

Master planning affordable housing: streamlining the creation of affordable housing for
Manhattan Kansas, and other cities.

by

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A REPORT

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College of Architecture, Planning & Design

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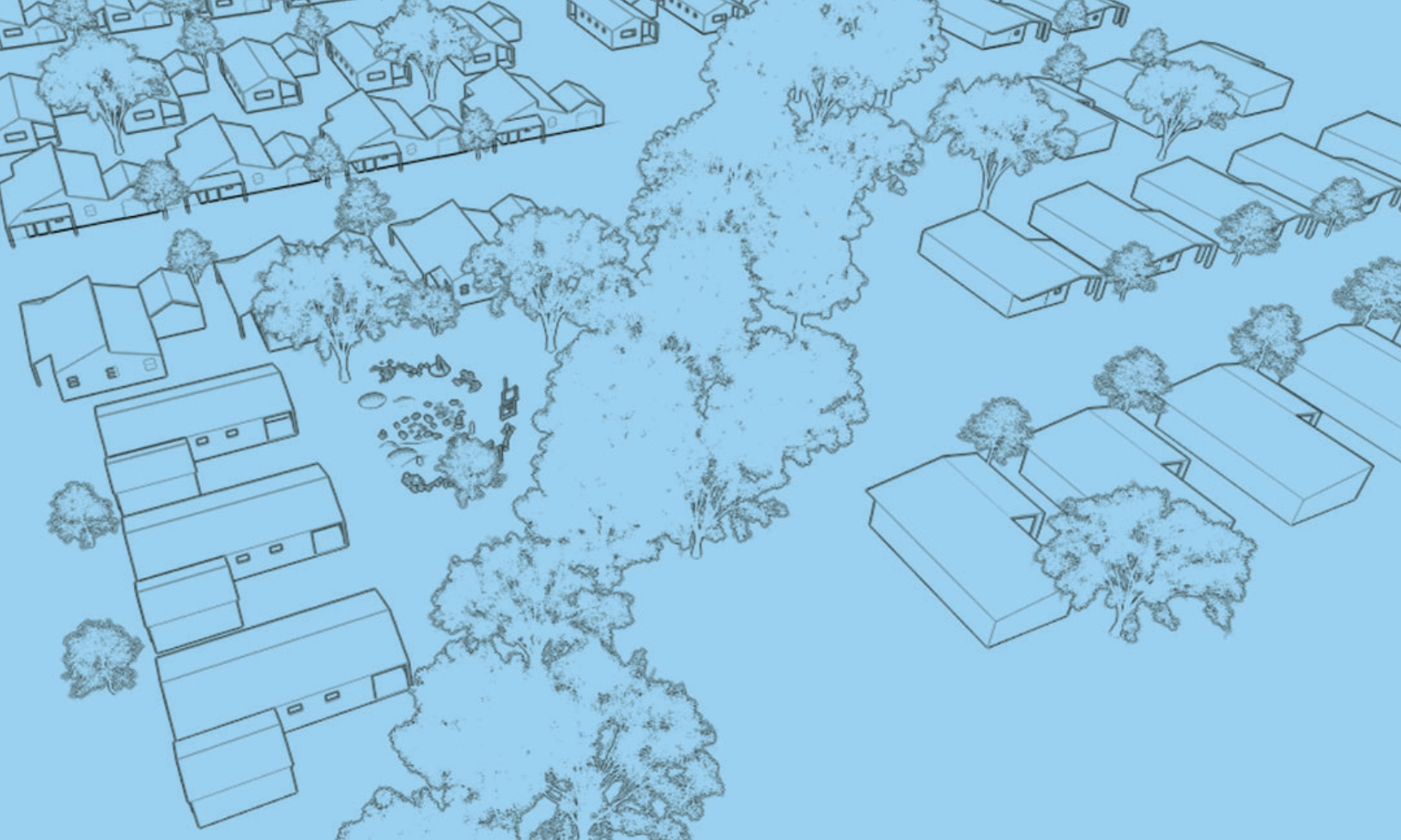
Major Professor
Howard Hahn

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Abstract

In 2022, city planners in Manhattan, Kansas, identified a need for expanding mid-to-low-income housing stock within the city through a comprehensive housing market analysis. To meet the projected demand for over 2,000 additional dwelling units in the next two decades, implementing strategies to increase affordable housing stock will be imperative. Given the historical involvement of landscape architects in master planning and neighborhood amenity development, a thorough exploration of affordability factors: site selection, site infrastructure, housing selection, and overall site design by landscape architects could contribute to innovative affordable communities. This study is grounded through a literature review, an examination of precedent projects that highlight aspects of affordable housing, and a review of Manhattan's financial conditions. Collecting data from the literature review, precedents, and financial data in Manhattan was used to inform an application of the affordability factors on a local site. Projective designs were used to illustrate and summarize strategies to reduce the cost of owned housing that can be applied to other cities.



MASTER PLANNING AFFORDABLE HOUSING

Streamlining the creation of affordable housing for Manhattan
Kansas, and other cities

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Go Cats

Abstract

In 2022, city planners in Manhattan, Kansas, identified a need for expanding mid-to-low-income housing stock within the city through a comprehensive housing market analysis. To meet the projected demand for over 2,000 additional dwelling units in the next two decades, implementing strategies to increase affordable housing stock will be imperative. Given the historical involvement of landscape architects in master planning and neighborhood amenity development, a thorough exploration of affordability factors: site selection, site infrastructure, housing selection, and overall site design by landscape architects could contribute to innovative affordable communities. This study is grounded through a literature review, an examination of precedent projects that highlight aspects of affordable housing, and a review of Manhattan's financial conditions. Collecting data from the literature review, precedents, and financial data in Manhattan was used to inform an application of the affordability factors on a local site. Projective designs were used to illustrate and summarize strategies to reduce the cost of owned housing that can be applied to other cities.

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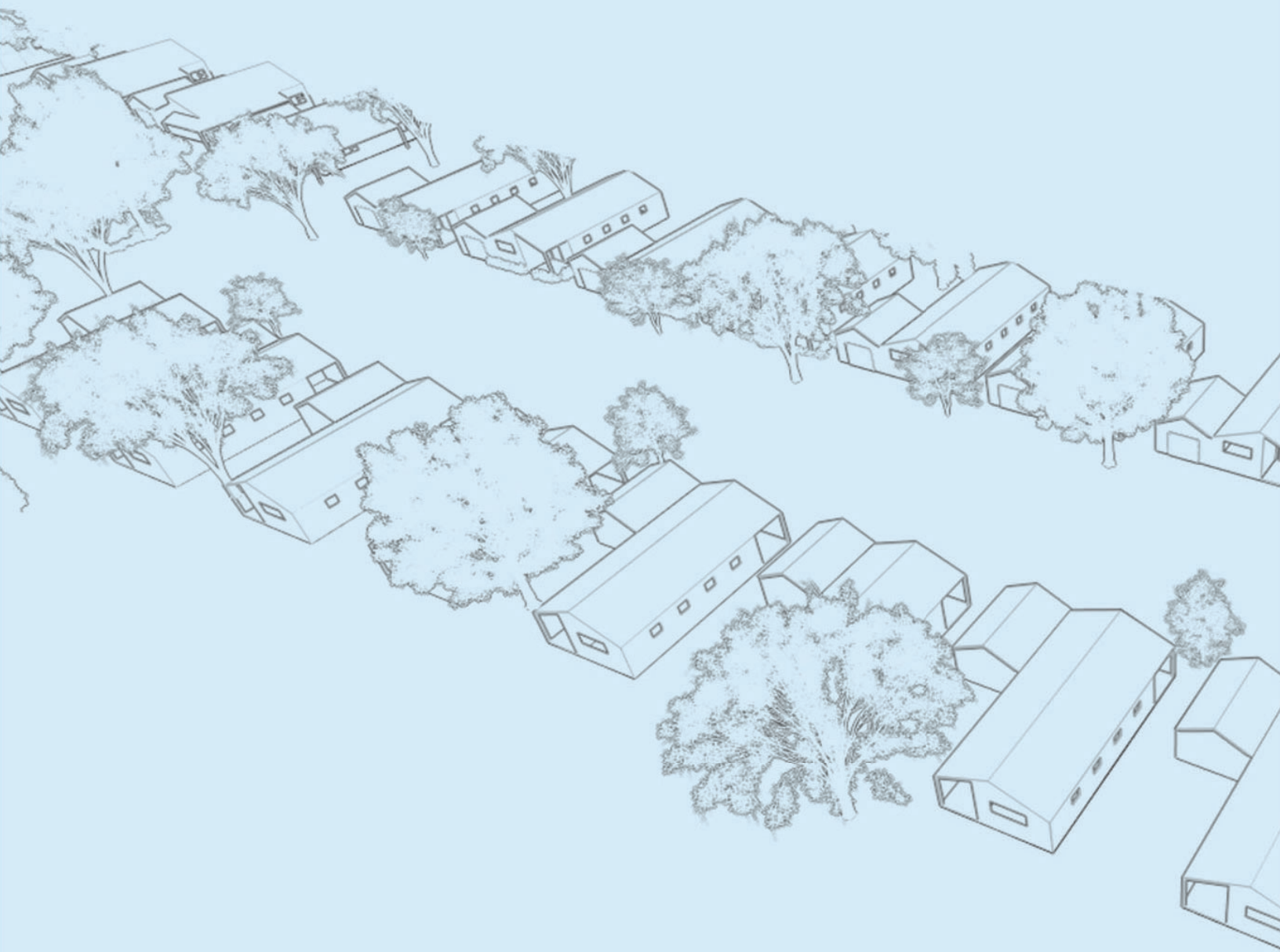
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An aerial, hand-drawn sketch of a city layout in light blue ink on a white background. The sketch shows various building footprints of different sizes and shapes, some with internal details like windows or doors. Interspersed among the buildings are several stylized trees with dense, rounded canopies. The perspective is from directly above, looking down on the city plan.

01

INTRODUCTION

Problem Statement

More than 80,000 (60%) residents of Manhattan Kansas fall below 120% of area median income, qualifying them for housing assistance. While this may seem like a high percentage of people qualifying for assistance it is roughly in line with the national level of need. Manhattan is unique in its need for affordable housing because there is a housing stock shortage. There is an estimated need to increase the existing housing stock by at least 2,800 units in the next 20 years. While this may seem like a daunting task it is actually a great opportunity to explore new development approaches and design interventions. There is also an opportunity to create more sustainable developments which is essential due to the growing climate crisis. Landscape architects are positioned to encourage experimentation within housing developments with the intent to lower housing costs. As advocates for sustainable design, skilled in community engagement and master-planning, landscape architects may be leaders in a new era of affordable housing that is inclusive, sustainable and aesthetically pleasing.

Research Question

How can landscape architects inform the design of affordable housing communities through a series of affordability factors: site selection, site infrastructure, housing selection, and overall site design, to create housing developments that allow occupants to grow equity and create social communities?

Secondary Question

How can affordability factors be applied to Manhattan Kansas to create site specific affordable housing?

Project Goals

This project aims to simplify affordable housing development within Manhattan Kansas by achieving each of the three goals detailed below:

Goal One: Analyze Manhattan's existing financial data and housing data to better understand where affordable housing is needed and how it can be achieved.

Goal Two: Analyze existing housing types, cluster formations, and overall site designs to better understand how to increase affordability and create a sense of place within housing communities.

Goal Three: Apply the affordability factors laid out from the literature review in tandem with the knowledge gained through the analysis of Manhattan and of the case studies and precedents to show developers how each of the affordability factors can be used.

Project Outline

Chapter One: The introduction chapter summarizes the problem at hand and presents the research questions and corresponding goals.

Chapter Two: The background is a summary of existing literature and information on the subject of affordable housing. It covers the past affordable housing need and how it has been addressed. The background also discusses the importance of landscape architects' role within affordable housing and how different design decisions affect the cost of development. The final portion of this chapter covers factors that are often out of a designer's control but are important to understand and consider.

