Portland. The three prominent open spaces are the Eastern Promenade, Western Promenade and Deering Oaks Park. The Eastern Promenade is located along the east end of the peninsula, offering unobstructed views to Casco Bay, a boat launch and trails for bikers and pedestrians. Open spaces are also defined by parking lots. The expansion of vehicle infrastructure systems during urban renewal took place in cities, leading to the creation of city blocks as parking zones. The site for this thesis is located on two large parking lots that service many employees that commute from outside of the downtown area of Portland. By transforming these parking lots into programmatic functions for people, it will greatly improve and transform the character of Portland.



Figure 43: Land-use diagram of downtown Portland (source by author)





Figure 44: Open Spaces of downtown Portland (source by author)



Figure 45: Grocery stores/markets in downtown Portland (source by author)



Figure 46: Commercial and private docks of Portland's waterfront (source by author)

Existing Streets and Buildings



Figure 47: Street hierarchy of downtown Portland (source by author)



*Figure 48: Maximum building heights of downtown Portland (source by author)*

### Local Typologies

#### Elevation Studies

The proposed thesis site is surrounded by a context of historical buildings that contain classical orders in the facades. In order to create a successful design, the proposed design of the master plan and market hall must respond to the hierarchy of order and repetition that defines the urban edge of the Old Port district. Façade studies were conducted to understand the relationship between the composition of classical orders and programmatic spaces contained within these buildings.



*Figure 49: Overall north Commercial Street Elevation (source by author)*



*Figure 50: North Commercial Street Elevation – section 1 (source by author)*



*Figure 51: North Commercial Street Elevation – section 2 (source by author)*



*Figure 52: North Commercial Street Elevation – section 3 (source by author)*



*Figure 53: South Commercial Street Elevation (source by author)*

## Complete Streets

A complete street is essential to creating a pedestrian-oriented experience in the city. This type of street is broken down into four main guiding principles that outline the design and composition of these streets. First, the design of sidewalks provides safety for pedestrians; creating separate but similar zones for these pedestrians and vehicles. Second, these streets apply traffic calming measures like incorporating traffic-slowing pavers to create a comfortable atmosphere in the city. Third, there are accommodations for bikers in the city to extend existing surrounding bike paths into the city; incorporating bike lanes as part of the street design. Last, there are public transportation accommodations that are introduced to promote this form of transportation, moving away from the dependency on the automobile in the city. Overall, the concept of the complete street design is important to incorporate into the proposed master plan design for Portland.

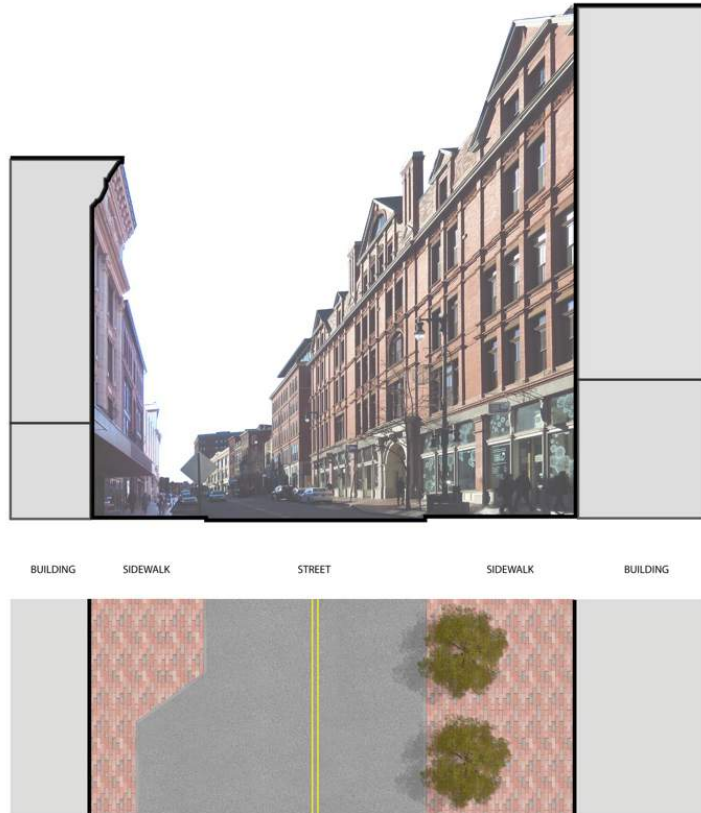


Figure 54: Congress Street Section Perspective (source by author)



Figure 55: Wharf Street Section Perspective (source by author)

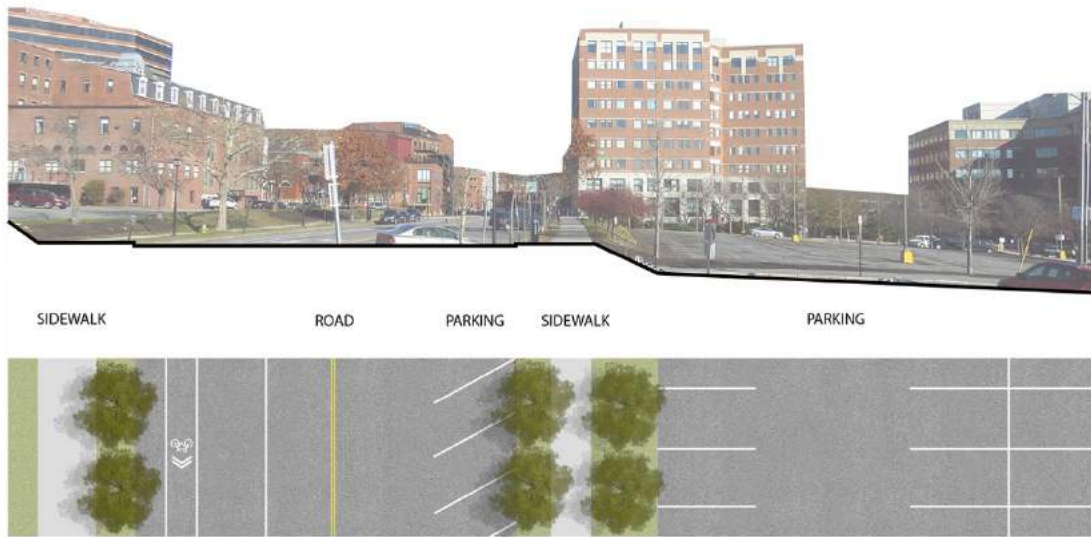


Figure 56: Spring Street Section Perspective (source by author)

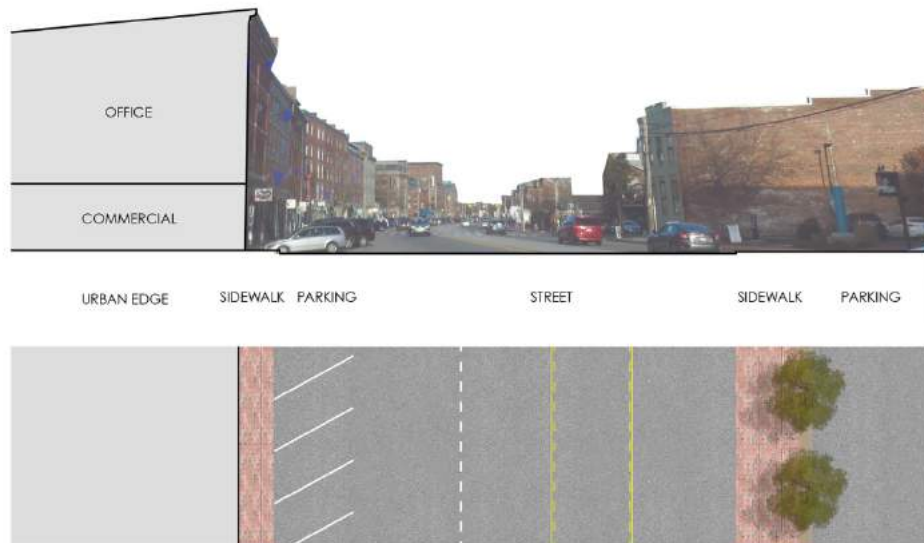


Figure 57: Commercial Street Section Perspective (source by author)

## Economic

### *New Developments*

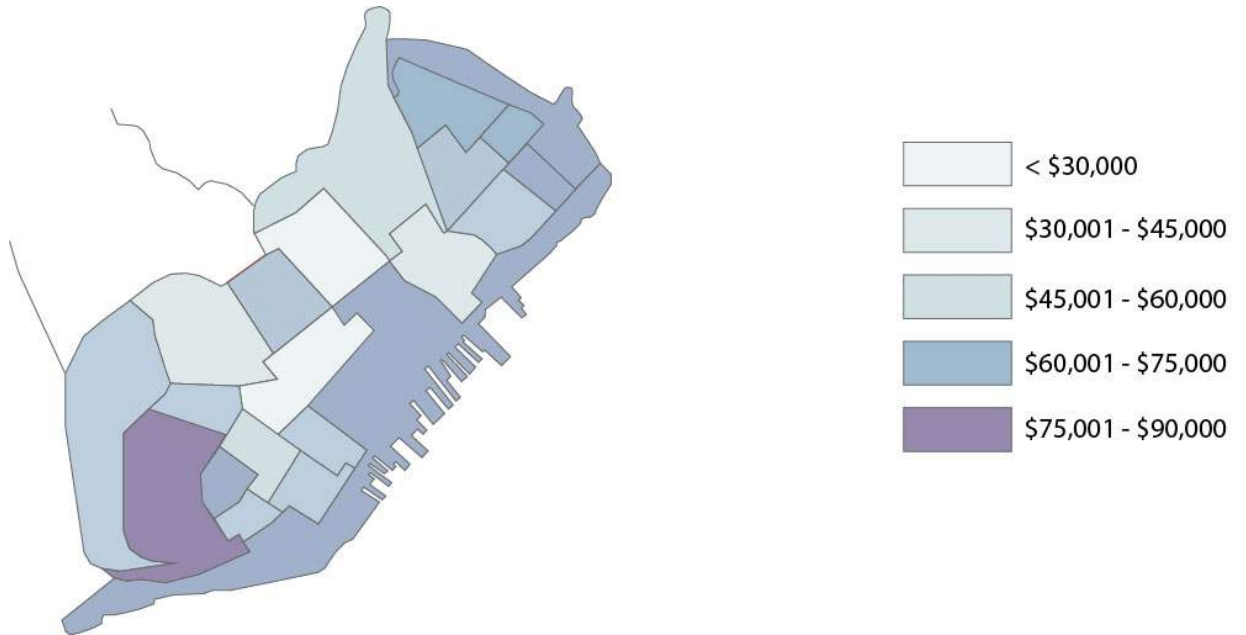
Within Portland, there are many major developments that have been occurring since 2015. As the city becomes more prosperous and more young adults and single people realize the potential of living in Portland, there is a population growth that is occurring in Portland. Much of the development that is shown is aimed towards middle and low-income earners that have difficulty finding housing because of the current lack of housing in the city. Two of the biggest projects of the city are Rufus Deering Phase 1 and 58 Fore Street; both located along Commercial Street and the wharves.

