ABSTRACT

Title of Document: SUSTAINABLE PLACEMAKING: RESTORING THE VITALITY OF UNDERUTILIZED INFRASTRUCTURE

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A city experiences natural manipulation through time as the demographics, economy, technology, and industry evolve. As a result, formally prominent sites and buildings become neglected. This thesis explores a model of sustainable placemaking that adaptively reuses currently underutilized infrastructure to sponsor a restored definition of place for a community. I will illustrate how a small town has the opportunity to inform the larger society that living in a self-sustaining localized environment is achievable.

The model of sustainable placemaking is illustrated through a case study in Frederick, Maryland. This historically sensitive, yet progressive, city offers exemplary circumstances of how a modest sized town, attentive to preserving its historical heritage, can

incorporate sustainability. My study focuses on a blighted area, adjacent to a newly developed pedestrian creek front, to demonstrate how the City of Frederick can revitalize its sense of place with the sustainable redevelopment of existing underutilized infrastructure.

# SUSTAINABLE PLACEMAKING:
# RESTORING THE VITALITY OF UNDERUTILIZED INFRASTRUCTURE

By

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# Preface

> The world will not evolve past its current state of crisis by using the same thinking that created the situation.
>
> - Albert Einstein

Global warming is real. One could pick up a newspaper, turn on the local news, or partake in a coffee shop conversation and undoubtedly our global environmental catastrophe will be discussed. However, Bill McKibben, an animated environmentalist, points out that the continued rise in carbon emissions exemplifies the overall lack of success our society has achieved in producing impactful results. In other words, while we are all talking about the environmental change, not many impactful results are being felt. McKibben points out, "Most of us are fundamentally ambivalent about going green: We like cheap flights to warm places, and we're certainly not going to give them up if everyone else is still taking them."[1] His analogy reaches a fundamental point about society, we aren't going to change unless we have to. Typically that entails a catastrophic event or government mandates, however, there may be other ways to intervene an impactful shift to a sustainable future.

[1] McKibben, Bill., "Global Warming's Terrifying New Math." *Rolling Stone.* August 2, 2012.

This thesis attempts to explore an alternative method of change by starting with a small intervention. This path will focus on a model of sustainability applicable to a modest-sized town in order to revitalize the uniqueness of individual communities. This will exhibit the essential changes that need to take place now to influence the fundamental societal changes necessary to end our petroleum dependence. Most important to this sustainability model will be reenergized health and vitality of the overall community, the re-use of existing infrastructure, and the use of proper building technology and renewable energy sources.

I will begin this thesis study with an exploration of the theory of sustainable placemaking. Next I will develop a set of design principles from the examination of a set of precedent studies based in five categories – waterfront development, adaptive reuse, Multifamily Passive House design, Passive House design in the United States, and mixed-use development. I will apply these principles to a case study at the level of master planning sustainable urban design while also focusing into the details of revitalizing an existing structure as part of this sustainable placemaking strategy.

By starting small, through the insertion of this model into a progressive-minded town, the effects will be immediately apparent with great public spaces, healthier living conditions, and a shared sense of pride for the community. The measurable improvements of this localized model of a self-sustaining town will generate attention for future implementations.

As David Orr points out, “We are approaching the end of a brief era in which we could burn cheaply priced fossil fuels while ignoring the ecological consequences.”[2] We must begin to make changes now. This thesis will illustrate how this model of sustainability can exist within our historic towns and not require dramatic changes to our livelihood. Buildings don’t have to take on dramatic changes in appearance. Instead, as illustrated in the case study below, sustainable building practices can fit into, and spur the growth of, the existing historical context of a city.

Sustainability is a difficult term to define. It upholds a variety of meanings ranging from its jaded product marketing use, to the effective efforts of dedicated design professionals to improve their ecological design impact. Stephen Mouzon, an architect, author, and activist of the New Urbanism movement, in his book *The Original Green: Unlocking the Mystery of True Sustainability*, developed a provokingly simple and clear definition of sustainability, “Keeping things going in a healthy way long into an uncertain future.”[3]

I have kept this fundamental definition in my mind throughout the course of this study.

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[2] Orr, David W., *Design on the Edge : The Making of a High-Performance Building,* 178.

[3] Mouzon, Stephen A., *The Original Green: Unlocking the Mystery of True Sustainability,* 45.

# Dedication

To my wife, Alicia. For her unconditional support.

# Acknowledgements

This thesis study would not have been possible without the assistance and support of many individuals. For the guidance and support of my thesis committee. For the assistance in setting up the technology associated with my thesis presentation, Paul Brown – IT Coordinator, Cindy Frank – Director, VRC, and Tom Swift – Shop Manager. For the assistance in providing technology resources, Francis Bass – A/V Operations Manager, Ryan Knapp – Production Manager, Clarice Smith Preforming Arts Center, and Erik Trester, Production Coordinator, Clarice Smith Preforming Arts Center. Lastly to those involved with providing research and access to my thesis site, Paul Millstein – Douglas Development, Richard Griffin – Director of Economic Development, City of Frederick, and Jeff Whitman – GTM Architects.

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# 00 – Introduction

Before we begin a discussion of placemaking, it is important to understand importance that *place* will have in the inevitable post-petroleum dependent society the world will face. The United States is currently part of an ever-growing path to a globalized market and its inevitable societal effects; where imports and exports dominate over the local vendor; where purchasing a new vacuum cleaner makes more sense than visiting the corner repair shop; where visually stimulating electronics are more desirable than visiting the local park. Globalization has been emphasized by the unprecedented advancements in technology to create a market that fixates on economy of scale and value with little regard for the impact on the environment or local marketplace.

We face technological advancements that are part of this globalized model on a daily basis. Do you know how your new iPhone got to your doorstep? While the technology for the device was conceived in Cupertino, California the manufacturing actually took place in China. To only then be shipped back around the world to the United States and then ultimately distributed to your locality. Within the space around you right now, or possibly even touching you, there are a range of products that follow a similar manufacturing and distribution process. The most troubling aspect of this inefficient model is that it is based solely on economic profitability with no regard for environmental impacts including carbon emissions.

A globalized marketplace is advantageous on a scale of corporations and world economics based on the current system. As global warming becomes increasingly proven through scientific data, efforts in the industrialized world have started to encourage a market for sustainability. However, as Bill McKibben bluntly acknowledges, efforts to combat global warming have fail.

> "The planet's emissions of carbon dioxide continue to soar, especially as developing countries emulate (and supplant) the industries of the West. Even in rich countries, small reductions in emissions offer no sign of the real break with the status quo…"[4]

McKibben is specialized in quantifying the impact of the global warming crisis. What is clear is that based on these facts, many individuals are aware of the crisis and would like to see change, "Nearly two-thirds of Americans would back an international agreement that cut carbon emissions by 90 percent by 2050."[5] While we can only speculate on the direct implications this will have on our daily lives in the future the scientific data proves that it will require

[4] McKibben, Bill., "Global Warming's Terrifying New Math." *Rolling Stone.* August 2, 2012.
[5] McKibben, Bill., "Global Warming's Terrifying New Math." *Rolling Stone.* August 2, 2012.

fundamental change from a petroleum-dependent society within the next century.

In this thesis I am proposing that the strategy to creating this fundamental change would be to create a model of sustainable placemaking for a community. This method would act as a grassroots system of success rather than striving for federal government directives. Additionally, this “lead by example” approach will immediately affect the vitality of a community and undoubtedly provide precedent for the re-introduction of a localized model.

# 01 - Placemaking

## 01.01 - Introduction

> "The memory we have of urban places is formed to varying extents by the way individuals form ideas on the identity of places, the way individuals and groups understand the notion of territory, and the way in which people and society formulate an understanding of the qualities of place in urban locations."[6]

In this chapter I will discuss the act of placemaking and the implications that a transformative sustainability model will have in defining a place. Placemaking involves more than just the physically shaped environment an individual encounters; There are also social, cultural, and economic factors involved. I will break these factors into four primary categories: People, Place, Resources, and Development[7] in order to describe the important factors of placemaking that will influence this transformative model of sustainable place.

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[6] Moser, Gabriel, *People, Places, and Sustainability*, 61.
[7] Awotona, Adenrele, *Tradition, Location and Community : Place-Making and Development*, 37.

## 01.02 – People

### **01.02.01 –** *Community*

When one contemplates the definition of community, adjectives such as cohesion, group, public compassion, and ethics may come to mind. Mark Roseland, Professor and Director of the Centre for Sustainable Community Development at Simon Fraser University, defines community through a description of, *social capital*. He defines social capital as, "The organizations, structures, and social relations which people build up themselves independently of the state or large corporations."[8] This informally organized perception of happiness through cohesion of those around us brings to mind the differences in the common phrases, "quality of life" and "standard of living." Roseland describes standard of living to be characteristic of the individual and their disposable income used to purchase physical things. Quality of life refers to, "The sum of all things which people purchase collectively (e.g., the health care system, public education, policing), or those things which are not purchased at all (e.g., air quality)."[9]

This thesis explores the importance in creating a sense of community and what elements, both physical and social, influence the choices people make to invest themselves in the community. Roseland

[8] Roseland, Mark, *Toward Sustainable Communities : Resources for Citizens and their Governments,* 13.

[9] Roseland, Mark, *Toward Sustainable Communities : Resources for Citizens and their Governments,* 13.

emphasizes that, "social capital substantially enhances returns to investments in physical and human capital."[10] Therefore, it is imperative that community remain the backbone of exploration and be considered in all design decisions.

**01.02.02 –** *Culture*

The definition of a culture overlaps many of the characteristics of a community. However, while community is inclusive of all social demographics of a society, culture is the distinctive set of characteristics that define certain people, religions, arts, politics, and environments. Multiple cultures can exist within a single community. In fact, a diversity of cultures is what enlivens a community.

As pointed out by William McDonough and Michael Braungart in their book, *Cradle to Cradle*, diversity is an essential part of the natural world. Diversity ensures the liveliness and health of the human population as well as the ecologic system we inhabit. In the design and manufacturing process, diversity can be treated as a problematic element of the design intent. "Brute force and universal design approaches to typical development tend to overwhelm (and ignore) natural and cultural diversity, resulting in less variety and greater homogeneity."[11] A monoculture model results in a stale and repressive physical environment.

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[10] Roseland, Mark, *Toward Sustainable Communities : Resources for Citizens and their Governments,* 9.

[11] McDonough, William, *Cardle to Cradle: Remaking the Way We Make Things,* 33.

When implementing change to an existing culture it is important to respect the traditions and beliefs of the history that defines the place. When tradition is engraved in a society it is natural for resistance to be felt. However, if completed correctly with respect to the traditions and history that define a place the benefits of intervention will be gradually incorporated.

### **01.02.03 –** *Political Economy*

To understand the organization of people we must understand the ways in which their society maintains economic vitality, or the Political Economy. David Orr, author and Distinguished Professor of Environmental Studies and Politics at Oberlin College, describes political economy as, "The study of society's way of organizing both economic production and political processes that affect it and are affected by it… the 'system dynamics' of a society's processes of economic and political self-maintenance"[12] The order in which a society chooses to, or is dictated to, organize has direct implications on the way people participate and respond to the notion of community.

Orr points out that the political economy ultimately affects all of the decisions involved with consumption, the resulting built environment, and the way waste is handled.

[12] Orr, David W., *Design on the Edge : The Making of a High-Performance Building,* 176.

> "Political economy has to do with the way society provisions itself with food, energy, materials, and water from farms, wells, mines, forests, and the hydrosphere and returns its wastes back to nature; society's energy sources and related technologies; the corresponding distribution of wealth, power, public policy, and societal risk; and how these, in turn affect governance and longer-term prospects."[13]

In terms of the transformation of energy consumption in a large democratic society such as the United States, overarching goals to transform primary energy sources and create energy independence should be handed down from the federal level, but the true implementation of successful strategies will come from a localized model. These local political economies must be susceptible to innovative strategies to change their current societal provisions.

## 01.03 – Place

### 01.03.01 – *Space*

When we think of space in terms of a place, we must consider what it is about the place that gives definition to the space. As Ali Madanipour, author and Professor of Urban Design at Newcastle

[13] Orr, David W., *Design on the Edge : The Making of a High-Performance Building*, 176.

University in the United Kingdom, describes, "[Place] is not a physical location, nor is it a state of mind. Rather it is the engagement of the conscious body with the conditions of a specific location."[14] The mind engages its senses to identify the unique characteristics of a location.

One must first classify the identifiable characteristics of a space. It is important to think broadly about the way the enclosure of the space creates a memory and what those defining elements include. As Ombretta Romice, author and lecturer for the Department of Architecture at the University of Strathclyde in Glasgow describes, "Memory of specific urban spaces is… less dependent upon the characteristics of particular buildings than it is upon urban space and the transformations that occur in the environment become assimilated in the established memory of the space."[15] The most memorable aspects of a space often include the unique imperfections of a place. These imperfections should be celebrated as part of the space's unique character.

### **01.03.02 –** *Water*

Water is inevitably part of every place through its natural cycle of precipitation. The ways in which rivers, fountains, lakes, and other hydrological features celebrate the cycle and movement of water often have a large impact on the definition of place.

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[14] Menin, Sarah, *Constructing Place : Mind and Matter*, 51.
[15] Moser, Gabriel, *People, Places, and Sustainability*, 63.

The way we handle water, both in its natural cycles as well as the disposal of wastewaters, is becoming more critical as the quality and quantity of water shifts due to climate destabilization.[16] Therefore, as we move forward in revitalizing existing places, we must focus on, as David Orr describes, "how to purify water using the science of ecological engineering, how to recharge groundwater, and how to restore rivers and streams."[17] The successful integration of processing water locally will dramatically reduce infrastructure and allow for unrealized economic benefits.

## 01.04 – Resources

### 01.04.01 – *Human*

We, as intellectual beings are inevitably in control of our own destiny. Our own intellect seen in research, design, and discovery proves our capabilities as a society to sustain our existence. Humans, like all creatures of the earth, require organization and communal interest in order to maintain structure and goals of our communities. Therefore, the local government must be vested in policy that promotes the uniqueness of its place.

The local government plays a pivotal role in creating an agenda which is accommodating to forward-thinking solutions to maintain its local sense of place. For example, if regulation such as building code,

[16] Orr, David W., *Design on the Edge : The Making of a High-Performance Building*, 181.
[17] Orr, David W., *Design on the Edge : The Making of a High-Performance Building*, 182.

historical review, or zoning ordinances are strictly mandated they can create a barrier to unconventional building technology, leaving no place for innovative solutions within the community. A local government must have a clear agenda for the local environmental and communal identity while remaining malleable to creative solutions.

Since the local government is the indigenous form of bureaucracy it is also the most directly related to its constituents. Environmental issues emerge in local government through one of four models.

- Outside initiative model: outside individuals and/or groups pressurize the policy makers to adopt their concerns or solutions.
- Mobilization model: local government leaders initiate policy and attempt to secure the popular vote.
- Inside initiative model: entrepreneurs within the local government promote their objectives internally to avoid public scrutiny if they do not win popular support.
- Convergent voice model: the same issue is promoted by different groups, within the local government and outside individuals and/or groups at about the same time.[18]

[18] Selman, Paul H., *Local Sustainability : Managing and Planning Ecologically Sound Places,* 88.

With the exception of the Mobilization model, which although is initiated within the local government is likely of interest to the community based on the elected officials desire to maintain their position, each model represents the involvement of a non-governing member of the community in creating environmental policy. This exemplifies how the community members such as religious organizations, architects, and other local businesses have the opportunity to directly influence the environmental and placemaking policies of the local government.

### **01.04.02** – *Financial*

## 01.05 – Conclusions

As David Orr points out, the post-fossil fuel era, "Will require us to be smarter about energy use and more competent, learning to provide a substantial fraction of our energy by improved efficiency, local ingenuity, distributed technologies, better design, and cooperation."[19] By revitalizing existing towns through this model of sustainable placemaking, planned improvements such as a greener landscape, enlivened street life, and renewable energy sources will produce additional unknown results such as the health, happiness, and

[19] Orr, David W., *Design on the Edge : The Making of a High-Performance Building*, 180.

pride of the town's citizens. Along with the integration of sustainable building practices and energized public spaces is the need for mixed-use programming of spaces. This includes enlivened public use ground floors that engage the street edge, but also a diversity of residents. By integrating different socioeconomic and demographics and cultures an enriched sense of diversity is created.

In creating a program for this thesis I plan to incorporate these principles of placemaking in order to invigorate this new development with activity. Critical to the successful integration of this new identity is to remain contextual and respectful to the heritage of the space. Additionally, incorporating the community in the design development can be the most beneficial strategy in gaining the advocacy of the community.

# 02 – Design Precedents

## 02.01 - Introduction

In a growing trend towards sustainability the benefits of New Urbanism are becoming widely evident. New Urbanism seeks to revitalize urban areas to bring people back into the city to live and work. Mixed-use buildings provide desirable amenities for residents. Public transportation and density allow for accessible and often walkable destinations. Lastly, with sustainable design strategies becoming widely accepted these rehabilitations and new development are generating smaller carbon footprints.

In this section I will explore a set of precedent studies which implement principles relevant to my case study. I will break this into five categories – waterfront development, adaptive reuse, Passive House Multifamily design, Passive House design in the United States, and mixed-use development. From these precedents I will develop a set of guiding principles to implement strategies on my case study.

## 02.02 – Waterfront Precedents

### 02.02.01 – *Anacostia Waterfront Initiative - Washington D.C.*

The Anacostia Waterfront Initiative was designed to propose a new generation of growth along the Anacostia River. The area had previously fallen into an underutilized waterfront whose banks were taken by military infrastructure, highway and railroad corridors, and absorbed large quantities of the region's surface run-off and pollutants.[20] Ultimately, as Mayor Anthony Williams proclaimed, the Anacostia Waterfront project would, "Let the river that once divided us as two cities, unite us as one city. Let it bridge the gap between the haves and have-nots."[21]

**Figure 1: Anacostia Waterfront Initiative - Master Plan**
(source: Chan Krieger Sieniewicz)

**This master plan of the over 900 acres of riverfront property accommodates 15,000-25,000 new mixed-income residential units, 20 million square feet of office and retail space, government facilities, and abundant parks and trails.**

The Anacostia Waterfront Initiative (AWI) is a large-scale project that focuses on five key themes of revitalization. The first theme was to create a clean and active river.[22] This was done by

[20] Brown, *Urban Design for an Urban Century*, 239.
[21] Brown, *Urban Design for an Urban Century*, 239.
[22] Office of the Deputy Mayor for Planning and Economic Development. "The Anacostia Waterfront Initiative: 10 Years of Progress," 5.

eliminating current point and nonpoint pollution sources with the aspiration to create a swimmable river by 2025.[23] The second theme was to break down barriers to create access.[24] Through time the existing roadways and bridges will be phased out and replaced with a network of transportation systems that complements the growth of the new waterfront.[25]

**Figure 2: Anacostia Waterfront Initiative - Park System Plan**
(source: Office of the Deputy Mayor for Planning and Economic Development)

[23] Brown, *Urban Design for an Urban Century*, 239.
[24] Office of the Deputy Mayor for Planning and Economic Development. "The Anacostia Waterfront Initiative: 10 Years of Progress," 5.
[25] Brown, *Urban Design for an Urban Century*, 239.

**Figure 3: Anacostia Waterfront Initiative - Canal Park**
(source: Office of the Deputy Mayor for Planning and Economic Development)

**The Canal Park provides a mix of hardscape and softscape spaces and multipurpose facilities. The fountain project provides a fun escape for youth during the summer months and transforms to an ice skating rink in the winter months. The open grass yard provides a space for large gatherings and activities such as watching a movie. This park was considered a demonstration project to illustrate the ability of property owners to share a stormwater management facility (part of the fountain system) and provide a desirable community amenity.[26]**

The third theme was to create a great riverfront park system.[27] The master plan designates a system of parks that are interconnected by the Anacostia Riverwalk and Trail. This pedestrian-oriented feature will connect the banks of the Anacostia River and reinforce a sense of community offered by desirable public spaces surrounded with restaurant and retail amenities.

[26] Office of the Deputy Mayor for Planning and Economic Development. "The Anacostia Waterfront Initiative: 10 Years of Progress," 27.
[27] Office of the Deputy Mayor for Planning and Economic Development. "The Anacostia Waterfront Initiative: 10 Years of Progress," 5.

**Figure 4: Anacostia Waterfront Initiative - Pedestrian Bridge**
(source: Office of the Deputy Mayor for Planning and Economic Development)

**The contrast of the new pedestrian bridge in a contemporary steel design blends with a backdrop of industrial smoke towers and warehouse structures, paying tribute to the heritage of the site. This blend of new and old with a refreshed network of pedestrian connections and public spaces generates a desirable place for both newly attracted residents and businesses as well as comfort and sense of place for the existing culture.**

The fourth theme was to produce cultural destinations of distinct character.[28] The character and heritage of the Anacostia River facilitate a desirable location for museums, cultural facilities, and sports venues.[29] By celebrating what gave a place its character rather than completely redefining it a cultural heritage is maintained. By maintaining a relatable character residents will be more inclined to utilize and celebrate what makes their place unique.

[28] Office of the Deputy Mayor for Planning and Economic Development. "The Anacostia Waterfront Initiative: 10 Years of Progress," 5.
[29] Brown, *Urban Design for an Urban Century,* 239.

**Figure 5: Anacostia Waterfront Initiative - The Yards Waterfront Park**
(source: Office of the Deputy Mayor for Planning and Economic Development)

**The Yards Waterfront Park provides a mix of civic, retail, marina, and housing amenities. This rich community-focused park offers a diverse sequence of spaces along the connecting Riverwalk Trail. Attention was focused on including sustainable landscaping.[30]**

Lastly, the fifth theme is to build stronger waterfront neighborhoods.[31] By creating desirable waterfront housing with shops and entertainment amenities an estimated 15,000-25,000 new households will be within walking distance of the Anacostia. With increased urban density comes a more sustainable lifestyle including overall walkability and access to public transportation. The extent of these five themes won't be fully established until this long-term AWI project is implemented.

[30] Office of the Deputy Mayor for Planning and Economic Development. "The Anacostia Waterfront Initiative: 10 Years of Progress," 27.
[31] Office of the Deputy Mayor for Planning and Economic Development. "The Anacostia Waterfront Initiative: 10 Years of Progress," 5.

To achieve the full scope of this complex and multifaceted project it must be completed in phases and maintain strong communication and coordination amongst the many stakeholders. The AWI partners understood the importance of informing the public and educating the community on the environmental implications of this plan. This included information to homeowners on how to positively influence the environment, providing educational materials to school children, and supplying landholders and businesses with assistance in adapting to the new environmental rules and regulations.[32]

**Lessons Learned**

While the scale of the AWI far exceeds the area of study in this thesis, there are valuable lessons learned that are applicable to any sustainable waterfront development. Foremost are the programmatic decisions that bring vitality and economic growth to the region. By placing a mixed-use development including residential units, retail, and office space into this area it creates an invigorated sense of place and community amongst those who live and work in the area. This is further perpetuated by the public amenities and green spaces which offer the community a multipurpose space for gathering and recreation.

[32] Office of the Deputy Mayor for Planning and Economic Development. "The Anacostia Waterfront Initiative: 10 Years of Progress," 15.

The AWI also exemplifies strategies for engaging the community and stakeholders with the value of this development. Often current residents and businesses may show resistance to change and expense for things not directly affecting their livelihood, especially when historical context is involved. By engaging the community and having them involved in the design development they become educated and involved with the design and begin to support the project goals which will ultimately make the project the most successful.

**02.02.02 –** *Historic Third Ward Riverwalk* **-** *Milwaukee, Wisconsin*

The City of Milwaukee sought to enhance the quality of life and create new opportunities for investment in their downtown by enhancing their unique character. They have continued to develop the blighted waterfront by creating a pedestrian riverwalk that continues to grow and connect with new development. The riverwalk engages the waterfront development and offers a pedestrian connection throughout the city. In the Historic Third Ward portion of the riverwalk development the design team, Engberg Anderson Design Partnership, sought to encourage the transformative growth of this historic commercial center into an enlivened arts district. The critical urban design issue was to create a new *front* to these historic structures to maintain their character, while engaging them with the new riverwalk.

Through this new pedestrian connection this district became an accessible and desirable waterfront development.

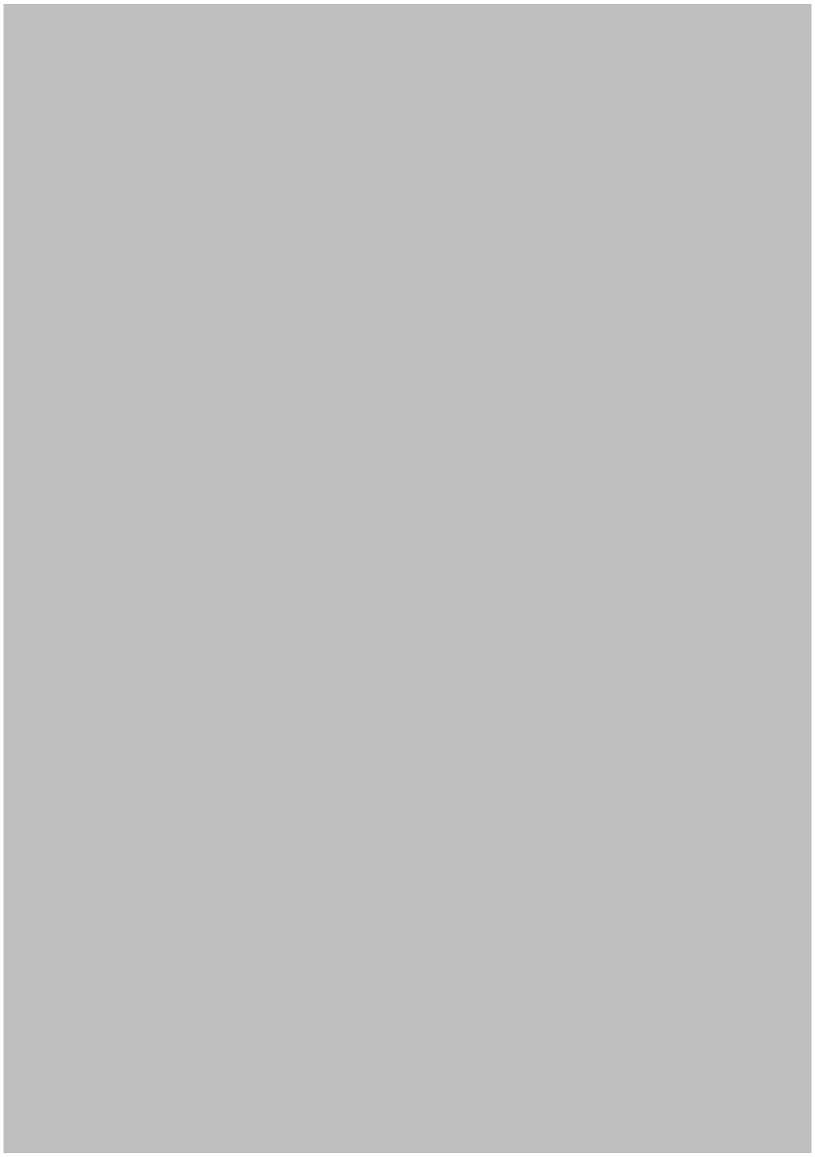

**Figure 6: Milwaukee Riverwalk**
(source: City of Milwaukee)

**This map highlights the overall riverwalk system that currently exists in Milwaukee. In the Third Ward area, the three-quarter mile stretch of riverwalk (shown as planned in this map) is the area of study for this precedent analysis.**

**Figure 7: Historic Third Ward Riverwalk**
(source: Ellen Pizer)

**This riverwalk creates a desirable pedestrian connection that engages the historic character of the old commercial and manufacturing buildings. The adaptive reuse of these buildings provides lofts, shops and offices with ground floor retail and restaurant use.[33] This mixed-use program supports activity and engagement for the waterfront district.**

[33] Brown, *Urban Design for an Urban Century,* 239.

**Figure 8: Historic Third Ward Riverwalk View**
(source: Ellen Pizer)

**This image displays the integration of the historic commercial and manufacturing buildings to have new fronts along the riverfront. The ground floor is activated by retail and restaurant use and the pedestrian riverwalk connecting these new fronts.**

**Figure 9: Historic Third Ward Riverwalk Parks**
(source: Ellen Pizer)

**By including these green park systems along the pedestrian riverwalk they unite the termination of the city grid to the riverfront. In this example architects, Engberg Anderson Design Partnership created a overlook bridge structure to provide views out across the river. The terraced nature of the park mitigates the elevation change between the city and the riverfront while also providing a seating and performance space.**

**Lessons Learned**

This precedent study is applicable to my analysis in adaptive reuse strategies, waterfront development, and scale. The City of Milwaukee was able to restore abandoned infrastructure as part of the master plan to develop the riverfront as a pedestrian oriented waterway. They successful engaged the buildings to the riverfront with new building fronts that maintain the character of the area. Through the programing of the ground floor to include retail and restaurants and newly developed housing, the area will be energized with people throughout the day and night.

## 02.03 – Adaptive Reuse Precedents

### 02.03.01 – *Trolley Quarter Flats*

MS&R Architects developed this affordable housing project through the adaptive reuse of an old trolley shed building in Wausau, Wisconsin. It was desired to maintain the building because it held a piece the community's legacy and therefore added value to maintaining its presence in future development. MS&R describes, "Buildings like the trolley shed are utilitarian by design, which renders them interesting to keep but not so distinctive that they are impervious to the evolving needs of the next generation of users."[34] While this shed isn't distinctive or exceptional in its appearance, its presence is

[34] MS&R Architects. *MS&R Making.*

important. Therefore the building was maintained as, “a touchtone to the past but not as a precious object.”[35] The additions to the shed structure sought to differentiate themselves in complementary fashion without the mimicry of materials.

Energy efficiency and sustainability were major factors in the development of this housing project. Each unit has a private deck or balcony, and ground floor units have a small front yard capable of growing vegetables or flowers. The building conforms to Enterprise Green Communities Standards through the Energy Star appliances and lighting and efficient glazing. Units are adequately sized for efficient living and he contaminates on site were remediated for healthy recreational space outdoors.[36]

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[35] MS&R Architects. *MS&R Making.*
[36] MS&R Architects. *MS&R Making.*

**Figure 10: Trolley Quarter Flats - Before**
(source: MS&R Architects)

**The existing structure was previously used as a storage facility and was rather mundane and expendable. However, the unique structure of the overhead trolley repair apparatus and the history behind the building gave motive to preserving its character.**

**Figure 11: Trolley Quarter Flats – Completed**
(source: MS&R Architects)

**The masonry additions complement the existing structure while not trying to replicate or detract from its character. The overhead structure was incorporated into the entry sequence and outdoor space is preserved for tenant use.**

**Figure 12: Trolley Quarter Flats – Design**
(source: MS&R Architects)

**This three-dimensional model shows the strategy of setting back the additions to maintain the presence of the existing structure. Additionally, this strategy leaves open outdoor space for the tenants.**

## Lessons Learned

This precedent study exemplifies the importance to the overall community to maintain historically valuable structures. By preserving this structure not only is the sustainable notion of recycling the embodied energy of the building completed, but the expressive appeal of its place is maintained. Indirectly a project of this nature also appeals to the communities perception of sustainability. This blend of maintaining place and sustainability reinvigorates the livelihood and appreciation of the community as a whole.

### **02.03.02 –** *Biscuit Company Flats*

This 1925 industrial factory was converted into 104 residential units and ground floor restaurant. The architect, Aleks Istanbullu Architects, sought to preserve the spirit of the factory environment in creating these residential lofts. The high quality of the original construction facilitated this preservation – one-inch maple floors, terrazzo tile, windows, brickwork, lamps, doors, and elevators.[37] There are a diversity of unit plans to accommodate the preservation of the plan and materials. The diversification of unit types accommodates varied tenants which creates a more energetic living environment.

[37] Architectural Record, "Biscuit Company Lofts."