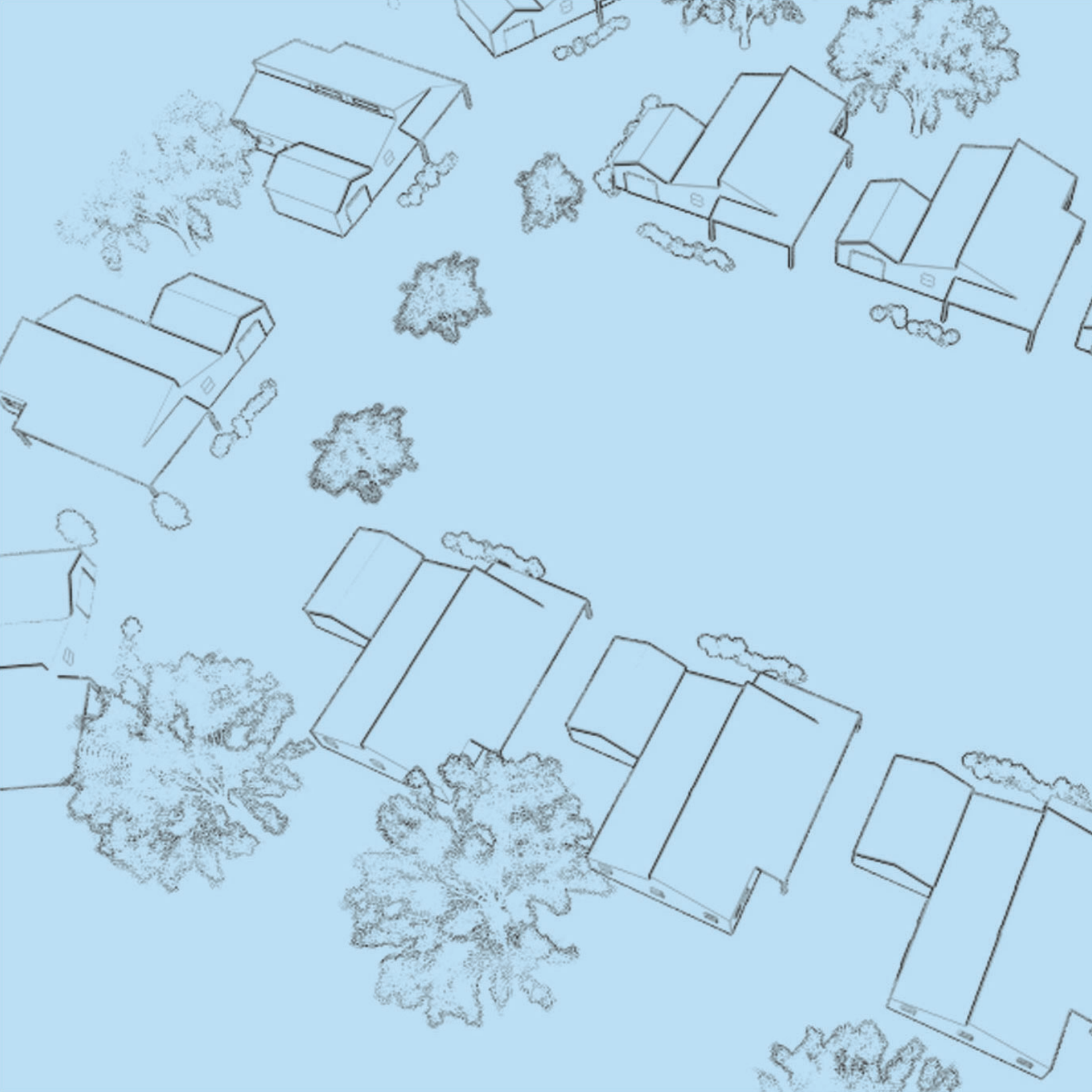
Chapter Three: The methods chapter covers the project's research process. This process includes local conditions analysis, precedent review, and projected design.

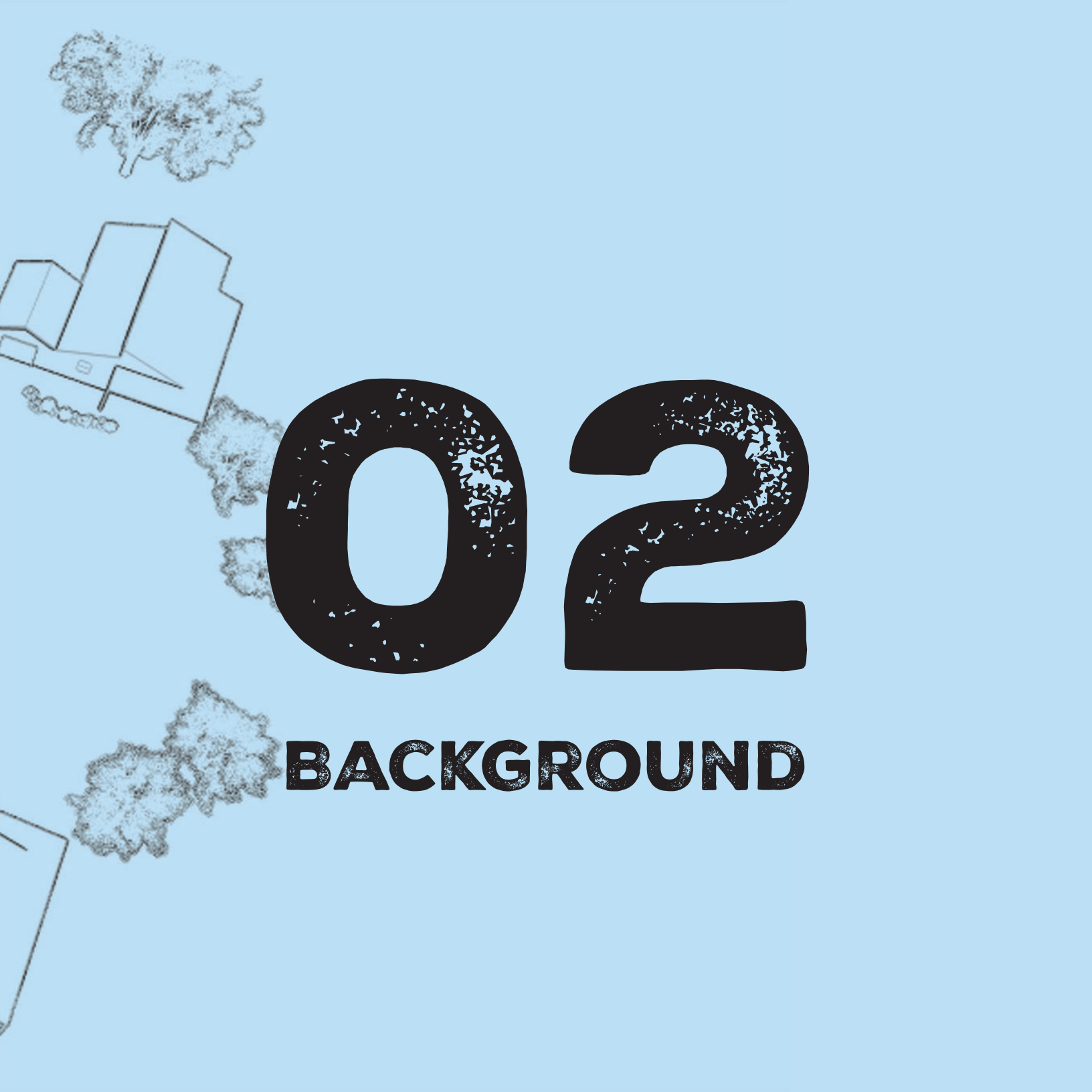
Chapter Four: This chapter reviews Manhattan's existing housing conditions, presents Manhattan's financial and housing data, and compiles precedents that address both site design and housing design.

Chapter Five: Chapter Five presents data laid out in the previous chapter, and informs and provides analysis relative to the affordability factors: site selection, site infrastructure, and site design. This chapter includes mapping exercises that assist in site selection, a review of site infrastructures' role within development, and prototypes for site design.

Chapter Six: This chapter leads readers through the steps involved with the approach to affordable housing design as dictated by the literature review. It uses data from Chapter Four and Five to demonstrate how to use the affordability factors to create affordable designs within Manhattan, Kansas.

Chapter Seven: The final chapter of this report contains the conclusions from the project, the limitations present, and potential future research that could be pursued.





02

BACKGROUND

Project Initiation

Setting the Stage

Since the Great Depression national and local governments have been involved in trying to provide affordable housing for their community (Wright 2014, 69). These efforts have grown and morphed over the years and now assistance can extend into the middle class (Parlow 2015, 384). It is important to look at affordable housing initiatives that have already been implemented as a means to learn and grow the body of knowledge. Current housing conditions have been affected by the recent Covid-19 Pandemic. The pandemic created volatile housing market conditions which are slowly steadying, but the cost of housing remains elevated (Harvard Graduate School of Design 2023,1). Specifically, during the three years of the pandemic from 2020 to early 2023, home prices rose 37.5%, over 10% a year (Harvard Graduate School of Design 2023, 2). In the study area of Manhattan, Kansas one thing contributing to the cost of housing is the cost of new development. New development is being affected by national trends and supply shortages (Crossroad MHK Initiative 2022, 12-13). On the national level there is a distinction between affordable housing and workforce housing. Affordable housing is for those below 80% of

area median income (AMI) (U.S. Department of Housing and Urban Development, n.d.). Major historical national efforts for affordable housing include the United States Housing Act passed in 1937 (Edson 2011, 195). In 1973, there was a big shift in how affordable housing was approached, bringing us to the current state. Before 1973, the government funded and maintained affordable housing initiatives, and then in 1973 there was a shift in which the government started to incentivize private developers to champion affordable housing efforts (Parlow 2015, 374-377). The workforce housing movement came after the affordable housing initiatives. It was observed in more recent years that middle-income workers do not qualify for affordable housing initiatives and are not being protected as the housing market continues to rise (Parlow 2015, 373). Workforce housing is defined by anyone between 60% and 120% AMI (Parlow 2015, 384). So, the term 'workforce' is a little misleading because it can include those who are not working like retired seniors or veterans within the middle class. 'Workforce' housing has been marketed using essential workers as its face such as teachers and emergency responders.

Homeownership and Equity

Homeownership is an essential part of American culture. Homeownership is a high priority for many American families due to the social and economical value of homeownership (Jacobus 2010). The value of homeownership is not just within the economic investment but what that investment represents to others. Low-Income families who own homes as opposed to renting are expected to become healthier, happier and more involved in the community as a result of their new environments. Low-Income families often struggle to maintain homeownership once entering the housing market but those that do remain in the housing market receive financial benefits for their continued homeownership. Homeownership is an asset-building strategy that allows owners to build equity in their homes which has long term benefits (Shlay 2006; Acolin et al 2016).

Renting and Building Credit

Owning a home is not the only way to increase equity and wealth. It has been shown that renting slightly below one's means and investing the money that would traditionally go to a downpayment on a house can be seen as a better investment than owning a home (Beracha et al. 2017). People may rent for many reasons, the most common being that renting is a much smaller financial commitment (Mulder 2006). Renting and paying utilities on time can also help build a good credit score which could lead to being a homeowner (Brevoort et. al 2016).

Landscape Architecture and Affordability

Landscape architects have long been involved with master planning and affordable housing creation. Major foundations of the landscape architecture community such as the American Society of Landscape Architecture (ASLA) and the *Landscape Architecture Magazine* have addressed affordable housing. As defined by the ASLA, landscape architects should strive to create affordable housing that is high quality, safe, accessible and preserves the health of the environment. The belief of ASLA is that high quality housing improves feelings of self-worth and community (ASLA, n.d.). It is the goal of ASLA to promote affordable housing that has social, economic, and environmental benefits (ASLA, n.d.). Another major voice within the landscape architecture community, *Landscape Architecture Magazine*, also speaks on the importance of landscape architects' involvement within affordable housing. *Landscape Architecture Magazine* advocates for infusing affordable housing communities with character or sense of place to 'camouflage' their tight budgets (Langdon 1991).

Additional Cost Factors

Management Style

Co-Ops

Co-operative housing is a way of limiting the cost of housing through a different management system. Co-operative housing relies on a system that makes individuals both homeowners and members of the community in two roles. The homeowners/members jointly own the land and also run it in a democratic manner (Sazama 2000). Those who own a house within a co-operative community not only live in the community but have a certain set of contributions they are required to make to the community as a whole. These contributions can vary from Co-op to Co-op (Suter 2018). There are seven major principles that apply to all co-operatives not just housing co-ops: i) Voluntary and Open Membership; ii) Democratic Member Control; iii) Member Economic Participation; iv) Autonomy and Independence; v) Education, Training and Information; vi) Cooperation among Cooperatives; and vii) Concern for Community' (Mitra 2014).

Community Land Trust

The first community land trust (CLT) was established in 1968 in Georgia and was followed by the first official written legal roadmap and guidelines written in 1972 and 1982. While the early CLTs were formed by local community activists there has been a steady incline in local governments funding and participating in CLT creation since the 1980s. The basis for a CLT is the dual ownership model in which the organizing body (the CLT) owns the land while individual homeowners own the improvements made on the land (housing). One way in which the individual homeowners experience ownership is through a long term 'land lease' which allows the CLT to have better control of the sale price of the home, protecting its affordability. - Decisions for CLT communities are made by a board of directors that contains representatives of those who live in the CLT, those who live by the CLT and benefit from the land trusts preservation, and those who run the CLT (Miller 2015).

City Codes

The city's role is ongoing during the design development process. Projects are passed back and forth from the city to the developers until the projects enter the implementation phase. The city can affect the developer's design through incentives, policies, and subsidies. The city puts developers through an approval process to ensure that the designs meet city code standards (policy) but cannot force developers to engage with incentives and subsidies. The Manhattan Kansas development code can be found online for anyone to access. It covers land uses, design standards, environmental standards, and site development information (City of Manhattan, Kansas 2021). According to the land development review portion of Manhattan's code, it appears that there is a requirement for both a preliminary review of all developments and then a final review (City of Manhattan Kansas 2021). One way that cities can increase affordable housing is through inclusionary zoning. Inclusionary zoning is an approach taken by local governments to increase the amount of below market housing available. Inclusionary zoning either requires or incentivizes real estate developers to include some below-market-rate houses within their developments. Oftentimes inclusionary zoning focuses on a need to increase the density in residential developments through the reduction of lot sizes. One reason that inclusionary zoning is sometimes favored as a method for creating more affordable housing is because it puts the cost of affordable housing on the developer as opposed to the city (Hamilton 2021; Freeman 2017).

Gentrification

Gentrification describes the process where higher socioeconomic groups move into historically low-income communities which escalates housing prices. The movement of higher socioeconomic groups spur an investment in previously disinvested areas which raises costs of living and pushes out existing low-income residents. Even individuals that own their homes will see an increase in property taxes (Hamilton 2021; Freeman 2017).

Green Gentrification

There have been many cases in which sustainable interventions and the implementation of open space have led to an increase in housing costs or 'gentrification.' There are ways to fight against gentrification, one of which can be the use of inclusionary zoning (Shoemaker 2002, 9).

Individual Cost Factors

Credit Conditions

Obtaining a good credit score is an essential step on the path towards homeownership. Having a poor credit score affects being able to obtain a mortgage and more specifically an affordable mortgage. An individual with a poor credit score will have a much higher mortgage rate that leads to higher monthly payments (Nelson 2010). It is also important to have an established credit history. Having no credit history can often be seen as negatively as having a poor credit score (Brevoort et. al 2016). One builds good credit by continuously borrowing a small amount of money and paying it off on time (CFPB 2020). This act can be difficult for those within lower income brackets since they may need to borrow more and find it more difficult to pay off.