While they may not be under construction yet, it is still important to take into account the large unit count and the high population increase potential. 58 Fore Street is a redevelopment project of a 6-block neighborhood that will include housing, shops, restaurants, hotel rooms and a marina. It is estimated that there will be around 638 rental and ownership housing and 132 hotel rooms within the project. This project will begin to address the increase need for housing in the downtown Portland area.

Rufus Deering Phase 1 is a redevelopment project that will include replacing the recently closed down lumberyard located along the west end of Commercial Street with approximately 300 units of housing located close to the waterfront. This project is part of the movement of establishing a connection between the West End of Portland and the Old Port district. This housing project will address a wide range of buyers from the low-end of \$200,000 to high-end buyers of \$1 million. These two



projects are just part of a larger string of housing developments that are appearing around the downtown area of Portland, Maine. Overall, the recent housing developments of downtown Portland, Maine is a reflection on the flourishing local economy and sets a standard for the years to come.



*Figure 58: Income levels of downtown Portland (source by author)*

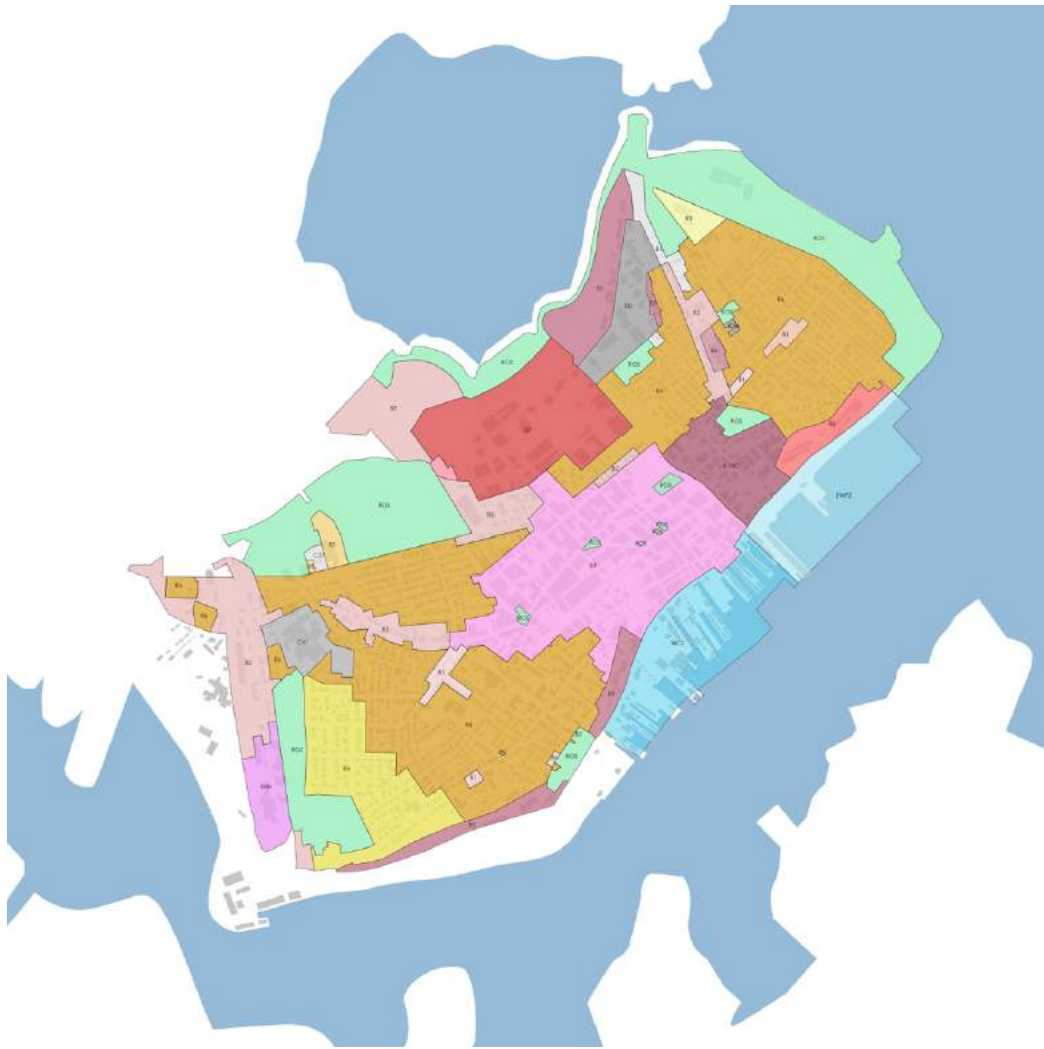


Figure 59: Location of new developments in Portland (source by author)

Inclusionary Zoning Development Projects: December 2015 - June 2017						
Address	Status	# of Units	Workforce Units	On-site	Off-site	Fee-in lieu
169 Newbury Street	Under Construction	26	2	-	2	-
62 India Street	Under Construction	29	-	-	-	\$290,000
443 Congress Street	Under Construction	28	4	4	-	-
70 Anderson Street	Approved	10	1	1	-	-
75 Chestnut Street	Approved	55	5	5	-	-
20 Thames Street	Approved	28	-	-	-	\$280,000
221 Congress Street	Under Review	17	-	-	-	\$170,000
218-220 Washington St	Under Review	45	5	5	-	-
161 York Street	Under Review	11	-	-	-	\$110,000
153-165 Sheriden Street	Under Review	19	1	1	-	-
1 Joy Place	Under Review	12	1	1	-	-
Rufus Deering Ph 1	Under Review	82	9	9	-	-
		<b>362</b>	<b>28</b>	<b>26</b>	<b>2</b>	<b>\$850,000</b>

\* 58 Fore Street is also expected with approximately 600 housing units

Figure 60: Unit count of new developments in Portland (source by portlandmaine.gov)



- R3: RESIDENTIAL
- R4: RESIDENTIAL
- R5: RESIDENTIAL
- R6: RESIDENTIAL
- ROS: RECREATIONAL OPEN SPACE
- B1: NEIGHBORHOOD BUSINESS
- B2: BUSINESS COMMUNITY
- B3: DOWNTOWN BUSINESS
- B4: COMMERCIAL BUSINESS
- B5: URBAN COMMERCIAL BUSINESS
- B6: URBAN COMMERCIAL BUSINESS
- B7: URBAN COMMERCIAL BUSINESS
- IS-FBC: INDIA ST FORM BASED
- EWPZ: WATERFRONT
- WCZ: WATERFRONT
- C37: CONDITIONAL R5 (189 PARK AVE.)
- C41: CONDITIONAL R6/B2 (22 BRAMHALL ST.)
- C46: CONTIONAL R6 (121 SHERIDIAN ST.)
- I1b: INDUSTRIAL - LOW IMPACT
- I1b: INDUSTRIAL - MODERATE IMPACT

Figure 61: Zoning of downtown Portland (source by author)

## Chapter 4: Adapting to the Future

### Urban Farming

*“The world’s population is expected to reach 9.7 billion by 2050, 33% more people than are on the planet today, according to projections from the United Nations. About two-thirds of them are expected to live in cities, continuing a migration that has been underway around the world for years.”*

*-Betsy McKay, Wall Street Journal*

As urban populations continue to grow around the world, pressure is placed on providing stable food supply levels to these people. Many city centers are located hundreds and thousands of miles away from farms, negatively affecting the environment through transportation.<sup>41</sup> New methods of food and agriculture growth must be implemented to locally supply urban environments. There has been a recent growth of interest in urban farming techniques because of the impact it has on the people. Not only does it affect the food supply, but urban farming has social/economic and health benefits on the cities. This section will focus on techniques of urban farming in the city as a way of redefining a sense of community.

#### Influences and Benefits

Introducing urban farming can benefit and diversify the local community. There are social and economic benefits urban farming addresses to improve of the community. Local urban gardens provide people with a place of interaction and to hone skills in the gardens. There are also health benefits urban farming can introduce

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<sup>41</sup> McKay, Betsy. “A Farm Grows in the City.” *Wall Street Journal* (May 17, 2017): 1–6.

to cities with the food being grown and distributed within the city limits. These cities become environmentally conscious with the elimination of the need for transporting the food from outside the city. Many cities currently rely on fossil-fuel forms of transportation that contribute to the current global climate change issues.<sup>42</sup> By introducing urban farming techniques into the cities, people in the cities are more likely to bring awareness to sustainability.

#### Case Study: GrowUp Box London

In London, GrowUp Farms is committed to providing healthy and affordable food choices to the people through environmentally-conscious concepts. This urban farm produces organic products through aquaponics and vertical growing technologies.<sup>43</sup> The growing techniques used to reflect contemporary ideas of urban farming that can be applied to proposed urban farming techniques in Portland, Maine.



Figure 62: The GrowUp Box (source by GrowUp Community Farms)

<sup>42</sup> Zbigniew W. Paszkowski. and Jakub I. Golebiewski, “The Renewable Energy City within the City. The Climate Change Oriented Urban Design.” *Science Direct* (2017): 423.

<sup>43</sup> “Our Business Values,” GrowUp Urban Farms, <http://growup.org.uk/our-business-values/> (accessed November 24, 2017)

The aquaponics and vertical growing techniques used in GrowUp Farms displays an efficient closed loop system between natural processes, marine culture and agriculture. These systems are placed in either an industrial warehouse or in used shipping containers located on the rooftop. As illustrated in figure 63, a typical growing unit consists of the shipping container with the fish farm as the base and a modular greenhouse unit above where the growing beds are located. The nutrient-rich water from the fish tanks is pumped upwards to the growing beds in the greenhouse component of the unit, fed to the roots of the plants to fertilize them. The water is then purified and pumped back down to the fish tanks.<sup>44</sup> By growing vertically in the city, vertical farming is located close to the consumers, eliminating transportation costs and carbon-dioxide emissions that are produced when transporting food.<sup>45</sup> GrowUp Community Farms is an example of sustainable urban farming that creates an efficient closed loop of producing food through natural processes.