**Figure 13: Biscuit Company Lofts**
(source: Aleks Istanbullu Architects)

**The exterior of this seven story structure maintains its industrial feel with its flat façade and large windows. Through its revitalization and improvements a transformation occurs in the appreciation of the buildings presence. From an abandoned decaying structure to the sensation of a new functional destination.**

**Figure 14: Biscuity Company Lofts - Unit Image**
(source: Aleks Istanbullu Architects)

**The interior of these units illustrates the open floor plan and expansive exterior windows offered by the industrial sized openings of the existing structure. This penthouse unit also includes an outdoor terrace space. The brick structure, tall ceilings, and exposed conduit give the units a trendy industrial feel.**

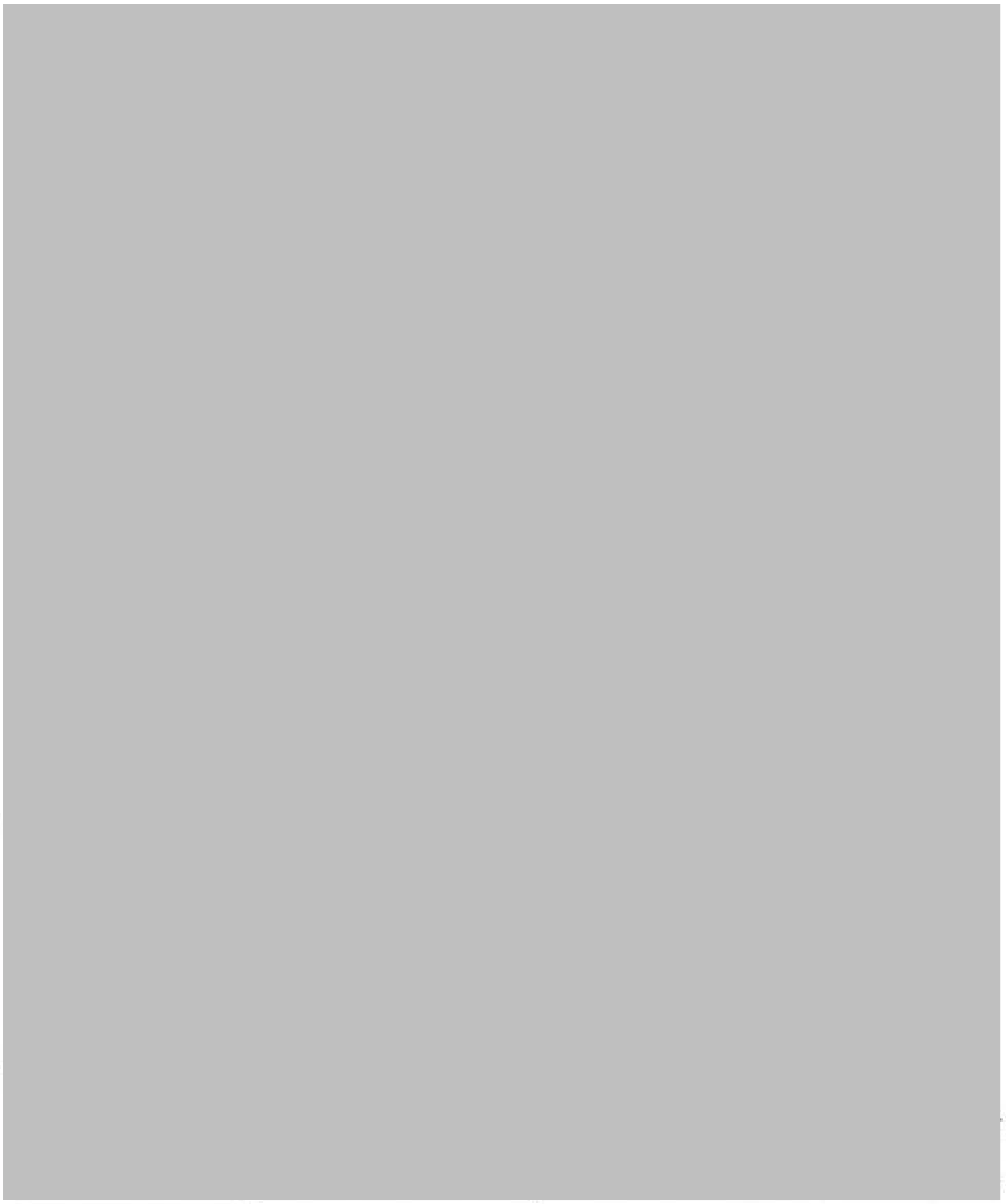

**Figure 15: Biscuit Company Lofts – Plans**
(source: Aleks Istanbullu Architects)

**The loft style apartment allows the deep floor plate to accommodate the highest number of units per floor through their narrow and deep floor plans. This may prove to be difficult in achieving adequate counts of accessible units in a smaller building. While the unit types vary greatly to accommodate the floor plate, fixtures and cabinetry layouts appear to be relatively consistent. This helps mitigate the added cost of construction for multiple unit types.**

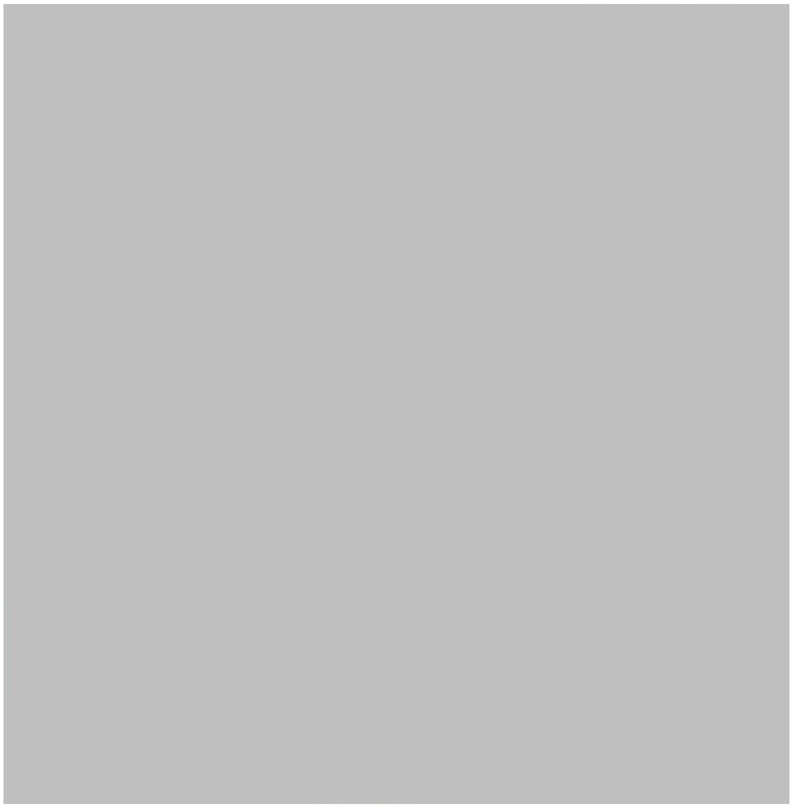

**Figure 16: Biscuit Company Lofts - Penthouse Unit Plan**
(source: Aleks Istanbullu Architects)

**Units are modestly sized and carry an open floor plan. The unit dimension is based off of a structural bay. Plumbing is stacked for efficiency and double height space along the external wall allow for deep penetration of light into the deep units.**

### Lessons Learned

This precedent study illustrates how the reuse of well-built historical structures can be widely salvaged in adaptively transforming the structure into a new use. The unique units offer an efficient use of the given building footprint while the exterior remains largely untouched. Along with adjacent developments following similar adaptive reuse, the district's image remains industrial while the function has transformed to be dominated by residential with a retail and commercial ground floor to provide amenities to the residents.

**02.03.03 –** *Arc Light Company*

This adaptive reuse project begins with a historic industrial California Electric Light Company building. The decision to maintain the existing structure was influenced by their ability to receive HUD-insured financing, public grant money, and state money for site cleanup.[38] HSK Architects developed this design by creating a new contemporary component on top of the existing one and two story structure. This contrast of sleek design against the heavy industrial brick structure creates a mix of homage to the industrial past and light present-day design. Inhabitable roof decks provide outdoor space for the residents and a two-story restaurant is situated on the ground floor. There is also an enclosed basement garage parking. The project also achieved LEED for Homes Mid-rise Gold certification through its attention to sustainable design.

[38] Buczynski, Beth. "HKS Architects' Renovated Warehouse."

**Figure 17: Arc Light Company**
(source: HSK Architects)

**Figure 18: Arc Light Company - Interior**
(source: Aleks Istanbullu Architects)

**Figure 19: Arc Light Company - Roof Terrace**
(source: Aleks Istanbullu Architects)

**Lessons Learned**

This project exemplifies how a historical structure can be maintained in order to enhance the character of a new design. Largely, this project simply maintained the building skin while excavating for parking below and creating new levels above for residential units. This type of adaptive reuse allows for the maintenance of a relatively monotonous, yet historically significant brick structure to accentuate the contrasting contemporary design engaging it. Another advantage of including a new construction component to an adaptive reuse project like this is the ability to employ the ideal dimension for the new building use. New construction also allows you to be in complete control of the efficiency of the design whereas reusing systems has the potential to have unavoidable inefficiencies.

## 02.04 – Multifamily Passive House Precedents

### **02.04.01 –** *The Olympic Village*

**Figure 20: The Olympic Village - Site Plan**
(source: Neue Heimat Tirol)

**Figure 21: The Olympic Village – Exteriors**
(source: Pichler, Romana, *The Olympic Village in Innsbruck*)

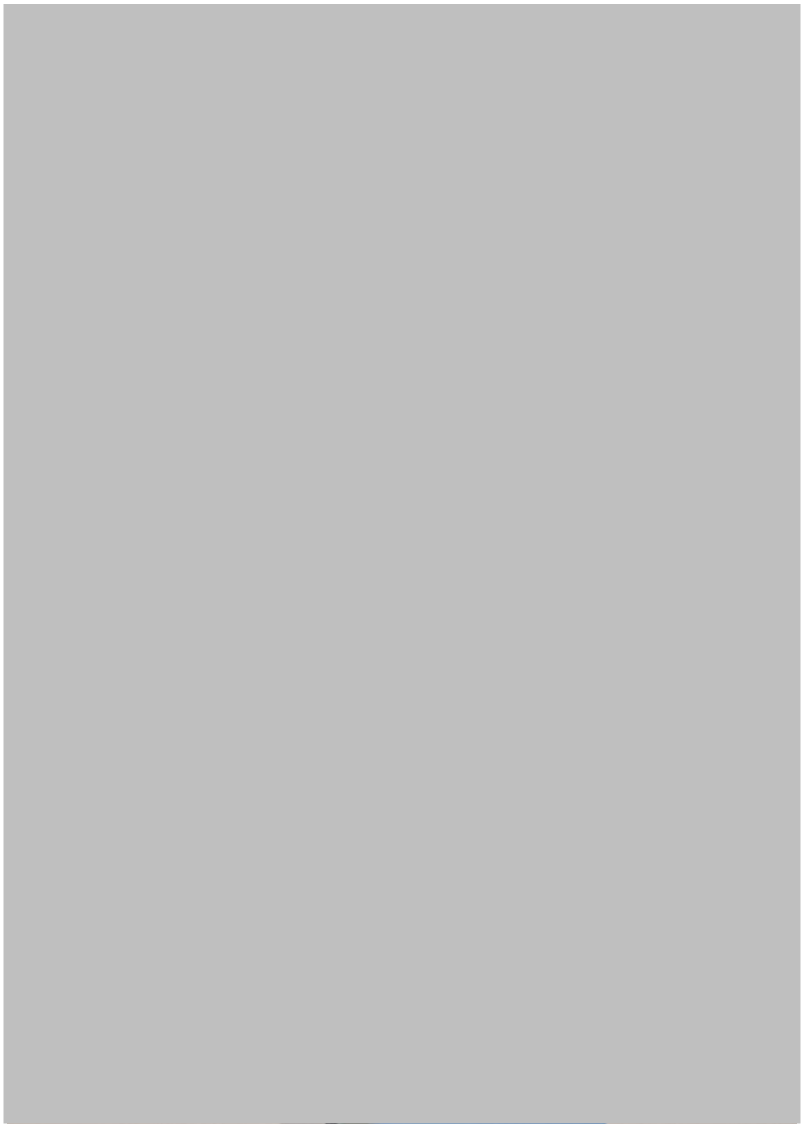

**Figure 22: The Olympic Village - Windows**
(source: Neue Heimat Tirol)

**Figure 23: The Olympic Village - Residential Unit**
(source: Pichler, Romana, *The Olympic Village in Innsbruck*)

**Figure 24: The Olympic Village - Stairwell**
(source: Pichler, Romana, *The Olympic Village in Innsbruck*)

**Figure 25: The Olympic Village - Aerial View**
(source: Pichler, Romana, *The Olympic Village in Innsbruck*)

### **02.04.02 –** *Brogarden, Sweden*

**Figure 26: Brogarden, Sweden - Elevation**
(source: Skanska)

**Figure 27: Brogarden, Sweden – Courtyard**
(source: Skanska)

**Figure 28: Brogarden, Sweden – Landscape**
(source: Skanska)

**02.04.03 –** *Sophienhof Apartments, Frankfurt*

**Figure 29: Sophienhof Apartments, Frankfurt - Site Plan**
(source: Passive House Institute)

**Figure 30: Sophienhof Apartments, Frankfurt - Street Elevation**
(source: Passive House Institute)

**Figure 31: Sophienhof Apartments, Frankfurt - Courtyard**
(source: Passive House Institute)

## 02.05 – Passive House in the United States Precedents

### **02.05.01 –** *Smith House*

**Figure 32: Smith House – Exterior**
(source: Passive House Institute United States)

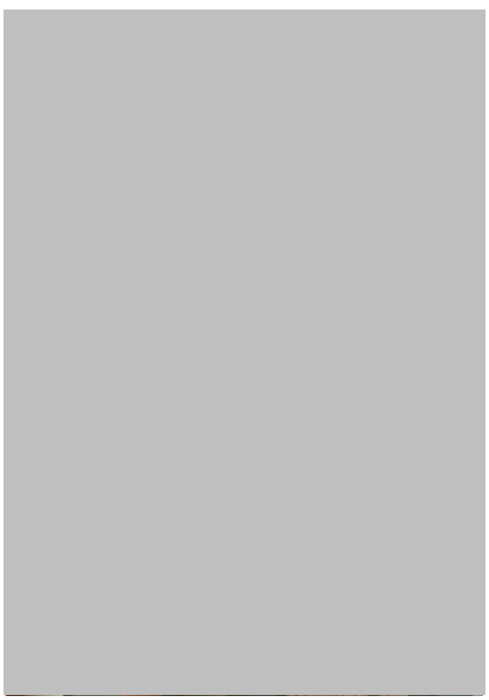

**Figure 33: Smith House - Interior**
(source: Passive House Institute United States)

**02.05.02** – *Peabody Residence*

**Figure 34: Peabody Residence – Exterior**
(source: Peabody Architects)

**Figure 35: Peabody Residence - Plans**
(source: Peabody Architects)

**Figure 36: Peabody Residence - Shading Devices**
(source: Peabody Architects)

### **02.05.03 –** *Trek Haus*

**Figure 37: Trek Haus – Exterior**
(source: Passive House Institute United States)

**Figure 38: Trek Haus - Balcony**
(source: Passive House Institute United States)

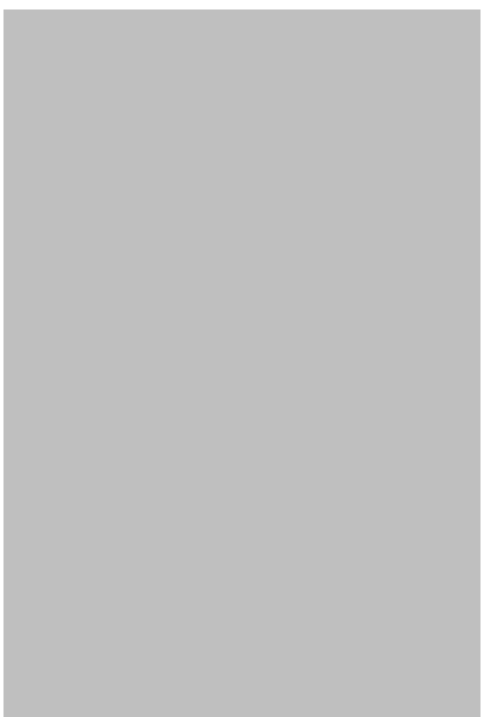

**Figure 39: Trek Haus - Interior Stair**
(source: Passive House Institute United States)

**Figure 40: Trek Haus – Interior**
(source: Passive House Institute United States)

## 02.06 – Mixed-Use Building Program Precedents

### **02.06.01 –** *1111 E. Pike*

This mixed-use building in Seattle, Washington includes 27 condo units spread over 5 stories, ground floor retail space, a rooftop garden, and two levels of underground parking. The architect for the project was Olson Kundig Architects. Cost was kept at a reasonable $170 per square foot through light wood construction and simple unit design.[39] This project also met LEED requirements for the site, development density, and storm-water management requirements.

[39] Architectural Record. "1111 E. Pike."

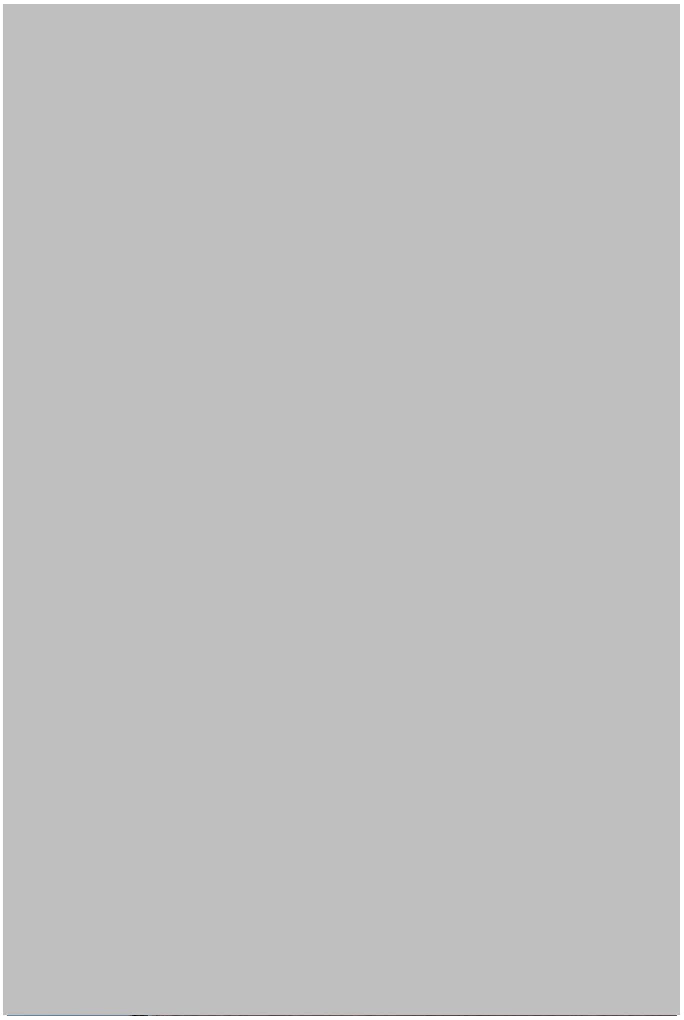

**Figure 41: 1111 E. Pike**
(source: Olson Kundig Architects)

**This infill project remained contextual to its neighbors. The floor to ceiling windows provide ample natural lighting to the units. The ground floor is divided amongst its multiple purposes, to the right is a inset vehicular garage entrance, in the center is the residential entrance, and the storefront on the left accommodates the retail use.**

**Figure 42: 1111 E. Pike - Typical Plan**
(source: Olson Kundig Architects)

**The unit layout is simple and straightforward. Similar unit designs helps to cut down on construction costs and minimizing corridors helps to maximize leasable space.**

**Figure 43: 1111 E. Pike - Building Section**
(source: Olson Kundig Architects)

**The ground floor holds a taller floor-to-floor height to accommodate the desirable retail height and allow vehicular entry to the garage. Plumbing is stacked for efficiency and the roof garden is placed on the south edge of the building.**

**Figure 44: 1111 E. Pike - Street View**
(source: Olson Kundig Architects)

**The pedestrian experience across this site forces the attention to the retail location. The residential entrance is disguised with a sold door, no widows, and is set back from the property edge. Additionally, the garage entrance on this narrow width lot is also set back in order to detract attention from itself. The retail is at the property edge and is appealing with storefront glazing and retail signage.**

### Lessons Learned

A mixed-use multifamily building requires strategic planning in order to efficiently incorporate the required program. This design problem is made more difficult when the site is an infill site with potentially only one accessible frontage. 1111 E. Pike successfully incorporated a ground floor retail tenant space along with a separate residential entrance and parking garage entrance. The parking entrance is inconspicuously disguised by being on the edge of the site and set in from the property line.

### **02.06.02 –** *Sand Studios and Residence*

This mixed-use building is a live/work building design for a multidisciplinary studio. Sand Studios designed their own space in the adaptive reuse of this old masonry-and-timber structure in San Francisco. The ground floor features a gallery or retail space with a machine fabrication shop. The second floor is an office space and the third is their loft-like residence. It's location on a 3,730 square-foot corner lot make it a desirable with two exposures.[40]

[40] Lentz, Linda C. "San Studios and Residence."

**Figure 45: Sand Studios and Residence**
(source: Ken Probst)

**The three story vivid, yet unornamented façade is representative of its three programmatic functions through its window openings. The large storefront windows on the ground floor are ideal for a retail or art gallery use.**

**Figure 46: Sand Studios and Residence - Ground Floor**
(source: Ken Probst)

**Inside on the ground floor the lofty open structure and bare concrete floors give a unique character to the space and provide a free form plan for an art gallery.**

**Figure 47: Sand Studios and Residence - Second Floor Offices**
(source: Ken Probst)

**The office space has lower ceilings and an open floor space. Two exposures on the corner lot allow for sufficient day light.**

**Figure 48: Sand Studios and Residence - Third Floor Residence**
(source: Ken Probst)

**The third-floor residence is a loft-like space with tall exposed ceilings. The expansive windows pay homage to the buildings industrial past.**

**Figure 49: Sand Studios and Residence - Upper Floor Plans**
(source: Architectural Record - Sand Studios)

**Spaces are adequately sized and circulation space is minimized through the open floor plan.**

**Figure 50: Sand Studios - Ground Floor Plan**
(source: Architectural Record - Sand Studios)

**The double-wide building accommodates multiple tenants. The central entry vestibule provides uninterrupted circulation between building uses.**

**Lessons Learned**

This mixed-use building example shows how a relatively small building on a tight corner site can still provide multiple uses. The live/work design of a building, shown on a micro-level in this precedent, exemplifies how the circulation can function to serve each level independently. Additionally this project shows how a space can be maximized to create good spaces for each building use.

**02.06.03 –** *The Q*

The construction of this mixed-use building holds an interesting story. Originally the building was designed and the structure had been built for an office building program. The market for office space dramatically dropped off during construction and architect Jonathan Segal transformed the 90,000 square-foot building into a mix of residential rental units. The ground floor consists of two restaurants, a café, and a retail location. Two levels of underground parking provide parking for the residents. Sustainable measures including low-e glazing and deep overhangs to provide shading, and operable “fins” provide ventilation on the north façade. The rooftop includes solar panels which power the common areas of the building.

**Figure 51: The Q**
(source: Jeff Durkin)

**This contemporary design on a corner lot provides a mix of ground floor retail and restaurant use with residential units above.**

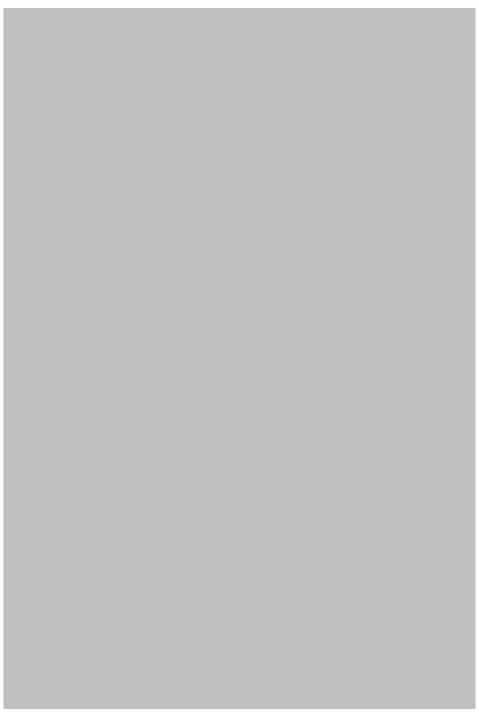

**Figure 52: The Q - Street Elevation**
(source: Jeff Durkin)

**The garage entry is disguised in a monotone mass on the least prominent building façade.**

**Figure 53: The Q - Typical Floor Plan**
(source: Architectural Record – Jonathan Segal)

**The typical floor plan provides a mix of unit types. Each with adequate solar exposure.**

**Figure 54: The Q - Ground Floor Plan**
(source: Architectural Record – Jonathan Segal)

**The ground floor plan of this narrow site provides retail and restaurant amenities as well as a separate residential entrance leading to the elevator lobby and the garage entry.**

**Figure 55: The Q - Building Section**
(source: Architectural Record – Jonathan Segal)

**The building section illustrates how the building mitigates the site topography to its advantage with a tall retail ground floor and an at-grade rear garage entry and two full levels of parking deck below. The penthouse duplex units with a roof garden are also seen in this section.**

## 02.07 – Conclusions

These precedent studies have demonstrated critical principles in sustainable placemaking. The waterfront development precedents have demonstrated the successful engagement of a city's body of water as an amenity rather than a divider. They have demonstrated how the waterfront can be revitalized from an underutilized industrial district to an adaptively reused mixed-use district.

The adaptive reuse precedent studies demonstrated the effective reuse of relatable, yet not always precious, local structures. I learned that it's not simply the preservation of beautiful historic landmarks that is most important to maintaining a sense of place for a community. Rather, it could be the incorporation of a simple warehouse building into a contextual new construction addition. Then, the previously insignificant structure becomes a highlighted and rejuvenated icon in the new development. Lastly, the reuse of existing structure is the most sustainable form of construction. By leveraging the embodied energy already in place, the destruction, reconstruction, and new materials involved in creating a new building are avoided.

The Passive House precedents demonstrate successful high energy performance building strategies. These buildings are particularly respectful to solar orientation and climate. The design strategies for each climate zone will vary, creating a diverse set of solutions to building envelope design. In multifamily applications, reaching the high energy performance thresholds is made easier because of the density of the units. Shared walls and limited external building envelope exposure drastically reduce the energy demand of individual living units. Passive House design also provides more sustainable buildings through strong, tight, efficient building design and construction. This will result in lower maintenance and longer lasting buildings, helping to decrease lifecycle cost. The most important benefit Passive House design offers is to create a healthier living environment through the controlled supply of fresh ventilation air.

The mixed-use precedents verified the benefits of placing housing into these dense urban environments. A mixed-use building provides residents a variety of amenities within a pedestrian-oriented network. Also seen in the waterfront development precedents, the inclusion of a pedestrian-oriented waterfront in a mixed-use district further promotes recreation and a healthy lifestyle.

# 03 –Design Methodology

## 03.01 – Introduction

Through this series of precedent analysis I have extracted the relevant principles organize the design methodology of this thesis study. In this section I will break the design methodology of sustainable placemaking into three strategic categories – urban design, public spaces, and energy efficiency. Through these strategies of sustainable placemaking I will interject the principles learned in the precedent analysis.

## 03.02 – Urban Design

### **03.02.01 –** *Historic Preservation*

The defining aesthetic of the City of Frederick is its historical character and human scale. Therefore, maintaining this quality is essential to the identity of the town as well as the spirit of its residents. As Ian Thompson describes, "Community identification with places is what gives such force to arguments for historic conservation."[41] Historic qualities give an elevated sense of pride and prestige to a place and they should be preserved and celebrated in a revitalization effort. Undoubtedly preservation of historical character will elevate the value of, as Mark Roesland described, the "Physical Capital" of a place.

[41] Menin, Sarah. *Constructing Place : Mind and Matter,* 74.

### 03.02.02 – *Adaptive Reuse*

The reuse of existing buildings is advantageous to the success of a sustainable place. As previously discussed, maintaining the built structure of a historical piece of a community is also beneficial to the identity of the town. As Edwin Brierley points out, "Changes in use of buildings, which were originally designed for a specific use, are often accompanied by alterations to the form and fabric of the building, and yet there always remains elements of the original use which can still be sensed in the redeveloped building."[42]

## 03.03 – Public Space

### 03.03.01 – *Landscape*

The creation of good public space is critical to the long-term use of the space. "Just as to live with another human being is to recognize their physical and psychological uniqueness, so too is attachment to a landscape, and the sense of relationship and belonging this can bring, much easier to promote if that landscape has a recognizable character, full of the unique irregularities that add to distinction"[43] Historic spaces offer this uniqueness and are further articulated by adaptable and multi-purpose public spaces that reconnect the user with nature through landscape.

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[42] Moser, Gabriel. *People, Places, and Sustainability,* 63.
[43] Menin, Sarah. *Constructing Place : Mind and Matter,* 75.

### **03.03.02** – *Street Section*

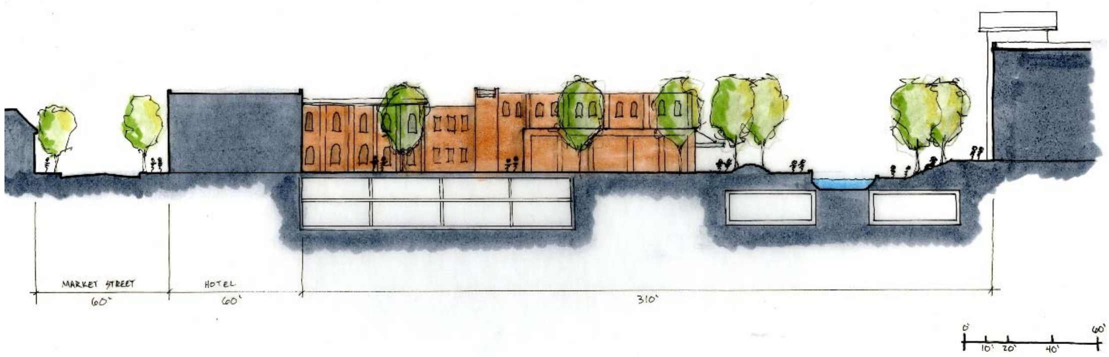


**Figure 56: Site Section Scheme I**
(source: author)

**This schematic site section shows both the street and pedestrian waterfront solutions to public space. It is important to consider the use of space and sense of enclosure created by the surrounding buildings.**


**Figure 57: Site Section Scheme II**
(source: author)

**This schematic site section shows both the street and pedestrian waterfront solutions to public space.**

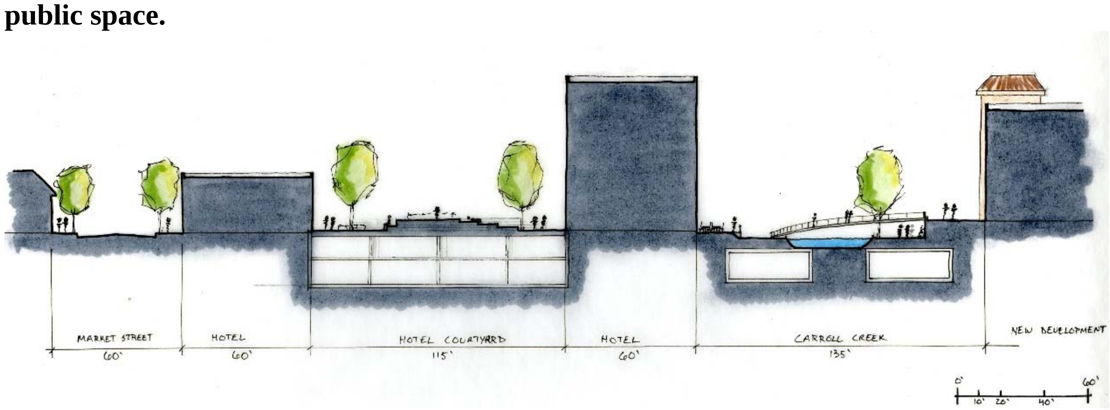


**Figure 58: Site Section Scheme III**
(source: author)

**This schematic site section shows both the street and pedestrian waterfront solutions to public space.**

## 03.04 – Energy Efficient Building Design: Passive House

### 03.04.01 – *Introduction*

The Passive House design methodology is relatively new to the United States in terms of the number of built precedents and the development of climate specific design strategies. However, through study of its German derivatives, Passive House design has proven to be one most stringent systems of building energy performance.

I will utilize the Passive House design strategies in order to dramatically reduce the energy consumption of this building. By reducing the energy consumption and the introduction of on-site renewable energy sources, this will create a self-sustaining net-zero energy consumption building. Since Passive House design uses conventional, yet high standard, materials and best construction practices, I believe that this system will prove to be the best solution to creating healthy indoor living environments while realistically achieving a carbon-neutral building.

The most prominent takeaway of the Passive House design methodology is the minimal prescriptive requirements necessary to achieve a Passive House design. Since the methodology is based solely on building energy efficiency, the system allows for flexibility and innovation to achieve these thresholds.

Since this building technology is relatively untested in the United States I anticipate a few challenges in creating innovative solutions. I will face difficulty in adapting these design strategies to accommodate a mixed-use building type. Additionally, the humid summer climate will be a challenge to create properly designed systems for year-round user comfort.

In this section I will explain the Passive House design system, the advantages of using this system, the history of Passive House design, the challenges of applying this technology in the United States, and lastly the methodology for multifamily housing.