Housing Assistance

Housing assistance can be extended to both homeowners and renters that qualify. Renters qualify for housing assistance if they fall within the low income to extreme low income tax categories. This includes anyone who is making below 80% of area median income. These individuals will still be required to pay 30% of their monthly income towards housing but the assistance will cover the rest of the cost of rent (HUD n.d). The specifics of what type of housing unit one would be eligible for depends on the family makeup. However, it typically will cover any unit up to fair market rate costs (Bianchi 2024). The fair market rate in Manhattan Kansas is between 770 and 1,623 dollars depending on family needs (HUD User 2023). Homeowners may have access to multiple mortgage assistance options. One option of focus is the First Time Homebuyer Loan. Individuals below 80% of area median income qualify for this assistance. This program works in addition to another mortgage. The first-time homebuyer program will allow individuals to pay for 15%-20% of their home with 0% interest. The rest of the home is financed based on a typical mortgage. This lowers monthly mortgage payments for homeowners (Kansas Housing Resource Corporation n.d.).

Monthly Cost

More goes into the monthly cost of homeownership than just monthly rent or a monthly mortgage payment. Renters often have less additional housing associated payments compared to homeowners. Along with rent, renters have to pay utilities which can include electric, gas, and water, in addition to needing renter's insurance (Mueller 2019). Homeowners have a much longer list of additional costs including property taxes, homeowner's insurance, mortgage insurance, flood insurance, and utilities (Grace n.d; Tavin 2023).

Neighborhood Creation

Placemaking

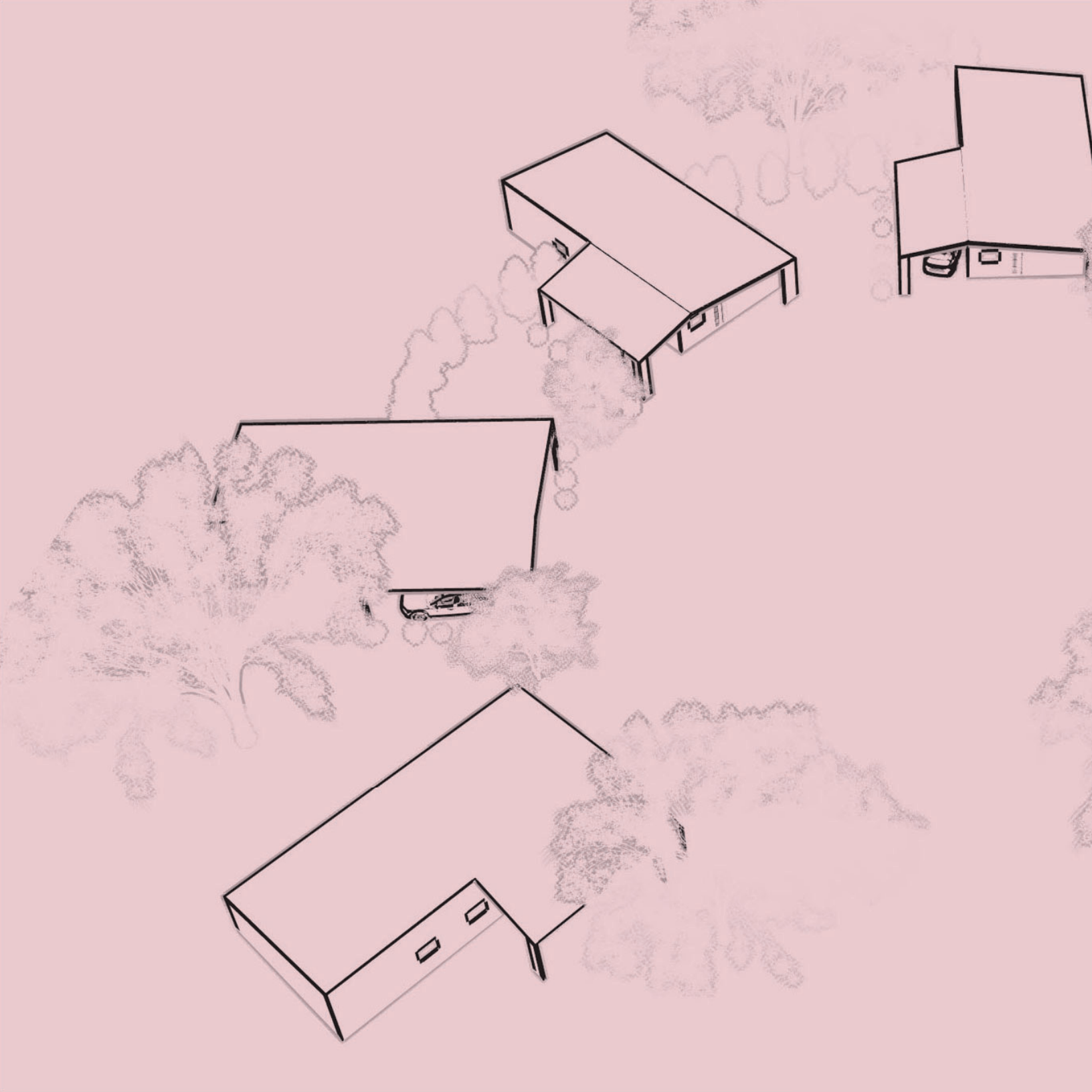
Placemaking can be interpreted in many different ways. For the purposes of this study, placemaking will be defined as a design approach that aims to add value and meaning to a place so that residents can create community and thrive. It is proven that a personal or group identity attached to the physical environment strengthens the bonds between people and place (Main 2015). This attachment or investment in a space or neighborhood increases the exhibited care and pride in the neighborhood in addition to advocacy for the place that has been created (Main 2015). Once a space becomes a place it adds to an individual's sense of identity and creates a perception of community (Zelinka 2005). Neighborhoods have been found to be essential places for developing children along with adults. While

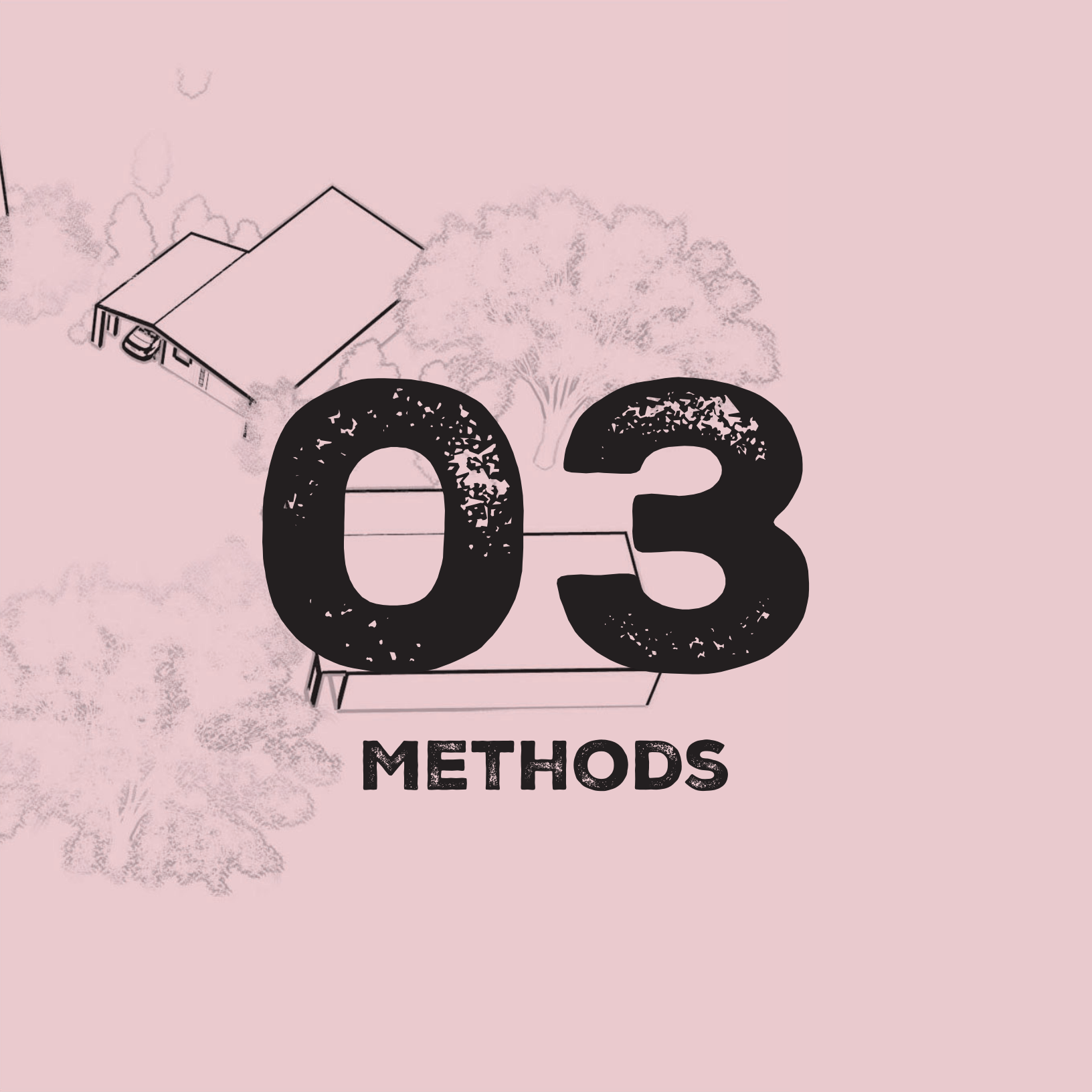
adults may lean on community support created in neighborhoods in hard times, children are encouraged to interact with neighborhood places through play (Zelinka 2005; Janet 2010). While it is easy to understand the value of strong placemaking it may be more difficult to understand how placemaking is accomplished. This topic is central to continuing and varied research and knowledge of placemaking is always growing. However, at its core many would argue that the first step of placemaking is gaining a deeper understanding of the community already established in or around the space a designer is attempting to enhance, followed by the creation of a strong vision for the place being created that has been crafted with the community. There are many tools that have been created to ease the process of placemaking (Walljasper 2007).

Mixed Income Housing Communities

There are varied opinions regarding the dynamics of mixed-use housing. Advocates think it is important to have varying levels of income in neighborhoods for a variety of reasons. Highly segregated neighborhoods can lead to large disparities between socio-economic groups. Diverse neighborhoods on the other hand allow for all residents to have the same social and economic opportunities which lead to a greater sense of equity (Reardon et. al 2015). The basis for the benefits of mixed income housing is that higher income individuals in the neighborhood will pull or provide more funding for amenities and

transit (Levy et al. 2013). There have also been counter arguments made against increasing mixed housing. Some say that the social interactions that are intended to happen between income levels rarely do, decreasing the power of the diverse spaces (Levy et al. 2013). Others state that an increase of mixed housing in low-income areas just leads to gentrification and the breaking up of already strong communities (Lipman 2009).





03

METHODS

Methodology Overview

The methods employed through this study include a local condition analysis, a precedent analysis, and a targeted literature review. The Inform section lays out some of the local conditions of Manhattan and covers the case studies and the targeted literature review. Then, in the Analyze section, there is an in-depth analysis of three affordability factors including site selection, site infrastructure, and site design. All three categories are analyzed in relation to Manhattan using the data laid out in the Inform section. The goal of these methods is to lead to an application of the affordability factors that is well-informed.

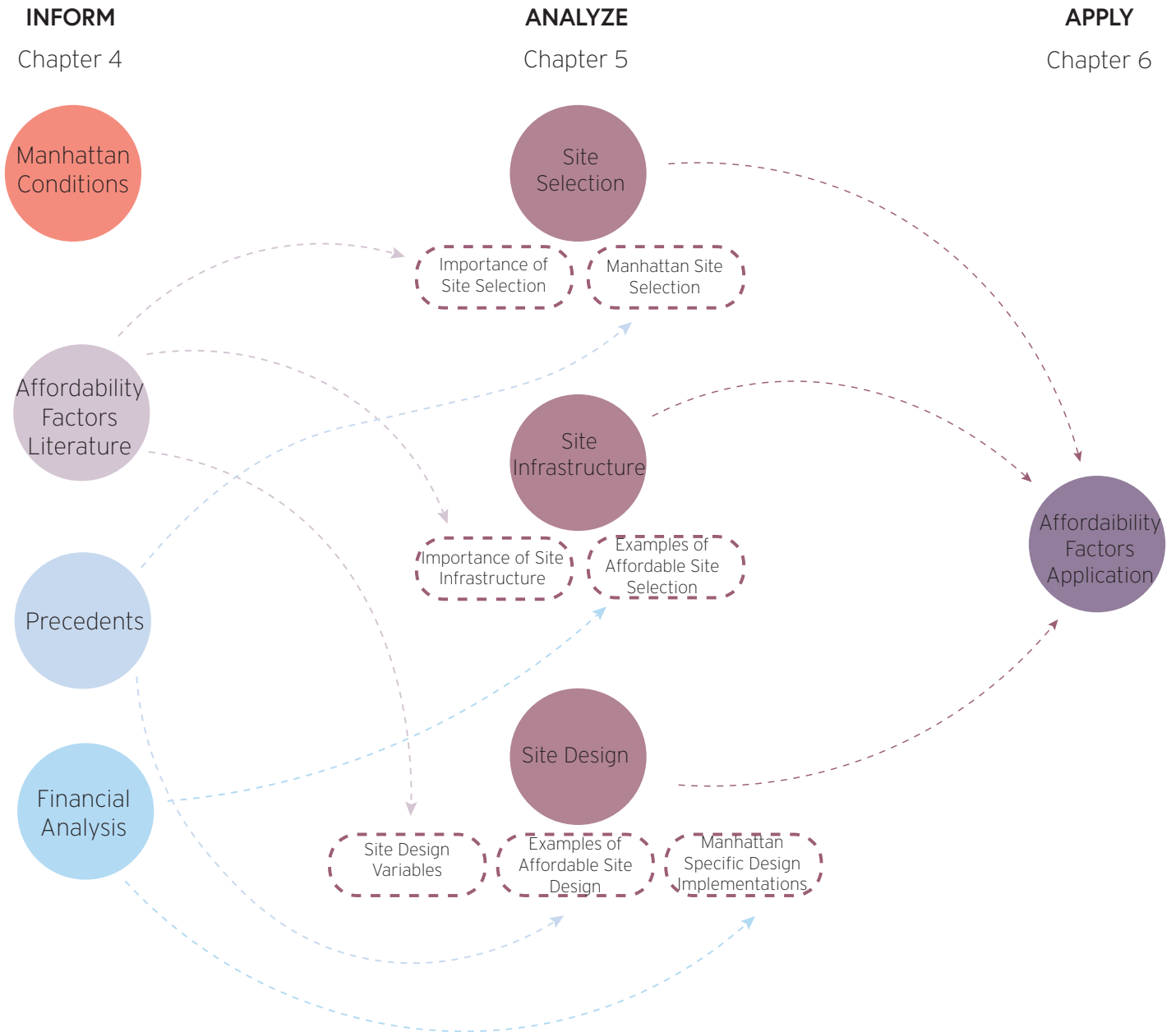


Figure 3.1 Methodology Map

Inform

The Inform section of this project contains all the data that will be used and analyzed both in the Analyze chapter and in the affordability factors application. This starts with an overview of Manhattan's conditions including the city's desire to increase affordable housing and further documentation of the need for more affordable housing in Manhattan. A targeted literature review then covers the three affordability factors: site selection, site infrastructure, and site design. This is followed up with financial data that is later analyzed to support the affordability factors. Finally, precedents are presented that cover both large site designs and specific housing typologies.