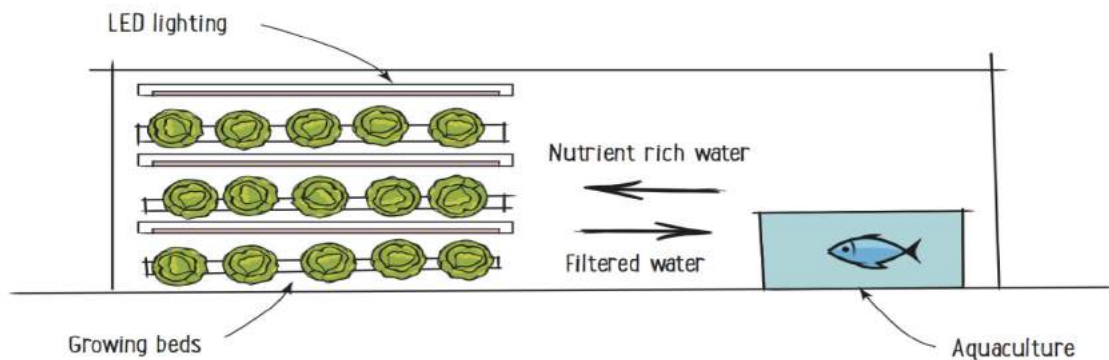


Figure 63: GrowUp Farms Growing Process (source by GrowUp Community Farms)

<sup>44</sup> “GrowUp Community Farms – GrowUp Community Farms,” GrowUp Urban Farms, <http://www.growup.community/> (accessed November 24, 2107)

<sup>45</sup> “Unit 84,” GrowUp Urban Farms, <http://growup.org.uk/growup-urban-farms/> (accessed November 22, 2017)



Figure 64: GrowUp Community Farm industrial warehouse growing space (source by GrowUp Community Farms)

### Renewable Energy

*“To be sustainable, cities must themselves, or in the resources that they command, become low-carbon, resilient, and livable.”*

-Simon Joss, *Governing for Urban Innovation*

City-integrated sustainability and renewable energy resources is an effective approach to an environmental issue. 75% of the power consumed around the world is within cities.<sup>46</sup> Many cities today are not prepared for adapting to climate change and incorporating sustainable energy-saving techniques into existing building systems. Portland contains many potential layers of energy generation through local natural energy sources. These forms of energy generation can be introduced and integrated into Portland as a model for future developments. These systems include renewable energy in future building forms and regional sustainable master planning techniques.

#### Sustainable Master Planning Techniques

Sustainable master planning techniques is formed by layers of natural and built systems that come together to form a harmonious balance. The principles of

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<sup>46</sup> Daniel M. Kammen and Deborah A. Sunter. “City-Integrated Renewable Energy for Urban Sustainability.” *Science*, no. 6288 (2016): 922.

approach for master planning include connectivity of neighborhoods and responding to indigenous urban context and introducing built and natural landscapes that are long life, loose fit oriented.<sup>47</sup> There are three spheres of focus in sustainable master planning that include the community, the economy and the environment of the city to be solved simultaneously.<sup>48</sup> This section will focus on how these three spheres are approached in sustainable master planning.

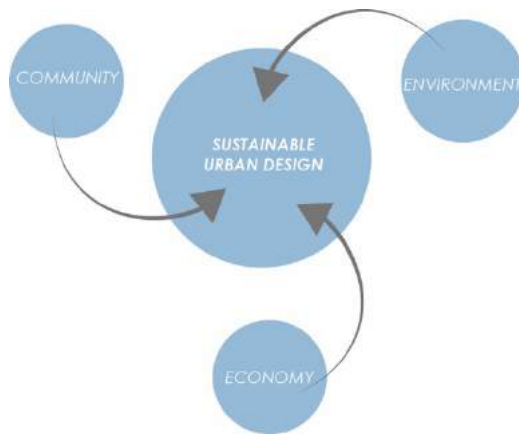


Figure 65: Components of Sustainable Urban Design (source by author)

The community requires making safe and walkable places for people that form practical relationships with streets and vehicles. A sustainable community is defined by places where people want to live and to work now and in the future, environmentally conscious and promotes a high quality of life.<sup>49</sup> Effective community designs have the ability to promote local historical attributes, contain effective

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<sup>47</sup> Daniel Williams, *Sustainable Design: Ecology, Architecture, and Planning* (Hoboken, New Jersey: John Wiley & Sons, 2007), 14.

<sup>48</sup> Williams, 14.

<sup>49</sup> Paul Appleby (*Integrated Sustainable Design of Buildings*. London: Earthscan, 2011), 185.



developments, and develop within the existing city pattern.<sup>50</sup> Parkways and waterways can bring safety to city. Identifying and designing these parkways forms open and dynamic public spaces. They introduce celebrated sidewalks, bike lanes and narrower streets. Creating a safe relationship between pedestrians and vehicles is important to creating a community in the city.

The economic value of incorporating sustainable master planning techniques into the city is based on the place itself. “As much as people follow jobs, businesses follow people to take advantage of local markets for skilled labor and consumer dollars – the *place* in itself is a value.”<sup>51</sup> Part of the master planning mission is providing revenue generating-based functions in the design as part of attracting additional visitors to the site. Portland, Maine is a popular destination of tourists and prides itself in local businesses and restaurants. Incorporating mixed-use building program to generate tourist visitation year-round, support local events and provide a range of housing options will benefit the city greatly in the future. In order for sustainable master planning to be realistic, the economic value must be ideal to support the proposed buildings.

The third sphere, the environment, is crucial to forming master planning techniques that are sustainable. Future master plans of cities should include a progression towards reintegration of natural-system functions, creation of better flood-control systems and water-recharge areas that integrate storm water

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<sup>50</sup> Daniel Williams, *Sustainable Design: Ecology, Architecture, and Planning* (Hoboken, New Jersey: John Wiley & Sons, 2007), 96.

<sup>51</sup> Daniel Williams, *Sustainable Design: Ecology, Architecture, and Planning* (Hoboken, New Jersey: John Wiley & Sons, 2007), 93.

management. These plans must respond to sun, water, topography, wind, climate and flood zones.<sup>52</sup> Replacing hardscape in the city with permeable surfaces will eliminate the heat island effects and storm-water runoff in the city.<sup>53</sup> The localized collection of water to re-use it through water treatment plants has the benefit of air cooling and cleaning the air within urban environments.<sup>54</sup> Including the environment as one of the spheres of master planning will create a more effective city plan for the future of Portland.

#### Renewable Energy in the Building

Incorporating sustainable techniques of renewable energy into the urban building design consists of layers of functioning systems that work together in an effective and efficient way. The architecture becomes a form of place-based design that integrates and connects the natural characteristics of the relative site with the systems of the building.<sup>55</sup> The layers of the building that relate to the sustainability include the building layers, configuration of interior spaces and building integrated renewable energy.

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<sup>52</sup> Paul Appleby (*Integrated Sustainable Design of Buildings*. London: Earthscan, 2011), 89-91.

<sup>53</sup> Ester Charlesworth and Rob Adams (*The EcoEdge: Urgent Design Challenges in Building Sustainable Cities*. New York: Routledge, 2011), 12.

<sup>54</sup> Charlesworth, 12.

<sup>55</sup> Daniel Williams, *Sustainable Design: Ecology, Architecture, and Planning* (Hoboken, New Jersey: John Wiley & Sons, 2007), 105.

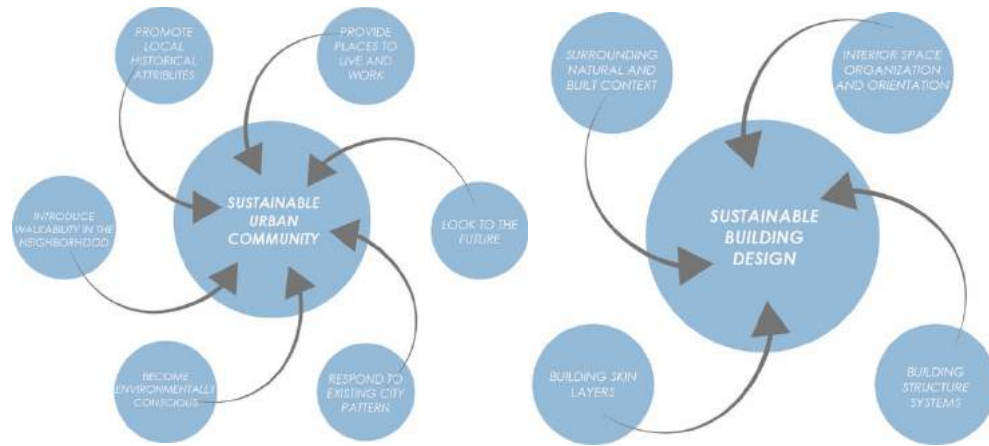


Figure 66: Components of Sustainable Urban Community (source by author)

Figure 67: Components of Sustainable Building Design (source by author)

The building layers are composed of the building skin and the structure. The building skin should act as a natural form that creates a balance between interior and exterior. The components of building layers; floor, wall and ceiling, coexist to form a building skin that can breathe, let water out, cool by evaporation and protect from moisture and the cold.<sup>56</sup> Forces on the building wall system includes contraction, expansion, heat, cold, moisture, rain, sleet, snow, wind, ultraviolet light, humidity and sunlight.<sup>57</sup> The building skin must complement the local natural resources and work with all other systems of the building. The structure of coastal city building design includes orientation and location of these structures based on prevailing wind forces. Structures achieve effectiveness based on working with wind forces. An example is the composition of a palm tree and how the flexibility of it allows it to survive after a

<sup>56</sup> Ester Charlesworth and Rob Adams (*The EcoEdge: Urgent Design Challenges in Building Sustainable Cities*. New York: Routledge, 2011), 117.

<sup>57</sup> Charlesworth, 119.

hurricane.<sup>58</sup> The building skin and structure work together to achieve functional layers of sustainable building design.

Configurations of interior spaces is based on the building skin, structural systems and context. Effective interior spaces address types of programmatic spaces, sunlight directionality and green materials. Interior spaces has the opportunity to connect occupants with natural light through bouncing, enhancing and filtering sunlight into spaces.<sup>59</sup> Introducing natural ventilation and open interactive work spaces decreases space requirements and create a more efficient design. Green materials include using local materials that eliminate large transportation costs. Addressing components of interior spaces is key to sustainable building design.

#### Renewable Energy in the Building

The concept of sustainable building design addresses regional sustainable tactics and applies similar techniques at a smaller scale within the building. Malmo, a city in southern Sweden, contains a sustainable waterfront urban development. The plan creates a gateway into the city and a series of requirements for the sustainable development. Located along the industrial docks, the project displays a balance between urban and green spaces and will receive 100% of its energy from renewable sources like wind turbines, heat pumps, solar collectors and urban waste.<sup>60</sup> Urban waste from occupants is collected by a twin pipe vacuum tube collection network, one

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<sup>58</sup> Ester Charlesworth and Rob Adams (*The EcoEdge: Urgent Design Challenges in Building Sustainable Cities*. New York: Routledge, 2011), 112.

<sup>59</sup> Charlesworth, 127.

<sup>60</sup> Peter F. Smith (*Sustainability at the Cutting Edge*. Oxford: Architectural Press, 2003), 141.

tube for food and one for residual waste that are converted into biogas and filtered back to the residential spaces of the development.<sup>61</sup> Technology is incorporated into the design by implementing a communication network of information that provides residents with energy usage levels and local public transportation times.<sup>62</sup> Overall, the waterfront sustainable development in Malmo is a strong example of urban integrated renewable energy.