**03.04.02** – *Definition*

The objective of Passive House design is to dramatically reduce the energy consumption of a building in comparison to a conventionally designed, code-compliant, structure. This is achieved by creating a well-insulated and air-tight building envelope that attains prescriptive energy performance thresholds. Passive House design measures a building's energy performance using the Passive House Planning Package (PHPP) design software which a designer can use as a design tool. This software is meticulously precise in modeling energy performance of a building specific to the actual site conditions of climate, occupancy, and primary energy. While some construction details of a Passive House are not standard practice, the on-site verification process during construction ensures proper installation of critical design elements in accordance with the PHPP model and design intent.

Passive House design is arguably the most stringent and focused set of energy efficiency design principles available. Not to be confused with Passive Solar design, which is a design concept without comprehensive strategy for energy efficiency, Passive House design is a complete energy efficiency standard. The Passive House design system does however utilize Passive Solar concepts in order to absorb the natural solar heat gains offered by the sun. The resulting improved energy efficiency offered by Passive House design is staggering.

Worldwide, it is estimated that there are approximately 37,000 Passive House buildings with a growing number of retrofit and non-residential buildings including schools, office buildings, manufacturing plants, and hotels.[44] Since the concept of a Passive House design is based on energy performance measures, its design principles can be applied to any building type. Furthermore, the principles are applicable in all climate zones. However in zones outside of a moderate climate, added tribulations have cause increased difficulty in adapting the system.

It is widely acclaimed by the Passivhaus Institute (PHI), based in Germany, that a Certified Passive House building can achieve

[44] Passive House Institute, Passipedia, www.passipedia.org

energy savings of up to 90% over conventionally-built buildings and 75% over a typical new construction building.[45]

**Figure 59: The Passive House Design System**
(source: Passive House Institute. www.passiv.de)

Research has also shown that a Passive House building can be constructed at only 10% over conventional construction cost.[46] This is due to the redistribution of construction cost that a Passive House entails. For instance, in a conventional building an elaborate HVAC mechanical system conditions the indoor air, yet in a Passive House a simplified active ventilation system with heat recovery is utilized. Otherwise, additional costs for a Passive House design are often found

[45] Passive House Institute, www.passiv.de
[46] Passive House Institute US, www.passivehouse.us

in elements such as high-performance windows and doors and energy efficient appliances, costs that many homeowners are already willing to incur for better quality and performance.

Many super-energy efficient Passive House homes can escalate far above the 10% price increase depending on the additional sustainability measures added to the system. One example may be to add an active solar system capable of offsetting the already extremely low energy demand of a Passive House design. This addition can quickly convert this ultra-efficient Passive House design into a building that produces a total net energy consumption of zero, termed a Net-Zero building. Regardless of the sustainability level a client strives to achieve, all Passive House buildings must begin with a design implemented through the PHPP energy modeling software.

The PHPP is meant to be a design tool for architects and engineers to optimize a project design. Through accurate input into this Microsoft Excel based workbook, a designer is able to use tools to calculate and manipulate building components such as R or U energy values, window specifications, heating and cooling loads, air ventilation systems, domestic hot water systems, summer comfort, auxiliary electricity, and primary energy requirements. Through the development of this sophisticated modeling software the developer, Dr. Wolfgang Feist, generated a simplified model that focuses on the critical design factors which will prepare reliable results for the planning of a design.[47] The first Passive House built under this system in the mid 1990's, the Darmstadt Kranichstein, illustrates how the PHPP modeling software confidently portrays an accurate image of a buildings' performance.

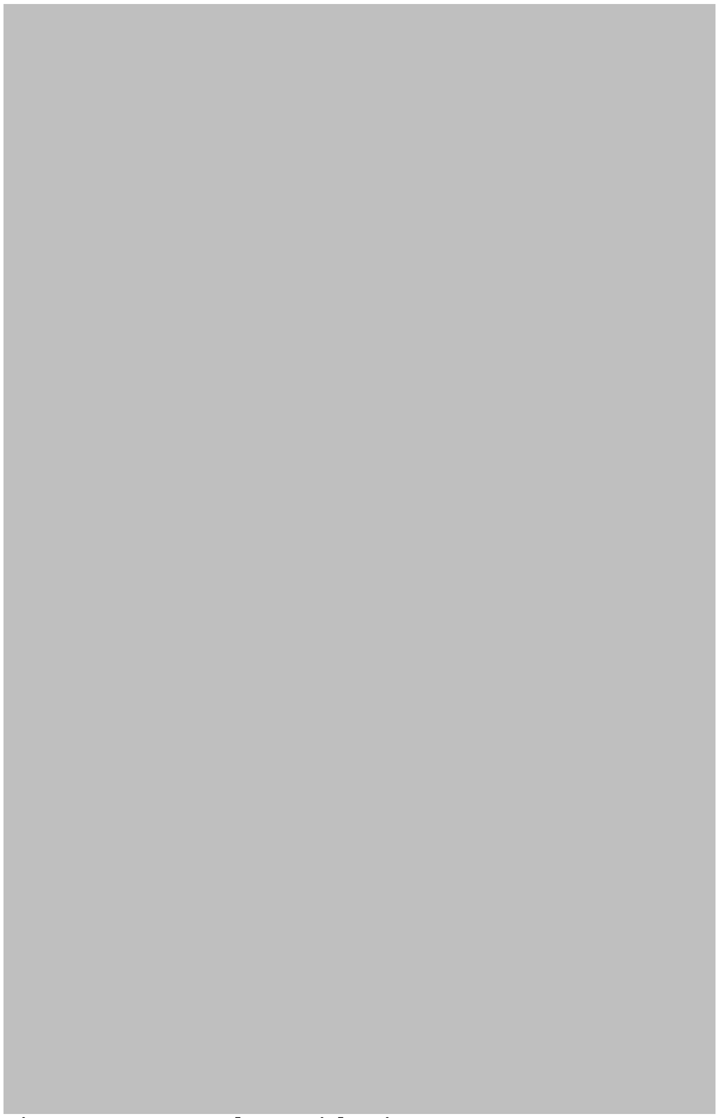

**Figure 60: Darmstadt Kranichstein**
(source: Passive House Institute: Dr. Wolfgang Feist, www.passivhaustagung.de)

[47] www.passivhaustagung.de/Passive_House_E/PHPP.html

Achieving Passive House certification begins at the design phase of a building and continues through the construction phase. It is imperative that the actual construction of the building strictly follow the design and details approved for construction. Any number of minor deviations from the approved design can result in a larger than anticipated weakness to the building system. During the design phase the building designer must first submit a complete PHPP model and set design documents demonstrating the satisfactory completion of the performance requirements. Through an evaluation process the PHPP model is then verified against the construction document information. Once construction has commenced, verification of proper installation is encouraged due to the difficulty of curing air sealing problems and the installation of non-conventional construction details. Final certification is granted based on inspection of proper construction and the successful completion of an air pressurization test.

An air pressurization test is conducted once the building is air-tight, or in other words, the doors and windows are installed and the air-barrier layer in place. The test is completed by a blower door test and must meet the performance of 0.6 Air Changes per Hour (ACH) at 50 Pascals (Pa) of air pressure uniformly applied across the building envelope. This number provides a method of describing the number of complete air changes allowed in a one hour time period at a standard pressure of 50 Pa. Additionally, air-tight construction is the reason a

Passive House is required to have a mechanical ventilation system. As outlined by Max Sherman of the Energy Performance of Buildings Group at the Lawrence Berkeley Laboratory, under guidance of ASHRE 62, a building under 2.0 ACH50 would be required to have a balanced ventilation system.[48]

To give perspective on the stringency of this 0.6 ACH at 50 Pa, David Keefe of the Vermont Energy Investment Corporation describes, "Houses with less than 5 or 6 ACH50 are considered tight, and those over 20 are quite leaky, though these numbers can be misleading without considering other variables such as climate, house size, and old versus new construction."[49] If we consider a conventional wood constructed home in the 1990's we would most likely find an airtightness measure of 20 ACH50. Today, a new construction Passive House at 0.6 ACH50 will undoubtedly require stringent detailing, unprecedented in conventional construction. Additionally, let's consider a performance rating system such as LEED for Homes: Multifamily, the air-tightness requirement specifies that only a sampling of individual units need to be tested for a maximum air leakage of less than 7.0 ACH50. This system fails to verify every unit in the building, the overall building air-tightness is not considered, and a 7.0 ACH50 performance measure is not stringent enough based on today's construction capabilities. While LEED for Homes:

[48] Sherman, www.epb.lbl.gov/blowerdoor/BlowerDoor.html
[49] www.greenbuildingadvisor.com/blogs/dept/musings/blower-door-basics

Multifamily should be commended for including an air-tightness prerequisite, the requirements are not stringent enough to effectively impact a buildings energy efficiency.

In addition to the air pressurization test, as illustrated on the verification page in the PHPP, there are only two other performance requirements that a building is required to meet in order to become a Certified Passive House, the specific heat and cooling demand, and specific primary energy demand. We must fully understand each of these requirements to understand the principles of a Passive House design.

**Figure 61: PHPP Verification Page**
(source: Passive House Institute, 2007 PHPP)

The heating and cooling energy demand criteria for a Passive House building limits demand to 4.75 kBTU per square foot per year. Again, because this system was created for the Central European climate zone where space heating is the primary need, the Passive House system was initially developed based on measuring heat rather than considering the cooling needs of a humid climate. As Passive House design developed, the practical need to extend the 4.75 kBTU/sq.ft./yr. requirement to cooling energy was added. In order to calculate the heat demand a simple heat demand balance equation is utilized. First, heat losses are calculated by adding up the losses from transmission and ventilation.

Transmission heat losses are due to thermal bridges. Passive House design seeks to eliminate as many thermal bridge conditions as possible, but where unavoidable, they can be calculated into the project and accounted for in the energy modeling. Thermal bridges decrease the energy efficiency of the building as well as decrease the user comfort by creating a zone of heat transmittance that will cause localized temperature fluctuation. A computer program called THERM developed at Lawrence Berkeley National Laboratory (LBNL) is a two-dimensional building heat-transfer modeling software which is able to calculate and illustrate the heat loss from specific thermal bridge locations.

**Figure 62: Window Sill THERM Analysis**
(source: Lawrence Berkeley National Laboratory http://windows.lbl.gov/software/therm)

After calculating heat losses due to thermal bridging and ventilation losses, the heat gains are calculated from solar and internal gains. Solar gains are calculated based on the window U-value and percentage of glazing per building face. The building orientation and shading devices are also critical to these calculations. Internal gains include everything from human occupancy to appliance heat. The total heat gains are then subtracted from the heat losses to create the total heat demand, which again, must be below 4.75 kBTU per square foot per year.

Lastly, the third certification requirement for a Passive House building is the Specific Primary Energy Demand. As defined in the Passive House Planning Package,

> "The specific primary energy demand is the sum of all primary energy demands for heating, DHW [domestic hot water], auxiliary and household electricity, i.e. for all energy consumptions within the building, referred to the TFA [total floor area]. The specific primary energy demand describes the amount of non-renewable primary energy which is necessary for providing the energy carrier."[50]

To meet the Passive House standard the building must limit its Primary Energy Demand to 38.0 kBTU per square foot per year. Through this requirement the Passive House system imposes a stringent requirement to minimize the amount of energy consumed. Designers are therefore forced to constantly pay attention to the energy efficiency of the design decisions they make. Ultimately every decision made including the efficiency of the ERV system, the percentage of glazing on each building face, the efficiency of the appliances specified, the type of hot water system used, and even down to the size of a monstrous flat screen television have an impact

[50] Fiest, PHPP 2007, 162.

on the overall primary energy demand of a building. Based on these three energy performance criteria a building can achieve the Passive House standard.

### **03.04.03** – *Advantages*

There are many advantages to this minimal requirement performance rating system. While the requirements are rigid, the system allows for a diversity of solutions to reach the performance thresholds. For example, the Passive House system does not prescribe requirements for the shape or orientation of the building, the window U-value, the efficiency of the ERV motor, the amount of under-slab insulation, or the use of Energy Star appliances. However, if an efficient grouping of the above listed elements is not utilized, the three Passive House energy requirements will be difficult to achieve in most climates.

This flexibility allows Passive House design professionals and equipment manufactures to have a constantly evolving set of technology advancements and lessons learned with each new project and monitoring data. Therefore, as technology develops, new products will be introduced, and new climates will be experimented in, which advances the knowledge base of Passive House design. This natural facilitation of an open network of learning and communication is essential for the future of this technology. The United States holds many zealous professionals that have already established regional alliance organizations to facilitate the growth of the parent organization Passive House Institute United States (PHIUS), more on that later.

Through many built projects around the world, Passive House design has collectively recognized some measures that are a good beginning value to strive for to reach the energy performance thresholds. In an article on buildingscience.com, author John Straube outlines some of these recommended measures. He includes examples such as a window U-value of less than 0.15 BTU per square foot per degree Fahrenheit, a HRV which is over 80% efficient with a low electric consumption, a peak heating demand of less than 3.2 BTU per square foot, and a total site energy of less than 13.3 kBTU per square foot per year.[51] By defining and utilizing approximated measures design professionals are able to use PHPP as a tool to fine tune their building design to successfully achieve Passive House energy standards.

Unique to Passive House design is the idea of a variety of building design options available for each performance measure. Furthermore, each building design could have multiple solutions. For example, if a triple-pane, low U-value, wood window is not available for the south facing glazing of your residential project, you may substitute a different window, maybe only a double-pane, and make

[51] Straube, "The Passive House Standard," 2.

the necessary modifications to the PHPP model to compensate for the lower performing windows. Possible alterations may include shading devices or adding additional R-value to the wall assembly. Within this example we begin to see how aesthetics may be affected by the choice of external shading device or thickened wall assembly, but ultimately, depending on the climate and site conditions of the building, a variety of solutions will exist. The aesthetics of a Passive House design does not necessarily have to be mandated by this energy performance system. However, it also could pressure the design decisions that are made. Ultimately, while there are a variety of design solutions available to every project, there are some characteristic aesthetic elements inherent to a Passive House design.

As previously mentioned, almost undoubtedly, Passive House wall assemblies throughout all climates will be thicker than traditional construction. This is due to the added insulation for the building envelope. While wall assembly strategies vary dramatically between climates, some reoccurring trends have developed of preferred systems. One example is a Structural Insulated Panel (SIP) wall system which is pre-manufactured and therefore lends itself to supplement the air tightness requirements because of its minimal joints. In addition to this system, pending climate, supplemental rigid insulation can be attached to the exterior for added R-value. This wall system provides the structural qualities necessary for the building as well as inherent insulation value.

**Figure 63: TerraHaus at Unity College, Main. SIP Wall**
(source: www.terrahaus.wordpress.com)

Another innovative wall system is the use of a Larsen Truss system. This wood construction method utilizes a TJI truss, manufactured or stick built on site, in a vertical orientation to create a supplemental insulation cavity on the exterior of the traditionally built light-frame wood construction. This system allows for minimal thermal bridging through the wood truss system and creates an exterior wall cavity of the desired depth for supplemental building envelope insulation.

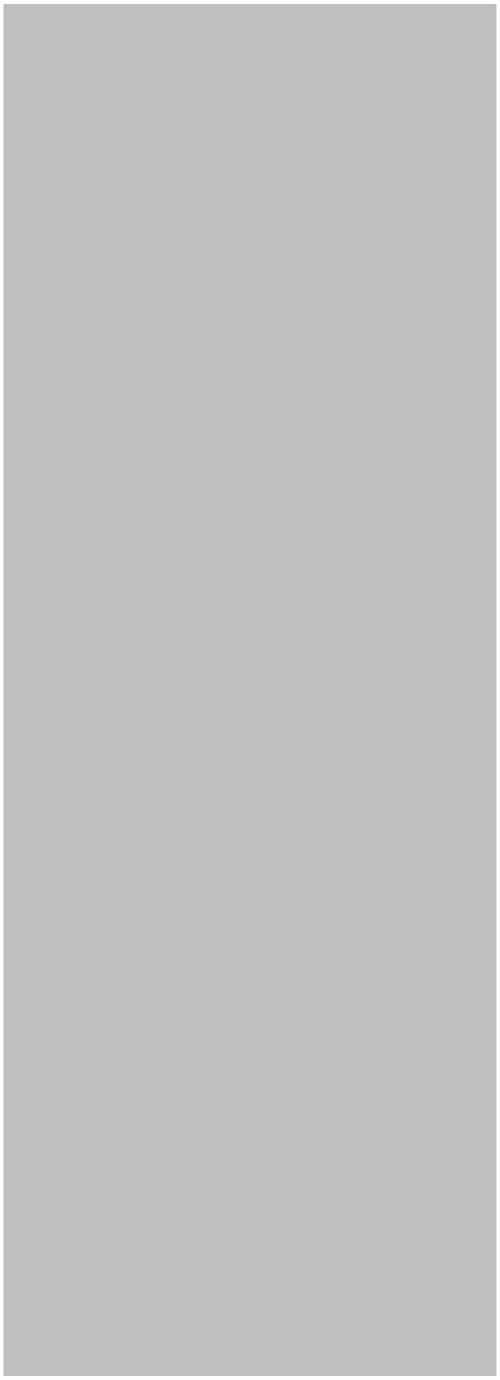

**Figure 64: Everhart Passive House. Larsen Truss**
(source: www.everhartpassivehouse.net)

Equally important to the building envelope of a Passive House is the choice of windows. Passive House windows are often very high quality and have a technologically advanced design. Standard to these high-performance windows are insulated frames, triple-pane glazing, low-E coatings, gas filled glazing cavities, and warm edge spacers which ensure a thermal bridge-free system.

**Figure 65: Passive House Window**
(source: www.seriouswindows.com)

These windows are currently a high price point for United States applications because there is limited access to these high performance windows. They are primarily available in the European market, but a growing number of manufacturers are expanding to the United States.

**Figure 66: Passive House Window**
(source: www.intuswindows.com)

Of the selection of Passive House certified windows, and others not officially certified but highly preforming, there are many aesthetically beautiful windows with exceptional hardware design options. Equally important to the quality of the window is the detailing and installation of the window. As pointed out in the illustrations below, a properly placed window can have a major impact on the effectiveness of the window in achieving the desired air-tightness and thermal performance. In a wall section the most ideal location for a window is in-line with the thermal insulation so that temperature variations do not stretch at window locations. Instead, they are able to evenly contract at the thin glazing and then return to the same thermal levels achieved by the wall insulation above the window.

**Figure 67: Window Placement**
(source: Quantum Builders Presentation. Original Reference: Protokollbund Nr. 37, Passive House Institute, Darmstadt, Nov. 2008)

A fundamental aesthetic difference of a residential Passive Hose design in the United States is the style of windows. Double-hung windows are not installed on a Passive House home because of their extremely inefficient design. As opposed to a casement or awning window, double-hung windows do not provide the continuous gasket seal when in the closed position.

Evident in the majority of single-family Passive House projects is the desire to keep a modest building footprint. In contrast, in 2010 the average single-family home in the United States was 2,392 square feet, down from a high of 2,521 square feet in 2007.[52] Many Passive House projects feature much smaller building footprints because they are limited in size by the occupancy of the building. The standard occupancy rate prescribed by PHPP is 377 square feet per person[53] (a translation from 35 square meters per person). This is based on a building square footage calculated by German standards (discussed later in, *Passive House for the United States*). PHPP also allows for flexibility in the planning stages for variations in occupancy from 215 to 538 square feet per person.[54] While there are examples of single-family Passive House projects much larger than the prescribed occupancy rate, it is unknown if this measure is an enforced limitation to the certification process or simply a recommendation. Whether simply a recommendation or an enforced requirement, one can imagine the impact a frivolously sized building would have on PHPP calculations. Two of the three prescribed thresholds of Passive House design, total heat demand limited to 4.75 kBTU/sq.ft./yr. and primary

[52] U.S. Department of Commerce, United States Census Bureau, "Median and Average Square Feet of Floor Area in New Single-Family Houses Completed by Location," www.census.gov
[53] Fiest, PHPP 2007, 34.
[54] Ibid.

energy demand limited to 38.0 kBTU/sq.ft./yr., are directly related to the square footage of the building. The third, a blower door test, is related to conditioned volume of the building. Therefore, excessively sized spaces will only add difficulty to achieving these prescribed performance measures.

In addition to the modesty of the building size, the building shape and orientation play an important role for the success of the overall energy model created in PHPP. Again, characteristic to the design of many residential and multifamily precedent buildings, designers tend to default to a simple building shape.

**Figure 68: Hudson Passive Project, NY and Sophienhof Frankfurt**
(source: www.jetsongreen.com and www.secretsprings.de)

Often undulations and material changes are forfeited in exchange for simple plains and clarity. With each added corner to a building presents a troubled area susceptible to a break in the air barrier or difficulties creating a continuous layer of insulation. For this reason a simple building shape is preferred.

Also fundamental to Passive House design is the relationship of the building to the sun. Furthermore, in residential design, the location of building program is influenced by the solar orientation of the building. The living space, kitchen, and office are typically oriented towards the south side while the entry, bathrooms, and bedrooms are moved to the north. Characteristic to many Passive House designs, a majority of the building's glazing will be on the southern face of the building. To avoid the negative effects of overheating, windows on the east and west facades are typically smaller and include proper shading device. The solar gains from the southern glazing experienced during the heating months are able to provide the building, in conjunction with internal heat gains, with adequate heating for the building in most moderate climates.

Regardless of the climate, it is critical for the solar path to be studied through the various seasons of the year. Properly shading windows from direct solar contact during the cooling months, either through exterior solar shades or natural vegetation, is necessary to prevent overheating. The PHPP model accurately accounts for each season based on the input climate data and will calculate a percentage of overheating. It is important to keep the overheating number minimized or absent to ensure user comfort. Also, PHPP calculates the amount of building façade facing each cardinal point and the percentage of glazing on each corresponding face. Often, an ill preforming Passive House model will only need simple adjustments to the building orientation, the distribution of glazing, or addition of shading devices to bring the building within the proper limitations. Again, this is why so many Passive House projects exemplify common characteristics such as a long east/west axis with increased glazing on the southern façade.

Along with the passive nature of solar heat gain is another vital element to provide user comfort, the ventilation system. Through its high energy efficiency standards and intelligent design a Passive House is capable of making a conventional HVAC system obsolete. As a result, it is essential that a mechanical ventilation system be employed to remove the stale air from the building. Common to residential design, exhaust vents are located in the kitchen and bathrooms, while supply air, from the ventilation system, is returned to living spaces and bedrooms.

Not only does this eliminate the high material cost of the HVAC equipment, it also dramatically decreases the amount of ductwork in the building, which also decreases installation cost. Ductwork is further minimized because the conventional system of extending the run of supply ducts to the perimeter of the room and locate the vent at window locations is no longer necessary. The use of high performance windows eliminates the fear of temperature stratification from solar heat gains or condensation developing on cool glass. Rather, in a Passive House design it is recommended to place supply air vents high on the wall as soon as the duct reaches the space. This allows the supply air to carry in and across the room before being pulled out by a nearby exhaust vent. Positive occupant experiences describe a Passive House ventilation system as, "a well stirred bowl with small temperature differences."[55]

The ventilation system in a Passive House does not simply extract the indoor air and replace it with outdoor air. Instead the driving mechanical component of the ventilation system, a Heat Recovery Ventilator (HRV), recovers the inherent energy in the conditioned air being exhausted and energizes the incoming fresh air before being delivered through the supply ductwork.

**Figure 69: Heat Recovery Ventilator Diagram**
(source: www.thetyee.ca)

[55] Mlecnik and Van Loon, "Indoor Climate Systems in Passive Houses," 4.

Similarly, an ERV, or Energy Recovery Ventilator, has the added benefit of capturing the humidity of the air. This makes ERVs the more common applications in the United States as a majority of the county faces some need for humidity control. Comparable to other technology systems involved in a Passive House design, the efficiency of ERV systems has continued to improve with time.

A popular ERV model for residential applications in the United States is the RecoupAerator made by the company UltimateAir. This system is capable of up to 95% heat recovery done in a way that the air streams do not cross paths, ensuring that no stale interior air is recirculated back into the home. Additionally, the incoming air is filtered by a MERV 12 filter and the driving DC motor uses an average of 80-90 Watts, or about the same amount of energy as a single incandescent light bulb.[56]

In a moderate climate, the story is complete; the passive solar gain and heat recovery ventilation system provide adequate heating for a Passive House design. However, many climates including a majority of the United States, will require some supplemental heating and cooling for the most extreme days of the seasons. There are multiple solutions currently being used to supplement Passive House ventilation systems. Often an earth-air heat exchanger is installed to pre-treat the incoming outdoor air. This utilizes the earth's steady underground temperature to either pre-heat the outdoor air in the winter, or pre-cool

[56] www.ultimateair.com

the hot summer air prior to entering the ERV system. An in-line electric coil or hot water circuit can also be inserted after the ERV box to add additional heat to the air being distributed to the building.

Beyond these supplemental additions to the ventilation system, some climates will still require the safety net of additional point source heating or cooling during times of maximum dependency. Often this is done through a strategically located ductless mini split point source system which can provide added cooling or heating to a living space. Or, if only supplemental heat is necessary in an area such as a bathroom, a simple electric heat baseboard system can be added.

The results achieved by creating a Passive House Certified building are immediately felt through the user experience in the building, the added strength and quality of the construction, the long-term financial impact of lower energy costs, and the positive environmental impact of a significantly lower energy demand. For the building's occupants, the airtight construction of the building eliminates drafts and discomfort from localized temperature variations. The exceptional building envelope generated from a combination of high performance widows, added insulation, and thermal bridge-free construction also positively impact the building user. Temperature stratification between levels is eliminated, the noise transmittance from outdoors is lowered, and added comfort is delivered by the constant low-flow movement of fresh air provided by a ventilation system. Through a majority of research most residential projects provided positive user experiences and enthusiasm.

**03.04.04 –** *History of Design Principles*

The Passive House design concept began in the late 1980's with Dr. Wolfgang Feist and Professor Bo Adamson. Research and implementation began shortly thereafter in the early 1990's.[57] As all design concepts study precedents, Feist studied the critical thinkers on the topic of superinsulation from the mid 1970's. Most notably is Wayne Schick of the University of Illinois at Urbana-Champaign where he developed a, "computational study of how much energy you could save with high levels of thermal insulation, airtight construction and heat recovery ventilation using air-to-air heat exchangers."[58] His concept was termed the "Lo-Cal" House, standing for low calorie. The values proposed include an R-60 roof, R-30 walls, and an R-20 crawlspace floor. Another influence on Dr. Feist's studies was Harold Orr who in 1977 implemented and built the Saskatchewan Conservation House, the first super-insulated home, located in Saskatoon, Canada. The house featured airtight construction and an air-to-air heat exchanger for ventilation. Insulation levels were at R-60 for the roof, R-44 for the walls (made of a double-wall construction at 12 inches thick), and R-20 shutters over double glazed windows.[59]

[57] Straube, "The Passive House Standard," 2.
[58] Lstiburek, "Building America," 60.
[59] Lstiburek, "Building America," 60.

Unfortunately, the project did not gain much recognition as the active solar collector system failed and due to the engineered appearance of the design, it lacked architectural aesthetic.

**Figure 70: Saskatchewan Conservation House**
(source: www.thetyee.ca)

However, it was through these early theorists that Dr. Feist was able to develop his own philosophy. By 1996 Dr. Feist established the Passivhaus Institut (PHI) based in Germany. Through these early examples it is clear that the Passivhaus concept Feist devised was originally intended to be applied to residential design, and likely influenced the development of its founding name. Whether this design concept was intended to address multifamily buildings or any non-residential buildings from the time of its creation is unclear. As more buildings began to present themselves in Germany an ambitious Katrin Klingenberg of Urbana, Illinois sought to bring the Passive House design concept to the United States. In 2003 Klingenberg designed the first Passive House in the United States, the Smith House.

**Figure 71: Smith House**
(source: www.e-colab.org)

This first successful project was an instrumental step in moving the Passive House design strategies into the United States. Klingenberg continued to press forward in partnership with Feist and PHI in Germany to develop and promote Passive House design. In 2007, she introduced the Passive House Institute United States (PHIUS). Shortly thereafter, in 2008, the first English speaking training curriculum was launched in Urbana, Illinois where Klingenberg and PHIUS are presently located.

For years to follow, numerous trainings were accessible throughout the United States to educate design professionals on PHPP and the strategies of Passive House design. Ultimately, those who sought the training were following the path to become a Certified Passive House Consultant. To gain this title a participant must complete the training program and successfully pass the PHI’s internationally approved written examination to prove competence in the Passive House design field. With this title, consultants could market their certification to clients as knowledgeable design professionals for their services in Passive House design.

PHIUS saw a growing number of interested design professionals as the green building trend continued to grow through the early 21st Century. In an effort to grow the knowledge of Passive House design and create a network of enthusiastic professionals the Passive House Alliance United States (PHA-US) was created in 2010. This regional alliance organization promotes the growth of Passive House design in the United States in partnership with PHIUS. While interest in Passive House design in the United States grew exponentially, so did the voice of informed opinions of how the system had its flaws for the diverse climates in the United States.

**03.04.05 –** *Climate: United States*

During the course of a two and a half month period beginning in late March 2011 tension between the international organization PHI, with Dr. Feist, and PHIUS, with Klingenberg elevated. Due to the growing prominence of Passive House in the United States it was time for the two organizations to make difficult decisions on which direction to take the international stage of Passive House. The foremost discrepancy was the climatic differences in regions outside of Germany.

**Figure 72: U.S. Climate Zone Map**
(source: www.architecture.uwarterloo.ca)

Through Klingenberg's growing network of research on Passive House in the United States it was proven that the idea of a universal design criterion was not the most economically comprehensive solution because of the added hardship for the more extreme climates to meet the criteria. If PHIUS is to continue to grow and gain prevalence in the United States, the economics of the system have to be realistic.

The resilience of Dr. Feist and PHI to address the concerns of the PHIUS community at the May 30, 2011 annual meeting lead to a domino effect of legal finger pointing and personal attacks resulting in the permanent separation of the two organizations. In a statement from Dr. Feist he stated that, "breaches of contract and good faith, [and] unnecessarily reinforcing false divisions within the Passive House

Community,"[60] were the reasons for the division of organizations. In a response Klingenberg stated, "If the Passive House standard is truly international and a public good, in other words a physics principle that holds true everywhere and is owned by no one, then it will be and needs to be locally defined and adapted and take shape."[61] Despite this unfortunate falling out, Passive House in the United States has taken recent steps to move forward with this new freedom to make intelligent and informed modifications to the system for its varied climates.

In order to continue to rate and certify buildings PHIUS quickly introduced a new rating system, titled PHIUS+, on November 7, 2011. The advantage of the PHIUS+ system is that it utilizes a third-party certification group, Residential Energy Services Network (RESNET), to conduct the construction phase testing and verification. RESNET is the leading energy rating organization in the United States and creator of the HERS Index Score.[62] Therefore, each certified building is given a HERS Index Score. This first major step by PHIUS, post-PHI divorce, to generate a partnership with an established United States organization improved overall confidence that the PHIUS organization can succeed on its own. By giving PHIUS+ certified buildings a HERS index score the project instantly becomes recognized by many federal, state, and utility organizations and may

[60] Feist, "Passive House: a public good," 1.
[61] Klingenberg, "A Letter to Dr. Wolfgang Feist," 4.
[62] Passive House Institute US, www.passivehouse.us.

qualify for various other rebate incentives and tax credits. Additionally the project becomes eligible to be recognized for other green building programs such as LEED for Homes and Energy Star Certification.[63]

The tribulations of the PHIUS restructuring develops on a daily basis, but there are some key issues that will be addressed as the Passive House system is refined for the United States. Most importantly, as previously discussed, is the need to address varied climates. As Klingenberg states in her online blog,

> "The 15 kWh figure (4.75 kBTU/sq.ft./yr.) is a good median starting point for passive designs, as it is derived in a median type climate — median delta T, median length of time when heating is required — where the peak load balancing act is fulfilled almost perfectly. But this is only one specific climate with one specific combination of climate characteristics. This 15 kWh (4.75 kBTU/sq.ft./yr.) criterion will need to flex as the delta T and amounts of heating degree days change and the underlying principles are applied in different, more extreme climates that deviate significantly from the median base line climate of Central Europe."[64]

[63] Passive House Institute US, www.passivehouse.us.
[64] Passive House Institute US, www.passivehouse.us/blog

The argument is unavoidable. If an energy efficiency system, Passive House, is to be integrated into varied climates within the United States, the climatic differences must be addressed to allow for the optimum performance in each zone, ultimately allowing the project to be economically feasible in all climate zones. Quickly, this regional system will grab the attention of homeowners, developers, architects, and builders as an innovative way to market projects to an elevated level of energy efficient design.