Analyze

The Analyze section draws conclusions about Manhattan in connection with the three affordability factors: site selection, site infrastructure, and site design. The first factor is site selection which is supported by a series of maps of Manhattan's affordable housing conditions. The maps document the locations of affordable housing and identify potential sites for future affordable housing expansion. A discussion concerning site infrastructure follows which includes takeaways from the targeted literature review and the case studies in addition to a map of Manhattan's current infrastructure. Finally, site design is discussed where financial conditions from Manhattan are used to support design decisions in addition to housing layout "modules" created from the targeted literature review and case studies.

Apply

The Apply section takes the findings in the Inform and Analyze chapters and applies them to specific sites within the Manhattan area. Site selection, housing selection, and site layout is explored as tools to reduce the cost of development. Conclusions are drawn on what site layouts are most cost efficient creating the most affordable neighborhoods.





04

INFORM

Manhattan Housing Conditions

Manhattan concluded an analysis of housing market conditions in 2022 to inform how they will move forward beyond 2023. While the study concludes that Manhattan should focus on increasing the available workforce housing, it is easy to see there is also a need to increase affordable housing. There is also a need to further study the existing Manhattan housing stock. In 2020 the US Census reported a total of 24,342 housing units which exceeds the reported households in 2021; however, it does not leave much room for growth. The city has made it clear that they wish to support the community's workforce housing growth and to make a unified vision for workforce housing (Crossroad MHK Initiative 2022, 8). Some things that make Manhattan different from other communities is the large number of renters due to the university student population. Specifically, 82% of Manhattan citizens have found it difficult to find affordable housing (Crossroad MHK Initiative 2022, 29). In addition, Manhattan has an elevated poverty rate with 25% of citizens living in poverty which is double the national level, although it is important to note this data could be skewed due to the large student population in Manhattan (United States

Census Bureau 2022; Shrider and Creamer 2023). Interestingly there are some similarities between the 2022 study and an earlier 2000 housing market study. Both studies cite a need to increase affordable housing supply by roughly 2,000 housing units and express a desire to use remodeling of existing housing stock as a method to increase housing supply. In addition, the list of possible federal housing grants to be used in 2000 and 2022 are a very similar list. Moving forward from the analysis, a steering committee has made suggestions to the city commission on how to spend the portion of the economic relief tax going towards workforce housing (City of Manhattan, n.d.). Some examples of how the city can assist in creating workforce housing were listed in the housing market analysis. These include: the use of Community Asset Transition (CAT) funds, the Community Development Block Grant (CDBG), the Low-Income Housing Tax Credit (LIHTC), and the Housing Choice Voucher (HCV). In addition to the incentives listed above the city has also expressed interest in employing Limited Equity Housing Cooperatives (LECs) –two of which are already present in Manhattan and Community Land Trusts (CLTs) (Crossroad MHK Initiative 2022, 52).

Establishing Need

The City of Manhattan has already declared the need for additional housing to support residents within the “extreme low” to “moderate” income levels. It is important to establish within this document the strong need for more affordable housing for extreme low and very low-income levels before going further into the analysis of where affordable housing should be placed. There is a deficit in affordable housing stock available within Manhattan, Kansas which creates a difficult environment for those in need of affordable housing. Providing adequate affordable housing is essential for creating stable market conditions for all homeowners.

Index

It is important to establish the parameters defining both income levels and their relation to the cost of housing. For the purposes of this study, the guidelines and income categories laid out in the City of Manhattan's most current housing market analysis will be followed. Income categories are as follows:

- Extreme Low Income: 0-30% of AMI

- Very Low Income: 30-60% of AMI

- Low Income: 60-80% of AMI

- Moderate Income: 80-120% of AMI

- High Income: 120-200% of AMI

These categories translate to the cost of a single-family home according to the City of Manhattan as follows:

- Extreme Low Income Homes: \$61,000

- Very Low Income Homes: \$123,000

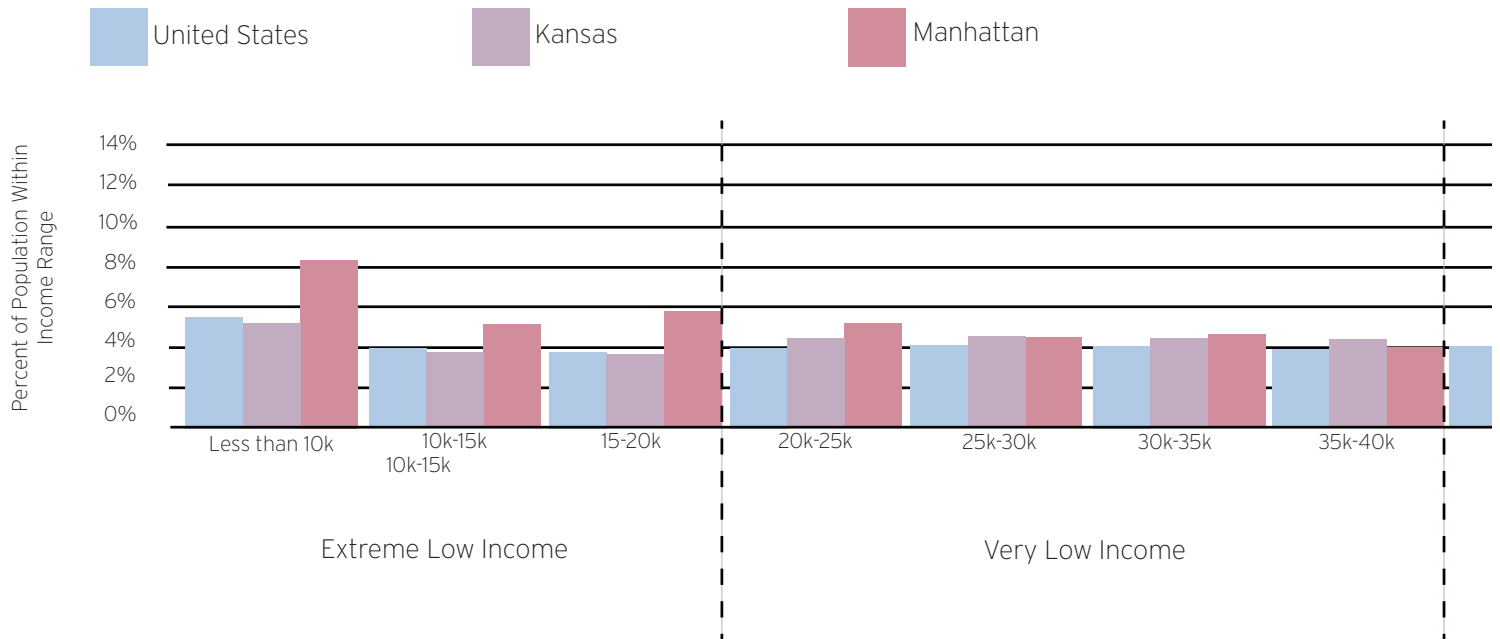
- Low Income Homes: \$164,000

- Moderate Income Homes: \$245,000

- High Income Homes: +\$500,000

Income Comparison Across Scales

Household Income



As seen in Figure 4.1, Manhattan has more people within the Extreme Low Income and Low Income categories than both the United States as a whole and Kansas. In addition, Manhattan has less people in the Moderate and High Income categories than both the United States and Kansas. The graph below uses United States Census data from 2021 taken from the website Data US. The height of each bar on the bar chart represents what percentage of the population lives in each income bracket.

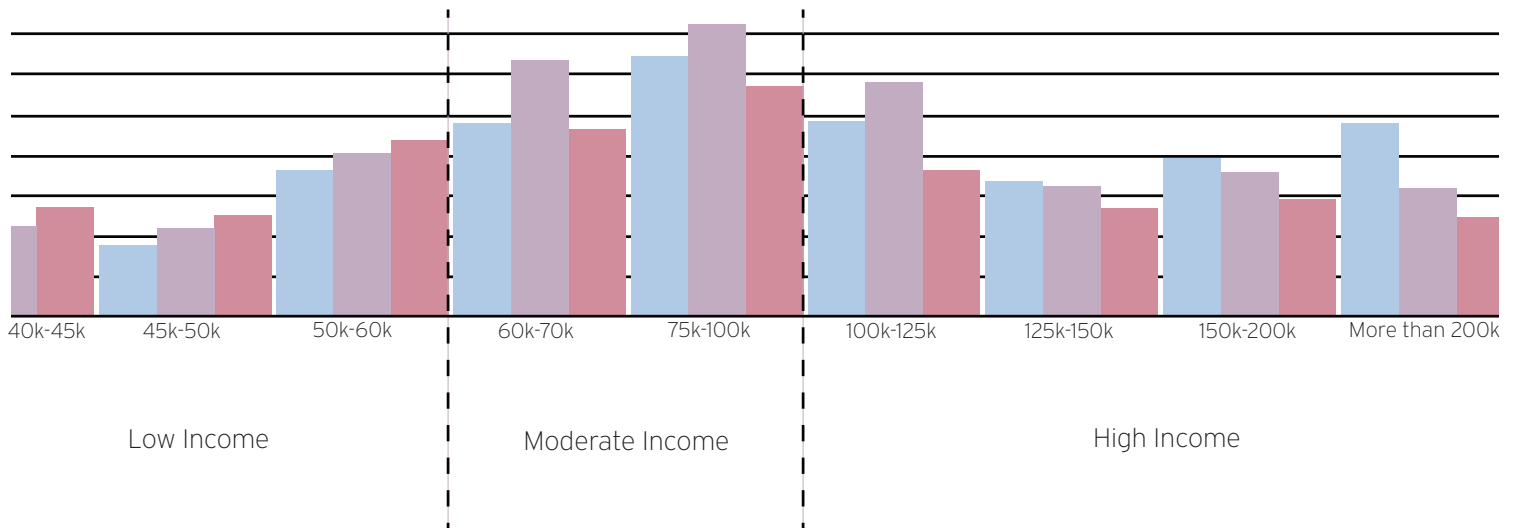


Figure 4.1 Household income data comparison for the city of Manhattan, the state of Kansas, and the United States (Deloitte 2021)