### *Adapting Waterfront Technologies: Rising Sea Levels*

*“There are inherit risks to living and working on the coast, from rare and infrequent events such as hurricanes, to everyday hazards such as erosion and waves.”*

*-Urban Waterfront Adaptive Strategies*

Coastal Components and Hazards

The edge conditions of waterfront cities rely on natural components of oceans and harbors. There are forces that determine how the city is organized and how it is placed and oriented in the local geography. The components of natural conditions that affect the waterfront edge range from small-scale tide conditions to large-scale hurricane events that drastically alter the city. This section will focus on these small-scale and large-scale conditions that directly affect the city’s planning techniques

Small-scale conditions of the waterfront include tides, currents, waves and erosion. Tides are fluctuations of daily sea levels that change heights in the water at

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<sup>61</sup> Peter F. Smith (*Sustainability at the Cutting Edge*. Oxford: Architectural Press, 2003), 143.

<sup>62</sup> Smith, 144.

certain times of the day.<sup>63</sup> The currents of the water is represented as the movement of water based on the relationship between tides and waves. Waves are represented as the oscillation movement of a water's surface that has a wide scale of oscillation levels. Erosion is mainly a negative long-term effect of the force of waves and currents on the land that is worn away over time.<sup>64</sup> Sometimes this erosion is a short-term reaction as a result of natural waterfront disasters. Small-scale conditions and reactions of the water along the city's edge form an influence on how the city planning is shaped.

Large-scale conditions of the water along the edge are hurricanes, tropical storms, nor'easters and storm surges. Hurricanes have wind speeds of 74 miles per hour or higher while tropical storms have wind speeds that are between 39 to 73 miles. Nor'easters affect Mid-Atlantic states and New England states and composed of a low pressure system that creates strong winds, heavy snow and rain and large waves along the coastal edge. Together with hurricanes and nor'easters, these natural disasters can create storm surges that raise water levels above the average sea level and moves inland to cause flooding along coastal cities and towns.<sup>65</sup> Addressing the large-scale conditions of the water regionally is crucial to understanding how the city can be organized in relation to the forms of water.

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<sup>63</sup> Department of City Planning: City Of New York, "*Coastal Climate Resilience: Urban Waterfront Adaptive Strategies*," [https://www1.nyc.gov/assets/planning/download/pdf/plans-studies/sustainable-communities/climate-resilience/urban\\_waterfront.pdf](https://www1.nyc.gov/assets/planning/download/pdf/plans-studies/sustainable-communities/climate-resilience/urban_waterfront.pdf) (accessed November 12, 2017).

<sup>64</sup> Department of City Planning: City Of New York, "*Coastal Climate Resilience: Urban Waterfront Adaptive Strategies*."

<sup>65</sup> Department of City Planning: City Of New York, "*Coastal Climate Resilience: Urban Waterfront Adaptive Strategies*."

## Adaptive Urban Waterfront Strategies

Adaptive urban waterfront strategies respond to water conditions and hazards with long-term resilient solutions for infrastructure systems and buildings. These strategies are broken down into an evaluative process that focuses on site and water reach. The goal of this comprehensive process is to existing city conditions to move forward and adapt to the long-term effects of rising sea levels and natural disasters.

The site is about forming a flexible relationship between site context, building form and water. There is a focus on how the different building systems are created to protect occupants against flooding conditions. These systems are broken down into elevated systems, stationary systems and flexible systems. Elevated systems can be applied to both existing and proposed building forms. The advantage of incorporating this system is the ability to allow water to move freely under the building without obstructing it. Fixed systems provides a permanent barrier around the base perimeter of the building to protect against water loads and infiltration. Dry flood-proofing involves exterior wall systems that incorporate waterproofing, impermeable membranes, aquarium glass and layers of concrete or masonry as part of the system.<sup>66</sup> Site protection systems is composed of adjustable bulkheads or natural berms built around the building, separate from the perimeter of the building.<sup>67</sup> This system could be effective but the building is still located within the flood zone. Flexible systems

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<sup>66</sup> Department of City Planning: City Of New York, “*Coastal Climate Resilience: Urban Waterfront Adaptive Strategies*,” [https://www1.nyc.gov/assets/planning/download/pdf/plans-studies/sustainable-communities/climate-resilience/urban\\_waterfront.pdf](https://www1.nyc.gov/assets/planning/download/pdf/plans-studies/sustainable-communities/climate-resilience/urban_waterfront.pdf) (accessed November 12, 2017).

<sup>67</sup> Department of City Planning: City Of New York, “*Coastal Climate Resilience: Urban Waterfront Adaptive Strategies*.”

are building forms that move with tide levels and storm surges and represented by floating structures and amphibious structures.<sup>68</sup> Amphibious structures are distinct from floating structures because they are placed on dry land with a buoyant foundation that allows the building to raise during flooding events.<sup>69</sup> An advantage of introducing flexible systems into building design is the resilience against flooding contained by these structures. These forms of adaptive urban building designs are further protected by adaptive water reach systems that are applied in a regional context.

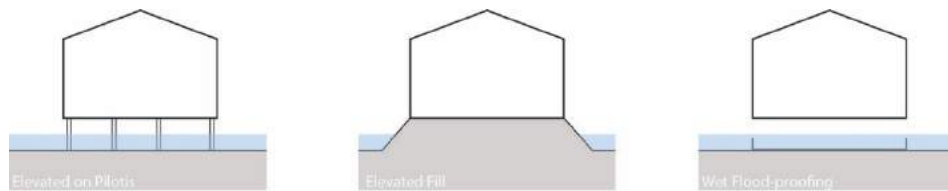


Figure 68: Elevated Building Approach (source by author)



Figure 69: Fixed Building Approach (source by author)

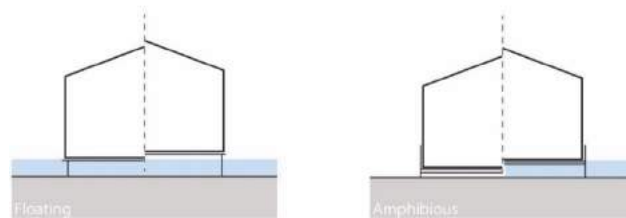


Figure 70: Flexible Building Approach (source by author)

<sup>68</sup> Department of City Planning: City Of New York, “Coastal Climate Resilience: Urban Waterfront Adaptive Strategies,” [https://www1.nyc.gov/assets/planning/download/pdf/plans-studies/sustainable-communities/climate-resilience/urban\\_waterfront.pdf](https://www1.nyc.gov/assets/planning/download/pdf/plans-studies/sustainable-communities/climate-resilience/urban_waterfront.pdf) (accessed November 12, 2017).

<sup>69</sup> Department of City Planning: City Of New York, “Coastal Climate Resilience: Urban Waterfront Adaptive Strategies.”



The water reach is about providing protection from catastrophic natural events through forms of barrier systems for waterfront cities. Water reach is broken down into three distinct categories; upland, shoreline and in-water approaches.<sup>70</sup> The upland approach is about relocating or planning building sites above the flood zone levels that range from floodwalls to waterfront parks.<sup>71</sup> Shoreline strategies of water reach is about creating an interactive shoreline context that integrates bulkheads, seawalls, multi-purpose levels or coastal vegetation into the sustainable urban design.<sup>72</sup> The advantage of doing this is the potential of creating public spaces for visitors to experience and find a closer connection to natural form. In-water strategies are focused on integrating natural barriers within the flood zone that filters water through the water reach is important to urban design as a component for protecting building systems and its occupants.



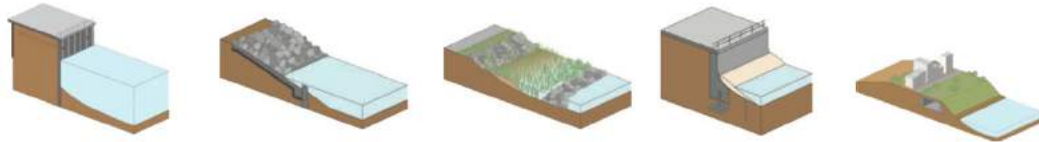
Figure 71: Inland Edge Approach (source by Department of City Planning: City Of New York)

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<sup>70</sup> Department of City Planning: City Of New York, “Coastal Climate Resilience: Urban Waterfront Adaptive Strategies,” [https://www1.nyc.gov/assets/planning/download/pdf/plans-studies/sustainable-communities/climate-resilience/urban\\_waterfront.pdf](https://www1.nyc.gov/assets/planning/download/pdf/plans-studies/sustainable-communities/climate-resilience/urban_waterfront.pdf) (accessed November 12, 2017).

<sup>71</sup> Department of City Planning: City Of New York, “Coastal Climate Resilience: Urban Waterfront Adaptive Strategies.”

<sup>72</sup> Department of City Planning: City Of New York, “Coastal Climate Resilience: Urban Waterfront Adaptive Strategies.”



*Figure 72: Shoreline Edge Approach (source by Department of City Planning: City Of New York)*

Overall, there are many different layers of sustainability in design, ranging from an urban scale to the individual rooms of building design. Addressing the current issue of climate change and reacting to the inevitable change that is occurring in the environment is crucial to waterfront cities like Portland adapting to the future to preserve the livability of the city, provide more environmentally-friendly modes of transportation and introducing effective techniques like urban farming. Responding to this important topic of architecture and sustainability will create an reimagined and timeless urban and building design for Portland's waterfront.

## Chapter 5: Understanding the Waterfront City Typologies

### New England Waterfront Cities: Portsmouth, New Hampshire

#### Connection to City

The connection to the city in Portsmouth, New Hampshire from the waterfront is reflected by two primary streets that service the waterfront edge and creates a transitional zone into the small New England city.

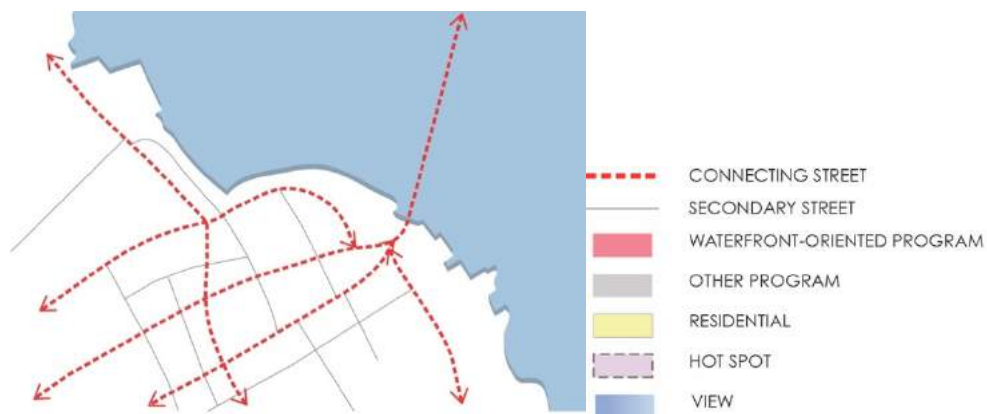


Figure 73: Portsmouth, NH: Connection to City (source by author)

#### Waterfront Program

The program along the waterfront is contained within historical buildings with linear nodes of retail spaces closer to the water for an intimate connection with the natural environment of the water.