Therefore, in an open dialog format, PHIUS hopes to reinvent a strategic regional system of certification criteria which addresses these climatic differences. In a statement on her blog website, Klingenberg states, "We are proposing a departure from a single one-size fits all international standard. We welcome everybody who would like to contribute to this effort."[65] This new system, not yet publicly discussed, will undoubtedly allow Passive House design to filter into the mainstream, a trend that has already begun with the PHIUS+ certification process.

**03.04.06 –** *Multifamily*

As previously mentioned, the Passive House design system has never limited itself to only be applicable to single-family residential design. There are many elements of this discussion that would make

[65] Klingenberg, "15kWh is dead. Long live 15kWh," www.passivehouse.us/blog

some skeptical about whether this could be proven true, look at the name of the program for instance, Passive House (see, *Passive House: The Name*). Yet, while the majority of precedent buildings that follow this stringent building science are in fact single-family residences, there are a generous amount of multifamily and even some commercial applications available.

The PHPP does include some use-specific predefined standard values for certain building types including nursing homes, office and government buildings, and schools. For non-residential buildings, the PHPP will require some additional inputs and considerations. Since many non-residential buildings are not intended to be used for a full day, calculations such as internal heat gains need to be redefined using the PHPP internal heat gain calculation worksheets.[66] The varied occupancy levels, intermittent operation of heating and ventilation systems, and higher air exchange rates, all factor into the balance between energy use and proper systems operation. Therefore, calculating these non-residential uses is conceivable through PHPP with some custom analysis. In a multifamily residential building however, the analysis method is fairly similar to a single-family application.

To begin the discussion of multifamily applications we must first understand what Passive House design does to accommodate for this different, yet related, building program. The multifamily building

[66] Fiest, PHPP 2007, 16.

type actually poses many advantages in Passive House design. When inputting a multifamily building (i.e. a row of townhouses or an apartment building) into the PHPP modeling software the user follows the same procedure as inputting a standard single-family residence.

As previously mentioned, this logic presents large advantages for multifamily applications. Let's first consider a row of townhouse units – the attached nature of the building design means that each interior unit goes from four building envelope exposures of a single-family unit down to only two exposures, a front and back, with the two end units having three exposures. Calculating the end units separately from the interior units in PHPP is recommended as a precautionary check due to the varied conditions the end units experience from their additional exposure. As one may have already concluded, an apartment or condominium style building includes even more benefits as some building configurations may minimize a unit to only a single exposure.

When transitioning from a free-standing single-family house with at least four exposed wall surfaces to a multifamily application where some of the wall exposures become internal and shared between units, the stringency of the Passive House requirements inherently becomes more relaxed. This occurs because the burden of meeting these high thresholds is now being shared between you and your neighbors. Therefore, in an example given by Katrin Klingenberg of

PHIUS, whereas a single-family home in Illinois may require envelope insulation of R-56 hr-ft$^2$- °F/Btu, a multifamily building may only require R-40 hr-ft$^2$- °F/Btu.[67] There is a real economy of scale factor related to Passive House in multifamily applications. This additional flexibility in PHPP tolerates performance measures such as window distribution to be more uniformly distributed around the building, allowing all units to receive adequate daylight.

Multifamily Passive House buildings also share similar building design characteristics. As discussed previously in the single-family characteristics, a simple, compact building footprint holds true in multifamily applications. The more compact a building shape, the more efficient the surface to volume ratio, leading to a lower necessary R-value for the building envelope.

[67] Klingenberg, Passive House Institute United States.

**Figure 73: Marbachshohe, Germany**
(source: www.passivhaustagung.de)

An additional element to consider in condominium or apartment style buildings (not as commonly encountered in single-family applications) is the use of balconies. Throughout the world, and the United States is no exception, a common amenity of apartment style living is a private exterior balcony. These balconies provide residents without land ownership the ability to access their own private outdoor space. Inherently, by tradition, balconies are a major trouble point for the thermal bridging effect that must be avoided in Passive House design.

**Figure 74: Balcony Thermal Bridge**
(source: www.schoeck.co.uk)

Therefore, it has been widely accepted that the best solution for the addition of balconies to the exterior of a Passive House envelope should be to independently structure the balcony system with minimal attachment points to the actual building envelope.

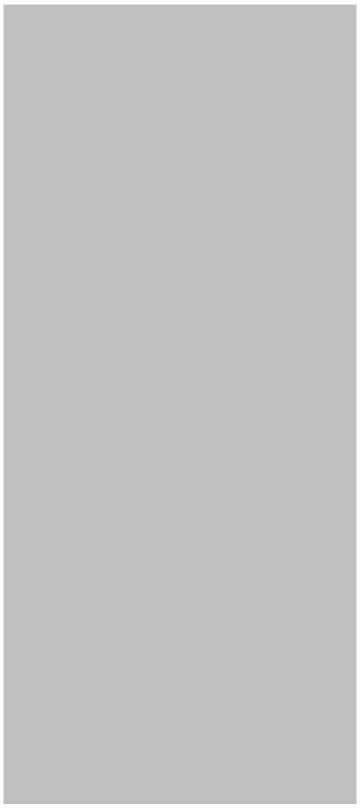

**Figure 75: Cologne Stellwerk 60**
(source: www.bouwfonds-immobilienentwicklung.de)

This is an important time to point out the benefits of technological innovations to Passive House design. Instinctively, the model solution to resolve thermal bridging at balconies was to independently structure the balconies, yet innovation and technological advances were able to offer new solutions through time. To continue with this example, a French engineering component company, Schock, developed a moment connection component, for multiple construction types, which thermally breaks cantilevered structure from the thermal envelope.

**Figure 76: Thermal Break Cantilever Wood Structure to Concrete**
(source: www.schoeck.co.uk)

With innovative solutions like this, as well as continued development of other Passive House required components such as high performance windows, insulation, and ERV systems, the characteristics and aesthetics of Passive House buildings will unquestionably evolve and diversify.

Another area of development for the application of Passive House design to multifamily buildings is the solutions for the ventilation and supplemental heating and cooling. Throughout time, the building industry in the United States has experimented with a variety of solutions for providing heating and cooling for multifamily buildings, and even today there is no uniform answer to the problem.

The variety of systems spans from earlier inefficient central boiler systems to decentralized approaches of individual through-wall heat pumps, to more recent ductless mini split systems which provide point source conditioning. Since there is not a system that is collectively energy efficient, cost effective, and maintenance-friendly, one must first examine the issues critical to a Passive House design to seek the best solution. First, ventilation is required. Will this be accomplished through a central system or individual unit ERV? Air sealing the entire building envelope and a blower door test are required for verification. Is it possible to do a blower door test for an entire apartment building at once? With a lack of multifamily Passive House precedent studies available, and even fewer with published information, it's concluded that there is no straightforward Passive House characteristic design methodology established at this point for the mechanical systems of a multifamily building.

However, this is not to say that this is an unprecedented task, it has been done. One of the largest applications of the Passive House standard is a housing project in Innsbruck, Austria for the 2012 Youth Olympics. A total of 444 apartment units comprise the 13 building in a 29,600 $m^2$ complex.

**Figure 77: Youth Olympic Village. Innsbruck, Austria**
(source: Passivhaus-Wohnanlage Olympicsches Dorf 2012 in Innsbruck, Tirol)

Following the Youth Olympic Games the units will primarily be rental apartments with 69 owner-occupied units. Fifty three of the rental properties will be made available to the Innsbruck Social Services (ISD) and some also reserved for assisted living.[68] It is important to note that these units are primarily rental and are also being made available to the social services for low-income housing.

Based on many single-family precedents one may assume that a Passive House design is only applicable to wealthy homeowners. However, due to the economy of scale benefits mentioned earlier, the additional Passive House construction cost is quickly offset by the added benefits including an improved construction quality and

[68] Maureder + Ornetzeder GmbH, "Europe's Largest Passive-House Residential Estate," 5.

improved indoor air quality. Most importantly though is providing truly affordable housing, energy bill included, to those who truly need lower housing costs.

At the Olympic Village project in Innsbruck the exterior building envelope achieved a U-value of approximately 0.12 $W/m^2K$ through a reinforced concrete structural wall 18cm (approximately 7 inches) thick and a 28cm (approximately 11 inches) EPS rigid insulation. This thick, 18 inch wall places the window approximately in the center of the wall system, illustrated in these building images and window detail drawing. The windows feature a triple-glazed system with a U-value of 0.6 $W/m^2K$.

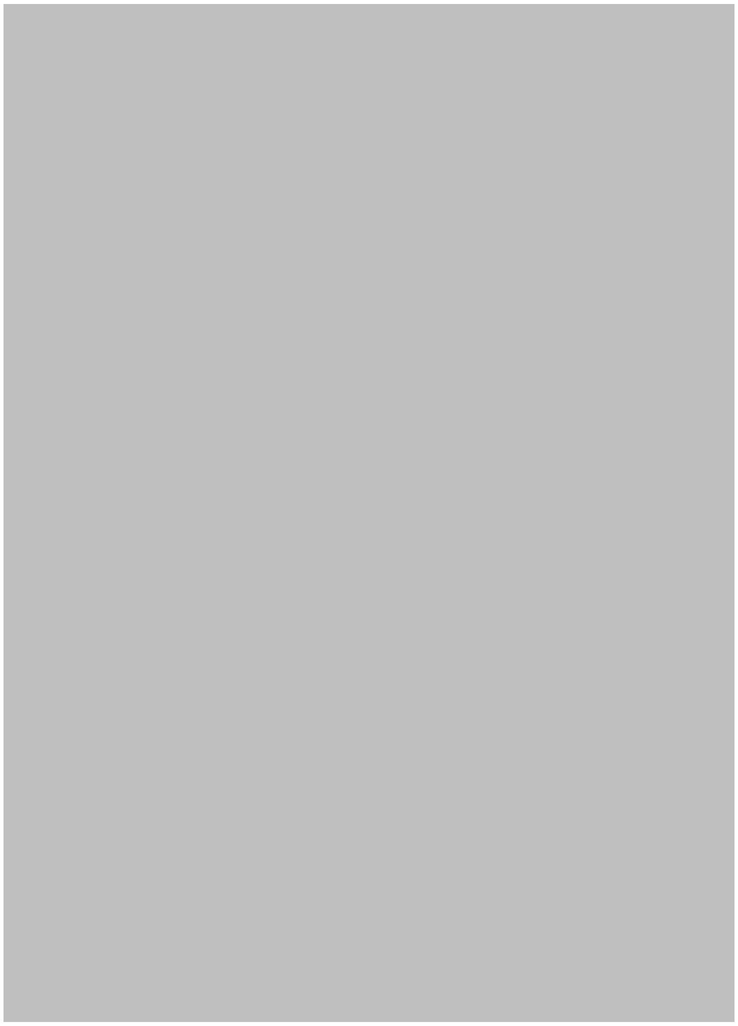

**Figure 78: Youth Olympic Village. Innsbruck, Austria**
(source: Passivhaus-Wohnanlage Olympicsches Dorf 2012 in Innsbruck, Tirol)

**Figure 79: Youth Olympic Village. Innsbruck, Austria. Window Detail**
(source: Passivhaus-Wohnanlage Olympicsches Dorf 2012 in Innsbruck, Tirol)

The heating system for the building complex is a central system that is then distributed to each building, and then ultimately individual zones within each building. A central district heating transfer station will supply 550 KW for heating and hot water for the complex. At each of the 13 buildings, a substation will be driven by this central district heating transfer station and the 1,100 $m^2$ of solar arrays on the roofs of the complex. This breaks down to approximately 2.5 $m^2$ of solar array per unit, an impressive investment.

**Figure 80: Youth Olympic Village. Innsbruck, Austria. Aerial View**
(source: Passivhaus-Wohnanlage Olympicsches Dorf 2012 in Innsbruck, Tirol)

The substations consist of an accumulator charged by the district heat and photovoltaic system and are completely encased and filled with cellulose flakes to minimize energy loss. The accumulators are an integral part of the individual unit ventilation system. The accumulator serves to precondition the outside air that replenishes the units. The plastic pipes that supply this air to the units travel from the top floor within prefabricated shafts filled with cellulose flakes. Sound-insulated distribution boxes are substituted to replace the need for an individual room noise suppression system creating, at the input valve, a noise level of approximately 22 dB. The user has three mode options for the system, Present, Absent, and Group.

For distribution of hot water for consumption and a radiating heat system, the accumulators of each building supply dual thermal transfer stations which consist of a heat exchanger that supplies approximately 34 units. Distribution of these dual thermal transfer stations are based on a calculated system that balances the maximum distribution with the increased heat losses. [69]

Illustrated by this large apartment complex Passive House project, there are innovative ways to solve the issues of ventilation and heat distribution in a multifamily building. In this application, a semi-centralized system supplemented with a large photovoltaic system provides adequate heating and ventilation needs for this complex. Through this and other pioneering examples we can learn and develop future buildings. After this Olympic Village housing project transfers to Innsbruck residents it will provide affordable housing, at an average rate of EUR 5.40 per square meter.[70] This commitment to providing

[69] The above discretion of the Olympic Village statistics and building systems is summarized from a description in: Passivhaus-Wohnanlage Olympicsches Dorf 2012 in Innsbruck, Tirol.
[70] Passivhaus-Wohnanlage Olympicsches Dorf 2012 in Innsbruck, Tirol, 4.

the most advanced energy efficient housing at an affordable rate is admirable.

Another way to continuously expand the market of multifamily Passive House design is through continued education, especially the education to the tenants of these rental units. This is an unconventional building system to most tenants and to maximize its impact they should understand the system and its controls. Through educational material, such as user manuals and information sessions, tenants can learn about the importance of proper use of their ventilation system and the direct impacts their habits can have on their monthly costs.

Armed with a growing number of single-family residential projects and their high energy performance data it is anticipated that the market for multifamily applications will continue to grow.

# 04 – The Case Study

## 04.01 – Introduction

The City of Frederick is ideal for the implementation of this set of sustainable placemaking principles. The city finds itself at a transitional period as they look forward to their definition of place for the future. Undoubtedly, the city will continue to be defined by its beautiful historical downtown. However, modern infrastructure improvements such as the flood control project will be necessary for the long term health of the city and its people. In an age of sustainable design the city is also faced with maintaining its iconic historical character while also ensuring its sustainability into the future.

Steps towards this sustainable future have already begun in the city and this helps illustrate the progressive-minded nature of the local government and its citizens.

**Figure 81: Nexus Energy Homes - Net Zero Homes**
(source: Nexus Energy Homes)

**In a redeveloped area of the historic district stylistically contextual attached homes are built to a net-zero energy consumption standard. These high-performance homes appear surprisingly ordinary however they incorporate super insulation, high performance windows, and solar panels to achieve a net-zero status.**

**Table 1: City of Frederick Population Change 2000-2010 Census**

| | 2000 | 2010 | % CHANGE |
|---|---|---|---|
| Total Population | 59845 | 67488 | 13% |
| Median Age | 35.80 | 39.88 | 11% |
| Total Male Population | 28518 | 32771 | 15% |
| Total Female Population | 31327 | 34717 | 11% |
| Total Households | 23530 | 26235 | 11% |
| Total Family Households | 14887 | 16422 | 10% |
| Average Household Size | 2.35 | 2.60 | 11% |
| Owner Occupied Housing | 14014 | 16081 | 15% |
| Renter Occupied Housing | 9516 | 10154 | 7% |

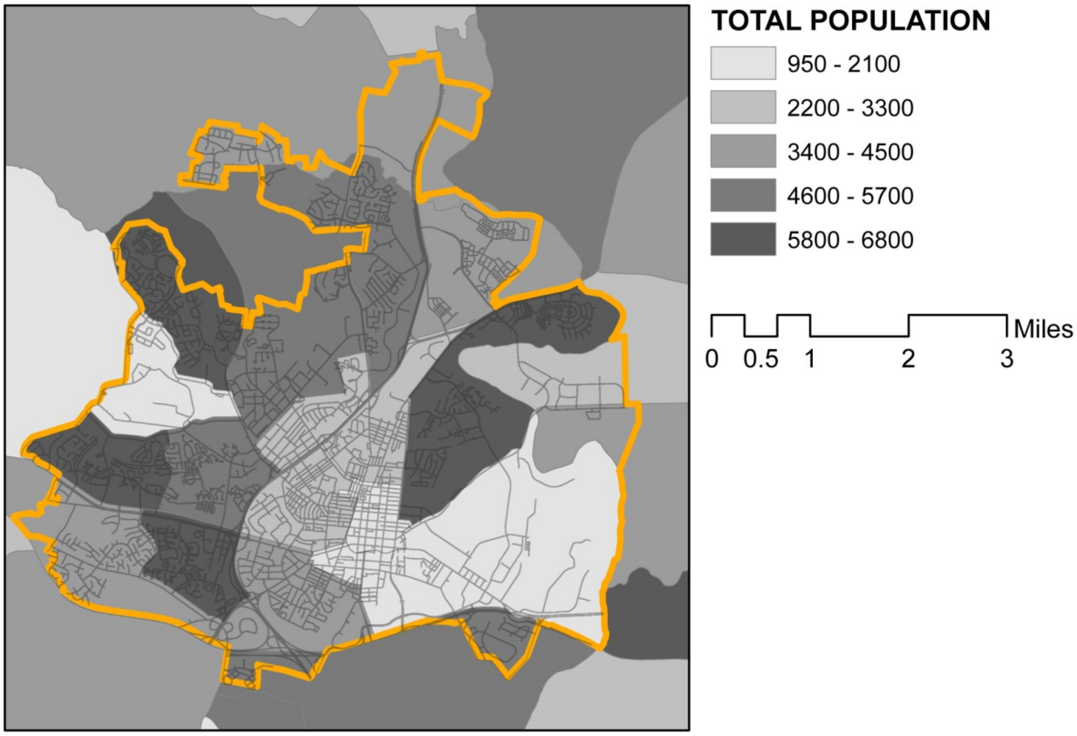


**Figure 82: Current Population by Census Tract**
(source: author)

**The population of the City of Frederick has universally grown since the last Decennial Census. Illustrated in this map, the area of study for this thesis falls in an area that is of the lowest population in city. Multiple factors lead to this including availability, density, and amenities. However, given the continued population growth of the city, underdeveloped areas such as this site area will have to creatively invest in the multitude of unrealized growth potential.**

Additionally, the City of Frederick faces a continued growing population. Through the master planning and adaptive reuse strategies this case study will illustrate, unrealized housing and density opportunities will be creatively established. Additionally I will address benefits such as the ability to be self-sustaining through localized agriculture in smaller secluded pockets of density such as the City of Frederick to provide alternative living and working opportunities from major metropolitan areas.

This chapter will introduce and analyze the City of Frederick. Additionally, it will illustrate the area of study for master planning development and the specific abandoned industrial site for adaptive reuse intervention. Lastly, I will propose multiple design concepts for the area of study and site based on the principles and strategies established earlier.

## 04.02 – Location

### **04.02.01 –** *The City of Frederick*

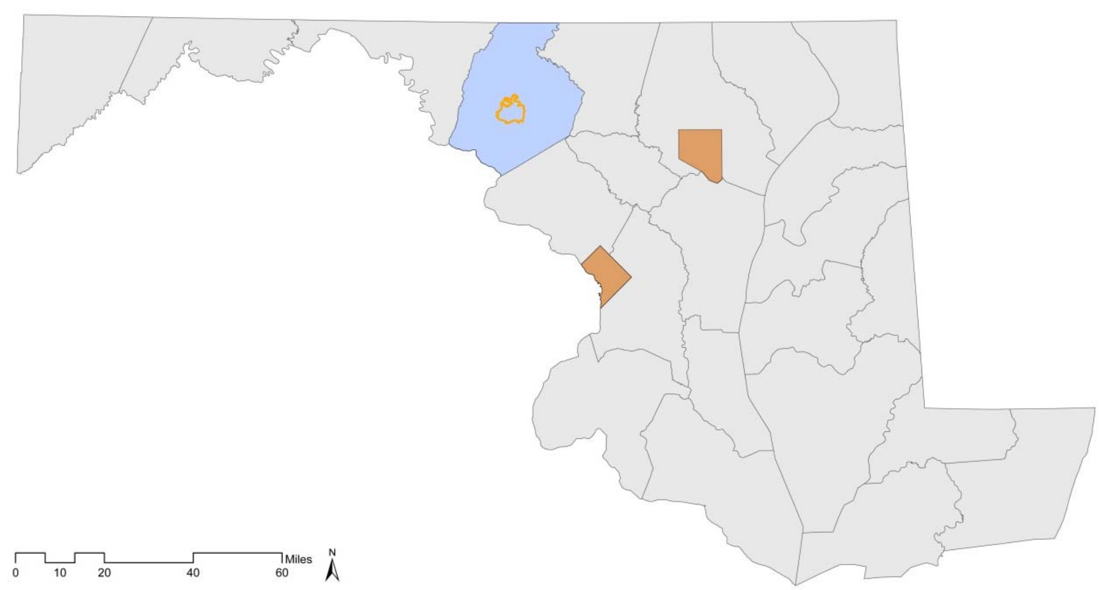


**Figure 83: City of Frederick - State of Maryland**
(source: author)

**The City of Frederick is located in Frederick County, Maryland. Frederick County is a western county of Maryland founded in 1748 with a total area of 667 square miles, the largest county, by area, in the state. According to the 2010 census, the total population of Frederick County is 233,385, Making the overall density a modest 352 per square mile.**

**Figure 84: City of Frederick - Figure Ground**
(source: author)

**The City of Frederick sits at the intersection of major arterial highways for the state of Maryland, Interstate 70, running east and west, Interstate 270 running south, and U.S. Route 15 running north. The area of study for this thesis is highlighted by the red dashed line and the site that will be rehabilitated is denoted by the solid red line.**

**Figure 85: City of Frederick - 1887**
(source: Digital Sanborn)

**In this early Sanborn Map record of Frederick in 1887 we see the original grid structure of the city which still exists today. Additionally, Carroll Creek is in its natural formation of widening and narrowing sections and divergent paths. Also shown in this early map is the Frederick Branch of the Baltimore and Ohio (B&O) Railroad which terminated on South Street and the southern termination of the Pennsylvania Railroad which came down East Street.**

The B&O Railroad station built in 1832 is one of the oldest permanent stations on the rail line. This station was primarily used for freight including exports of flour, milk, bricks, limestone, and other manufactured goods. In 1854 a new passenger depot was built at the intersection of All Saints Street and Market Street.

**Figure 86: City of Frederick - B&O Railroad**
(source: Frederick News Post)

**This image depicts October 4, 1862 when President Abraham Lincoln addressed the people of Frederick following his visit to the Battle of Antietam battlefield which occurred two weeks prior. This historic visit is an important part of the history of Frederick.**

**Figure 87: City of Frederick - Passenger Railroad Station**
(source: www.panoramio.com)

**While the railroad no longer runs to this passenger station, the historic nature of the site marks its reason for being today.**

**04.02.02** – *Agriculture*

Frederick County has a treasured history in agriculture. The present contrast of density between the City of Frederick and its adjacent farming commerce places this town in a position to be widely self-sustaining through local goods and produce. As part of this thesis I will explore the community and public space programing to encourage a model of local reliance.

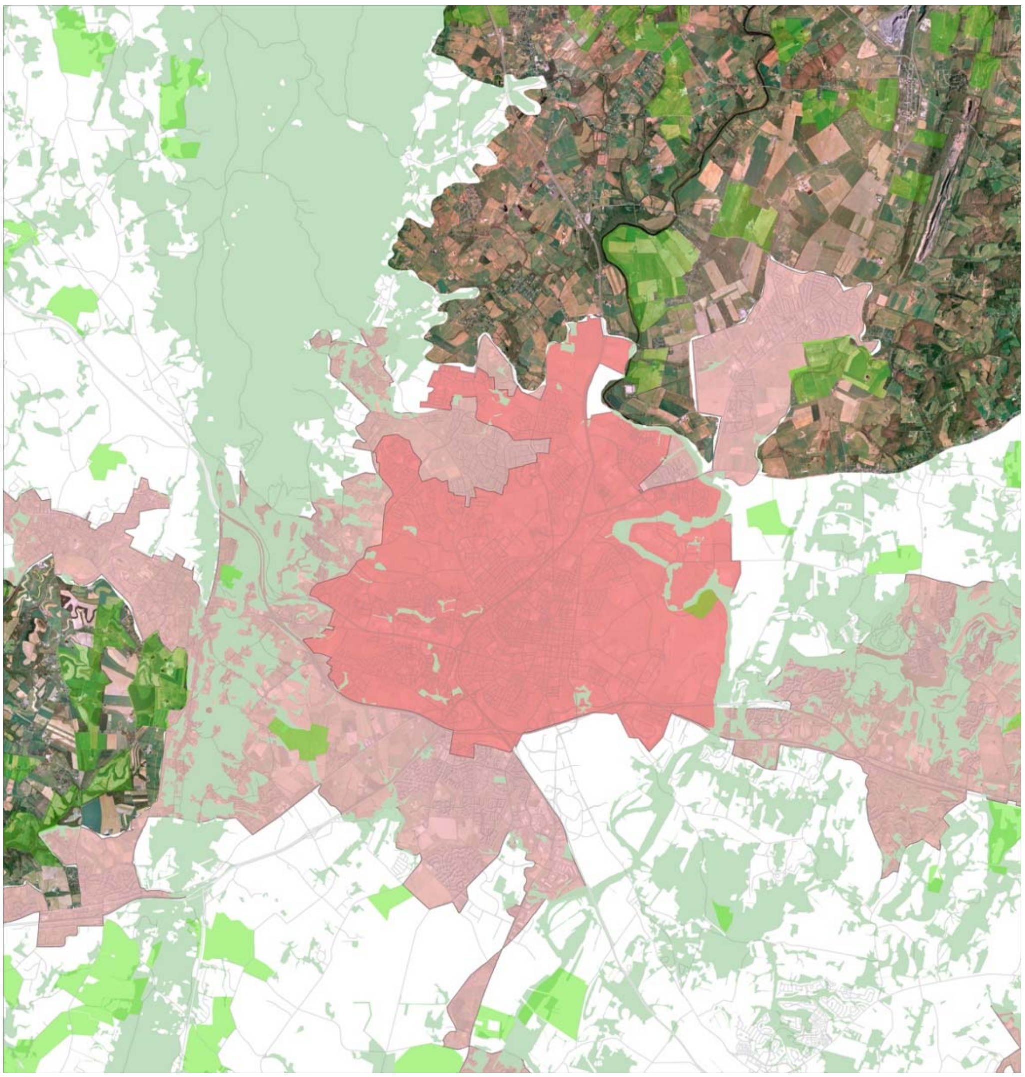

**Figure 88: Agriculture Adjacency**
(source: author)

**This diagram illustrates the density of the City of Frederick and surrounding dense areas in shades of red and their adjacency to agricultural land. The farms highlighted in a green shade are protected farmland.**

**04.02.03 –** *Public Transportation*

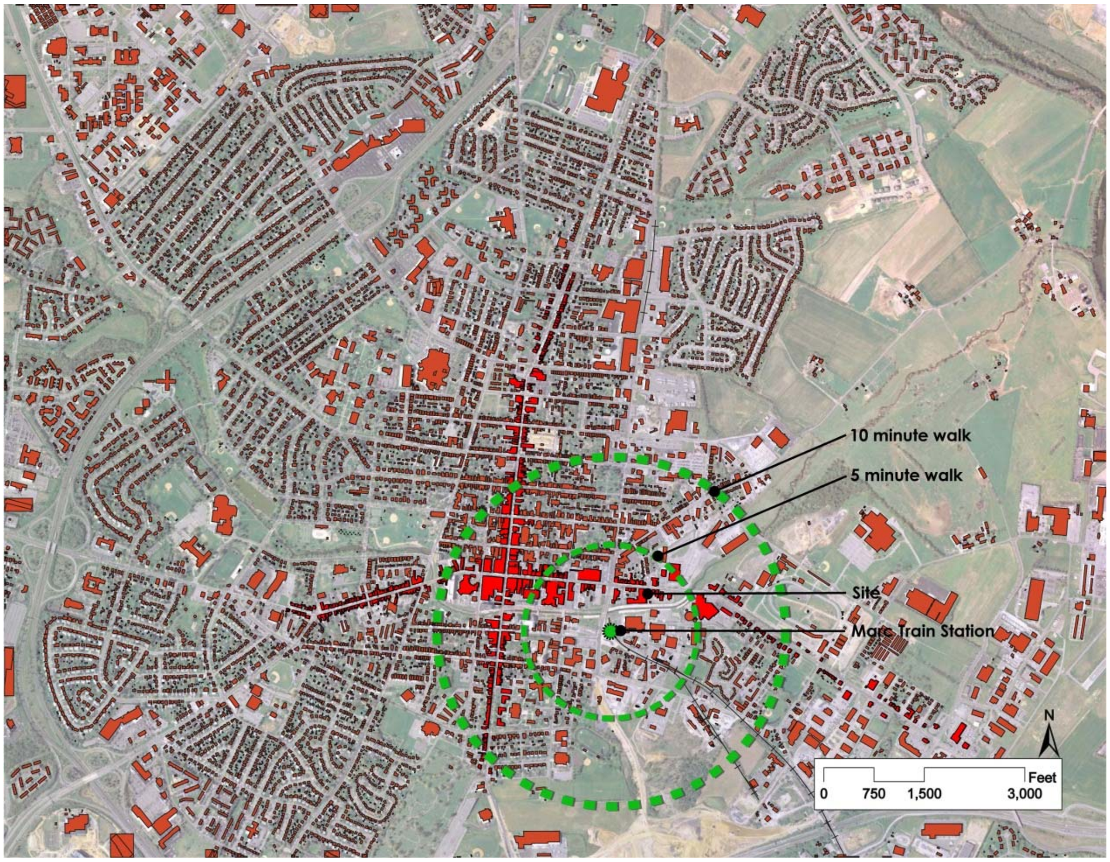


**Figure 89: Marc Train Station**
(source: author)

**The Marc Train Station is located diagonally from the Union Manufacturing Knitting Mill site on the south side of Carroll Creek. The site and entire area of development for this thesis falls within a five minute walking radius to the Marc Station. Through development of this area it becomes imperative to consider the regional commuting system provided by the Marc Train. Providing housing in this area will be desirable to residents wishing to have the urban waterfront residence and commute to major metropolitan areas.**

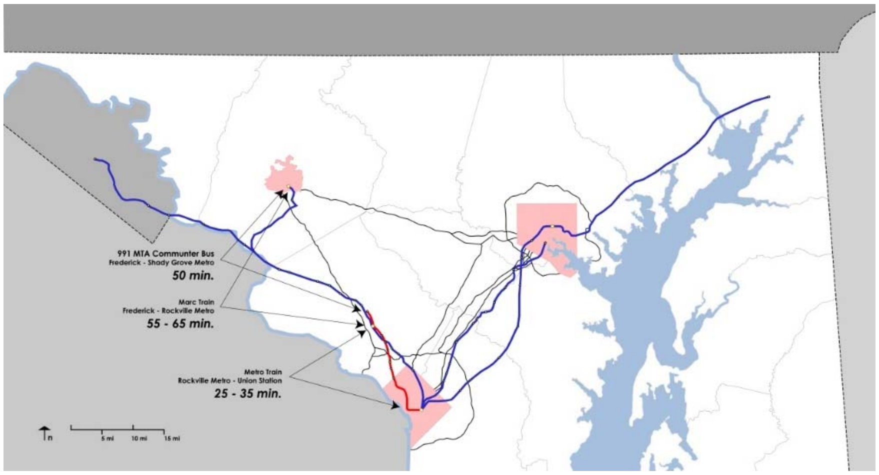


**Figure 90: Regional Public Transportation Network**
(source: author)

**The City of Frederick is well integrated into the Washington D.C. public transportation network through the Marc Train system. This rail line connects to the Washington D.C. Metro System and Union Station. From Union Station commuters are able to connect to a much wider network including Baltimore via the Marc Train, or a wider area with the Amtrak rail network. The Marc Train station in Frederick is located adjacent to the Union Mills Knitting Mill site.**

**04.02.04 –** *Approach*

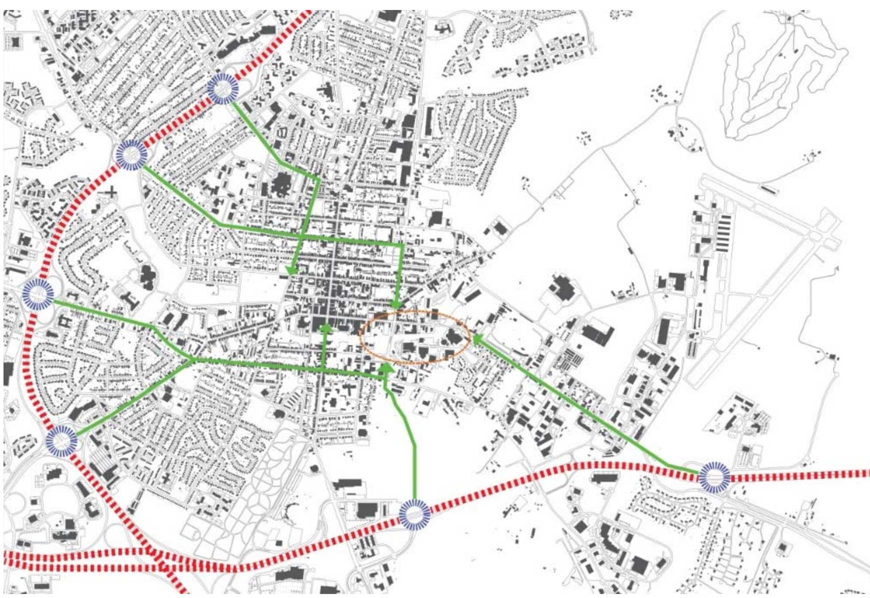

**Figure 91: Downtown Access**
(source: author)

**Access to the downtown area is primarily achieved along an approach from one of six highway exits. Either Interstate 70 traveling east/west, or Route 15 traveling north/south. The network of one way streets places the study area for this thesis as a prominent gateway to the downtown for a majority of incoming traffic.**

This sequence of diagrams will illustrate a common approach to the downtown of the City of Frederick from the East Patrick Street exit off of Interstate 70. This path places visitors into the downtown through the area of study for this thesis, illustrating the importance of this primary gateway into the downtown area.