City of Manhattan Analysis

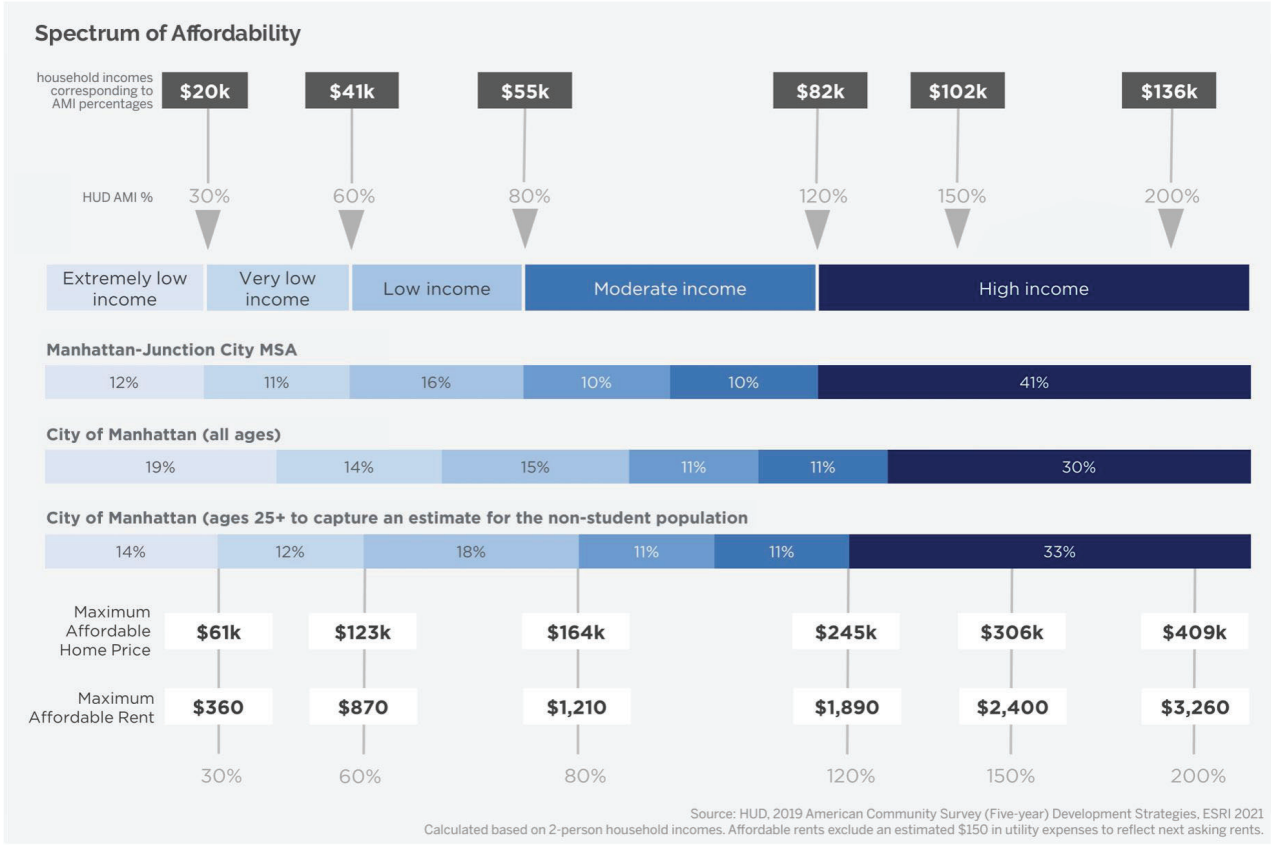
As previously mentioned the City of Manhattan had recently released the Housing Market Analysis: A Crossroads MHK Initiative 2022 that served as the catalyst for this project. Aside from being the inspiration for this project it was also essential for defining who is in need of additional housing and how designers and planners can better serve these groups. Figure 4.4 shows how the city of Manhattan has defined their income groups. There are also additional graphs showing how the housing is dispersed for these income brackets.



Figure 4.2 Manhattan's crossroads initiative cover

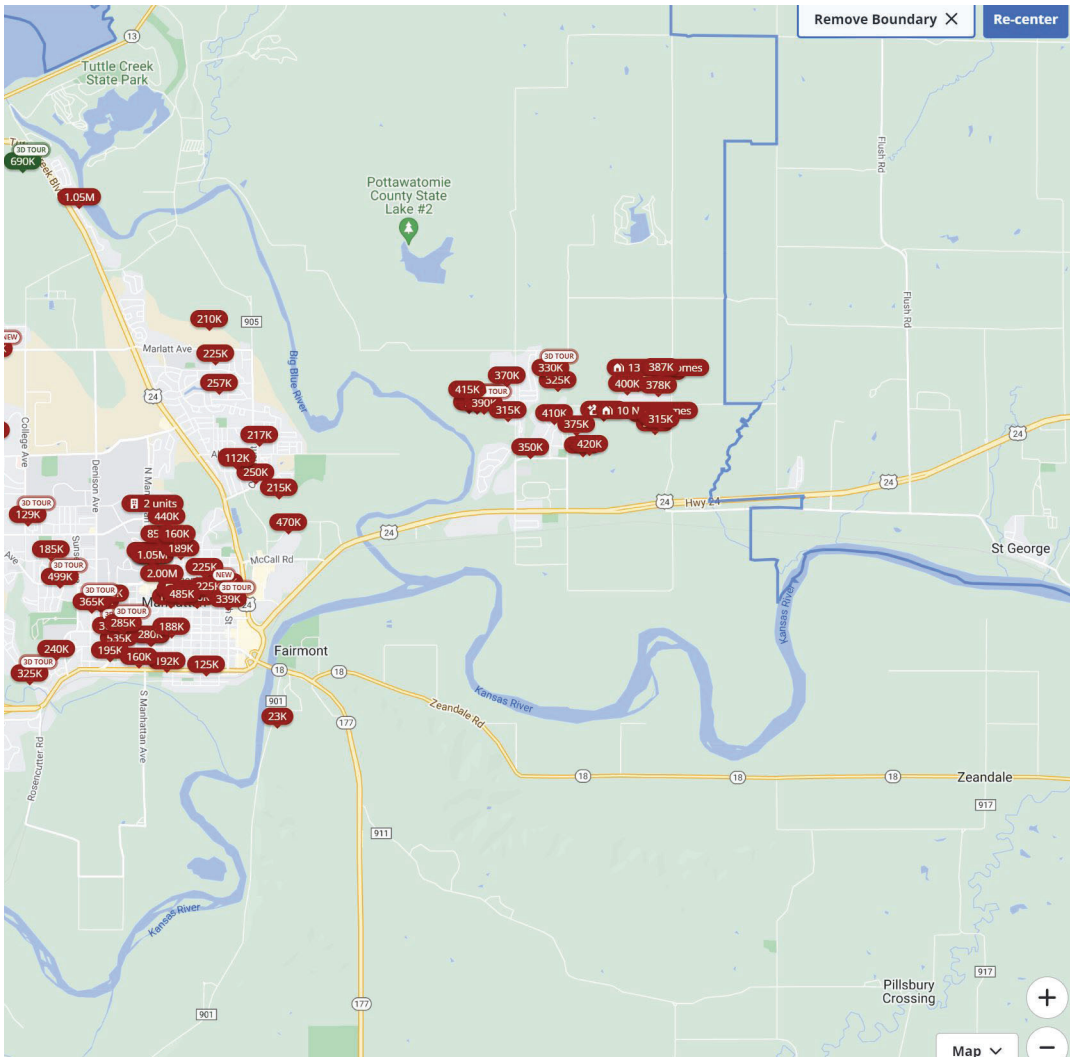


Figure 4.3 Manhattan's crossroads initiative



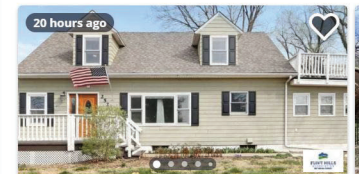
Manhattan Market Housing Snapshot

To provide a snapshot of Manhattan's housing properties for sale at current market rates, the online tool Zillow was utilized. Zillow can be used by a variety of realtors to list housing for sale or for rent. The houses are listed with a large amount of information including; Housing list price, square footage of the house, location of the house, and the number bedrooms and bathrooms within the house. Figure 4.5 shows an example of what the Zillow interface looks like.



Manhattan KS Real Estate & Homes F

182 results

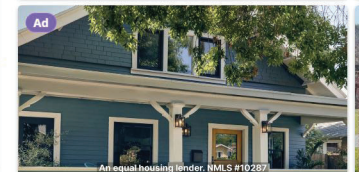


\$330,000

5 bds | 2 ba | 2,606 sqft - House for sale

2520 Marlatt Ave, Manhattan, KS 66502

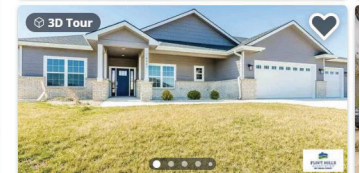
REALTY EXECUTIVES / WEIS



Find homes in your budget

See how much you can afford and get financed with us at Zillow Home Loans.

[Visit Website](#)



\$427,000

3 bds | 2 ba | 1,844 sqft - House for sale

4005 Macinnes Ct, Manhattan, KS 66503

ROCKHILL REAL ESTATE GROUP

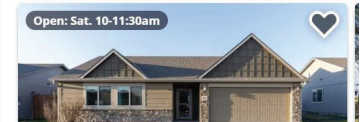


Figure 4.5 Zillow interface example

Available Housing Stock

Reviewing the data to the right, it is easy to see the disparity between housing stock and housing needs. The top graph shows what percent of people are in each of the income categories laid out in the index. Below, the percentage of housing Manhattan has proposed to serve each index is shown. It is evident that the percentage of people within the Extreme Low and Very Low Income categories outweigh the proposed housing for those income levels. More alarmingly, the bottom graph represents a snapshot of Manhattan's current market between November and December 2023. In this graph, 76% of housing available on the market currently is targeted for high income families with a very small percentage of housing serving Low to Extreme Low Income categories.

The information in Figure 4.4 has been gathered both from the most recent Manhattan housing market analysis, the Manhattan census data from Data: US, and the snapshot of Manhattan market conditions taken in December of 2023 that analyzed 100 different homes on the market at that time. The top graph shows what percentage of people in Manhattan live in each income bracket, data from the Manhattan census. The second graph shows what percentage of housing the city of Manhattan thinks should be allocated to each income bracket per the Manhattan housing market analysis. Finally the third graph shows what percentage of housing falls within each income bracket per the market snapshot that was previously discussed.

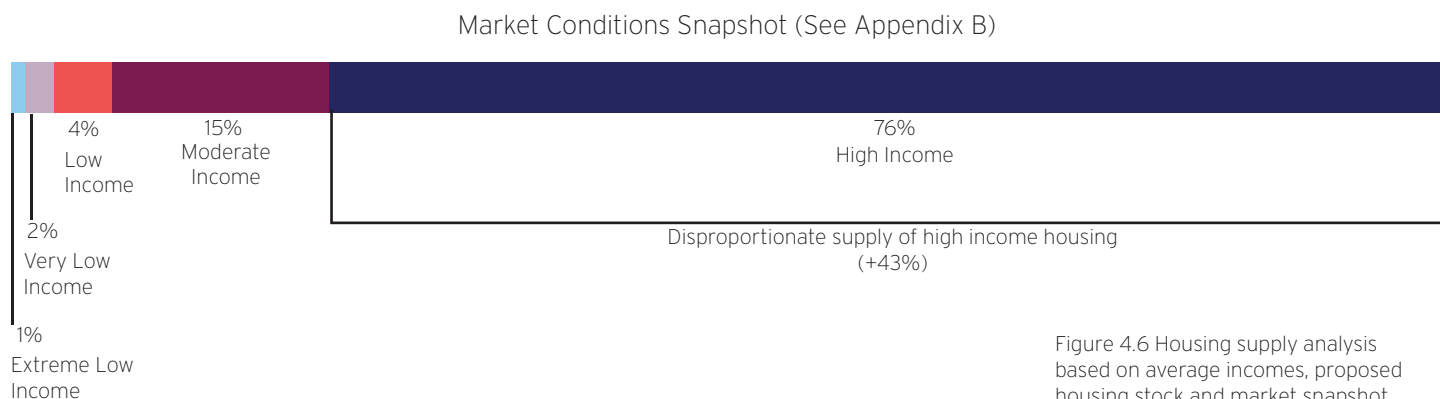
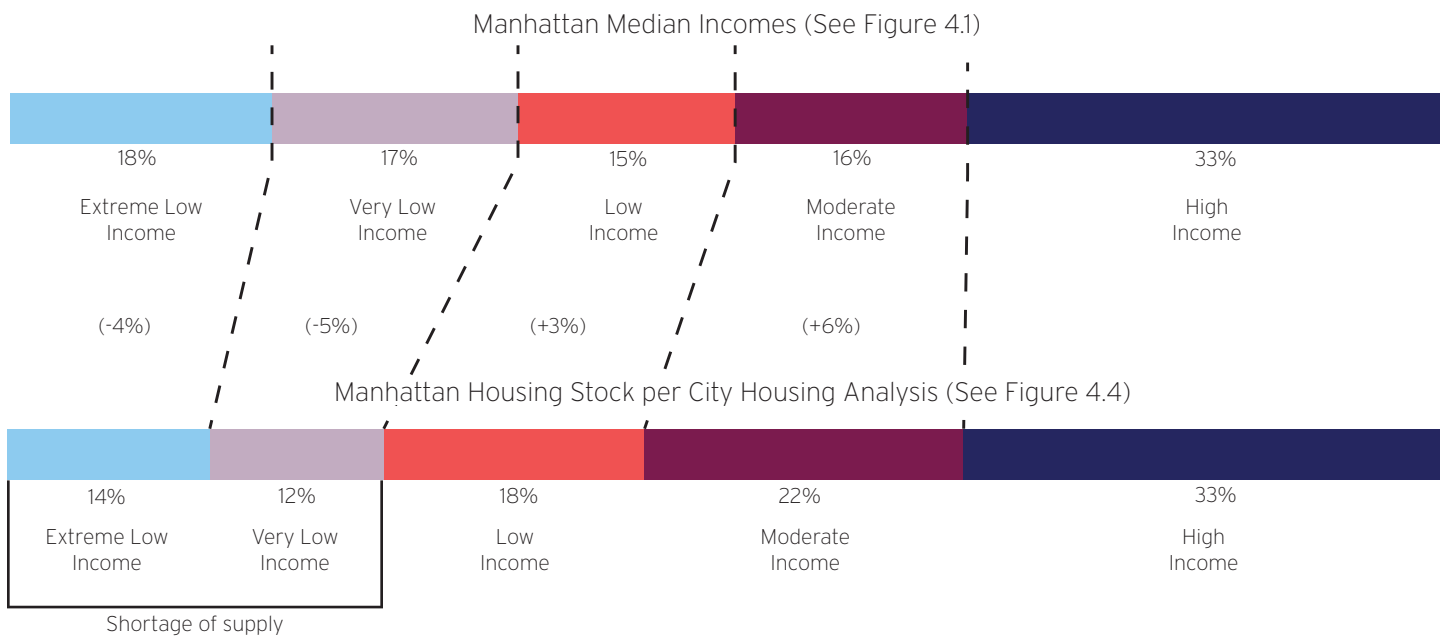


Figure 4.6 Housing supply analysis based on average incomes, proposed housing stock and market snapshot data (Compiled by author)

Literature on Affordability Factors

Since the need has been established for affordable housing within Manhattan, Kansas, it is now important to understand how housing affordability will be achieved. There are three affordability factors that will be covered in this study: site selection, site infrastructure and site design. These factors have all been studied extensively on their own and there is literature pertaining to each of them. Below, the literature on each affordability factor is presented to lay the foundation for the future study.