Figure 74: Portsmouth, NH: Waterfront Program (source by author)

### Hot Spots and Views

The hot spots of Portsmouth waterfront are represented by large green spaces and a performing arts center that provide opportunities to bring people closer to the waterfront.

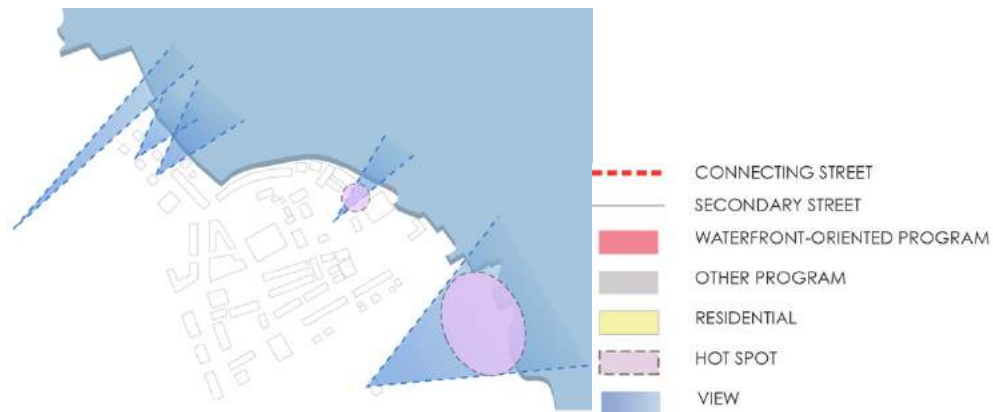


Figure 75: Portsmouth, NH: Hot Spots and Views (source by author)

### European Waterfront Cities: Oslo, Norway

#### Connection to City

Oslo, Norway has an organized connection to the city with four primary streets that lays out the regular grid system that organizes the city blocks as a

transition from the transparency of the water front to the dense environment of the city.

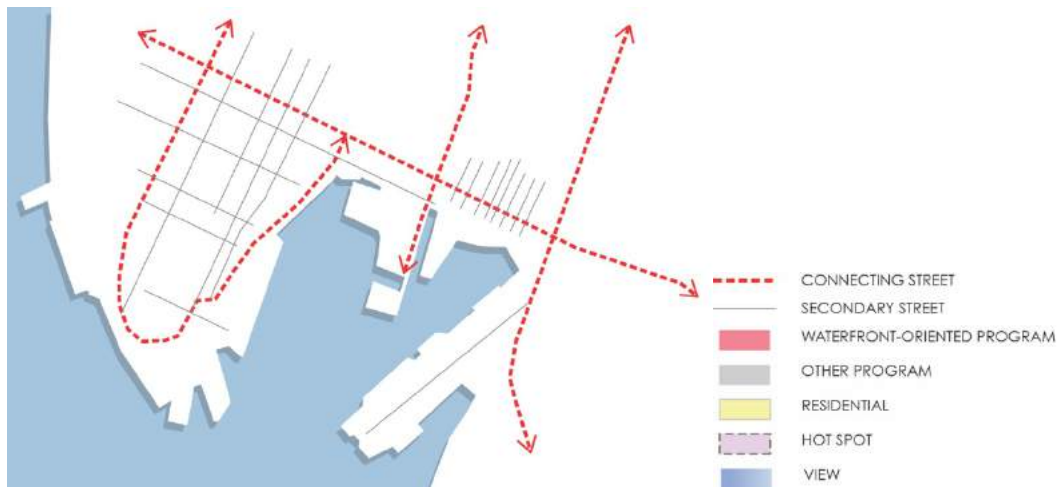


Figure 76: Oslo, Norway: Connection to the City (source by author)

### Waterfront Program

The important program space that celebrates the waterfront is the Oslo Opera House that addresses views to the water, interaction of people, and response to the surrounding city environment.



Figure 77: Oslo, Norway: Waterfront Program (source by author)

## Hot Spots and Views

The hot spots and views are organized to be situated from public gathering spaces and private waterfront residential areas. The waterfront edge buildings are organized to take advantage of the water and strategically placed to respond to the important views of the water.



## European Waterfront Cities: Helsinki, Finland

### Connection to City

The organization of the city's waterfront edge and the connection to the central city zones is very regularized and respond to manipulating the grid systems to the natural edges of the water and transition back to the regular city grid.

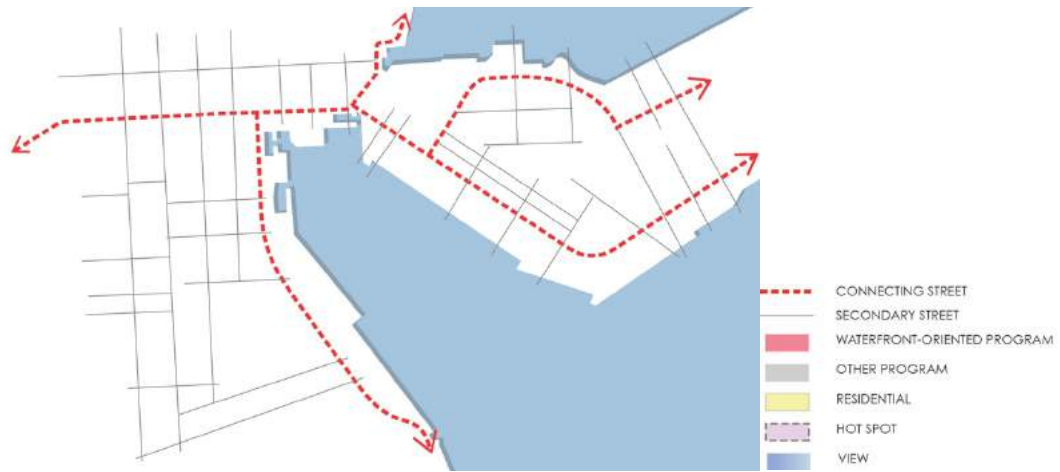


Figure 79: Helsinki, Finland: Connection to the City (source by author)

### Waterfront Program

The program surrounding the waterfront consists mostly of mixed use functions situated along grand gathering spaces that provide a linear and organized connection inwards toward the city.

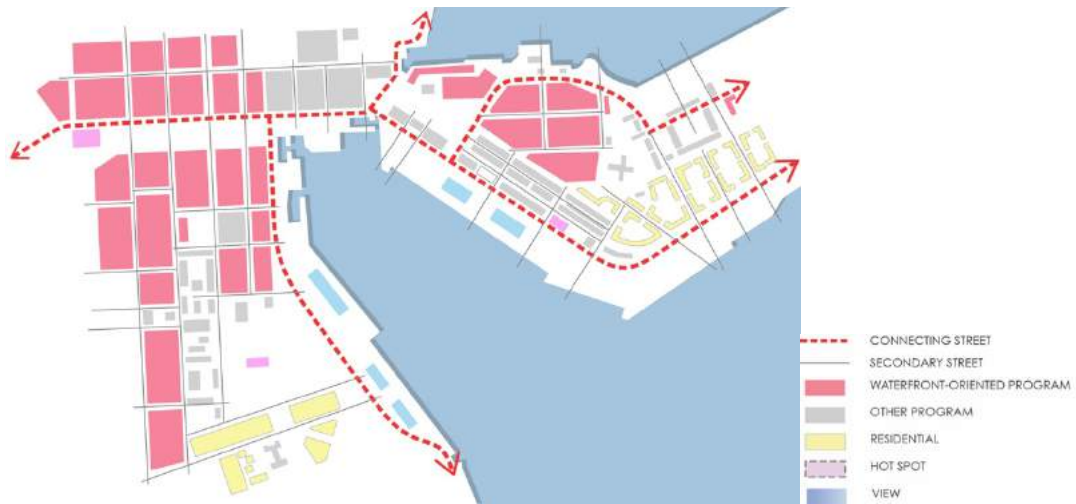
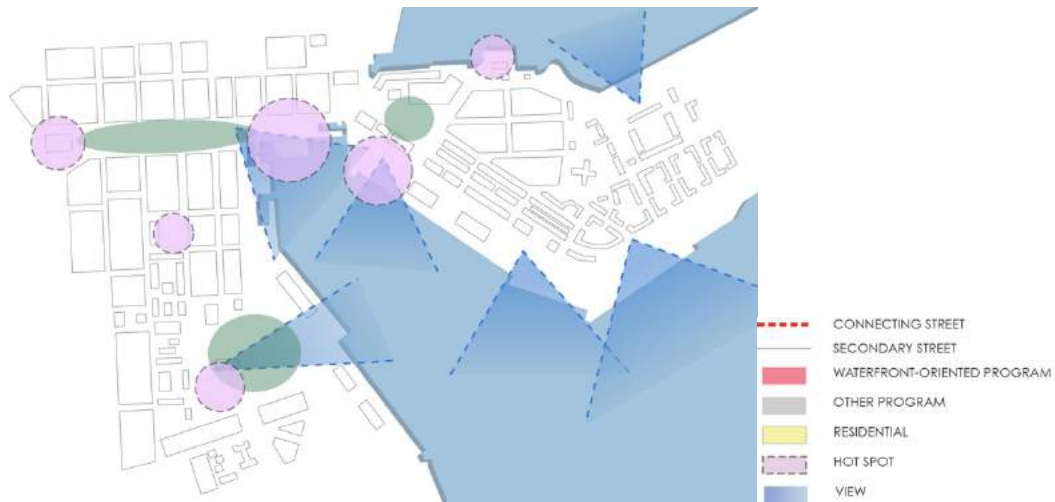


Figure 80: Helsinki, Finland: Waterfront Program (source by author)

### Hot Spots and Views

The hot spots and views of Helsinki's waterfront is organized around rationalized civic spaces that interlock with the city fabric to create a more rich connection with the waterfront and maintain a transparent edge along the waterfront

to illustrate a fine balance between the city environment and the natural environment of the water.



*Figure 81: Helsinki, Finland: Hot Spots and Views (source by author)*

### *Reconnecting the City's Waterfront Edge: Philadelphia, PA*

#### Connection to City

Philadelphia's waterfront is currently going through a revitalization to reconnect the waterfront to the city after it was disconnected due to the construction of Interstate 95 in the late 1900s during urban renewal. The revitalization is focused on introducing green spaces that will bridge over the interstate and bridge a connection between the city and the waterfront.