**Figure 92: The City of Frederick – Approach**
(source: author)

**Upon exit of the highway traffic begins a sequence of slowing down and sorting. The area is comprised of gas stations, strip mall shopping centers, and quick food shops to accommodate highway traffic.**

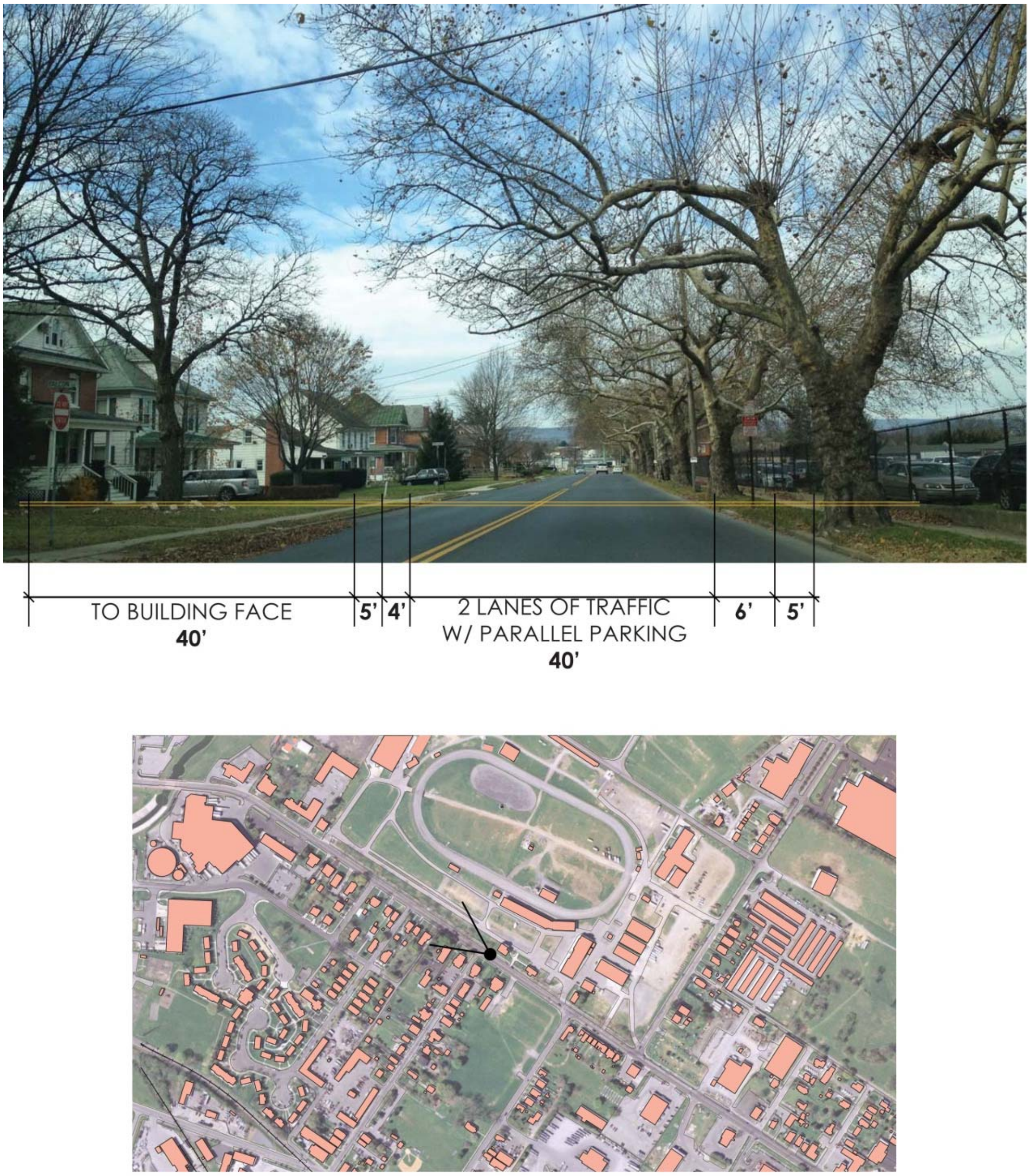


**Figure 93: The City of Frederick - Approach**
(source: author)

**The aged character of sweeping tree cover and historic single family homes begins to shed light on the personality of the City of Frederick. The county attraction of the Frederick Fairgrounds stand to the right as you approach the city.**

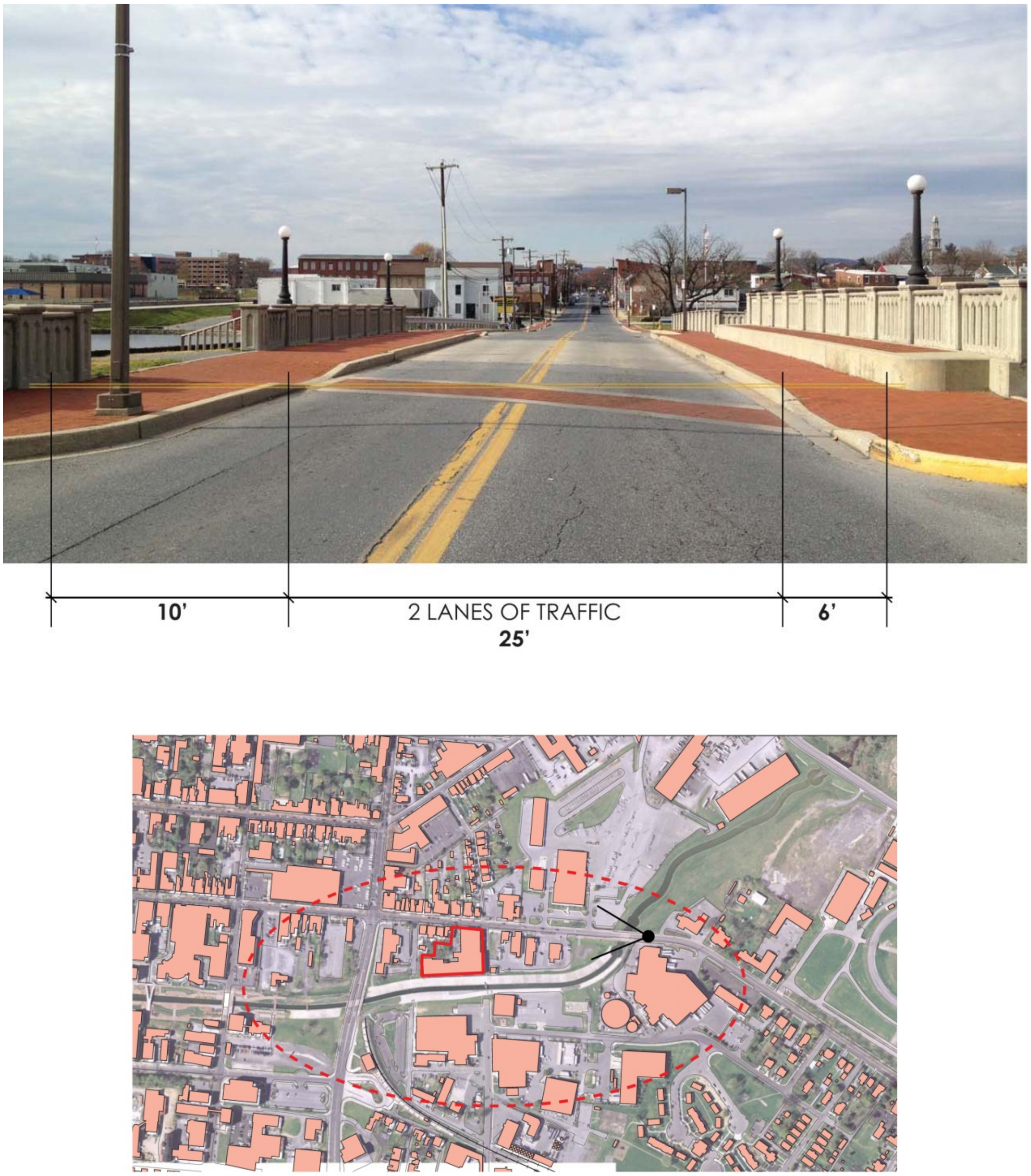


**Figure 94: The City of Frederick - Approach**
(source: author)

**As traffic crests over a modest bridge to take visitors over Carroll Creek the experience begins to transform into an urban setting. The absence of parking and narrowed lanes gives a moment of compression to vehicular travel and encourages reduced speeds.**

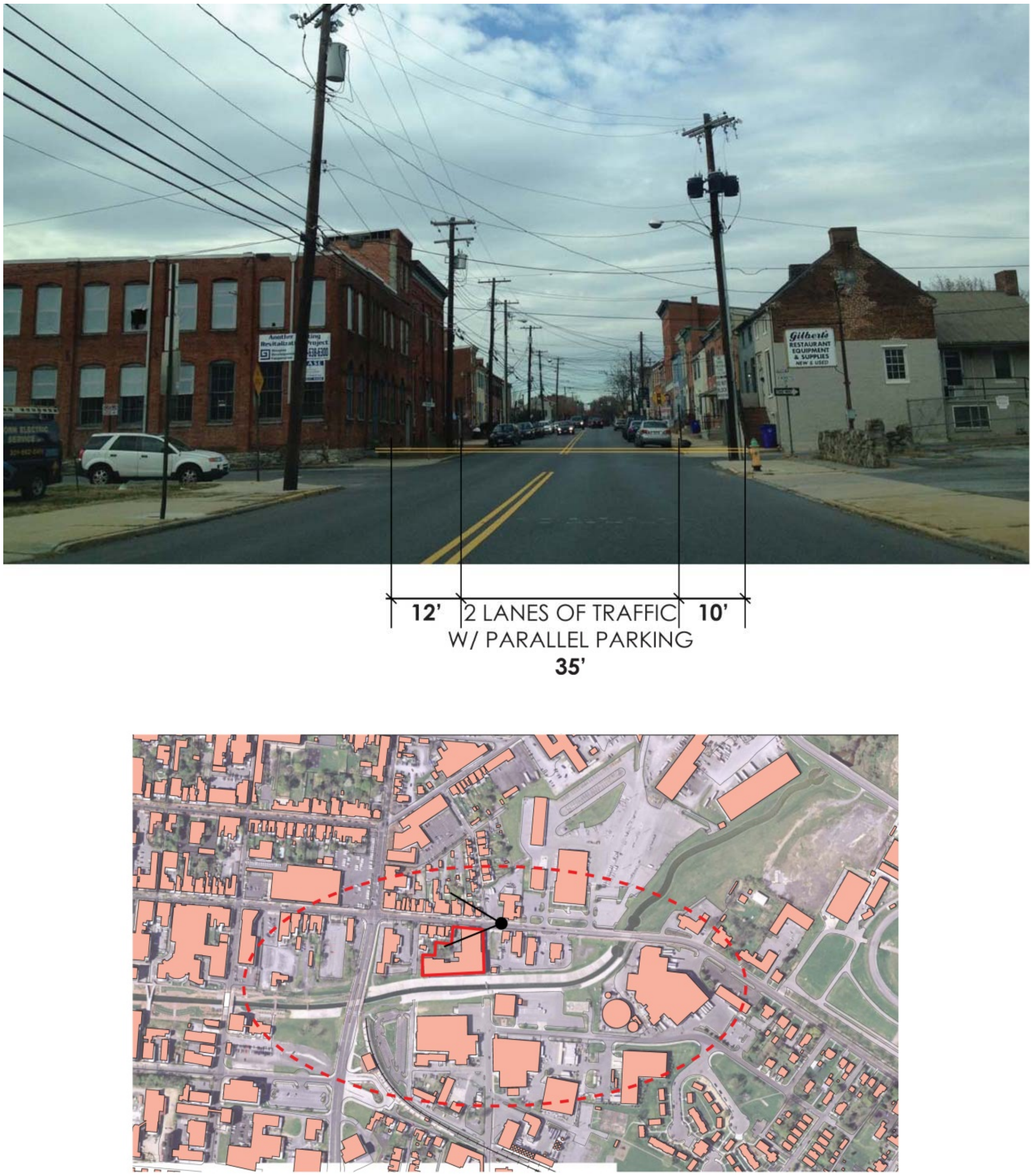


**Figure 95: The City of Frederick - Approach**
(source: author)

**At the Union Manufacturing Knitting Mill site one begins to experience an urban edge with buildings abutting the property edge. However, the fabric is still discontinuous and underutilized.**


**Figure 96: The City of Frederick - Approach**
(source: author)

**As one approaches the first major intersection of the downtown area, Patrick Street and East Street, the experience has a residential row home scale to the urban fabric. In the distance, at the intersection the urban edge is lost before entering the downtown. This is due to vacant lots and the post office service parking lot occupying three of the corners of this intersection.**


**Figure 97: The City of Frederick – Approach**
(source: author)

**Once in the downtown area, one feels the sense of urban enclosure with the continuous building edge and aged street trees. Parallel parking on both sides of the street and narrow travel lanes keep vehicular traffic speeds low.**

## 04.03 – Carroll Creek

### **04.03.01** – *Hydrological Network*

The City of Frederick hosts a significant hydrologic artery of Carroll Creek which bisects the downtown area. With this amenity comes the obligation to maintain its health in serving the larger watershed.

**Figure 98: Potomac River Watershed**
(source: The Potomac Conservancy)

**This diagram shows the extent of the watershed of the Potomac River. The City of Frederick is within this watershed due to the Monocacy River feeding directly into the Potomac River.**

**Figure 99: Monocacy River Watershed**
(source: The Potomac Conservancy)

**Looking closer at the watershed of the Monocacy River, the City of Frederick falls completely within its direct watershed. Carroll Creek, which passes directly through the downtown of the city feeds into the Monocacy River.**

**04.03.02 –** *Historic Context*

Carroll Creek faced two devastating floods, the first in 1972, and again in the most historically devastating flood of the City of Frederick in 1976. As a result, there were millions of dollars in property losses and many buildings left vacant or underutilized.


**Figure 100: City of Frederick - 100 Year Flood Plain**
(source: author)

**Denoted in solid red is the current 100 year flood plain in the City of Frederick. The area outlined in a dashed red line is the 100 year flood plain prior to the Flood Control Project completed in the 1990's.**

**04.03.03** - *Flood Control Project*

Following the flood of 1976, the City of Frederick conducted extensive studies of the Carroll Creek watershed to determine the best way to prevent future flooding of the downtown area.[71] The planning, implementation, and funding for the extensive infrastructure improvements were funded in part by the City of Frederick, Frederick County, and the State of Maryland.[72]

[71] Jacobson Wallace Associates. "Carroll Creek Park: Master Plan," 3.
[72] Jacobson Wallace Associates. "Carroll Creek Park: Master Plan," 3.

**Figure 101: Flood Control Project Typical Section**
(source: Carroll Creek Master Plan. City of Frederick)

**Figure 102: Carroll Creek Flood Control Project - Construction**
(source: Carroll Creek Master Plan. City of Frederick)

"The flood control project consisted of an underground system of rectangular concrete conduits intended to convey stormwater safely through downtown Frederick."[73] The culverts would carry excess storm water from Baker park to Huskey Park and also accommodate backwater floods from the Monocacy River.[74] To pay homage to Carroll Creek's place within the city of Frederick, a man-made surface water system following the creek's original path was incorporated into the flood control project. With the storm water controlled within the culverts a new ground plain was formed by the roof of the large concrete conduits. This new surface creates the connective tissue for a linear pedestrian waterfront development. Designed to be a public space, the new Carroll Creek Park system connects Baker Park to the west of downtown to Highland Street to the east.

**Figure 103: The Flood Control System at Baker Park**
(source: author)

**This is an image of the flood control system in action to control the flood waters of Hurricane Sandy on October 30, 2012.**

[73] Jacobson Wallace Associates. "Carroll Creek Park: Master Plan," 4.
[74] Jacobson Wallace Associates. "Carroll Creek Park: Master Plan," 4.

## **04.03.04 –** *Carroll Creek Park - The New Pedestrian Waterfront*

**Figure 104: Carroll Creek Park Master Plan**
(source: Carroll Creek Master Plan. City of Frederick)

**The master plan was designed by HNTB Corporation and RK&K Engineers. The park system spanned 1.3 miles along the roof of the flood control culverts to create abundant pedestrian amenities.**

**Figure 105: Carroll Creek Park Districts**
(source: Carroll Creek Master Plan. City of Frederick)

**The Carroll Creek Park system was divided into five districts which also align with phasing plans for development. To date, districts one through three have been substantially completed. The area of study for this thesis will be in district four which has not yet been completed.**

When the flood control project was completed in the mid 1990's unrealized benefits occurred. There was substantial land that lay vacant or held abandoned structures because of existing flood plain ordinances. Since the threat of flooding was removed with the flood control project this land could be revitalized for development. As the master plan documentation points out, "One important aspect of this new growth potential is that it will be accommodated within the existing downtown character without destruction of significant or historic structures"[75]

**Figure 106: Carroll Creek Park - Proposed Vignette**
(source: Carroll Creek Master Plan. City of Frederick)

[75] Jacobson Wallace Associates. "Carroll Creek Park: Master Plan," 5.

In order to create a long-term vision for Carroll Creek Park the City of Frederick created the Carroll Creek Commission to lead the project. A variety of public and private interest groups were included in identifying the proper land use, design vision, and implementation strategies for the new park system.[76] The commission adopted planning methodology to inventory, analyze, and evaluate the physical, social, and economic factors influencing the park design.[77]

**Figure 107: Carroll Creek Park - East Park**
(source: Carroll Creek Master Plan. City of Frederick)

[76] Jacobson Wallace Associates. "Carroll Creek Park: Master Plan," 6.
[77] Jacobson Wallace Associates. "Carroll Creek Park: Master Plan," 6.

**Figure 108: Carroll Creek Park - Downtown Amphitheater Section**
(source: Carroll Creek Master Plan. City of Frederick)

**Figure 109: Carroll Creek Park - Downtown Section**
(source: Carroll Creek Master Plan. City of Frederick)

The commission focused on creating, "Positive images of Frederick as an interactive, family oriented community, a town of historic character and a weekend destination for historical interests, shopping and dining should be enhanced."[78] Additionally, the physical character of the park system was thought to be important to be, "responsive to existing buildings, preserving views of historic structures and spires, using materials consistent with existing downtown paving, masonry, greenery and maintaining the human scale of existing street fronts."[79]

The City of Frederick has focused on the inclusion of public art projects within the scope of the Carroll Creek revitalization project. Projects range in typology and scope, however each tells a story about the identity of the city. For example, a project that has been planned, but not yet implemented, is a series of bronze inlays along the walking surface to memorialize historical community events. The intent was to focus on events relating to the citizens of Frederick. Below are images of other completed projects.

[78] Jacobson Wallace Associates. "Carroll Creek Park: Master Plan," 10.
[79] Jacobson Wallace Associates. "Carroll Creek Park: Master Plan," 10.

**Figure 110: Painting the Spirit of Carroll Creek**
(source: City of Frederick Department of Economic Development)

**In an effort to engage the community with the vigor of the Carroll Creek Pedestrian Waterfront Revitalization project, residents, businesses, and community groups were given a parcel of the concrete flood control project top to paint their "Spirit of Frederick." The art was then covered up by the waterfront improvements, but left intact for future discovery. The effort was also used as a fundraiser for the Carroll Creek Park Public Art fund.**

**Figure 111: Bronze Calf**
(source: City of Frederick Department of Economic Development)

**A life-sized bronze sculpture of a dairy calf located in the grass of Carroll Creek Park to commemorate the agricultural past of Frederick.**

**Figure 112: Mosaic Tile Pavers**
(source: City of Frederick Department of Economic Development)

**Inlayed Smalti mosaic tile pavers in varied sizes placed along the Blue Stone Path in Carroll Creek Park. The mosaics are influenced by water, commemorating Carroll Creek.**

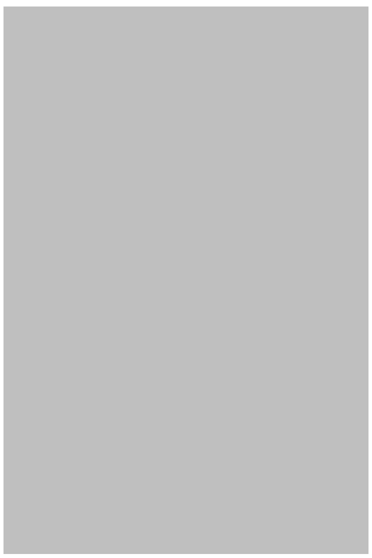

**Figure 113: Marie Diehl Memorial Drinking Fountain**
(source: City of Frederick Department of Economic Development)

**A sculptural public drinking fountain and pet-friendly drinking fountain done in honor of Marie Diehl, founder of the Society for the Prevention of Cruelty to Animals.**

**Figure 114: Iron Bridge**
(source: City of Frederick Department of Economic Development)

**Decorative hand forged iron railings for the wood bridge over Carroll Creek completed in an elaborate floral design.**

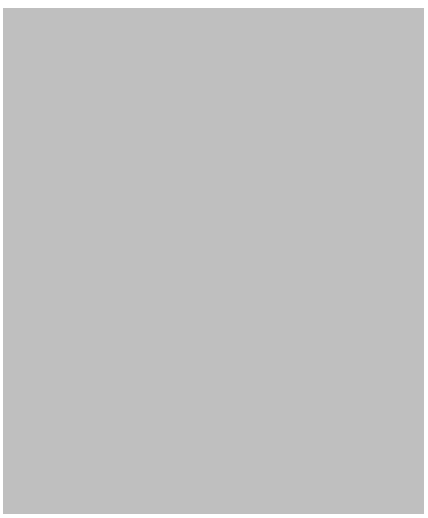

**Figure 115: The Spire**
(source: City of Frederick Department of Economic Development)

**Completed to commemorate the 75th anniversary of Baker Park this 25 foot tall steel sculpture is located in Baker Park.**

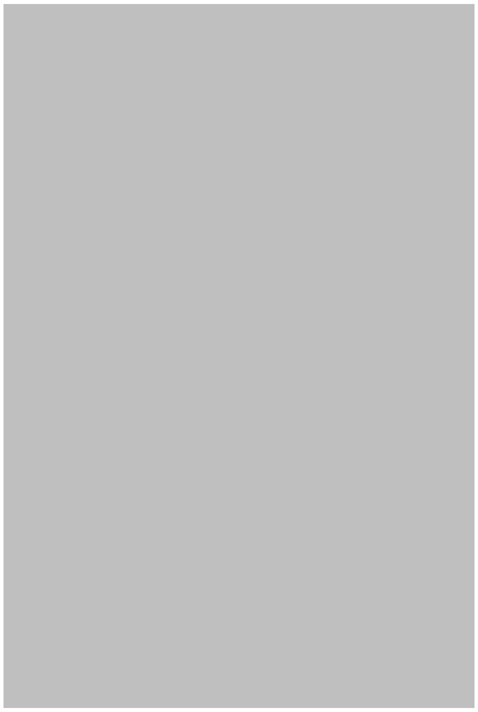

**Figure 116: Wind Swept**
(source: City of Frederick Department of Economic Development)

**A metal sculpture formed to be a tree blowing in the wind.**

**Figure 117: Community Bridge Mural**
(source: City of Frederick Department of Economic Development)

**A mural painting covering the pedestrian underpass of the Community Bridge, or the East Street vehicular bridge. The otherwise plain concrete traffic bridge was revitalized with this forged stone mural painting**

**04.03.05 –** *Carroll Creek Park Current Development*

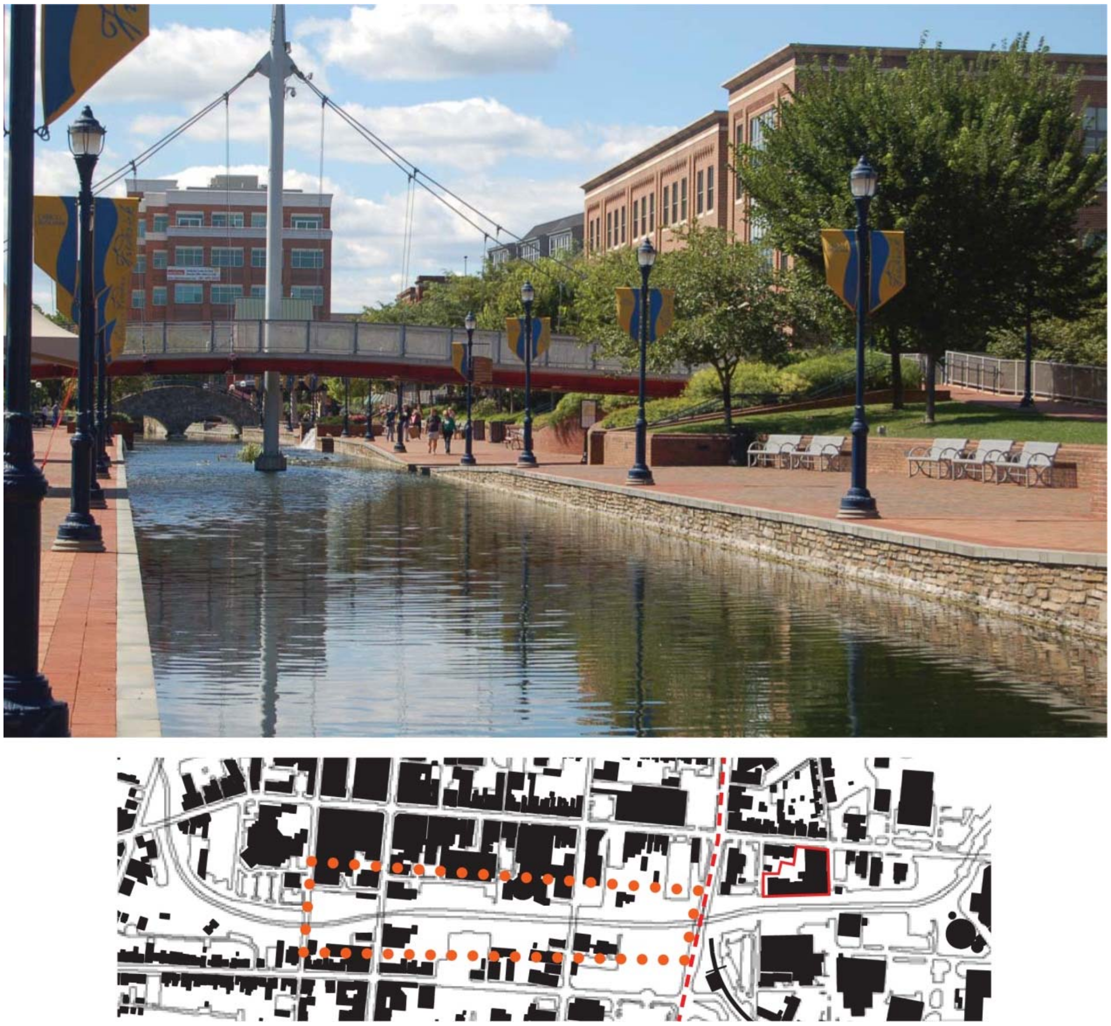

**Figure 118: Carroll Creek Park - District 3 Completed**
(source: author)

**A current image of the Carroll Creek pedestrian waterfront shows a park-like setting with varying bridge structures, lampposts lining the water edge, hardscape walking paths, and tree-lined edges. A backdrop of city buildings creates a frame to the space, but only indirectly engages the space.**

**Figure 119: Carroll Creek Park - District 4 Uncompleted**
(source: author)

**The uncompleted district four still bares the concrete conduit roofs lining the unmaintained creek. The Union Manufacturing building, pictured above to the left of the creek, holds a predominate south-facing frontage to the creek.**

Currently the park system has only been partially completed. The area from Baker Park connecting down to the downtown center at Market Street and over to East Street has been completed and reinforced with strong community support and economic success.

The area from East Street up to East Patrick Street and ultimately connecting to the end of the Flood Control Project at

Highland Street has yet to be completed. Unfortunately, economic factors have delayed further development. This provides a bittersweet opportunity to provide an updated amendment to the master plan that more accurately appeals to the demographics of today's demand as well as the additional incorporation of sustainability measures. As all long-term master plans do, the original master plan establishes that the plan is designed to evolve over time to accommodate the phasing of improvements.