Site Selection

The selection of a development site can have considerable impact on the overall cost of housing and the challenges that may occur on site. According to multiple sources the cost of the land itself is often the driving force of housing prices with some sources citing it as 40% of the cost of development (NAHB National Research Center 1987, v) (W.L 1986) (Langdon 1991). To make a profit on a large land tract being developed, every subdivided smaller parcel needs to be profitable to the developers. It is increasingly difficult to make both a profit and offer affordable housing prices due to decreases in easily available land ready for development (Anacker 2019).

Site Design

The design of the site can lower development costs through the timeline, housing selection, and housing placement. The timeline that occurs before site construction activities commence can be lengthy and expensive. The more variables that can be streamlined or pulled from existing projects, the quicker a project will move. Prolonged project timelines can increase the cost of a design before anything is even built (Anacker 2019; Affordable Housing: Challenge and Response. Washington, D.C: The Dept., 1987). Additional design factors can work in direct relation to the infrastructure costs above. Road and utility lengths can all be altered when designs are condensed and clustered (Long n.d). Housing selection, specifically the size of the house, can dramatically affect the cost of housing. Smaller houses allow for denser communities that lead to lower housing costs (Aurand 2010).

Site Infrastructure

Installation of site infrastructure adds to the cost of development, and greatly depends on the distance to existing utilities which can be extended, and difficulties associated with the type of terrain encountered. Major infrastructure costs include road creation, electric corridors, and water mains. Road creation can account for a major portion of a development's cost due to the cost of materials and labor (NAHB National Research Center 1987). Infrastructure decisions can also assist with lowering monthly costs for homeowners both through energy and water conservation. A home built with the proper infrastructure to be energy efficient and properly manage stormwater will not only save residents money through lower utility bills but benefit the greater community (National Academies of Sciences, Engineering, and Medicine et al. 2016, 126; Morrissey, Moore, and Horne 2011, 569; Wells and Vermeer 2020, 10). Sustainable interventions have many long-term benefits including assisting in lowering monthly cost-of-living for those who live in affordable dwelling units. (Wells and Vermeer 2020, 10). These sorts of implementations can be costly upfront, which should not be ignored, but long term can conserve resources and financially benefit homeowners and cities. Green infrastructure typically addresses electricity generation/management and stormwater

management. Electricity can be conserved via passive and active measures. Passive measures are essential due to their lack of large upfront costs. Passive solar conservation places houses at angles conducive to holding heat in the winter and cooling easier in the summer (Morrissey, Moore, and Horne 2011, 569). Solar panels are a more expensive option that can reduce the cost of electricity even more. They also require more site planning to optimize solar collection (Morrissey, Moore, and Horne 2011, 569). Stormwater conservation can reduce the cost of water utilities, both with stormwater collection and greywater treatment methods. Stormwater collection cisterns are the most cost-effective approach to lowering utility bills, with an upfront cost of 60-100 dollars (National Academies of Sciences, Engineering, and Medicine et al. 2016, 126). The water from these cisterns can be used to water lawns and gardens. Greywater systems collect water that is no longer potable but can still serve a purpose, an example being using rise water to fill a toilet (National Academies of Sciences, Engineering, and Medicine et al. 2016, 11). These systems can be initially costly but eventually save homeowners money and conserve limited water supplies.

Financial Data Analysis

Housing Costs

The data presented in Figures 4.5 and 4.6 are from the Riley County, Kansas GIS database. Each parcel contains associated data about the parcels including the total assessed building value as of 2021. This assessed building value also includes additional money invested through structural additions or improvements as recorded for taxation. The data have been split into two categories, parcels with buildings values below \$245,000 and buildings values above \$245,000. The assessed value is typically less than the market value.

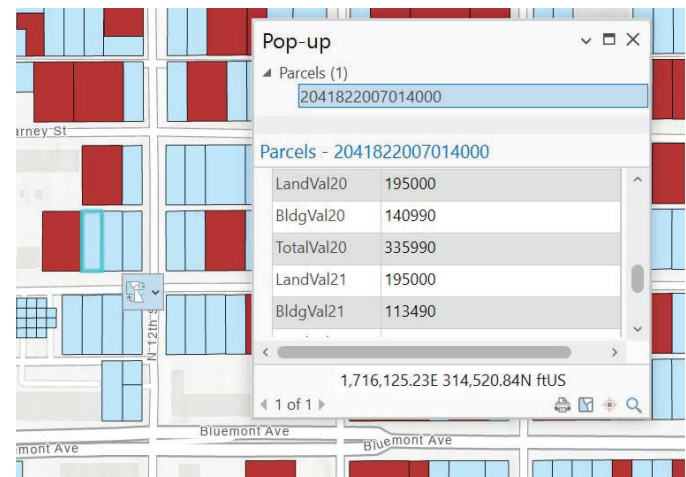
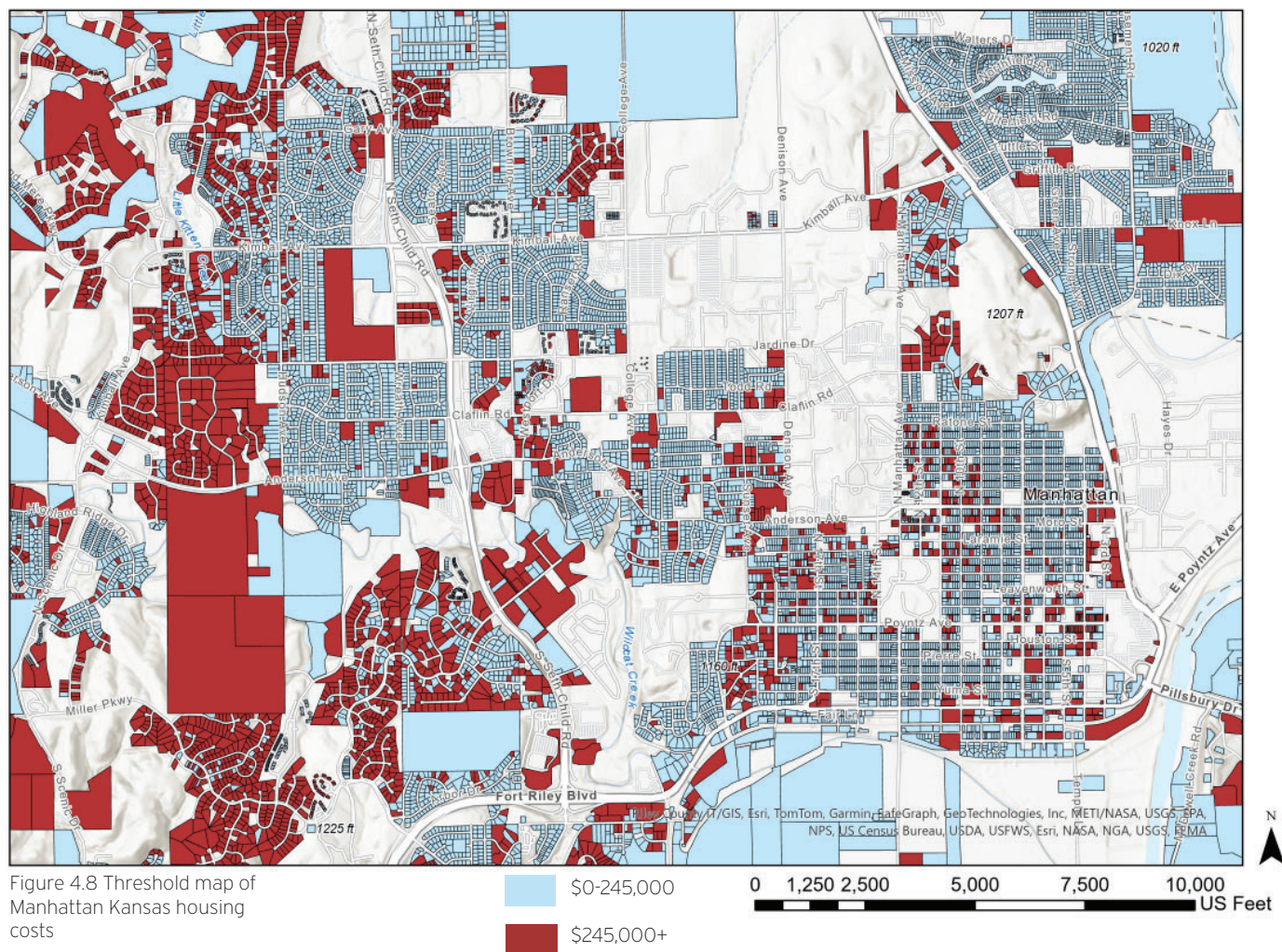
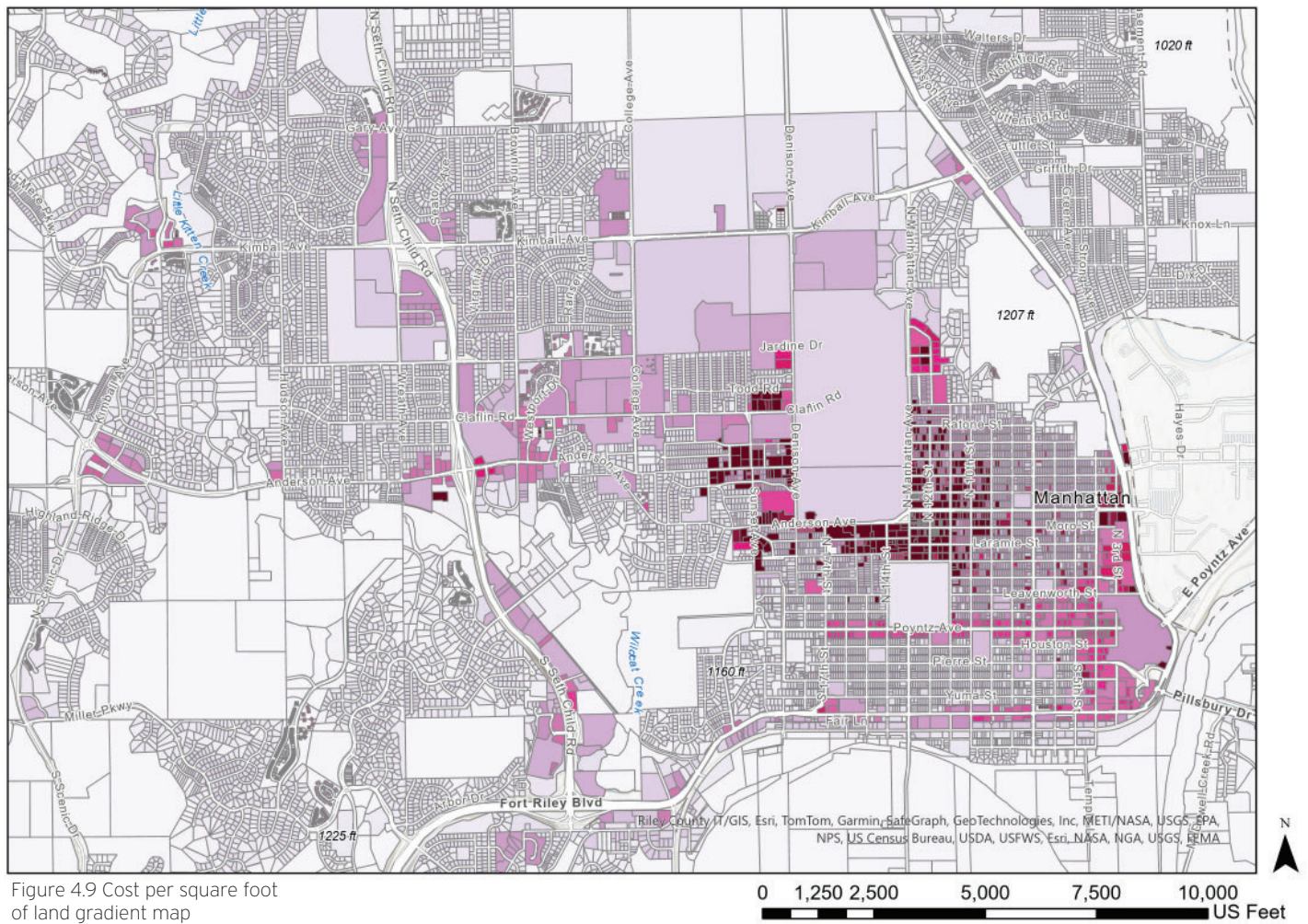


Figure 4.7 Shapefile data representation



Land Value

The data presented in Figure 4.7 is derived from the Riley County, Kansas GIS database. Each parcel contains multiple attributes including the land value as of 2021. The land value has been normalized to yield cost/area.



Current Market Rates

The current market value is important to analyze in addition to the assessed housing cost data because it accounts for the market conditions which can be in flux. A snapshot of market data from both Zillow and realtors.com were taken between November and December of 2023 to compile a snapshot of market data (Appendix A). This data allows an examination of house sizes and market prices for houses up for sale across Manhattan over a two-month end-of-year period (2023) and how it relates to the overall cost of housing. Average home cost per square foot has been calculated from this data. This data can be used to inform the housing design in the application portion of this project.

Manhattan Census Data

Understanding the overall financial state of Manhattan residents is the last portion of data that needs to be analyzed to understand how the housing market serves the general public of Manhattan. This information reflects local financial conditions including average household income and area median income markers based on City of Manhattan census data from the 2020 U.S. national census presented by Deloitte. A comparison is made with overall income and housing cost data representing the state of Kansas and the United States to give perspective to Manhattan's conditions.