Figure 82: Philadelphia, Pennsylvania: Connection to the City (source by author)

### Waterfront Program

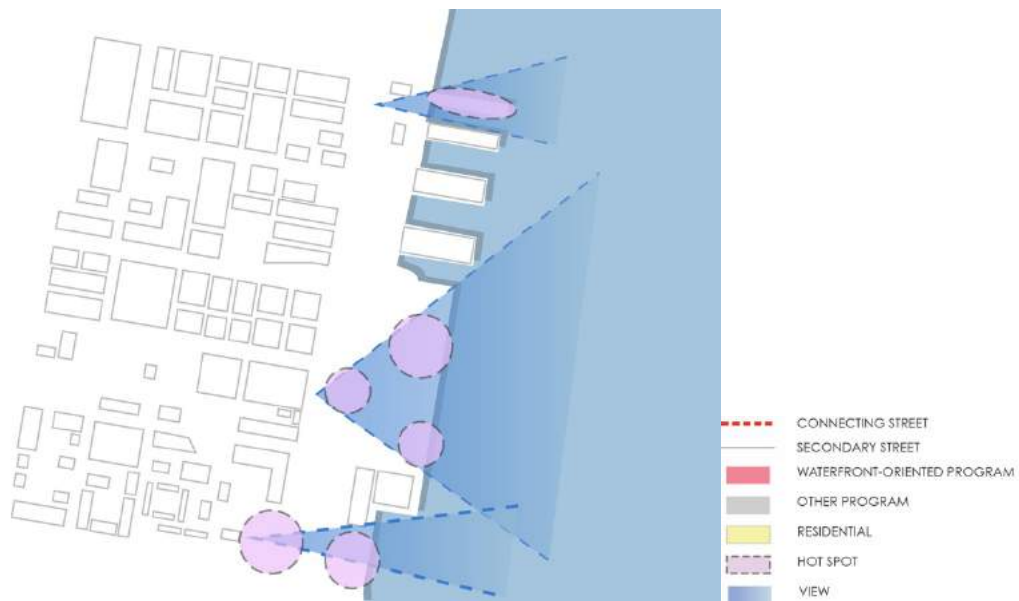
The waterfront program that is seen along the waterfront is an extension of the center city of Philadelphia with the storefronts and upscale residential developments that are developing on the wharves. The Penn’s Landing is project is crucial to revitalizing the city with the introduction of civic spaces and new public buildings that will connect with these proposed civic spaces.



Figure 83: Philadelphia, Pennsylvania: Waterfront Program (source by author)

## Hot Spots and Views

The urban edge of the city along the waterfront is very clearly defined and provides a harmonious balance between density and transparency and retains the transparency as a way of celebrating the views along the Delaware River and bringing the public towards the water.



*Figure 84: Philadelphia, Pennsylvania: Hot Spots and Views (source by author)*

## Chapter 6: The Cultural Market Hall: Celebrating Local Foods

### Quincy Market: Boston, Massachusetts



Figure 85: Quincy Market (source by Wikipedia)

#### Program

Quincy Market is an example of a market hall that celebrates the market hall space as a central programmatic space. Connected by a central public space, there were additional wings added along the sides of the market to create a multi-functional market hall that invites more visitors to this urban space of downtown Boston.

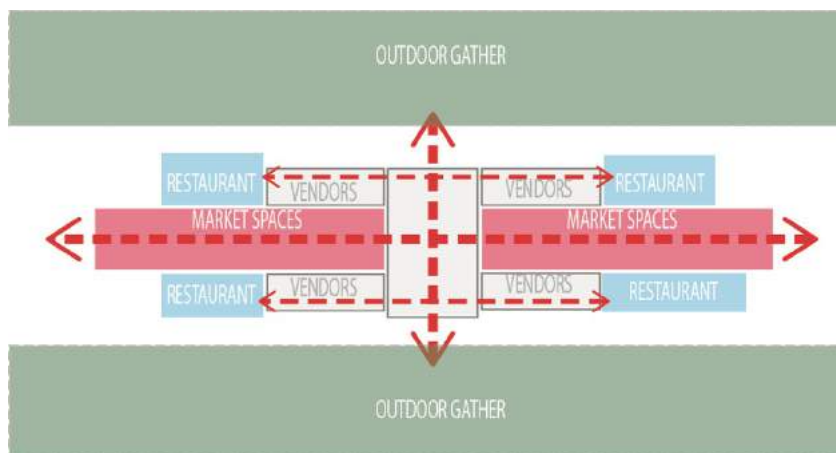


Figure 86: Quincy Market Program Plan Diagram (source by author)

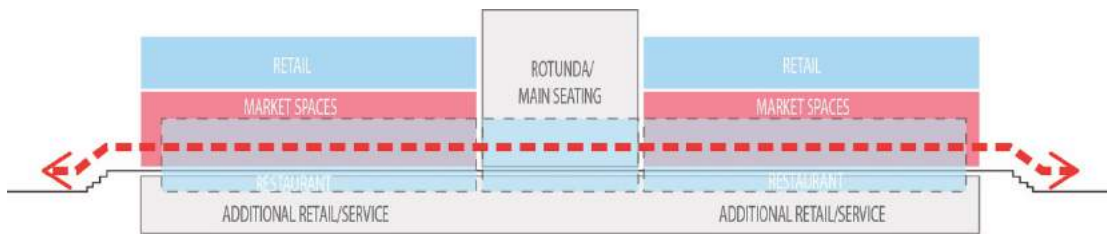


Figure 87: Quincy Market Program Section Diagram (source by author)

Union Market: Washington D.C.



Figure 88: Union Market (source by Flickr)

Program

Union Market is an example of a simple plan that designates the market as a central focus with individual vendors that populate the hall and permanent spaces like a restaurant and deli that work with the market hall to create a diverse experience for visitors.

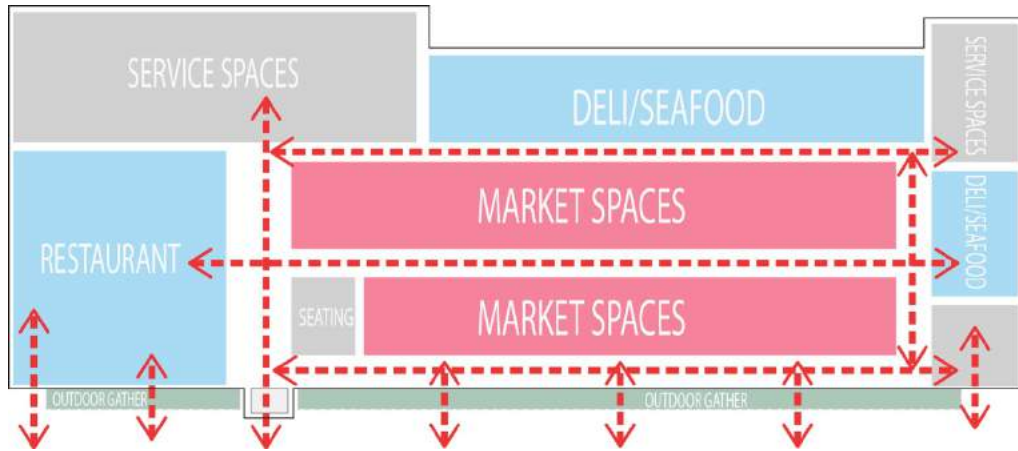


Figure 89: Union Market program diagram (source by author)

Boston Public Market: Boston, Massachusetts



Figure 90: Boston Public Market (source by Archdaily)

Program

The Boston Public Market is an example of a market space contained within a multi-functional urban building. The market occupies the first floor of the building, closely connected with the public along the sidewalk and providing multiple market spaces on the same floor that is connected by a central market “hub.” There is teaching kitchen that is serviced by the market and offers people the opportunity to learn how to create dishes from local food sources.

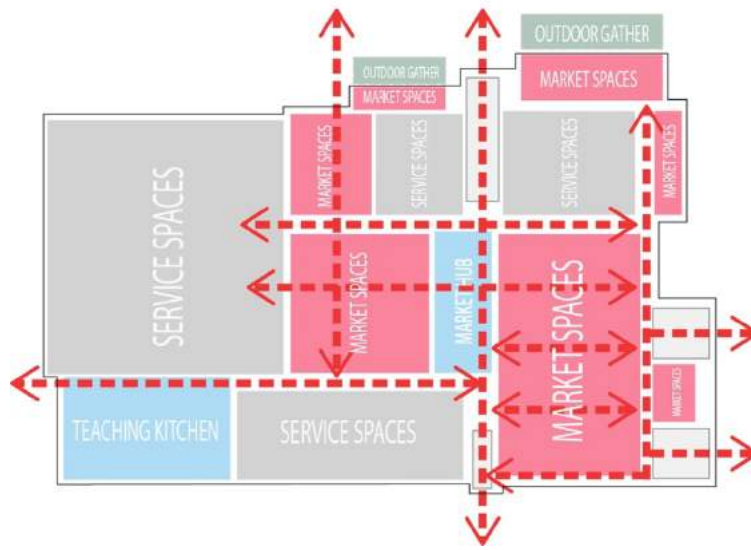


Figure 91: Boston Public Market program plan diagram (source by author)

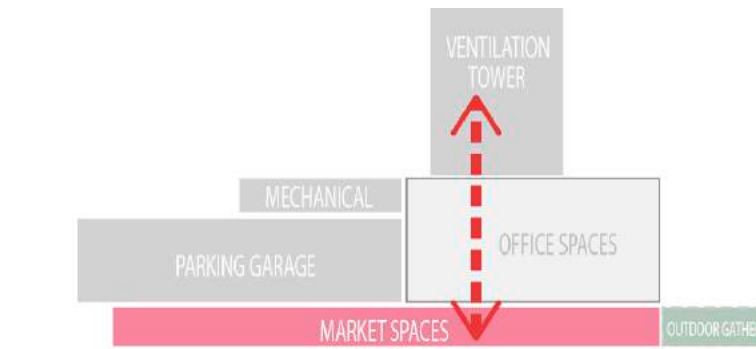


Figure 92: Boston Public Market program section diagram (source by author)

Bergen Fish Market



Figure 93: Bergen Fish Market, (source by Archdaily)

## Program

The fish market at Bergen is a contemporary example of a waterfront market space that reacts effectively to the surrounding historical context. The building responds to the transparency of the water, the surrounding existing civic spaces and providing additional programmatic functions that allows for a more diverse market hall for the city of Bergen.