**04.03.06 –** *Character*

**Figure 120: Typical Residential Street**
(source: author)

**Figure 121: Typical Commercial Street**
(source: Bill Adkins)

**Figure 122: Typical Alley**
(source: author)

**Figure 123: Historic Character**
(source: author)

## 04.04 – Design Concepts

### **04.04.01** – *Introduction – The Study Area*

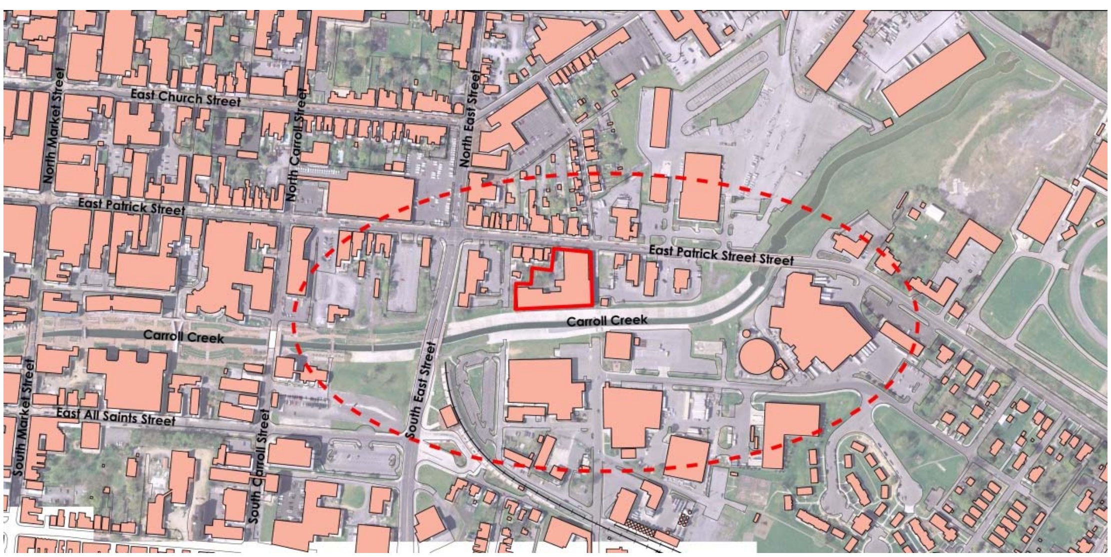


**Figure 124: Study Area**
(source: author)

**The area of investigation for this thesis project lies between the Carroll Creek waterfront and East Patrick Street. This will include the vacant lot at the south-east corner of East Patrick Street and East Street to the Union Manufacturing Knitting Mill site and the adjoining sites to the south of Carroll Creek.**

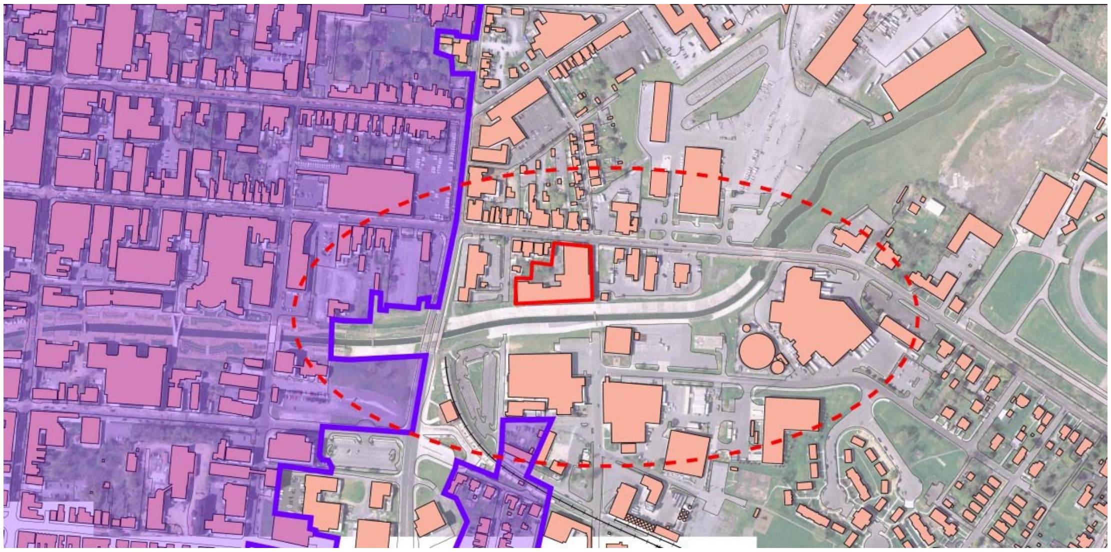

**Figure 125: Study Area - Historic District**
(source: author)

**This diagram highlights the buildings and properties that are part of the historic district. These properties are subject to regulations set forth by the Historic Preservation Commission. All alterations and improvements must go through an approval process.**

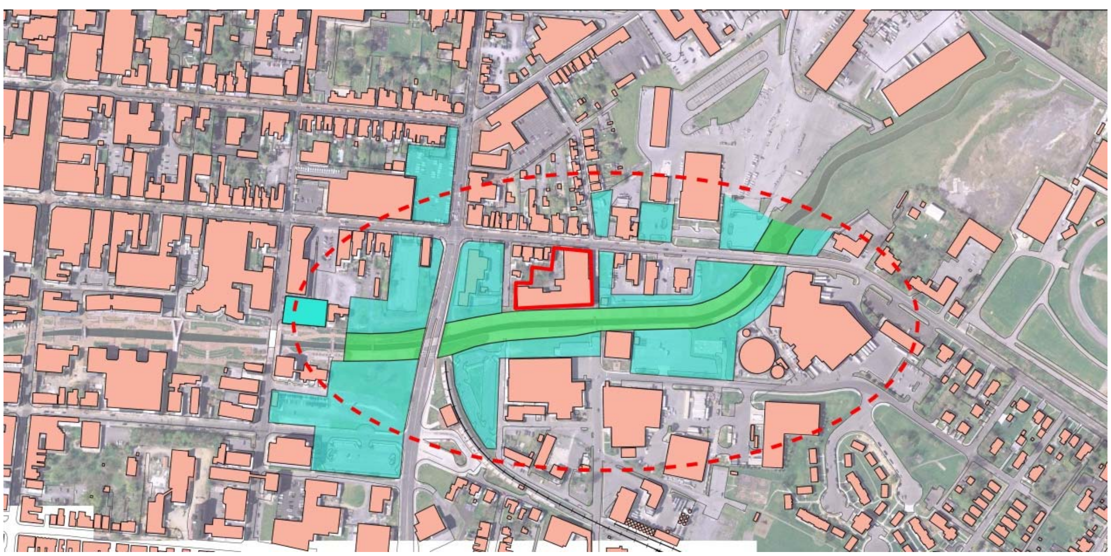

**Figure 126: Study Area - Defined Places for Intervention**
(source: author)

**Through analysis of the study area based on current conditions of the city fabric this diagram defines the places within the study area which are ideal for land improvements.**

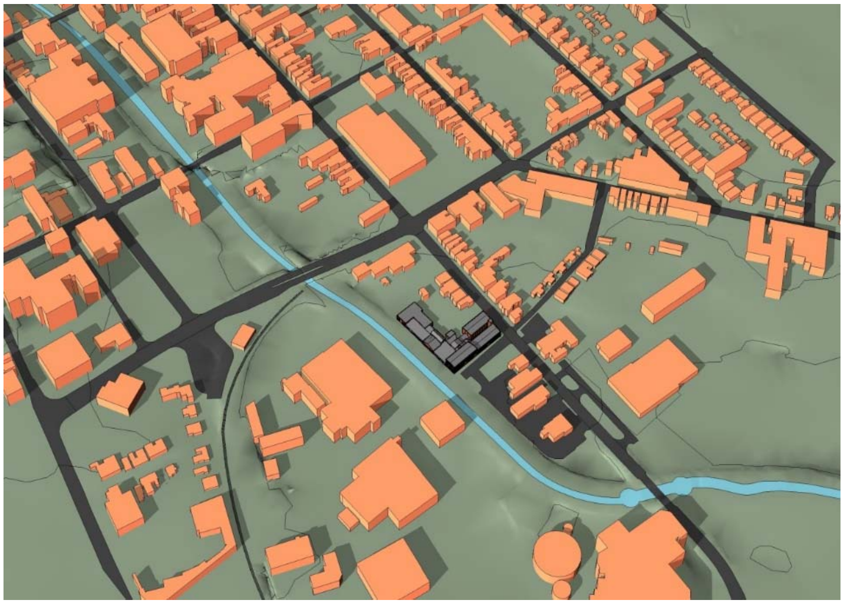

**Figure 127: Study Area Three Dimensional Analysis**
(source: author)

**This aerial diagram shows the lack of density existing in the study area. Also, there has been no engagement with the creek front.**

### **04.04.02 –** *Conceptual Study Area Approach I*

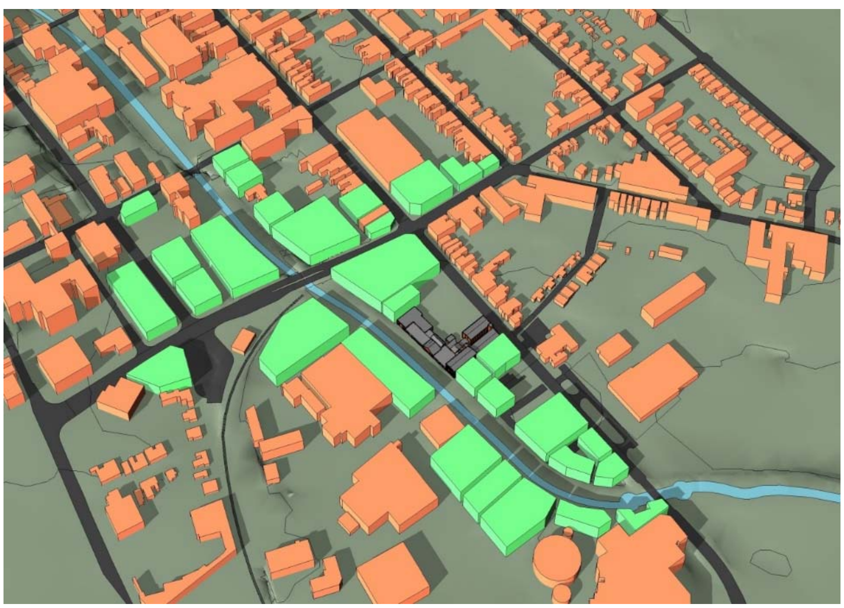

**Figure 128: Conceptual Study Area Approach I**
(source: author)

**The first strategy illustrates complete infill of developable land. This generates a dense edge along the creek front and the adjacent streets. This increased density would generate the maximum residents, employees, and visitors to the area.**

### **04.04.03** – *Conceptual Study Area Approach II*

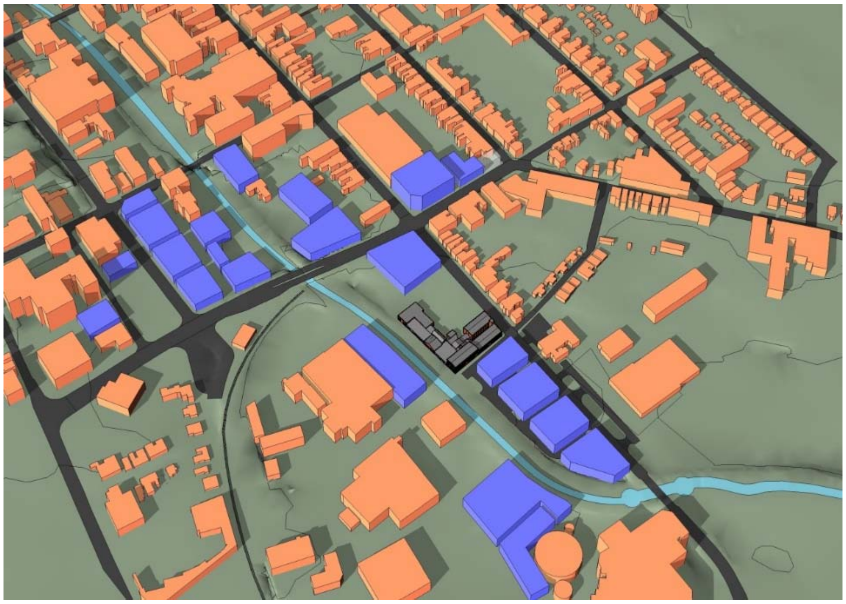

**Figure 129: Conceptual Study Area Approach II**
(source: author)

**The second approach would be to generate new development while remaining more sensitive to the public space. Leaving more open spaces creates hierarchy and an episodic user experience as they convey through the space. Leaving open public spaces allows for landscaped spaces, outdoor markets, performance spaces, art exhibits, and gathering spaces.**

## 04.05 – Union Manufacturing Knitting Mill Building

### **04.05.01** – *Introduction – The Site*

This thesis will focus on the detailed adaptive reuse of the Union Manufacturing Knitting Mill Building. This building holds a significant history in manufacturing for the City of Frederick. The entrepreneurial venture of five men sought to create an environment of dignified light manufacturing for women. “It was by no means an easy task to convince the girls that they were not compromising themselves by operating a knitting machine, nor was it less difficult to satisfy them that they really dignified their position in their efforts to become self dependent by their personal endeavors."[80] This mill was considered one of the most modern and well-equipped mills in the country. The operation of the mill was efficient with a printing plant, dye house, and stock rooms. The manufacturing mill continued to grow into the 1930s when a fireproof warehouse on the south of the creek was created.[81] The success of the mill was based upon the pursuit of perfection in the company slogan, "To produce only perfect, dependable hosiery."[82]

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[80] Williams, Thomas J. C., and Folger McKinsey. *History of Frederick County, Maryland.*
[81] Williams, Thomas J. C., and Folger McKinsey. *History of Frederick County, Maryland.*
[82] Williams, Thomas J. C., and Folger McKinsey. *History of Frederick County, Maryland.*

**Figure 130: Union Manufacturing Knitting Mill Building - From Carroll Creek**
(source: author)

**A current view of the Union Manufacturing Knitting Mill Building from Carroll Creek.**


**Figure 131: Union Manufacturing Knitting Mill Building - E. Patrick Street View**
(source: author)

**A current view of the Union Manufacturing Knitting Mill Building from East Patrick Street.**

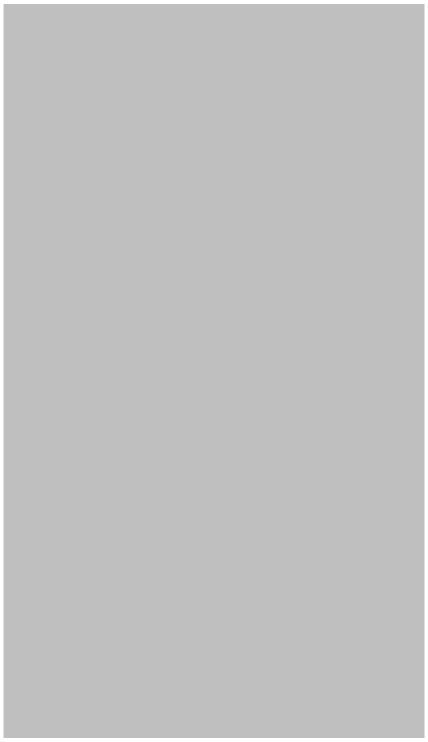

**Figure 132: Union Manufacturing Knitting Mill - 1892 Sanborn Map**
(source: Digital Sanborn Maps)

**The first record of the structure appears in this 1892 Sanborn Map. The structure began with two mill buildings and a dye house.**

**Figure 133: Union Manufacturing Knitting Mill - 1930 Sanborn Map**
(source: Digital Sanborn Maps)

**A later 1930 Sanborn Map illustrates the growth of the mill throughout the early 20th century. A fireproof warehouse structure was added to the south of Carroll Creek, closer to the rail line.**

**Figure 134: Union Manufacturing Knitting Mill - 1910**
(source: City of Frederick)

**The current state of this structure is identical to its appearance during its operational period in the early 20$^{th}$ century.**

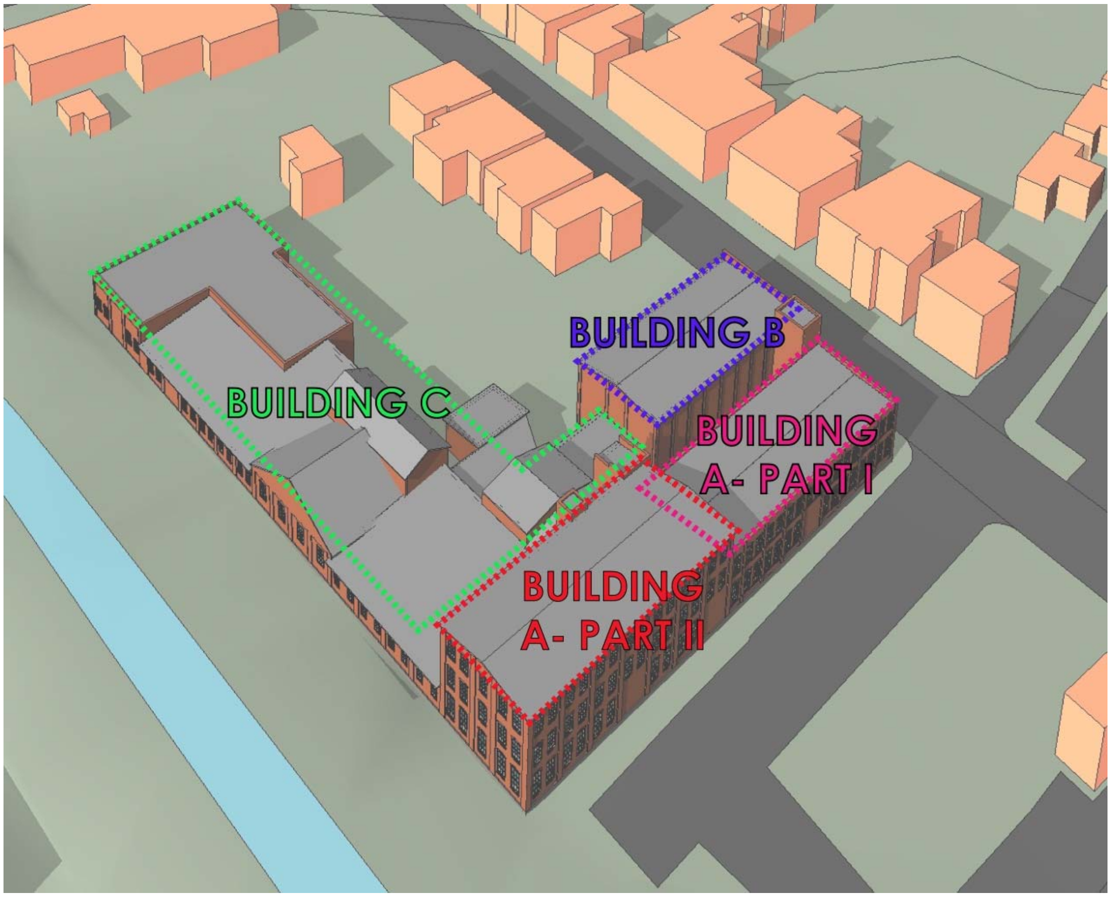


**Figure 135: Union Manufacturing Knitting Mill - Existing Conditions Diagram**
(source: author)

**For the development of this site the existing structure will be discussed in terms of its individual components.**

**Table 2: Floor Area - Existing Conditions**

| EXISTING SITE CONDITIONS | | | |
|---|---|---|---|
| **EXISTING BUILDING** | | | |
| | AREA PER FLOOR (SQ.FT.) | NUMBER OF FLOORS | TOTAL BUILDING AREA (SQ.FT.) |
| BUILDING A - PART I | 4,031 | 2 | 8,062 |
| BUILDING A - PART II | 3,527 | 3 | 10,581 |
| BUILDING B | 3,369 | 2 | 6,738 |
| BUILDING C | 15,027 | 1 | 15,027 |
| TOTAL EXISTING BUILDING AREA | | | 40408 |
| **SITE** | | | |
| TOTAL SITE AREA | 49,232 | | |
| ZONING F.A.R. | 4 | | |
| TOTAL ALLOWABLE BUILT AREA | | | 196928 |

**04.05.02** – *Conceptual Site Approach I*

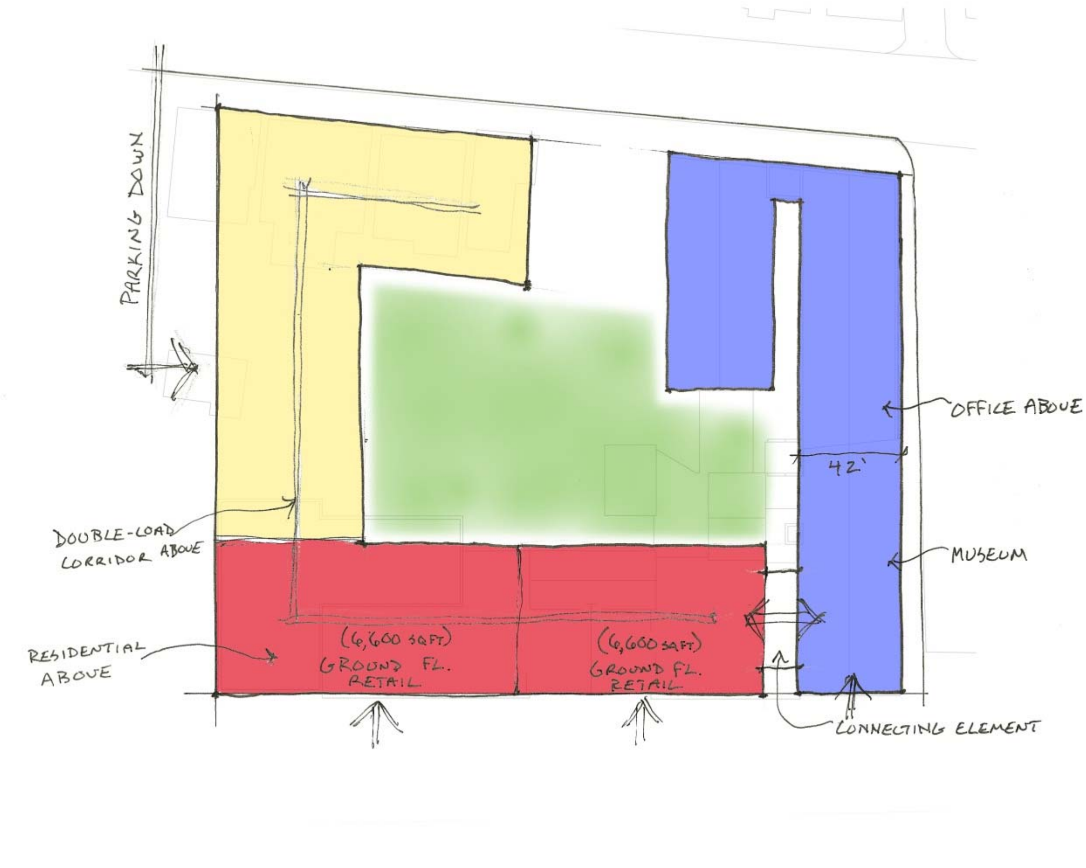


**Figure 136: Conceptual Site Approach I - Plan**
(source: author)

**Table 3: Conceptual Site Approach I - Floor Area**

| SITE CONCEPT I | | | |
|---|---|---|---|
| **EXISTING BUILDING** | | | |
| | AREA PER FLOOR (SQ.FT.) | NUMBER OF FLOORS | TOTAL BUILDING AREA (SQ.FT.) |
| BUILDING A - PART I | 4,031 | 2 | 8,062 |
| BUILDING A - PART II | 3,527 | 3 | 10,581 |
| BUILDING B | 3,369 | 2 | 6,738 |
| BUILDING C | 15,027 | 1 | 15,027 |
| TOTAL EXISTING BUILDING AREA | | | 25,381 |
| **NEW BUILDING** | | | |
| NEW BUILDING | 25,701 | 5 | 128505 |
| TOTAL NEW BUILDING AREA | | | 128505 |
| **SITE TOTALS** | | | |
| TOTAL BUILDING AREA | 153,886 | | |
| TOTAL SITE AREA | 49,232 | | |
| ZONING F.A.R. | 4 | | |
| TOTAL F.A.R. | | | 3.126 |

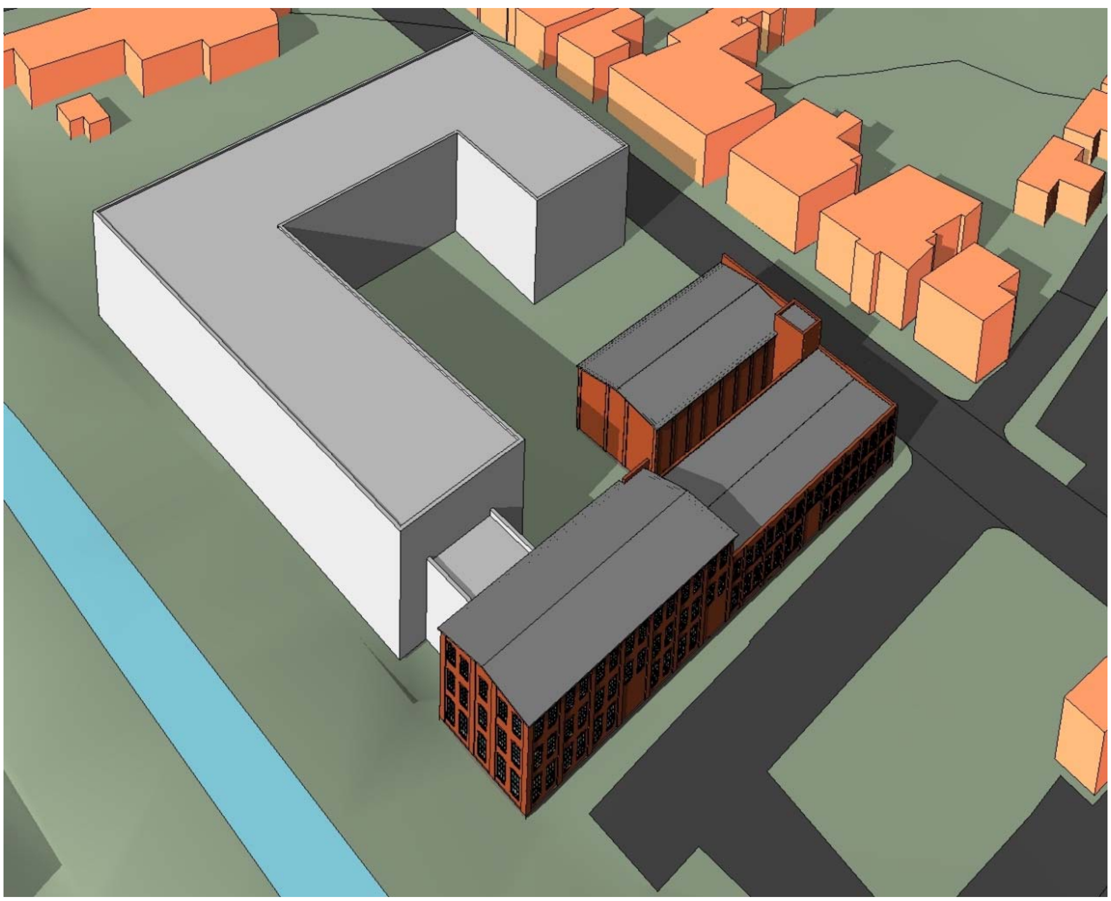

**Figure 137: Conceptual Site Approach I - Aerial View of Massing**
(source: author)

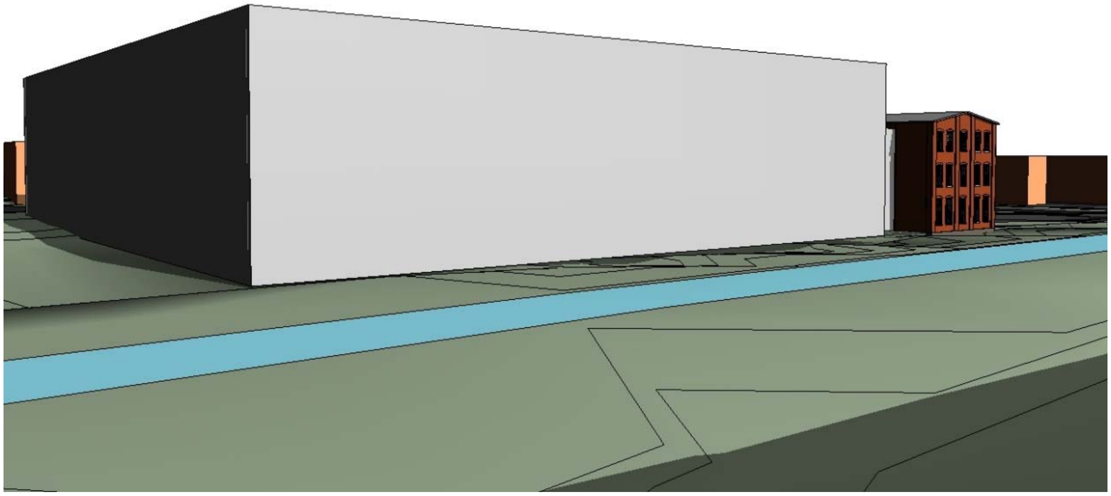

**Figure 138: Conceptual Site Approach I - Carroll Creek View of Massing**
(source: author)

**Figure 139: Conceptual Site Approach I - Patrick St. View of Massing**
(source: author)

**Table 4: Conceptual Site Approach I - Program**

| PROGRAM | | | |
|---|---|---|---|
| | AREA | PERCENTAGE OF TOTAL AREA | NUMBER OF UNITS |
| RESIDENTIAL | 113,594 | 73.82% | **100** @ 1,000 SQ.FT. AVG. |
| COMMERCIAL/OFFICE | 14,454 | 9.39% | **3** @ 4,600 SQ.FT. |
| COMMERCIAL/MUSEUM | 10,927 | 7.10% | **1** @ 11,000 SQ.FT. |
| RETAIL | 12,238 | 7.95% | **2** @ 6,600 SQ.FT. |

**04.05.03 –** *Conceptual Site Approach II*

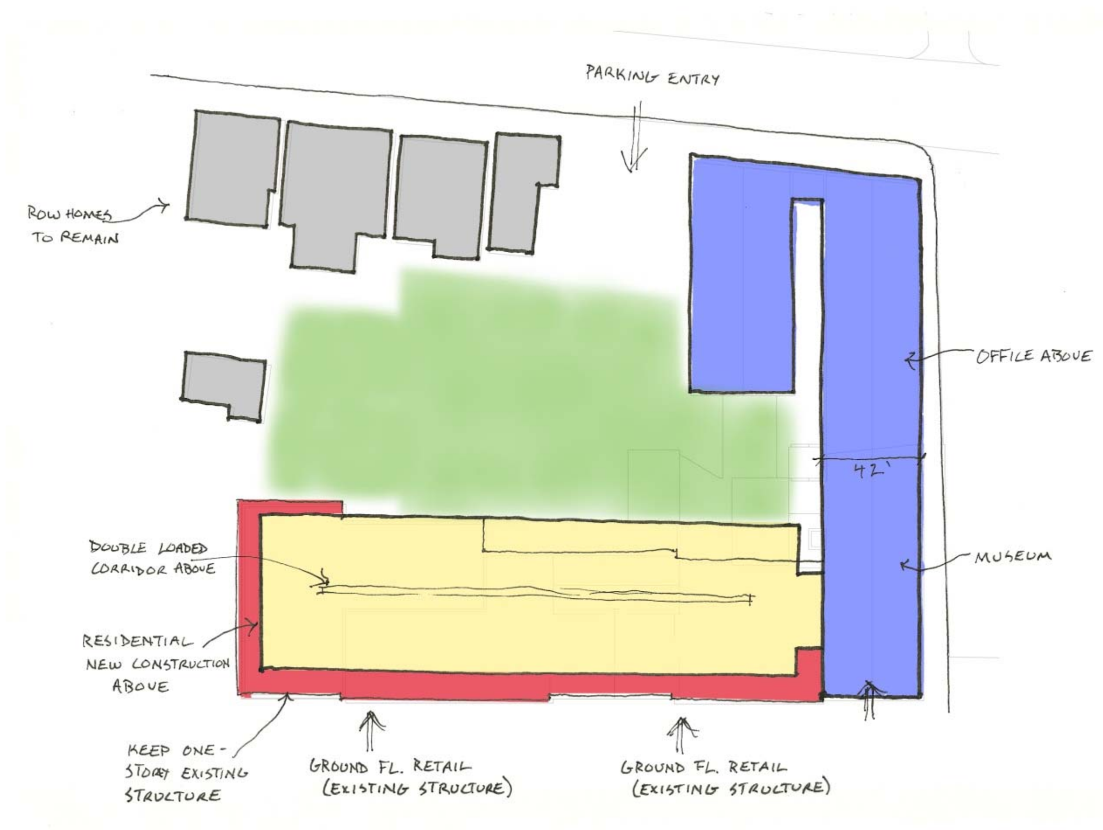


**Figure 140: Conceptual Site Approach II – Plan**
(source: author)

**Table 5: Conceptual Site Approach II - Floor Area**

| SITE CONCEPT II | | | |
|---|---|---|---|
| **EXISTING BUILDING** | | | |
| | AREA PER FLOOR (SQ.FT.) | NUMBER OF FLOORS | TOTAL BUILDING AREA (SQ.FT.) |
| BUILDING A - PART I | 4,031 | 2 | 8,062 |
| BUILDING A - PART II | 3,527 | 3 | 10,581 |
| BUILDING B | 3,369 | 2 | 6,738 |
| BUILDING C | 15,027 | 1 | 15,027 |
| TOTAL EXISTING BUILDING AREA | | | 40,408 |
| **NEW BUILDING** | | | |
| NEW BUILDING | 13,567 | 4 | 54268 |
| TOTAL NEW BUILDING AREA | | | 54268 |
| **SITE TOTALS** | | | |
| TOTAL BUILDING AREA | 94,676 | | |
| TOTAL SITE AREA | 49,232 | | |
| ZONING F.A.R. | 4 | | |
| TOTAL F.A.R. | | | 1.923 |

**Figure 141: Conceptual Site Approach II - Aerial View of Massing**
(source: author)

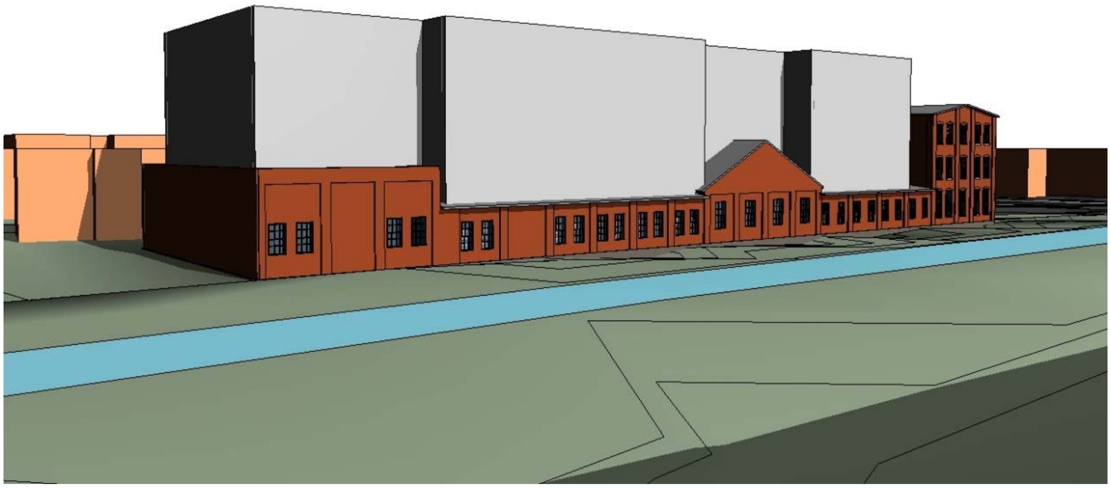

**Figure 142: Conceptual Site Approach II - Carroll Creek View of Massing**
(source: author)

**Figure 143: Conceptual Site Approach II - Patrick St. View of Massing**
(source: author)

**Table 6: Conceptual Site Approach II - Program**

| PROGRAM | | | |
|---|---|---|---|
| | AREA | PERCENTAGE OF TOTAL AREA | NUMBER OF UNITS |
| RESIDENTIAL | 54,268 | 57.32% | **46** @ 1,000 SQ.FT. AVG. |
| COMMERCIAL/OFFICE | 14,454 | 15.27% | **3** @ 4,600 SQ.FT. |
| COMMERCIAL/MUSEUM | 10,927 | 11.54% | **1** @ 11,000 SQ.FT. |
| RETAIL | 12,238 | 12.93% | **2** @ 6,600 SQ.FT. |