Precedents

Precedent studies will be used to set the stage for the initial site design. There will be an exploration of several precedents both site designs and housing types. All precedent studies will highlight varied factors of design creation. All precedents selected have been supported through literature research to be important examples of responsible design and design standards.

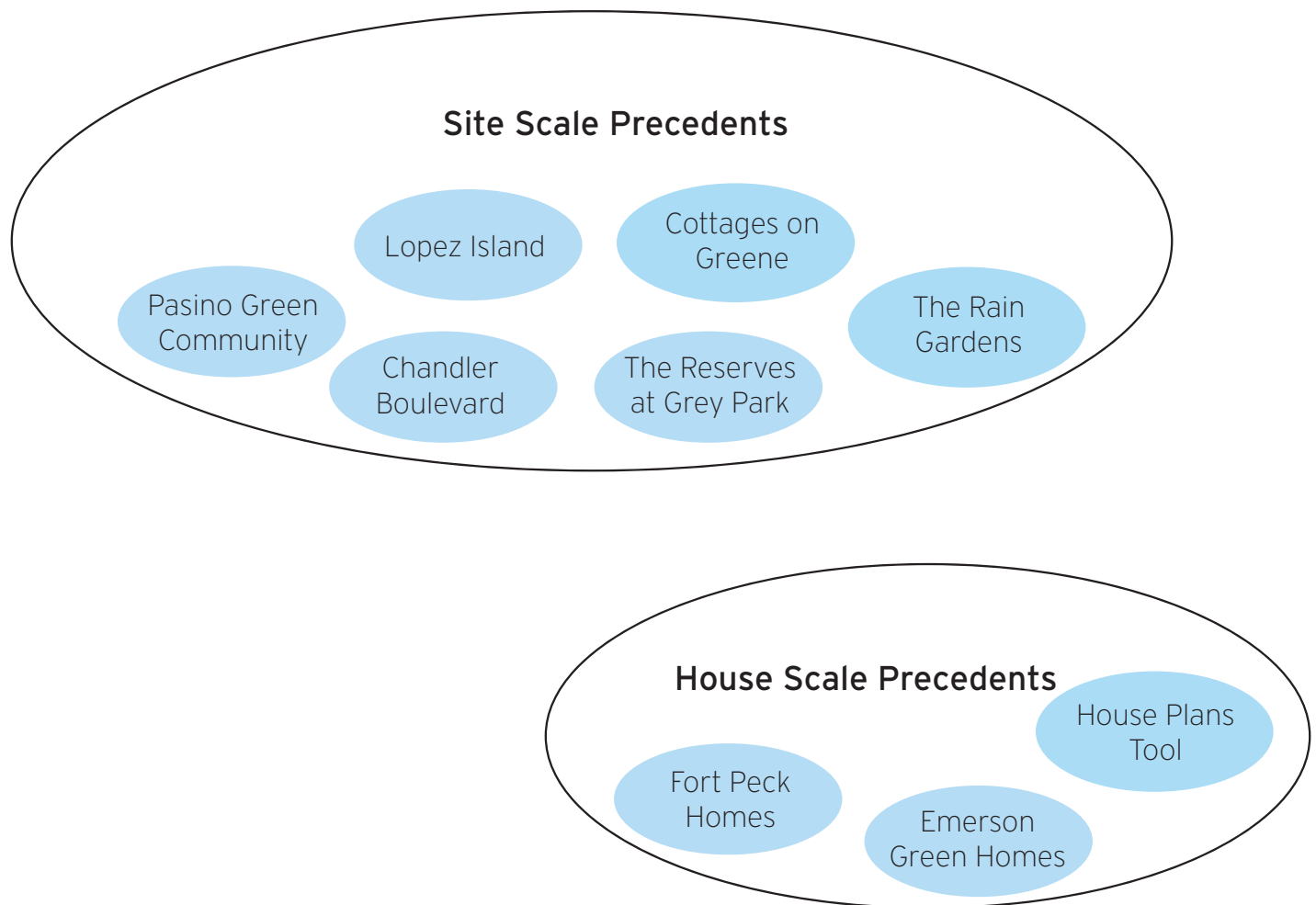


Figure 4.10 Map of precedents

Lopez Island Community Land Trust

Lopez Island, Washington

Lopez Island Community Land Trust is a great organization to look towards when approaching sustainable affordable housing design. The organization has built a total of 7 Co-Ops but for this precedent there is a focus on their common-ground co-op. The common-ground co-op contains 11 total homes all falling under the affordable housing target of \$245,000 that was established earlier in the report. The site employs solar panels to reduce utility costs for owners and other green infrastructure.

Metrics	
Size of Site	117 Acres
Developed Acres	27
Housing Units	53 Units
Net Density	1.9 DU/Ac
Estimated Housing SqFt for Large Housing	1,517 sqft
Estimated Housing SqFt for Small Housing	677 sqft

Table 4.1 Metrics from the Common-Ground Co-Op



Figure 4.11 A plan view photo of the Common-Ground Co-Op

Pasino Green Community

El Paso, Texas

The Paisano is a fitting example of a demographic specific green affordable housing community. The project is LEED platinum certified and has attained net-zero energy consumption. There was a large focus on building orientation and insulation to improve passive heating and cooling of the homes. Building orientation is one of the cheapest ways to reduce energy usage on site because it does not change the housing type, or material. The site layout is also notable, to be discussed later, and the funding of the site is also important. The project was pushed forward by the Housing Authority of the City of El Paso (HACEP) with grant money and was designed through a design competition.

Metrics	
Size of Site	4.2 Acres
Impervious Surface	57%
Housing Units	73 Units
Gross Density	17.3 DU/Ac
Estimated Housing SqFt	762 sqft

Table 4.2 Metrics from the Pasino Green Community

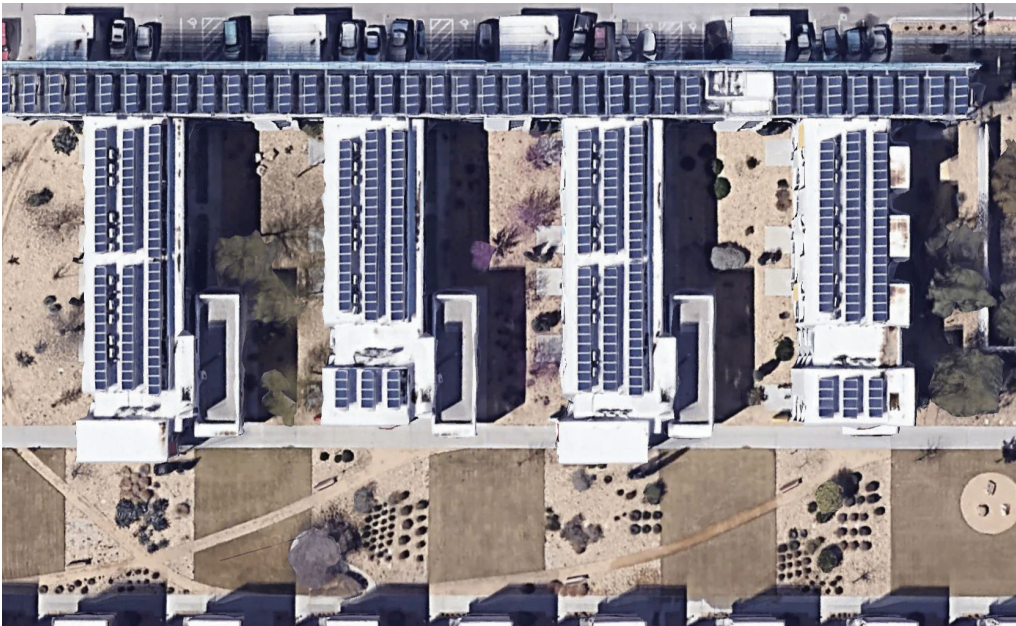


Figure 4.12 Plan view photo of the Pasino Green Community



Chandler Boulevard Tiny Home Village

North Hollywood, California

Chandler Boulevard was selected as a precedent for its unique use of space. The houses selected for this site are extremely tiny houses. The units come in at a shocking 64 sq. Ft. but still provide two beds per unit. The housing is meant to be transitional, so it does lack some regular household amenities. In addition to the housing type the site is an infill site which will be a common need within Manhattan.

Metrics	
Size of Site	0.66 Acres
Impervious Surface	80%
Housing Units	39 Units
Gross Density	59 DU/Ac
Housing SqFt	64 sqft

Table 4.3 Metrics from the Chandler Boulevard



Figure 4.13 Site Plan of Chandler Boulevard's Tiny Home Village



The Reserves at Gray Park

Greenville, Mississippi

The Reserves are an example of a affordable housing development designed to improve the overall workforce and economy of Greenville, Mississippi. Greenville has been cited as a community that has experienced ‘significant population loss, an aging housing stock, and persistently high levels of poverty.’ Greenville is like Manhattan in that the housing stock is aging and not always accommodating towards single families. The parking conditions on this site line the street with sidewalks connecting the houses within the community. Other valuable information about the site includes funding and sustainable interventions. The housing project was developed by a local improvement group, Greater Greenville Housing and Revitalization Association, and two-thirds of the development was funded by a nonprofit group. The buildings have been developed with Energy STAR guidelines in mind, with a general goal of increasing efficiency.

Metrics	
Size of Site	8 Acres
Impervious Surface	50%
Housing Units	42 Units
Gross Density	5.2 DU/Ac
Housing SqFt	750-1,200 sqft

Table 4.4 Metrics from the The Reserves at Gray Park



Figure 4.14 Site Plan of the Reserves at Gray Park



Cottages on Greene

Greenwich, Connecticut

The Cottages on Greene is a privately funded project similar to a developer-led project. The project is a mixed income housing development where some of the housing was sold at 'standard' housing prices to make up for the more affordable units on site. It is a small site with high density: one-acre site with 15 units on site. The site layout is notable due to the 'courtyard' approach. All housing units face towards a common greenspace with a sidewalk to all house front doors. The site is considered sustainable due to the smaller home sizes that lead to a reduction in energy consumption. In addition to the smaller houses, the designer looked towards the energy star requirements to increase energy efficiency.

Metrics	
Size of Site	0.9 Acres
Impervious Surface	55%
Housing Units	15 Units
Gross Density	16.6 DU/Ac

Table 4.5 Metrics from the Cottages on Greene

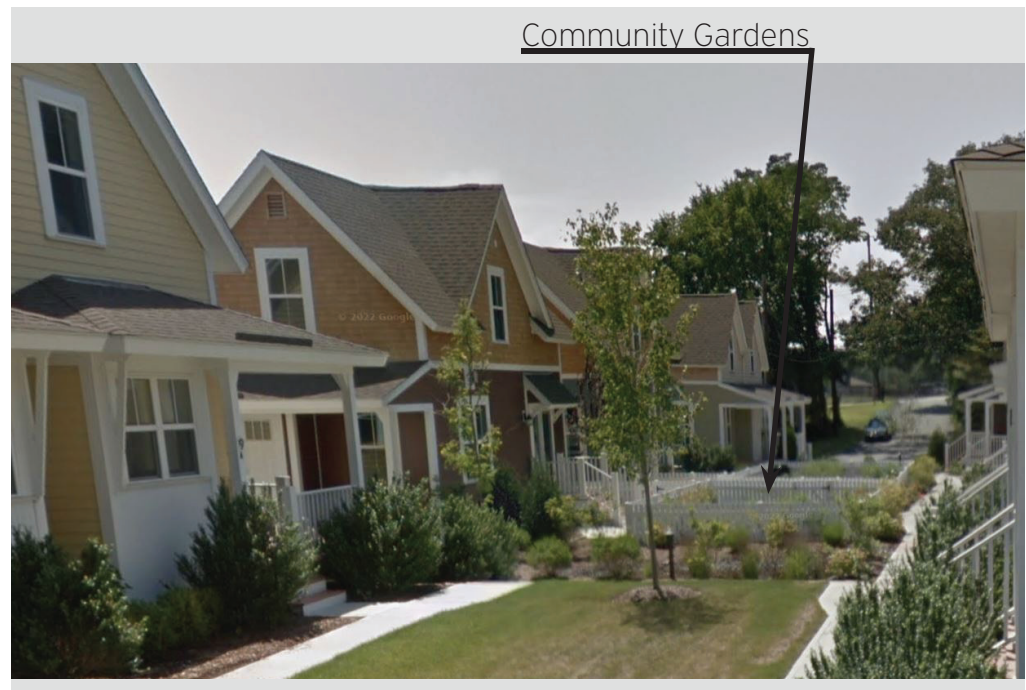


Figure 4.15 View down the courtyard of the Cottages on Greene

① Unit One: Single Family Detached							
Size	820 Sqft		Stories	2 Stories		Units	1

② Unit Two: Duplex							
Size	1,850 Sqft		Stories	2 Stories		Units	2

③ Unit Three: Triplex							
Size	1,980 Sqft		Stories	2 Stories		Units	3

Table 4.6 Housing metrics for all three housing types in the cottages on green development