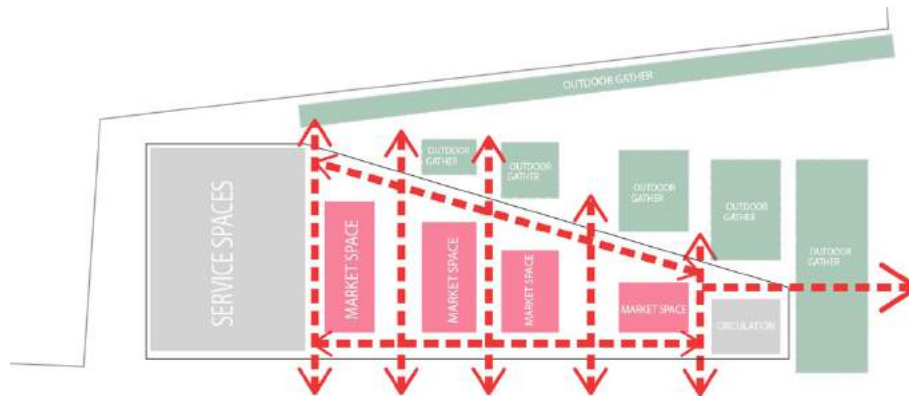


Figure 93: Bergen Fish Market program plan diagram (source by author)



Figure 94: Bergen Fish Market program section diagram (source by author)

## Chapter 7: Concept Explorations: Master Planning and Market

### Portland Waterfront Master Planning Concept Explorations



*Figure 95: Master plan scheme 1: Conservative approach (source by author)*



*Figure 96: Master plan scheme 2: Moderate approach (source by author)*





Figure 97: Master plan scheme 3: Radical approach (source by author)

Portland Waterfront Market Hall Concept Explorations

Cultural Market Hall: Programmatic Spaces

MARKET HALL | Portland, Maine

	SIZE (SQ FT)
<b>MARKET HALL</b>	
Primary Market Hall	8,400
Typical Vendor Stalls	100
Teaching Kitchen	1,800
Preparation Space	1,500
Restaurant	3,000
Entry Lobby/Vertical Circulation	800
Central "Market Hub"	800
<b>INDUSTRY SPACES</b>	
Loading/ Unloading	4,800
<b>SERVICE SPACES</b>	
Staff Support Room	1 Staff per 35 Sq Ft
Staff Offices	1 Staff per 150 Sq Ft
Storage	
Mechanical	
Bathrooms	600 (300 each)

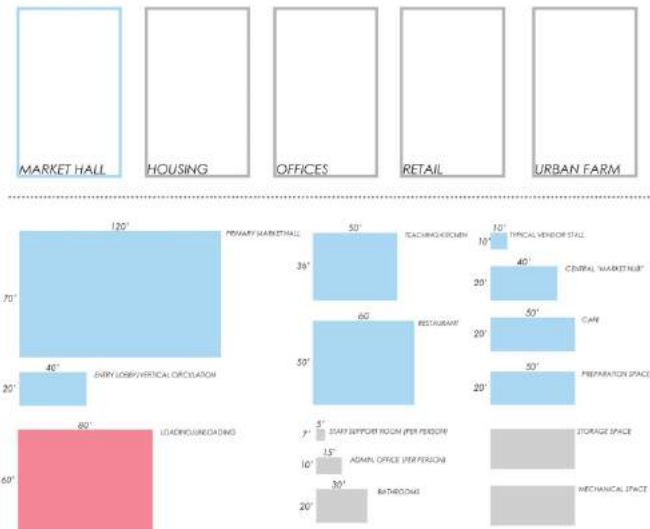


Figure 98: Area Tabulation chart of a cultural market hall (source by author)

**SCHEME 1: WHARVES**

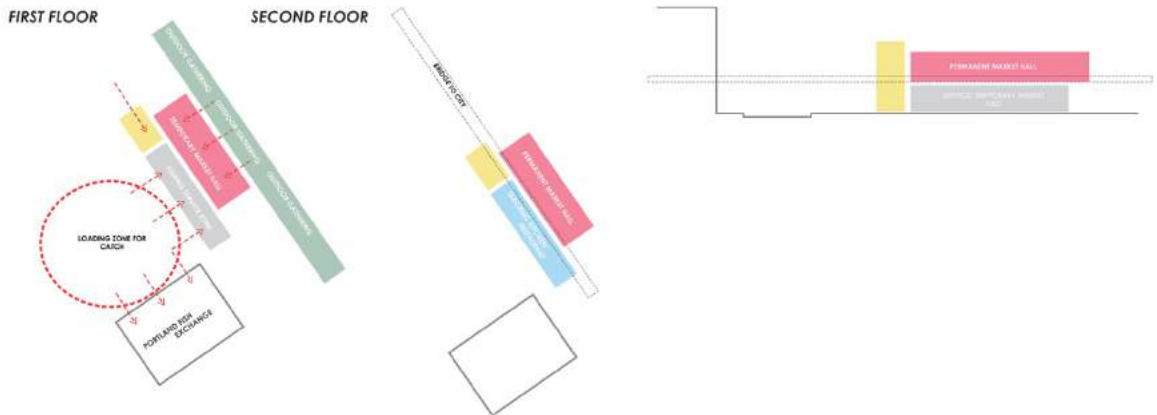


Figure 99: Market Hall Scheme 1: Response to the Wharves (source by author)

**SCHEME 2: WHARVES**

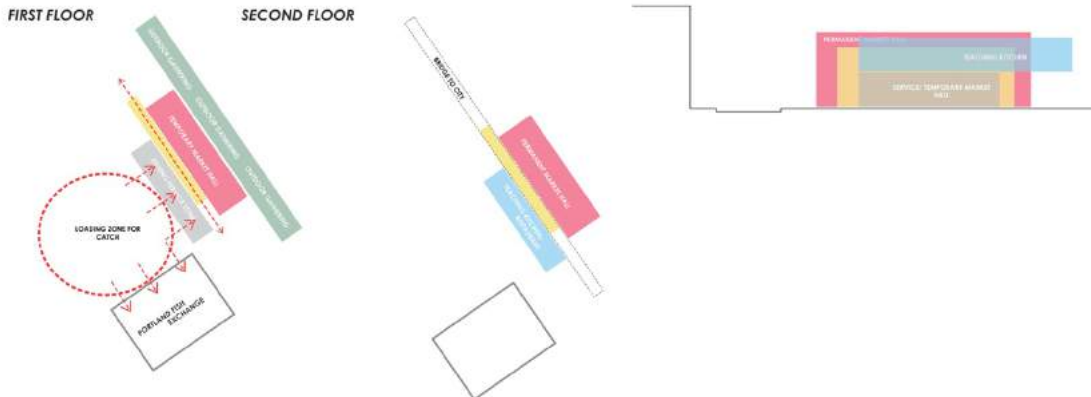


Figure 100: Market Hall Scheme 2: Response to the wharves (source by author)

**SCHEME 3: WHARVES/CITY**

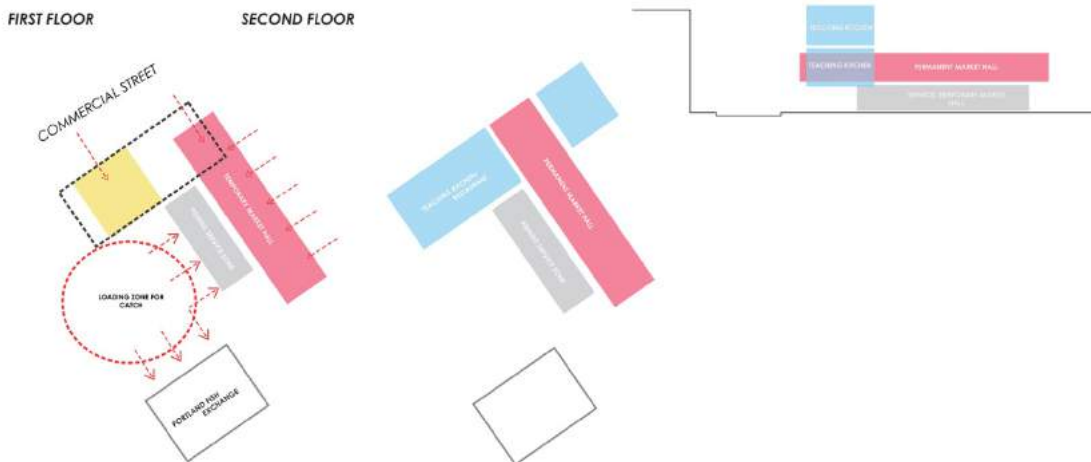


Figure 101: Market Hall Scheme 3: Response to the wharves and the city (source by author)

**SCHEME 4: WHARVES/CITY**

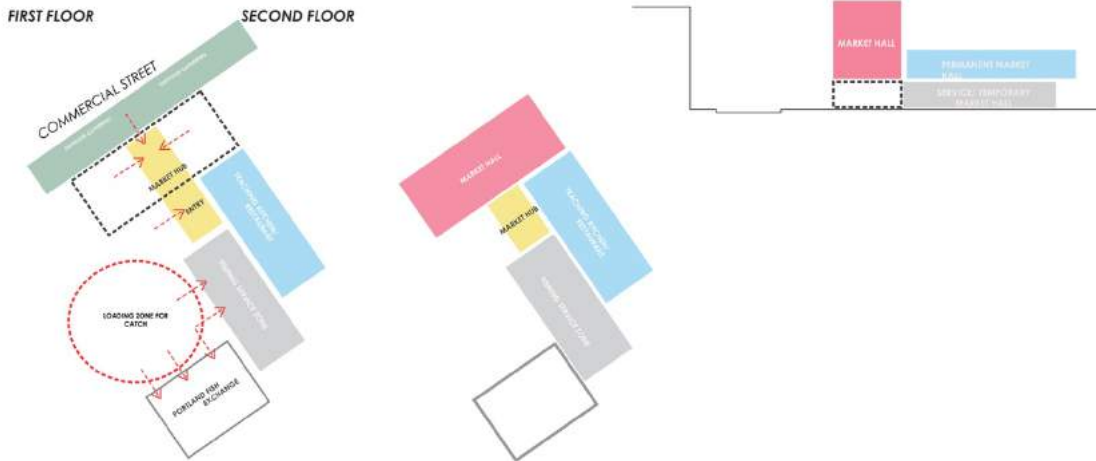


Figure 102: Market Hall Scheme 4: Response to the wharves and the city (source by author)

**SCHEME 6: CITY**

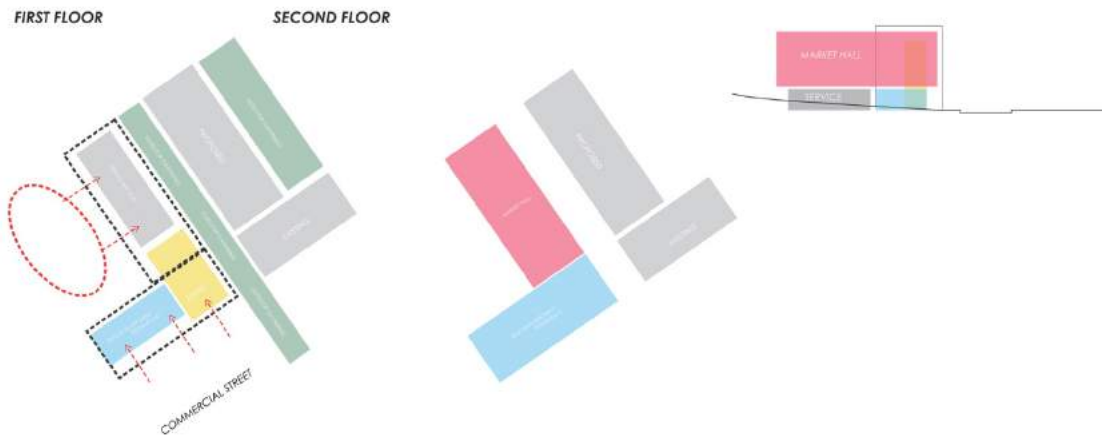


Figure 103: Market Hall Scheme 5: Response to the city (source by author)