### **04.05.04 –** *Conceptual Site Approach III*

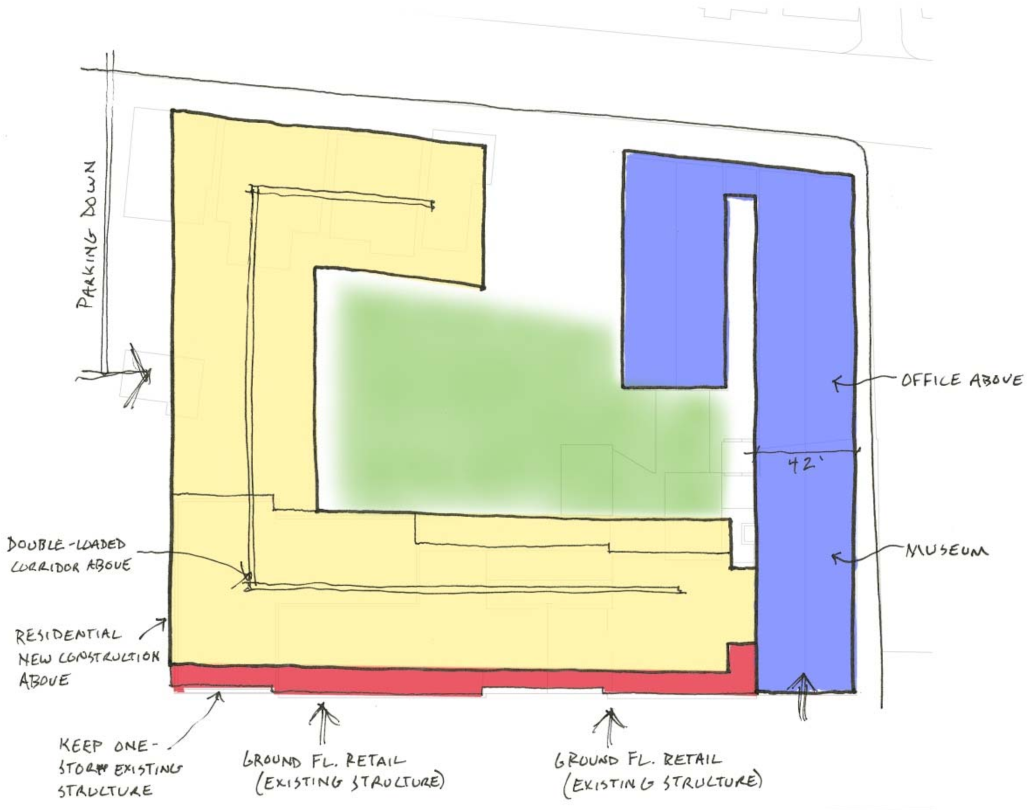


**Figure 144: Conceptual Site Approach III - Plan**
(source: author)

**Table 7: Conceptual Site Approach III - Floor Area**

| SITE CONCEPT III | | | |
|---|---|---|---|
| **EXISTING BUILDING** | | | |
| | AREA PER FLOOR (SQ.FT.) | NUMBER OF FLOORS | TOTAL BUILDING AREA (SQ.FT.) |
| BUILDING A - PART I | 4,031 | 2 | 8,062 |
| BUILDING A - PART II | 3,527 | 3 | 10,581 |
| BUILDING B | 3,369 | 2 | 6,738 |
| BUILDING C | 15,027 | 1 | 15,027 |
| TOTAL EXISTING BUILDING AREA | | | 40,408 |
| **NEW BUILDING** | | | |
| NEW BUILDING | 13,567 | 4 | 54268 |
| | 12,423 | 5 | 62115 |
| TOTAL NEW BUILDING AREA | | | 116383 |
| **SITE TOTALS** | | | |
| TOTAL BUILDING AREA | 156,791 | | |
| TOTAL SITE AREA | 49,232 | | |
| ZONING F.A.R. | 4 | | |
| TOTAL F.A.R. | | | 3.185 |

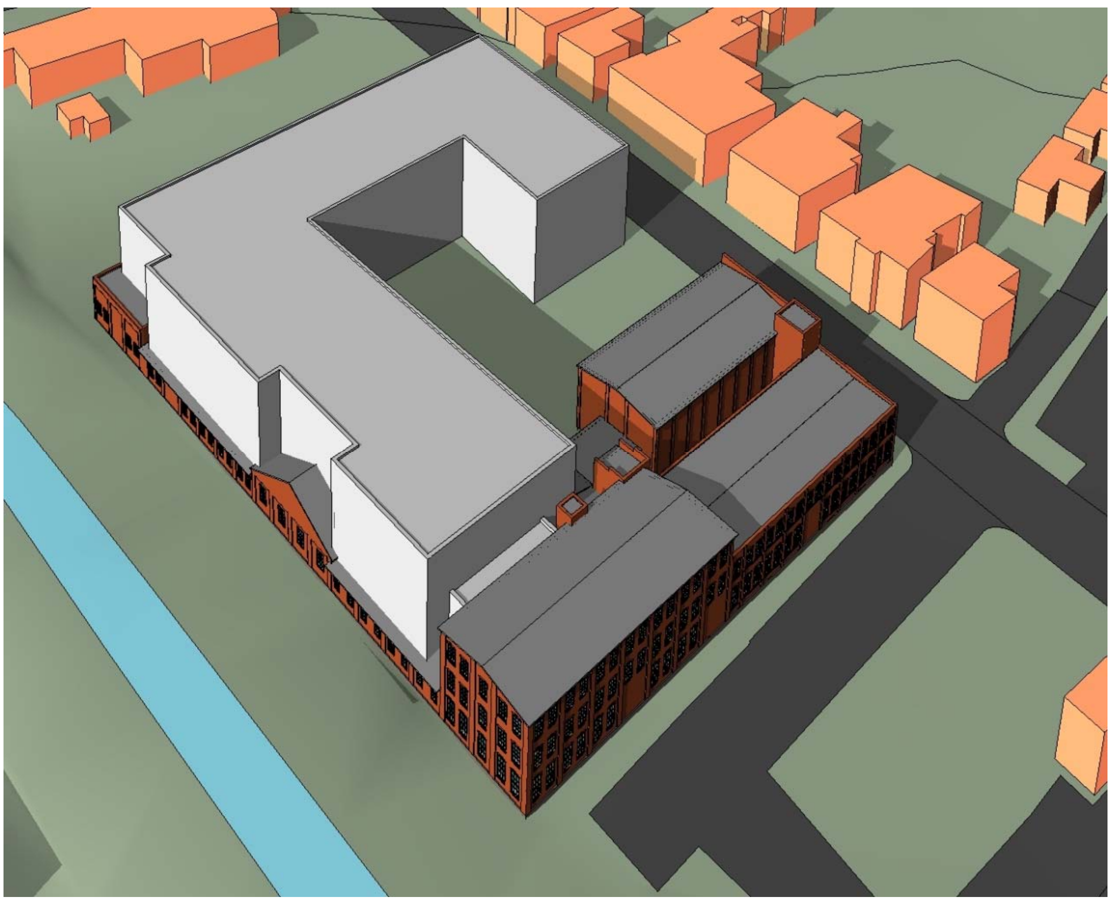

**Figure 145: Conceptual Site Approach III - Aerial View of Massing**
(source: author)

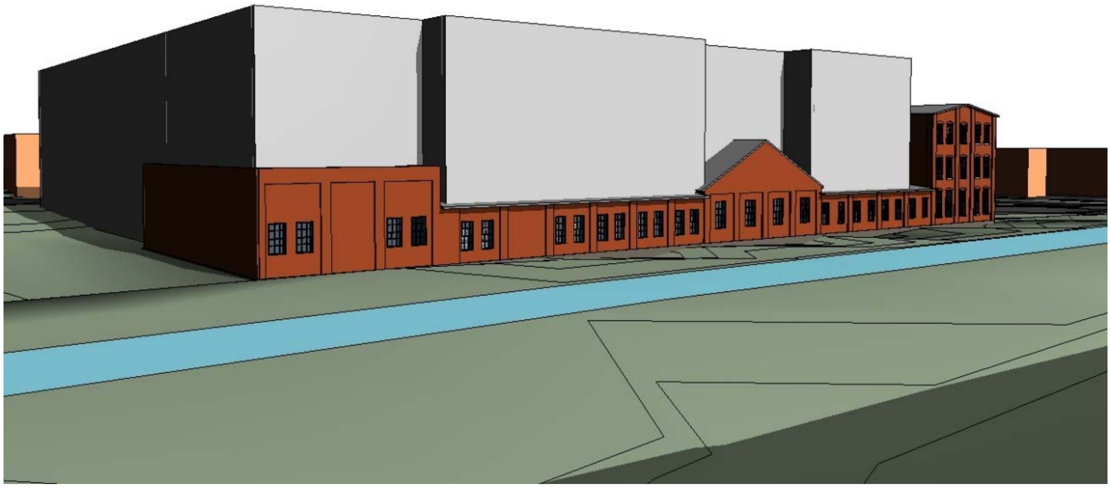

**Figure 146: Conceptual Site Approach III - Carroll Creek View of Massing**
(source: author)

**Figure 147: Conceptual Site Approach III - Patrick St. View of Massing**
(source: author)

**Table 8: Conceptual Site Approach III - Program**

| PROGRAM | | | |
|---|---|---|---|
| | AREA | PERCENTAGE OF TOTAL AREA | NUMBER OF UNITS |
| RESIDENTIAL | 116,383 | 74.23% | **99** @ 1,000 SQ.FT. AVG. |
| COMMERCIAL/OFFICE | 14,454 | 9.22% | **3** @ 4,600 SQ.FT. |
| COMMERCIAL/MUSEUM | 10,927 | 6.97% | **1** @ 11,000 SQ.FT. |
| RETAIL | 12,238 | 7.81% | **2** @ 6,600 SQ.FT. |

**04.05.05 –** *Conceptual Site Approach IV*

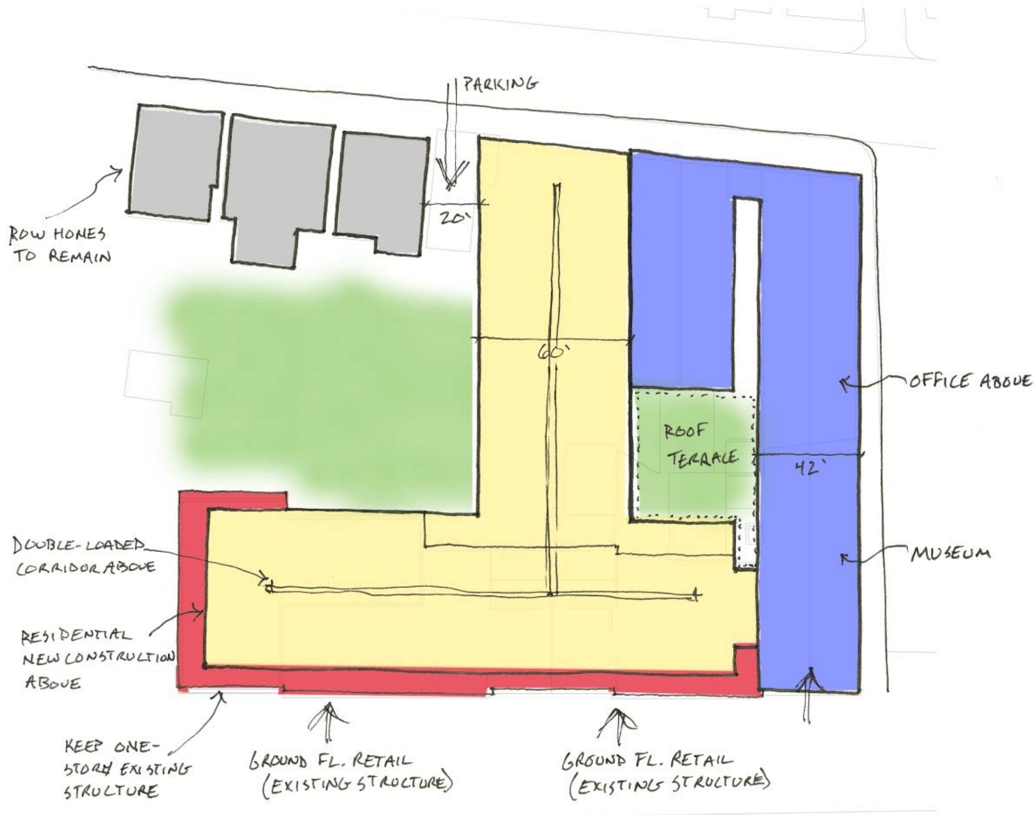


**Figure 148: Conceptual Site Approach IV - Plan**
(source: author)

**Table 9: Conceptual Site Approach IV - Floor Area**

| SITE CONCEPT IV | | | |
|---|---|---|---|
| **EXISTING BUILDING** | | | |
| | AREA PER FLOOR (SQ.FT.) | NUMBER OF FLOORS | TOTAL BUILDING AREA (SQ.FT.) |
| BUILDING A - PART I | 4,031 | 2 | 8,062 |
| BUILDING A - PART II | 3,527 | 3 | 10,581 |
| BUILDING B | 3,369 | 2 | 6,738 |
| BUILDING C | 15,027 | 1 | 15,027 |
| TOTAL EXISTING BUILDING AREA | | | 40,408 |
| **NEW BUILDING** | | | |
| NEW BUILDING | 13,567 | 4 | 54268 |
| | 8,640 | 5 | 43200 |
| TOTAL NEW BUILDING AREA | | | 97468 |
| **SITE TOTALS** | | | |
| TOTAL BUILDING AREA | 137,876 | | |
| TOTAL SITE AREA | 49,232 | | |
| ZONING F.A.R. | 4 | | |
| TOTAL F.A.R. | | | 2.801 |

**Figure 149: Conceptual Site Approach IV - Aerial View of Massing**
(source: author)

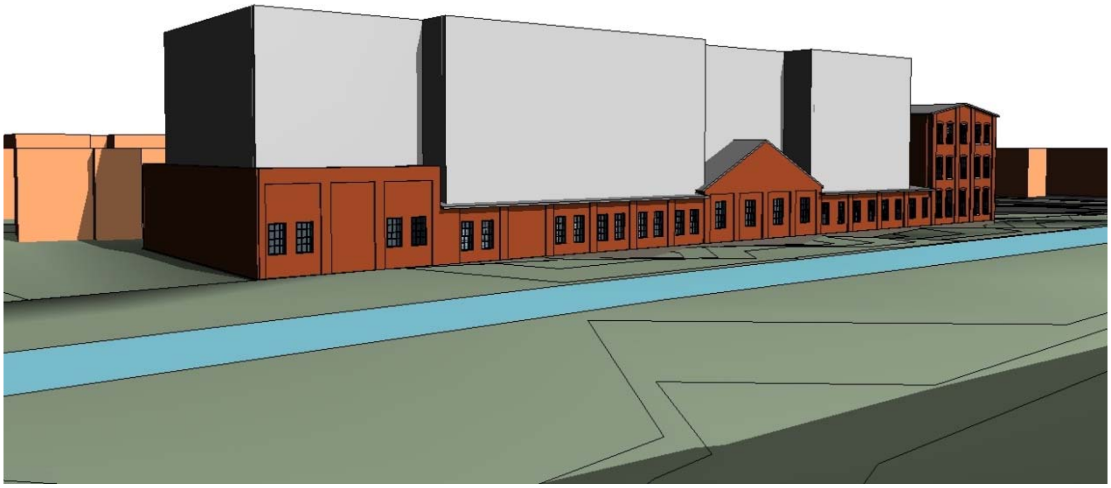

**Figure 150: Conceptual Site Approach IV - Carroll Creek View of Massing**
(source: author)

**Figure 151: Conceptual Site Approach IV - Patrick St. View of Massing**
(source: author)

**Table 10: Conceptual Site Approach IV - Program**

| PROGRAM | | | |
|---|---|---|---|
| | AREA | PERCENTAGE OF TOTAL AREA | NUMBER OF UNITS |
| RESIDENTIAL | 97,468 | 70.69% | **83** @ 1,000 SQ.FT. AVG. |
| COMMERCIAL/OFFICE | 14,454 | 10.48% | **3** @ 4,600 SQ.FT. |
| COMMERCIAL/MUSEUM | 10,927 | 7.93% | **1** @ 11,000 SQ.FT. |
| RETAIL | 12,238 | 8.88% | **2** @ 6,600 SQ.FT. |

**04.05.06** – *Conceptual Site Approach V*

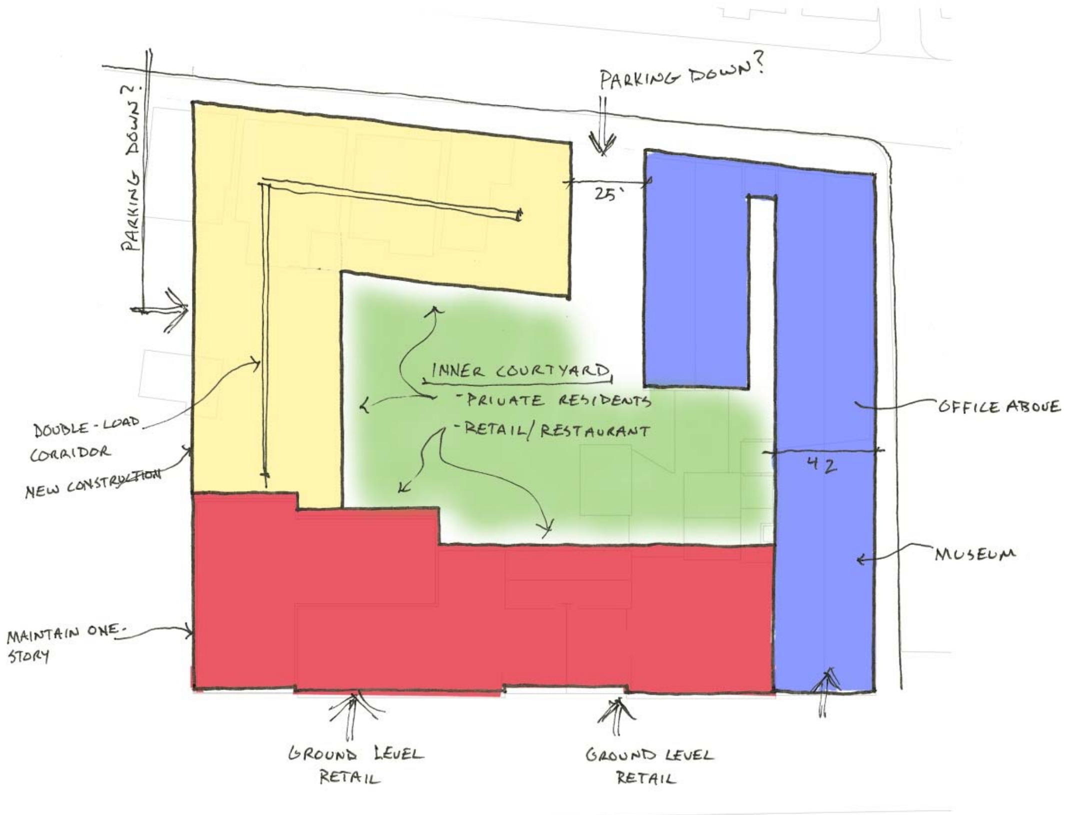


**Figure 152: Conceptual Site Approach V – Plan**
(source: author)

**Table 11: Conceptual Site Approach V - Floor Area**

| SITE CONCEPT V | | | |
|---|---|---|---|
| **EXISTING BUILDING** | | | |
| | AREA PER FLOOR (SQ.FT.) | NUMBER OF FLOORS | TOTAL BUILDING AREA (SQ.FT.) |
| BUILDING A - PART I | 4,031 | 2 | 8,062 |
| BUILDING A - PART II | 3,527 | 3 | 10,581 |
| BUILDING B | 3,369 | 2 | 6,738 |
| BUILDING C | 15,027 | 1 | 15,027 |
| TOTAL EXISTING BUILDING AREA | | | 40,408 |
| **NEW BUILDING** | | | |
| NEW BUILDING | 14,398 | 5 | 71990 |
| TOTAL NEW BUILDING AREA | | | 71990 |
| **SITE TOTALS** | | | |
| TOTAL BUILDING AREA | 112,398 | | |
| TOTAL SITE AREA | 49,232 | | |
| ZONING F.A.R. | 4 | | |
| TOTAL F.A.R. | | | 2.283 |

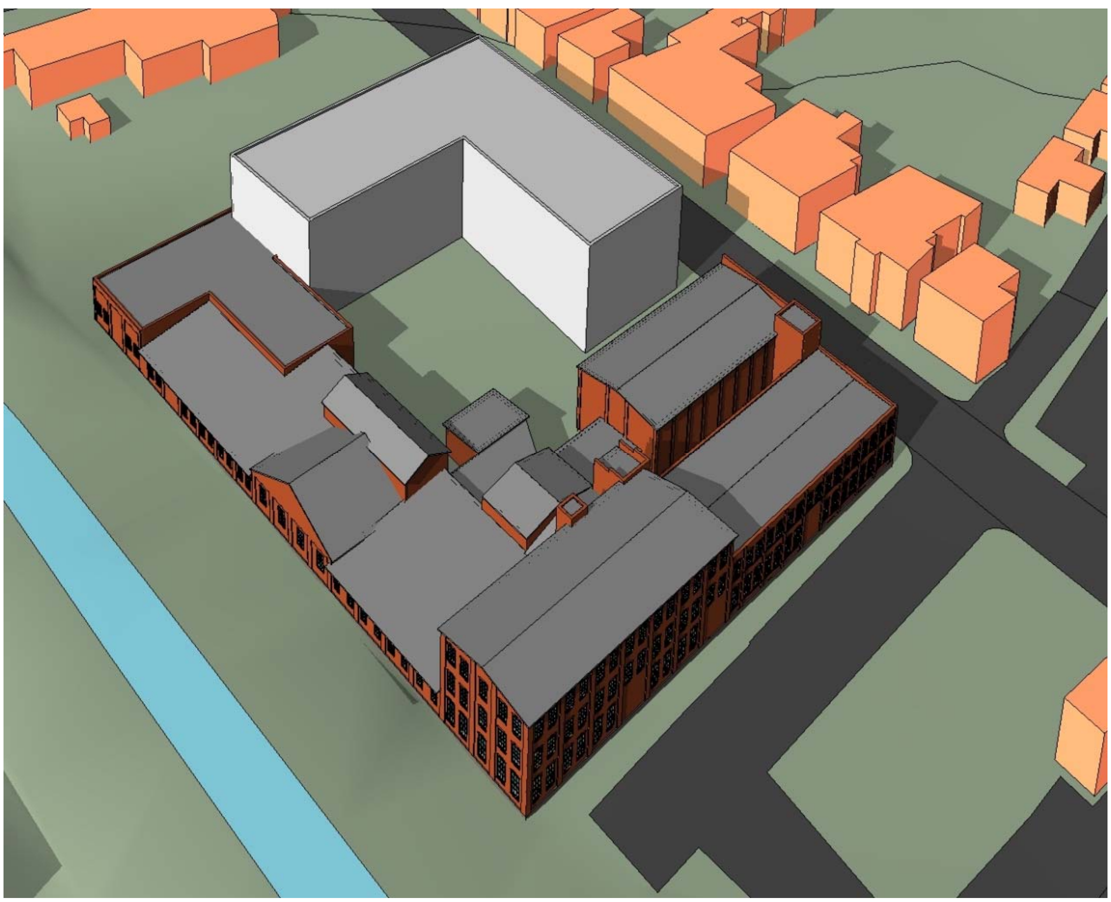

**Figure 153: Conceptual Site Approach V - Aerial View of Massing**
(source: author)

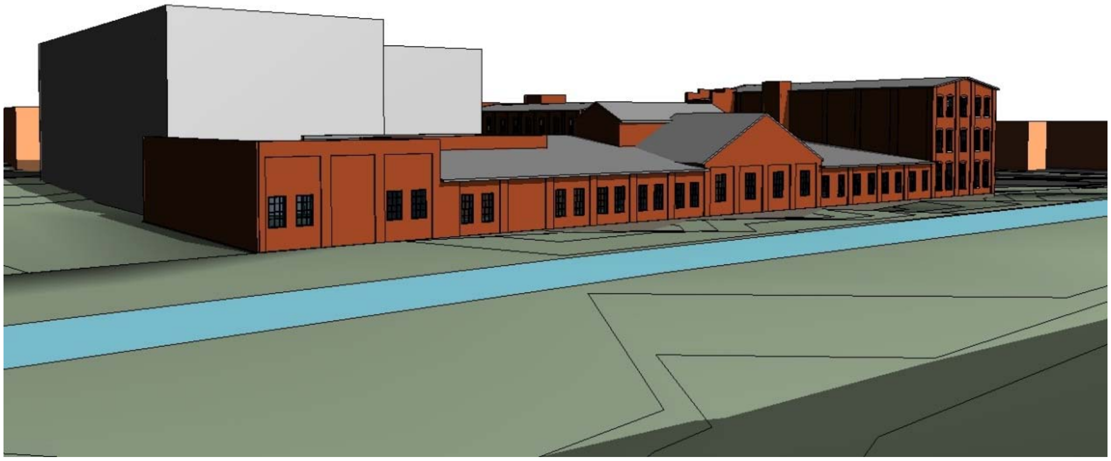

**Figure 154: Conceptual Site Approach V - Carroll Creek View of Massing**
(source: author)

**Figure 155: Conceptual Site Approach V - Patrick St. View of Massing**
(source: author)

**Table 12: Conceptual Site Approach V - Program**

| PROGRAM | | | |
|---|---|---|---|
| | AREA | PERCENTAGE OF TOTAL AREA | NUMBER OF UNITS |
| RESIDENTIAL | 71,990 | 64.05% | **61** @ 1,000 SQ.FT. AVG. |
| COMMERCIAL/OFFICE | 14,454 | 12.86% | **3** @ 4,600 SQ.FT. |
| COMMERCIAL/MUSEUM | 10,927 | 9.72% | **1** @ 11,000 SQ.FT. |
| RETAIL | 12,238 | 10.89% | **2** @ 6,600 SQ.FT. |

# 05 – Design Development

## 05.01 – Design Development Meetings

### **05.01.01** – *A-2: [12.18.12 3:30pm]*

The A-2 Meeting focused on defining the extent of my thesis study. I selected the three scales I would be evaluating – the master plan, the site, and the building. I concentrated on the analysis of the existing Union Mill building and imagined what programmatic functions the building could host in addition to a new construction component on the adjacent corner site.

The feedback from my committee steered me to examine how the existing Union Mill building would be utilized in its reuse. Additionally, I was encouraged to begin studying how my proposal would differentiate from the existing proposals for the Phase II of the Carroll Creek Park development. In other words, what elements will make this a sustainable place.

### **05.01.02** – *A-3: [02.07.13 9:00am]*

Through a continuation of research I learned about a study conducted by the City of Frederick to examine six potential sites for the development of a hotel and conference center program within the extents of the Phase II development of Carroll Creek Park. This proposal is supported by many downtown businesses and the local government who see this as a large asset to the downtown economy which currently does not have a hotel within the walkable downtown.

I was generiously hosted for a meeting with Richard Griffin, the Director of Economic Development for the City of Frederick, where I was able to explain to him the extent of my thesis study. I told him of my recent desire to include the highly desired hotel and conference center program on this site and he was intrigued by the concept. Richard mentioned that he also saw this site as a highly viable option for this building program, however the study conducted by the city did not include this as one of their six options because of the multiple property ownerships and other logistical issues that, in realistic practice, would be challenging to achieve. Nevertheless, he was highly motivated by my ambition for this study.

I brought these findings with me to the A-3 meeting and introduced my committee to this possible change to my building program.

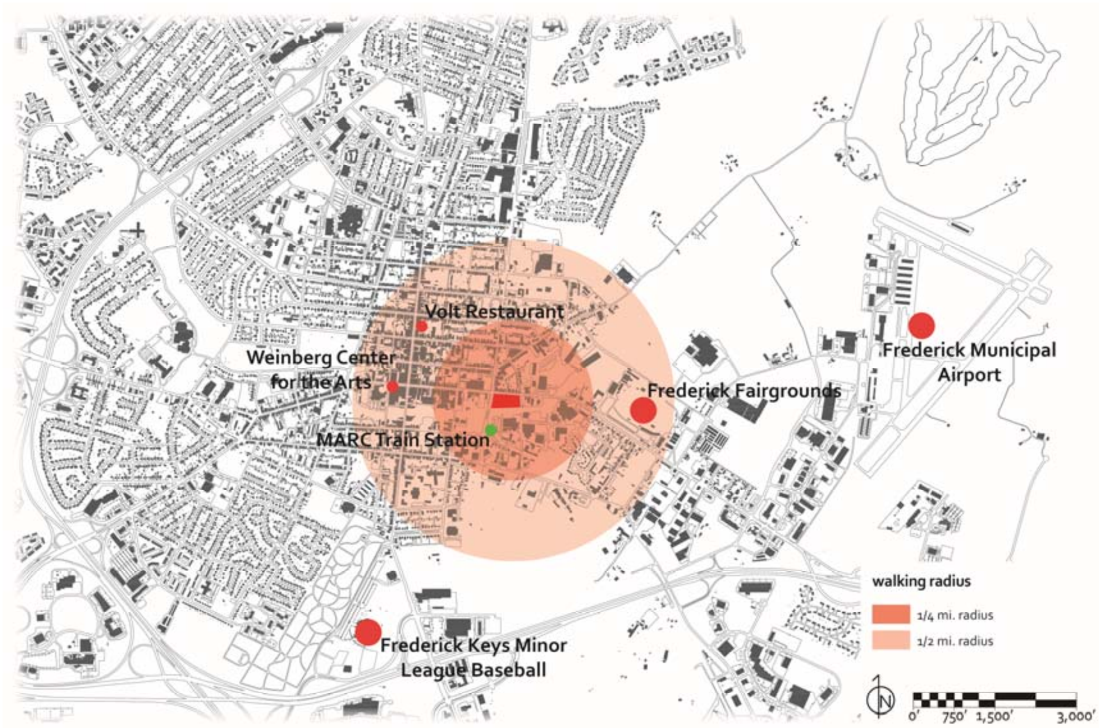


**Figure 156: Downtown Amenities and Walkability**
(source: author)

**The justification for the hotel and conference center program is based on the economic sustainability of including a highly beneficial building program to this prominent site. This diagram illustrates that many high profile amenities of the downtown are within a walkable distance from the building site. Additionally, the adjacency of the MARC Train line to the site offers a strong connection to Washington D.C. which could encourage many different clients to use this tranquil historic town as a venue for their conferences.**

**Table 13: Building Program**

| Hotel | |
|---|---|
| [200] Rooms | 250-350 sq.ft. per unit (~60,000 sq.ft.) |
| Restaurant | 60-80 seats |
| Bar/Lounge | 30-40 seats |
| Fitness Center | 1,000 sq.ft. |
| Business Center | 750 sq.ft. |
| Indoor Pool | 500 sq.ft. |
| Gift Shop | 1,000 sq.ft. |
| **Conference Center** | |
| Ballroom | 5,000-6,000 sq.ft. |
| Pre-function space | 2,000 sq.ft. |
| [2] Large Meeting Rooms | 1,500 sq.ft. ea. |
| [5-10] Individual Meeting Rooms | 300-750 sq.ft. ea. |
| **Other** | |
| Administrative Space | 1,000 sq.ft. |
| Parking | 1.25 spaces per unit (60,000 sq.ft.) |

**I adopted the building program for this site from the analysis done for the City of Frederick on the feasibility requirements for this building program to exist for the downtown.**

**Figure 157: Hotel + Conference Center Program Scheme I**
(source: author)

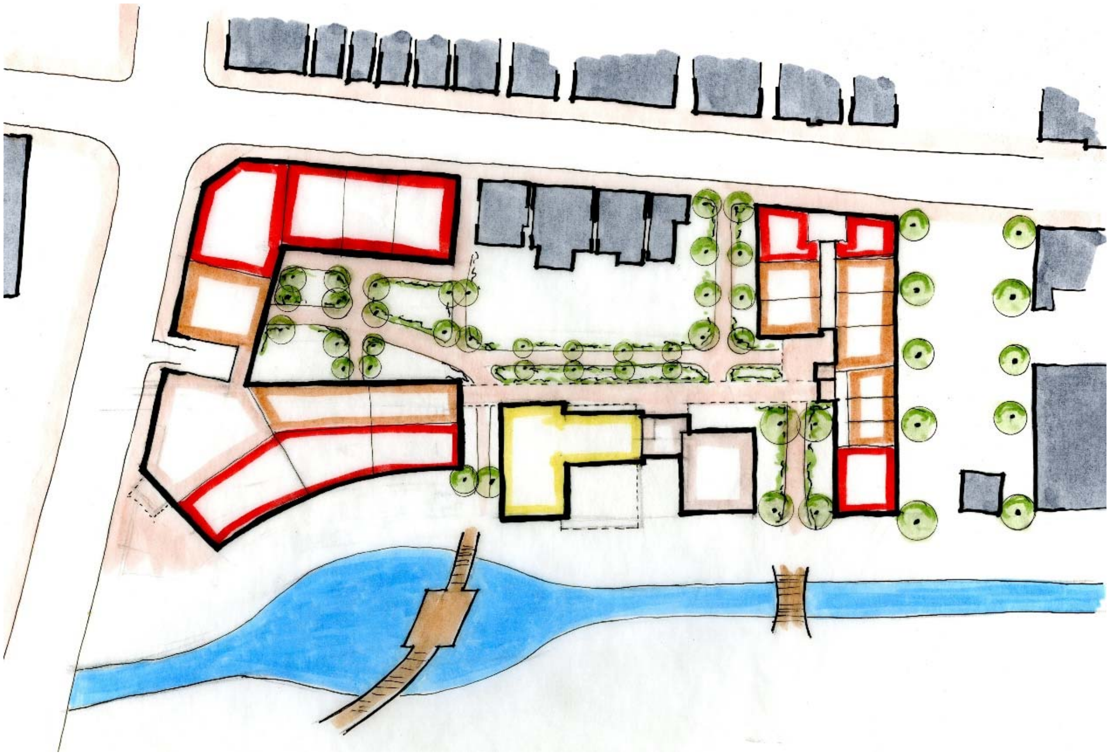

**Figure 158: Hotel + Conference Center Program Scheme II**
(source: author)

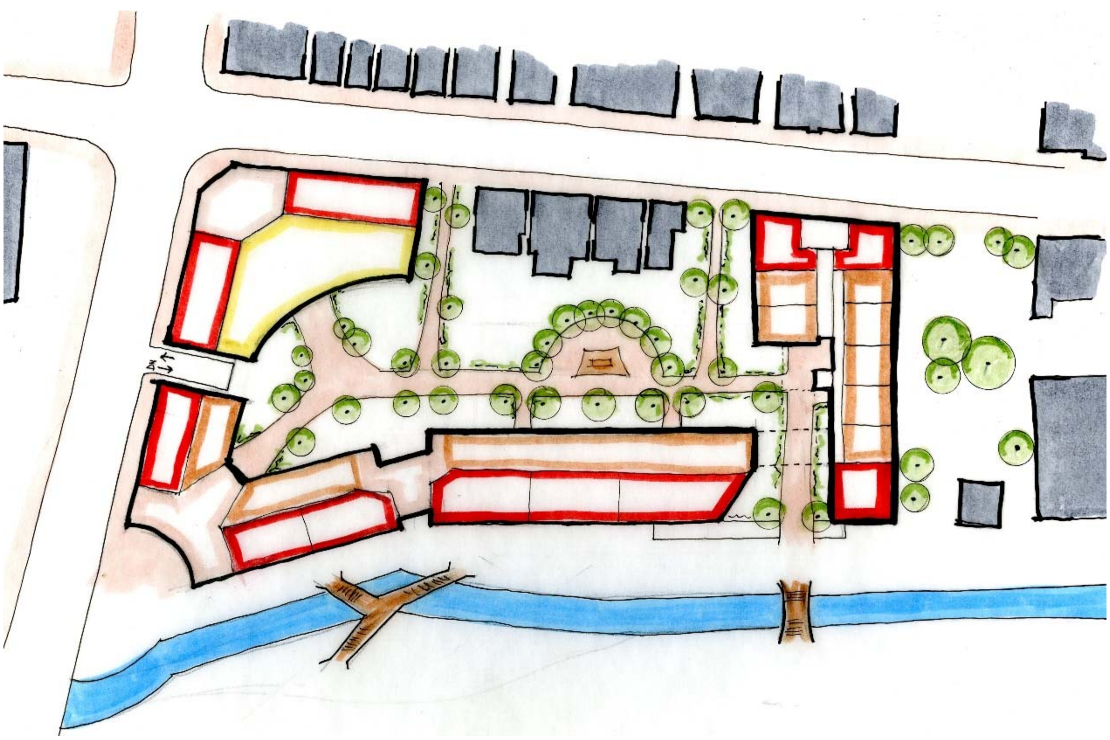

**Figure 159: Hotel + Conference Center Program Scheme III**
(source: author)

My committee's feedback requested that while the focus of my thesis will not be on the design of hotel floor plans, I should have an understanding of hotel precedents and drivers of form for a hotel program as I develop this building program. Additionally, I was encouraged to study how the hotel and conference center program would best fit between this new construction componenet and the existing Union Mill building. As I develop the new building's massing I should also make a decision of how the scale and proportions of this building will relate to the surrounding context. Lastly, in the sketch plans I included as my initial analysis, it was brought to my attention that I should consider the arrival sequence of visitors. Either by the MARC Train, vehicle, or as a pedestrian. In doing so I should consider the impacts of a vehicular drop-off zone.

**05.01.03** – *A-4: [03.07.13 9:00am]*

My A-4 meeting focused on the further refinement of the new construction component and programming of the existing Union Mills building since my decision to incorporate the hotel and conference center program.


**Figure 160: Select A-4 Progress Images - Ground Floor Plan**
(source: author)

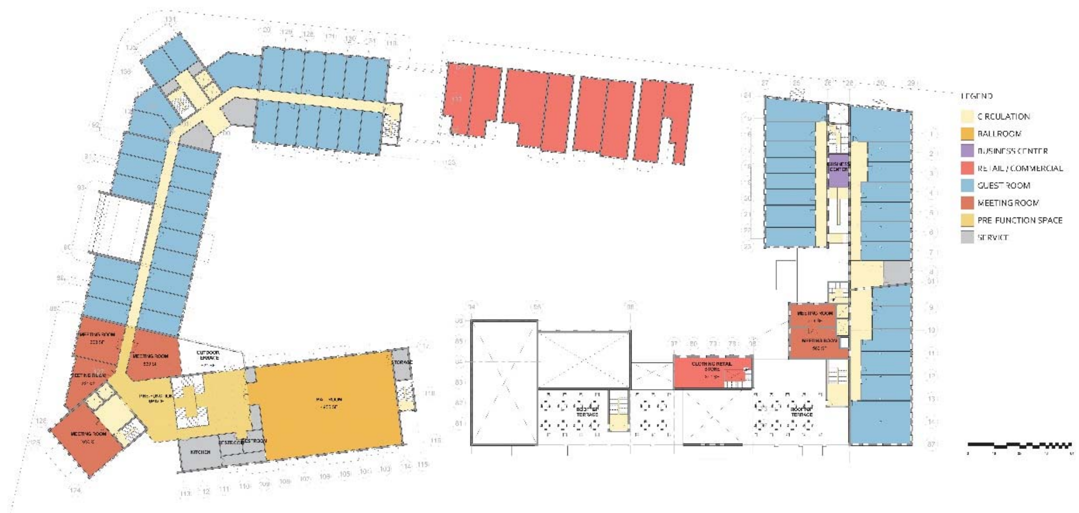


**Figure 161: Select A-4 Progress Images - Second Floor Plan**
(source: author)


**Figure 162: Select A-4 Progress Images - Carroll Creek Elevation**
(source: author)


**Figure 163: Select A-4 Progress Images - Patrick Street Elevation**
(source: author)

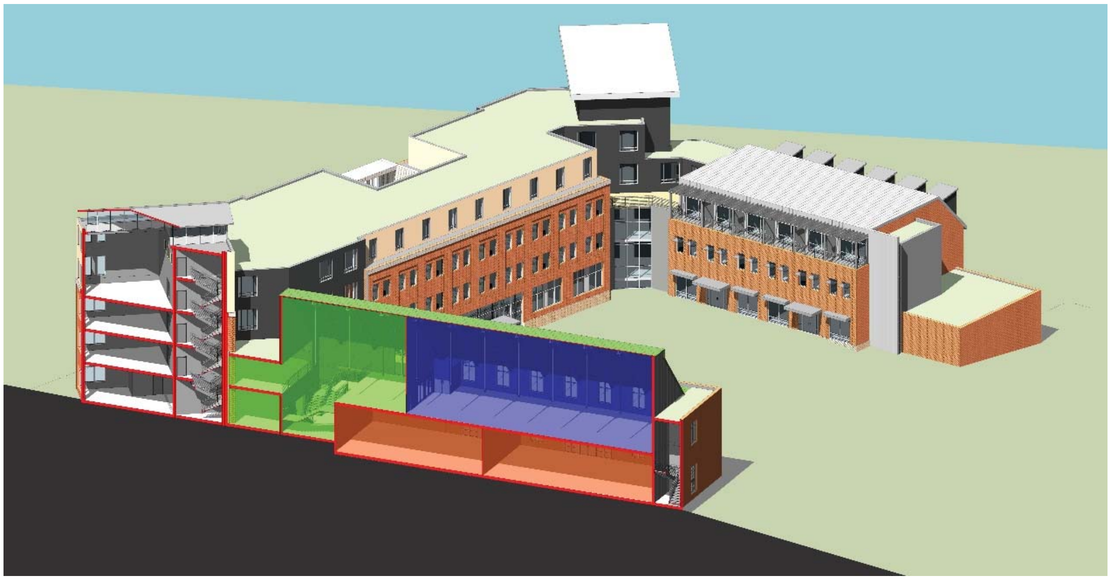

**Figure 164: Select A-4 Progress Images - Ballroom Sequence Section Perspective**
(source: author)

I also began my investigation of incorporating Passive House design principles to the existing Union Mills building and the new construction building. I chose to incorporate Passive House design to illustrate the energy efficiency achieved by incorporating this building strategy in both adaptive reuse and new construction applications.


**Figure 165: Thermal Envelope and Preserved Building Facde Diagram**
(source: author)

**This diagram illustrates the location of the continuous thermal envelop for both the new construction and existing Union Mills building. Additionally noted in a dashed green line all of the existing walls that will be left exposed to help preserve the historic quality of the building.**

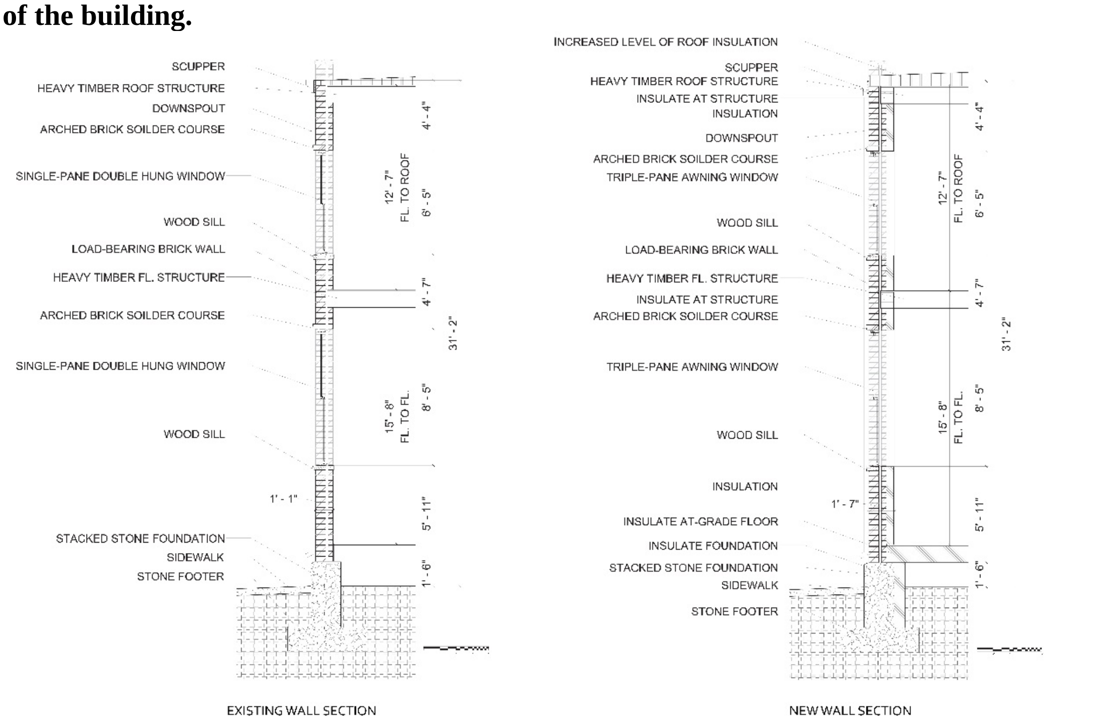


**Figure 166: Union Mills Building Wall Sections**
(source: author)

**The new thermal envelope of the existing Union Mills building will take place on the inside building face to preserve all of the exterior appearance of the building.**

I also shared my thoughts and documentation of my site visit to the Union Mills building. I was able to do a complete walkthrough of the structure. This was a very valuable experience in my study as it gave me a real sense of the space and its historic industrial qualities.

**Figure 167: Existing Union Mills Building Conditions**
(source: author)

With my committee, I also introduced my concept for presenting the final presentation in an all-digital format. Once approval to continue this investigation was granted, I continued to speak with audio/video production experts and explore the different resources I could incorporate to make this presentation format be beneficial.

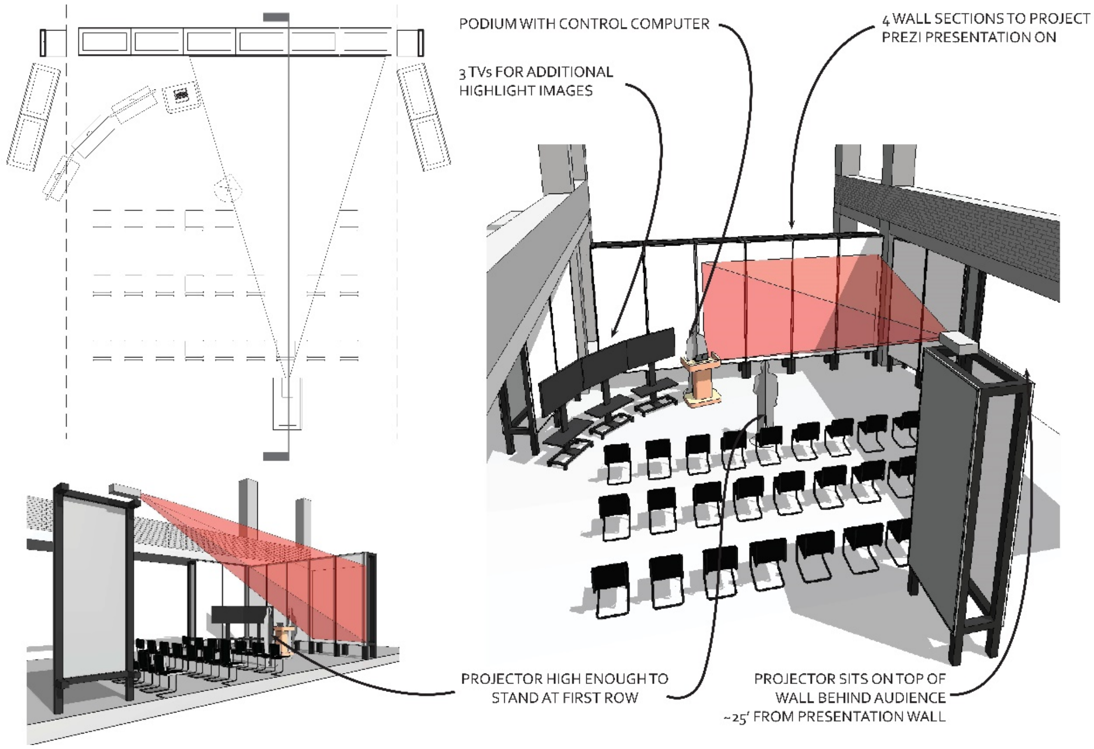


**Figure 168: Final Presentation Strategy Exploration**
(source: author)

**05.01.04** – *A-5: [04.18.13 9:00am]*

The A-5 presentation was a first run through of my final presentation arrangement. I tested the use of a Prezi presentation for the main projector screen. After consulting with my committee, it was concluded that this strategy was not the most beneficial method of utilizing the screen. The committee was content with the images and strategy I prepared and gave recommendations for improving the verbal and descriptive presentation.

## 05.02 – Final Review

### **05.02.01** – *The Final Thesis Proposal*

**Table 144: Design Strategies**

| | sustainable | placemaking |
|---|---|---|
| environmental | ▪ energy efficient building design<br>▪ mitigate ecological impacts<br>▪ towards net-zero | ▪ re-use / recycle<br>▪ incorporate public spaces<br>▪ strive for preservation |
| social | ▪ provide amenities<br>▪ sponsor diversity<br>▪ include local influence | ▪ Identity / historic heritage<br>▪ sense of community<br>▪ encourage activity |
| economic | ▪ growth / efficiency<br>▪ create lasting benefits<br>▪ marketability | ▪ create desirable places<br>▪ improve vitality<br>▪ provide destinations |


**Figure 169: Site Master Plan - Existing Conditions**
(source: author)


**Figure 170: Site Master Plan – Proposal**
(source: author)

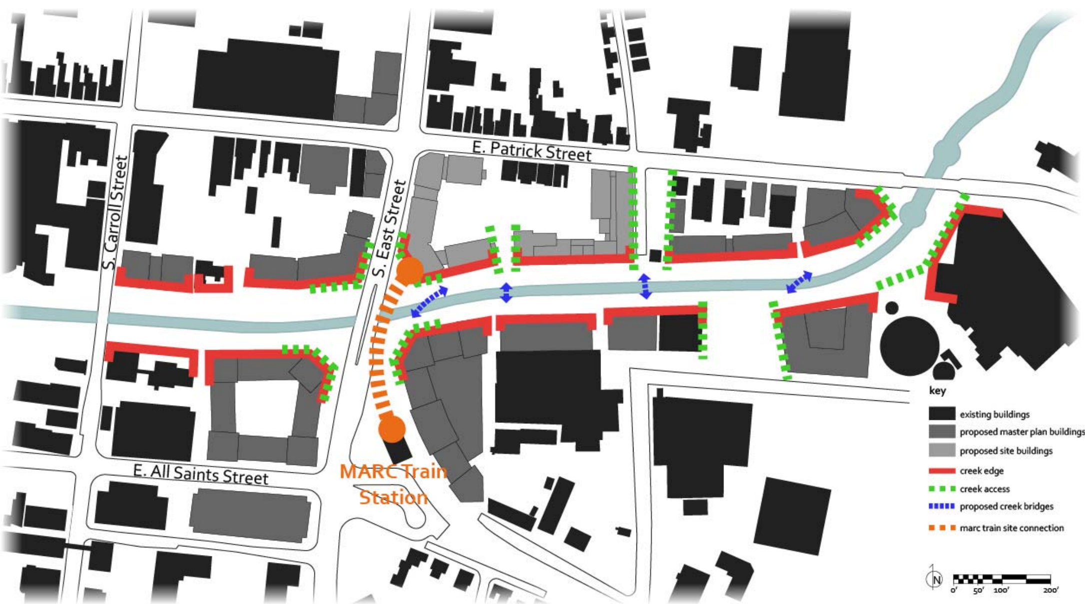


**Figure 171: Site Master Plan – Diagram**
(source: author)

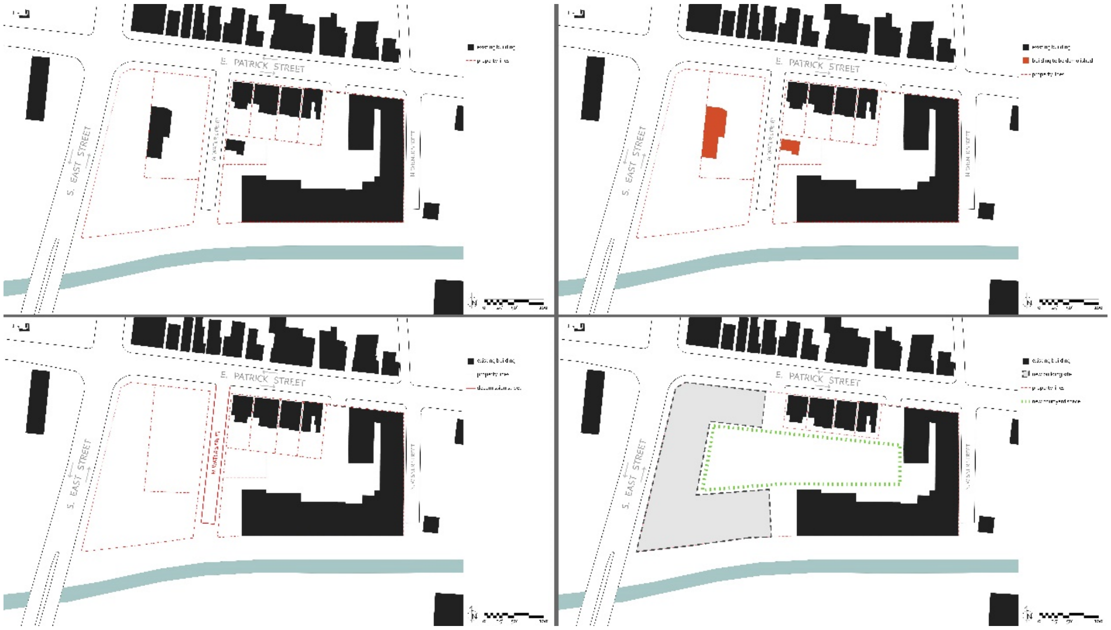


**Figure 172: Site Transformation**
(source: author)


**Figure 173: Building Site - Site Plan**
(source: author)

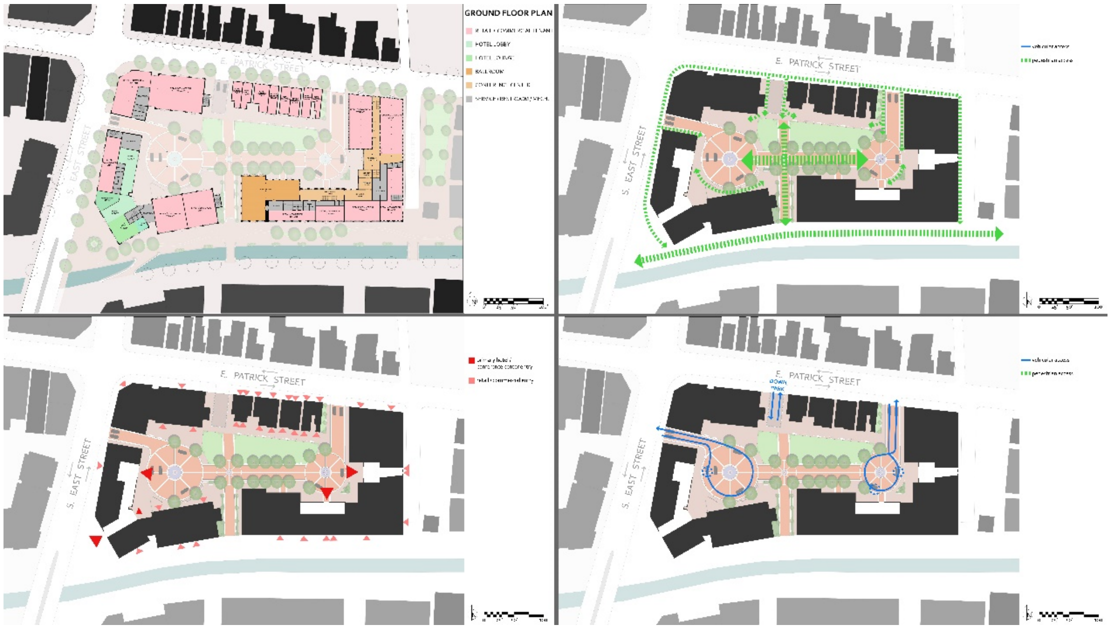


**Figure 174: Building Site – Diagrams**
(source: author)


**Figure 175: Building Site - Ground Floor Plan**
(source: author)


**Figure 176: Building Site - Second Floor Plan**
(source: author)


**Figure 177: Building Site - Third Floor Plan**
(source: author)


**Figure 178: Building Site - Roof Plan**
(source: author)

**Figure 179: Building Site - Carroll Creek Elevation**
(source: author)

**Figure 180: Building Site - Patrick Street Elevation**
(source: author)

**Figure 181: Building Site - East Street Elevation**
(source: author)

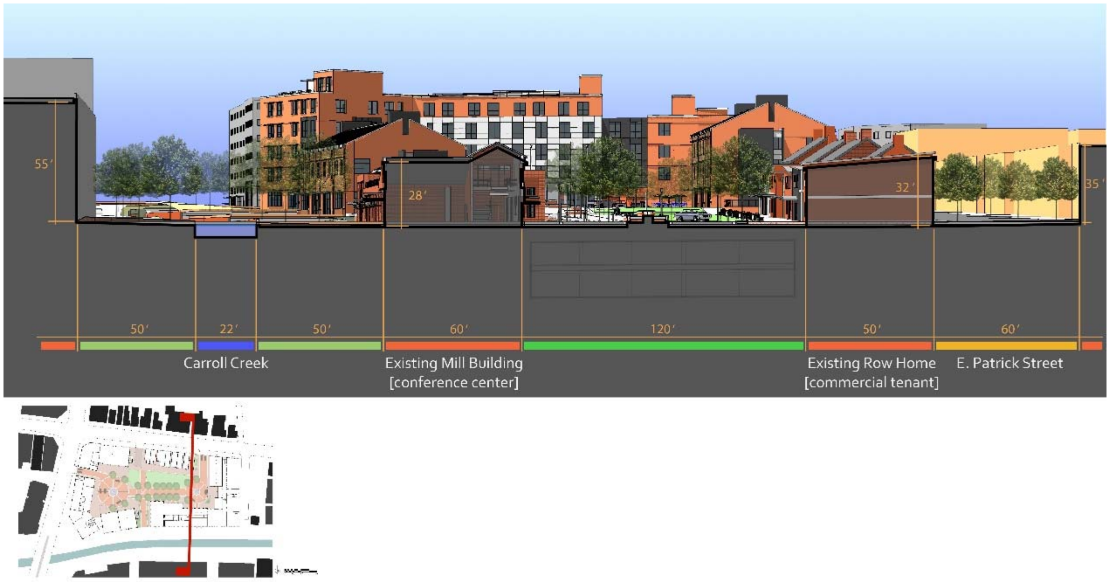


**Figure 182: Building Site - Union Mills Building Site Section**
(source: author)


**Figure 183: Building Site - New Hotel Building Site Section**
(source: author)


**Figure 184: Building Site - Carroll Creek Site Section**
(source: author)


**Figure 185: Carroll Creek Aerial View**
(source: author)

**Figure 186: Patrick Street Vignette**
(source: author)

**Figure 187: Courtyard Vignette**
(source: author)

**Figure 188: East Street Vignette**
(source: author)

**05.02.02** – *The Presentation [05.07.13 4:00pm]*

This thesis was presented for public review on May 7, 2013 at the School of Architecture, Planning, & Preservation at the University of Maryland.


**Figure 189: Layout for Public Presentation**
(source: author)

**Figure 190: Public Presentation Layout**
(source: author)

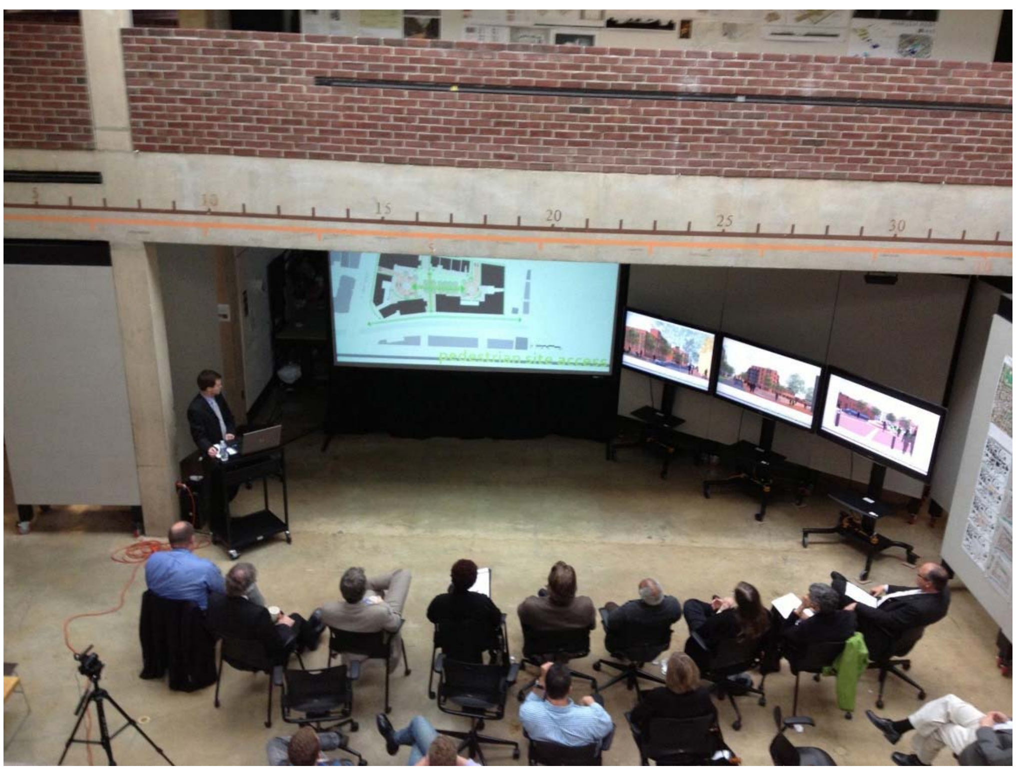
**Figure 191: Public Presentation Layout**
(source: author)

Complements were given for my choice to present in an all-digital format. My presentation consisted of a 12-foot by 7-foot rear-projection screen and three, 55-inch flat panel television screens. All screens were controlled from one computer source and were sequentially arranged to change appropriately as I presented the information. The jury found this digital media methodology of presentation to be beneficial to gaining a clear understanding of the presentation.

I opted for this all-digital format for multiple reasons. First, in the professional environment of today, digital means of production is most common. I saw that the traditional "wall of images" that graduate students presented was a dated methodology and I wanted to pioneer this new means of presentation at the school. Secondly, I believe that digital media allows for more options regarding animation and layering of diagrams to more clearly exhibit your design intent. Through the use of these multiple screens I logically walked the jury though my design process and multiple scales of exploration. I believe this methodology allowed the jury to more clearly understand my intent within the tight time allotment of the thesis defense. Lastly, I saw this use of digital presentation as a way to emphasize the focus of my thesis on sustainability. The large quantities of printed material – paper and ink – and the monetary cost of production are considerably unsustainable for a single presentation of the material. Digital presentation allows for more information to be presented and encourages a continuation of the study because of the lack of *final* production of the media.

**05.02.03 –** *The Feedback*

Overall the jury's comments were productive. The early part of the discussion focused around the new hotel building and the contextual nature of the façade design. Responses ranged from pushing the limits of this academic exercise to place a "jagged contemporary piece" to reconsidering the articulation choices of the brick façade treatment. I placed emphasis on my decision to remain contextual in both scale and materiality on my effort to create a desirable place in the small scale of the City of Frederick.

**05.02.04 –** *Reflections*

I was initially drawn to this site because of the existing Union Mills building. I have personally seen this Phase II section of the Carroll Creek Park development sit vacant for many years and I saw a real potential in the revitalization of this historic structure as part of the area's redevelopment. As I studied the history of the Carroll Creek Park development, the history of this site, and the economic drivers, I discovered that this city, and this site, would be a strong case study for my interests in sustainability.

This was an incredible experience to submerge myself into this study for the past year and I am very excited about the outcome. I believe my design solution achieved my primary goals of creating a place in the City of Frederick which would be sustainable in its environmental, social, and economic aspects. This schematic design warrants further analysis and detailing in the Passive House design software and sustainability design features. In a further study, I believe this project could easily incorporate photovoltaic and wind energy, water systems such as rainwater capture and greywater reuse, and other sustainable site features. With the use of Passive House design strategies, the dramatic decrease in energy consumption that is achieved will make a Net-Zero energy consumption obtainable with on-site renewable energy sources.

For anyone who has read this document and has any questions, feedback, or would like to continue a dialog about this thesis study, please feel free to contact me at taylor0131@gmail.com.

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