**SCHEME 5: CITY**

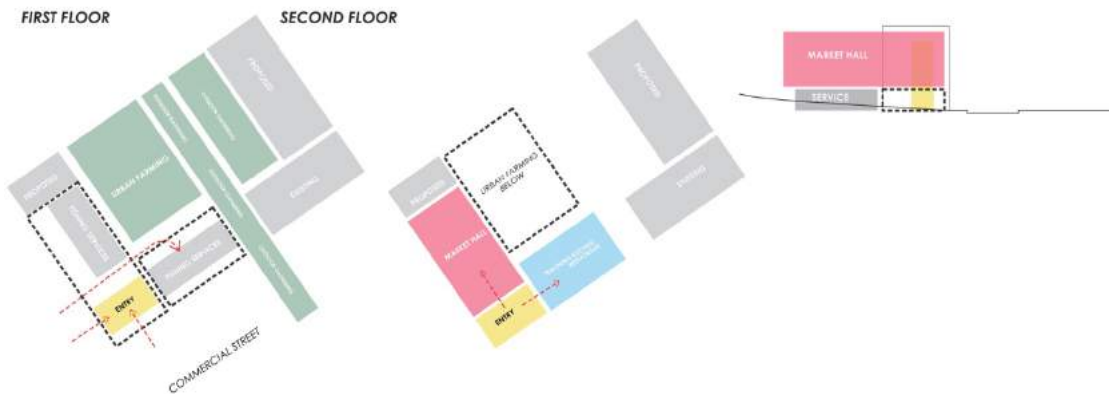


Figure 104: Market Hall Scheme 6: Response to the city (source by author)

## Chapter 8: Final Design and Conclusions

### Final Design Outcome

In order to address the reconnect of the city, the solution is based around revitalizing Center Street as a pedestrian-oriented street. Center Street contains two contrasting environments, with the Time and Temperature Building terminating the northern end of the axis and the Portland Fish Exchange terminating the southern end of the Center Street axis. As a result of a series of concept explorations that dealt with the relationship between the public and the working waterfront, a clear parti was established that blurred the boundaries between these two groups and created

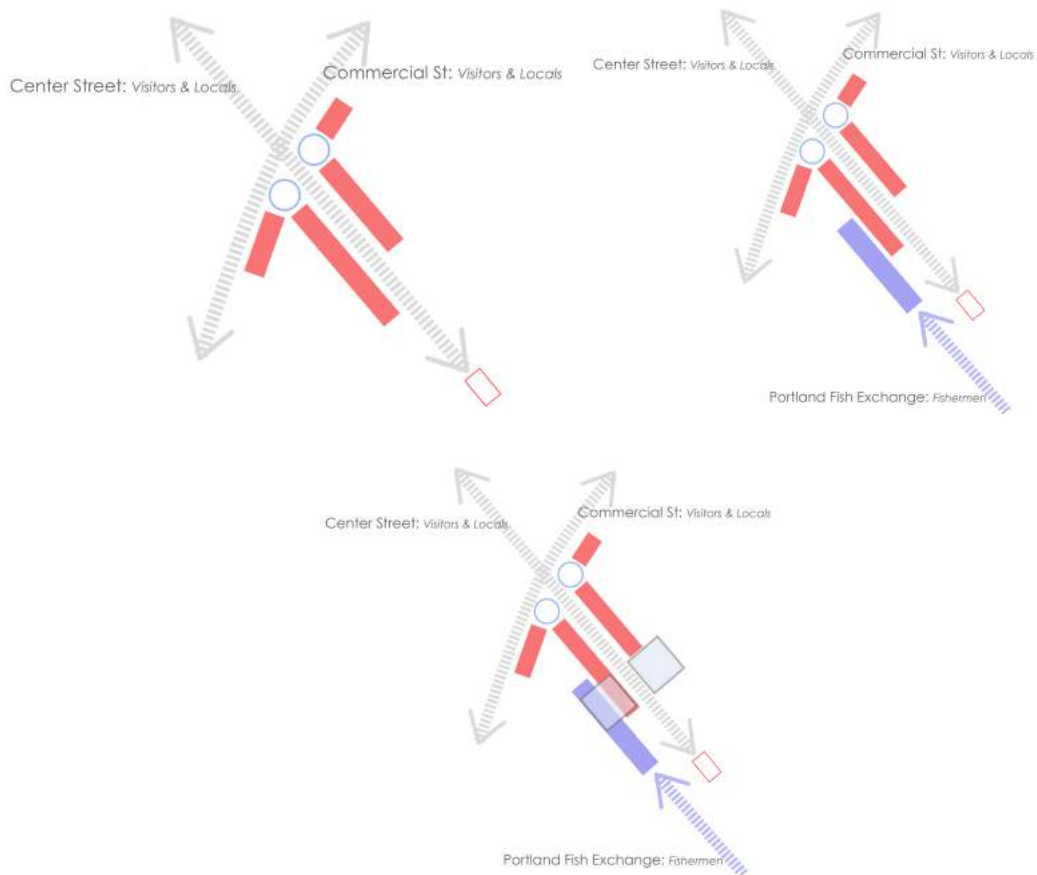
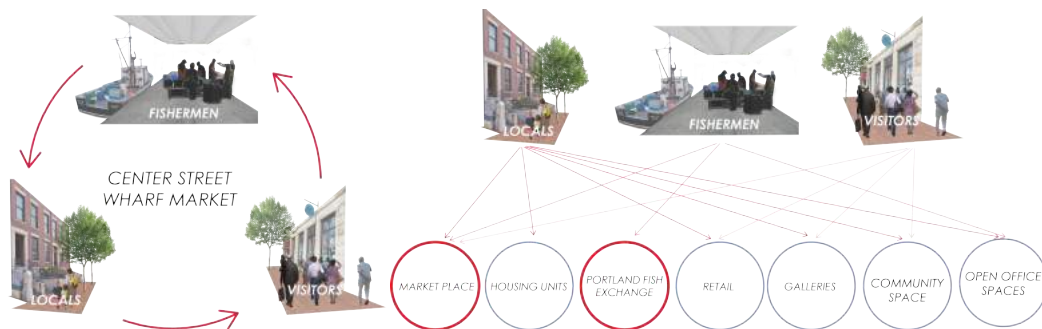


Figure 105: Community Gateway parti (source by author)

celebrated connections. This part formed what is known as the waterfront community gateway for Portland. Three types of relevant users were introduced to address the programmatic needs for this community gateway, these users included; the locals, the visitors and the fishermen. The synergy between these types of users creates the community gateway into what is known as the *Center Street Wharf Market*. This market space not only addresses the spaces within this community gateway design,



*Figure 106: Synergy of user types and programmatic spaces (source by author)*

but it addresses urban issues along the existing Center Street. The proposed master plan in this thesis is about introducing more mixed-use buildings that connect the surrounding residential neighborhoods



*Figure 107: Before and after site plan of downtown Portland (source by author)*

with the downtown area and addresses the ineffective void in the city. The proposed



Figure 108: Proposed site plan of downtown Portland (source by author)

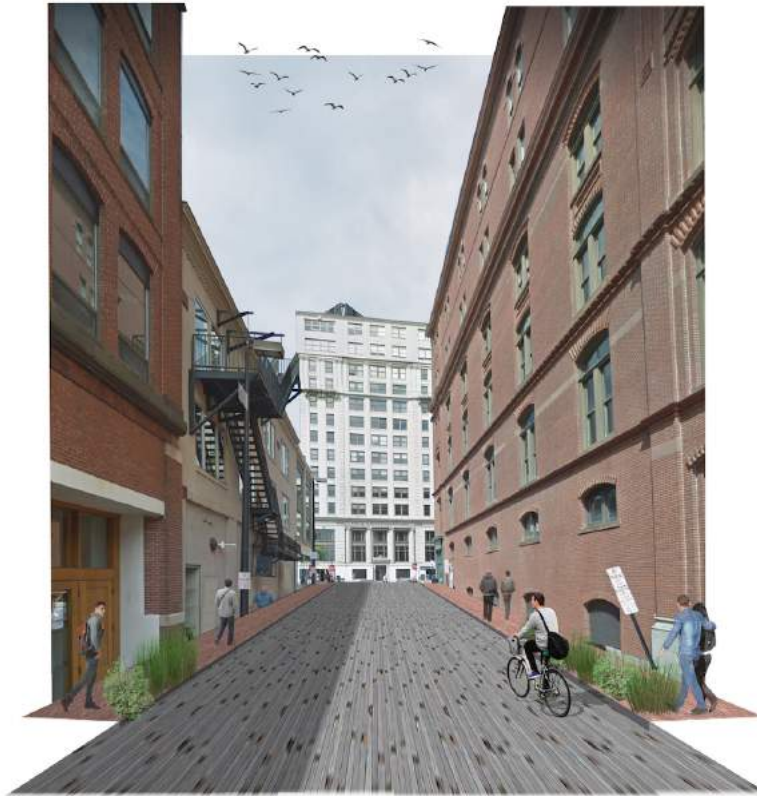


Figure 109: Proposed site section of Center Street (source by author)

Urban design for Center Street incorporates cobblestone paving in to protect the safety of the pedestrians and introduces vegetation as a way of controlling storm water runoff.



*Figure 110: Aerial view of proposed downtown and community gateway master plan (source by author)*



*Figure 111: Center Street view up to the Time and Temperature building (source by author)*



*Figure 112: Center Street view down to Center Street Wharf Market (source by author)*



*Figure 113: View of Center Street Market from Commercial Street (source by author)*





*Figure 114: Water Steps (source by author)*



*Figure 114: Pedestrian Street (source by author)*



*Figure 115: Waterfront urban space – farmer's market (source by author)*



*Figure 116: Waterfront urban space –summertime concert event (source by author)*



*Figure 117: Waterfront urban space –fireworks event (source by author)*



*Figure 118: Market Hall view (source by author)*



*Figure 119: Upper Market Hall view (source by author)*



*Figure 120: Harbor Pavilion view (source by author)*



*Figure 121: Portland Fish Exchange approach (source by author)*



*Figure 122: Portland Fish Exchange prepare space view (source by author)*



*Figure 123: Portland Fish Exchange auction space view (source by author)*

## Conclusions

This thesis explores the current disconnect between the city and the working waterfront forms interactive connections between the city context and the wharf context to create a linear experience along the proposed revitalized Center Street. This approach merges the city environment with the local wharf environment to eliminate the existing disconnect and create a celebrated connection between the locals, the visitors and the fishermen of Portland. This thesis strives to reimagine the existing Portland Fish Exchange structure and reform the open program spaces to link with a waterfront market hall that invites the public to enjoy the local fresh seafood brought in by fishermen and immerse themselves in the environment of the working waterfront. By creating a sequence of experiences down to the harbor from the central downtown area, this design thesis is reimagining the wharves of a small waterfront

city and incorporating the environment of Portland into the experience for the people. Overall, this thesis accomplishes the design challenges of overcoming the disconnect that was formed over time between the city and the working waterfront and re-establish the significance of the industry's role in supporting the city and creates interactive experiences for the locals, the visitors and the fishermen of Portland, Maine.

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