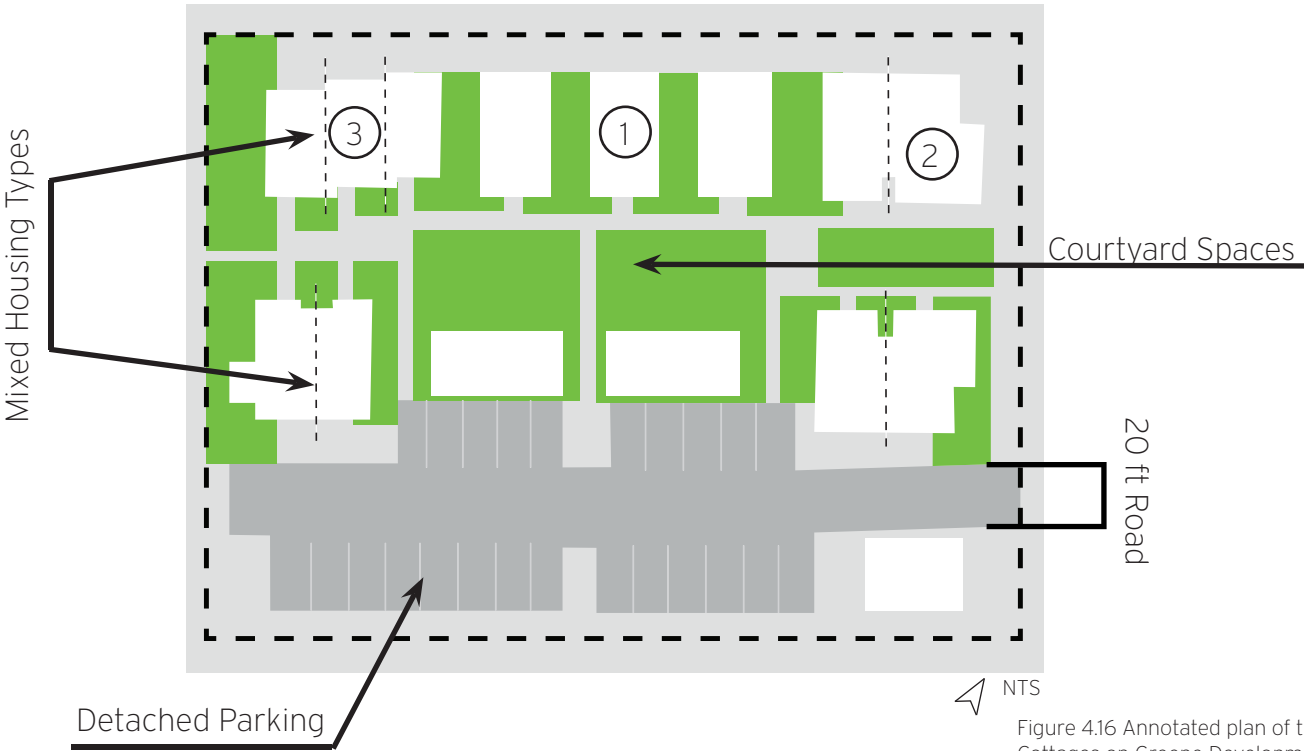


Figure 4.16 Annotated plan of the Cottages on Greene Development

The Rain Gardens at 900

Lexington, Kentucky

This project has been recognized by ASLA for a residential design excellence award. It is not a specifically affordable housing development. It was a retrofit of a small site in which the side yards were capitalized on to manage stormwater runoff. This is an excellent precedent due to its unique use of space and diverse set of tools in use. On site they have raised bio planters and forebays that collect water from the roof runoff. They also implemented pervious paving and native plantings.

Metrics	
Size of Site	0.5 Acres
Impervious Surface	42%
Housing Units	6 Units
Gross Density	17.3 DU/Ac
Estimated Housing SqFt	1,300 sqft

Table 4.7 Metrics from the The Rain Gardens at 900



Figure 4.17 View of one of the stormwater management interventions in the Rain Gardens at 900 development

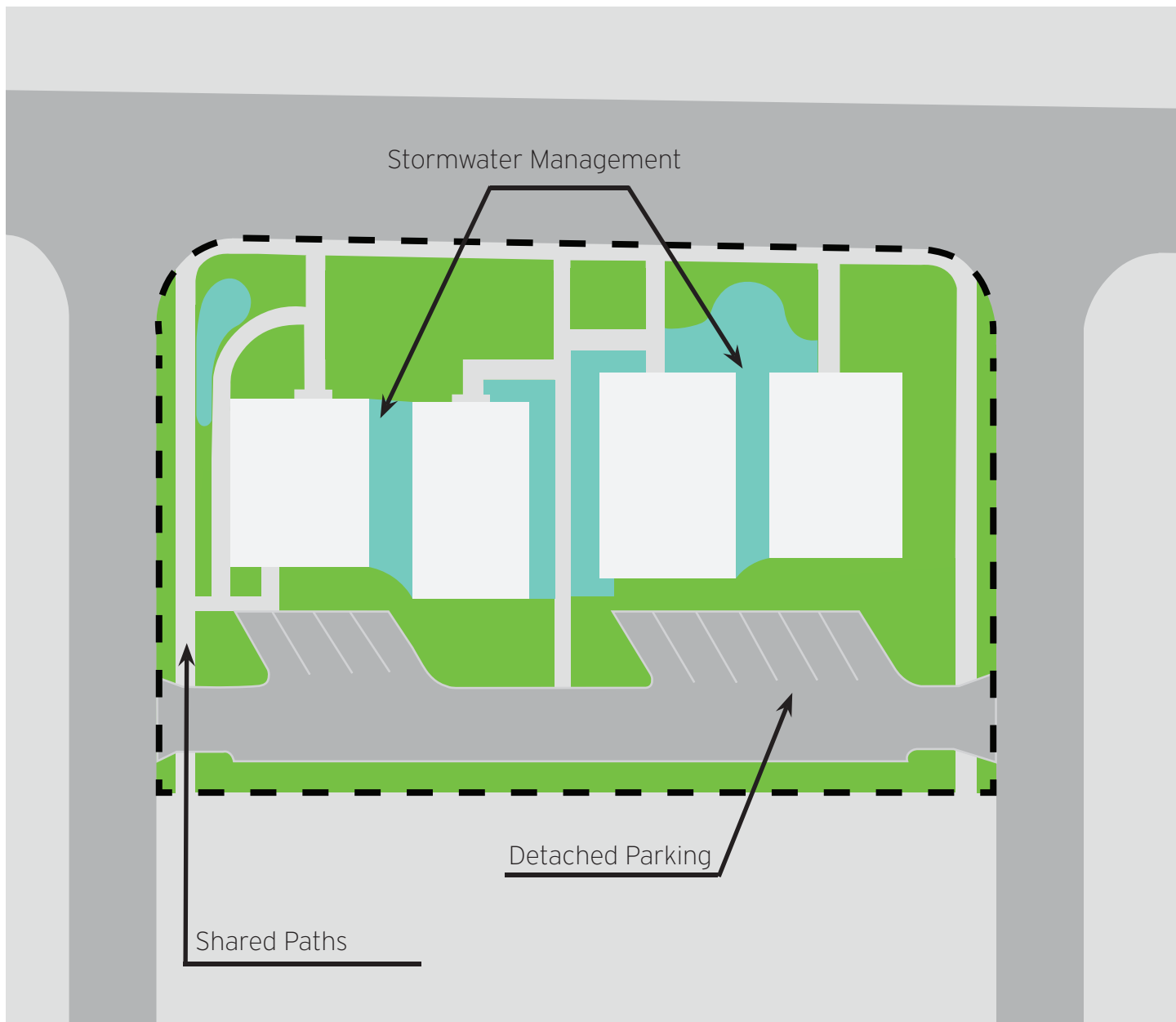


Figure 4.18 Annotated plan of the Rain Gardens at 900 Development

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Precedents Summary Sheet One						
Project	Location	Size	Density	Design Features	Image	Source
Lopez Island Community Land Trust	Lopez Island, Washington	117 Acres Total 27 Acres Developed	1.9 Dwelling Units per Developed Acre	Green Infrastructure, Shared Parking, Clustered Communities		Lopez Island Community Land Trust. n.d. "Common Ground."
Pasino Green Community	El Paso, Texas	4.2 Acres	17.3 Dwelling Units per Acre	Courtyard Clustering, Shared Parking, Green Infrastructure, Redevelopment		HUD Office of Policy Development and Research. 2014. "El Paso, Texas: Net-Zero Energy Housing for Seniors HUD USER."
Chandler Boulevard Tiny Home Village	North Hollywood, California	0.66 Acres	59 Dwelling Units per Acre	Infill Development, Small Homes, Shared Open Space		HUD Office of Policy Development and Research. n.d. "Chandler Boulevard Tiny Homes Village, Los Angeles California HUD USER."
The Reserves at Gray Park	Greenville, Mississippi	8 acres	5.2 Dwelling Units per Acre	Shared Open Space, Shared Parking, Infill Development		HUD Office of Policy Development and Research. n.d. "Greenville, Mississippi: Reserves at Gray Park Adds Affordable, Energy-Efficient Housing on Underutilized City Land HUD USER."
Cottages on Greene	Greenwich, Connecticut	0.9 Acres	16.6 Dwelling Units per Acre	Infill Development, Courtyard Clustering, Shared Parking		HUD Office of Policy Development and Research. 2012. "East Greenwich, Rhode Island: Cottages on Greene's Innovative Approach to Infill HUD USER."
The Rain Gardens at 900	Lexington, Kentucky	0.5 Acres	12 Dwelling units per Acre	Green infrastructure, shared parking, Redevelopment		Smith, Gresham. 2023. "The Rain Gardens at 900 Block ASLA 2023 Professional Awards."

Table 4.8 Precedents summary table

Precedents Summary Sheet Two

Project	Location	Site Selection	Site Infrastructure	Site Design
Lopez Island Community Land Trust	Lopez Island, Washington	Sites are selected based on land suitability	Green infrastructure on site and limited road lengths	Housing is clustered
Pasino Green Community	El Paso, Texas	Site was selected because it was previously developed	Redevelopment has reduced infrastructure costs	Courtyard clustering was used to create open space
Chandler Boulevard Tiny Home Village	North Hollywood, California	Site was selected because of its awkward shape making it unideal for traditional development	Infill development has reduced infrastructure costs	Shared open space has been created through the use of small houses
The Reserves at Gray Park	Greenville, Mississippi	Site was selected due to it's proximity to existing development	Infill development has reduced infrastructure costs	Courtyard clustering was used to create open space
Cottages on Greene	Greenwich, Connecticut	Site was selected due to it's proximity to existing development	Infill development has reduced infrastructure costs	Courtyard clustering was used to create open space
The Rain Gardens at 900	Lexington, Kentucky	Site was selected for redevelopment due to existing concerns on site	Green infrastructure was implemented on a redeveloped site, existing infrastructure reduced cost	Outdoor spaces on lot made site feel more public through seating

Table 4.9 Precedents summary table for affordability factors

Fort Peck Home II Projects

The Fort Peck Indian Reservation developments is an interesting case study because of how scattered the 'site' is. A standard style of housing was created and then developed in small infill sites. This housing development focused specifically on multigenerational housing which is desirable to Hispanic and African American households (National Association of Home Builders 2021). These communities do make up only roughly 13% of Manhattan's population but that does not mean these options should not be considered (U.S. Census Bureau 2022). Twenty-four houses were developed over two different towns. The precedent was selected due to the house's traditional front facing garage. Other valuable information about the site includes funding and parking. The project was mostly funded through the low-income housing tax-credit, and parking is discussed in later precedent groups.



Figure 4.19 Street view of Fort Peck Home

Emerson Green Homes

The Emerson Green homes are a precedent due to their unique layouts and facades. Emerson Green is a developer that focuses on creating dense and sustainable communities with a large amount of character. The home shown below is a creative duplex that uses the front facade to create the appearance of single detached homes. In addition to a creative facade the floorplan makes space for each home to have a private courtyard.



Figure 4.20 Perspective view of the front facade of the 'Hammock' housing type

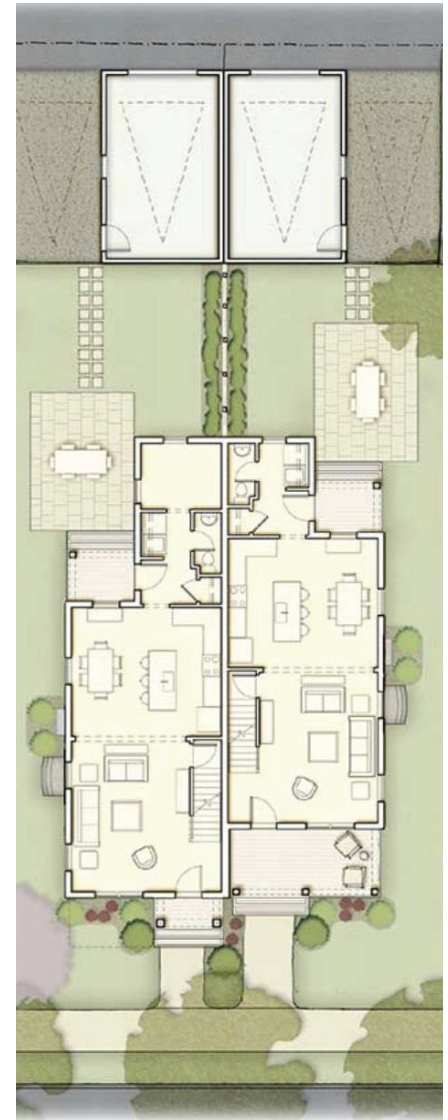


Figure 4.21 Plan View of the 'Hammock' housing type

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House Plans Tool

The Houseplans website is a comprehensive tool for finding housing typologies that fit into the price ranges of different income demographics. The site allows searches by size of house and gives data on the house such as: bedrooms, bathrooms, stories, and parking conditions. There is a wide variety of houses under each size category.

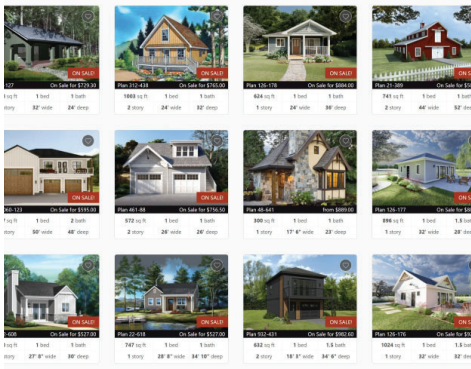


Figure 4.22 Example of search page



Figure 4.23 Search by size



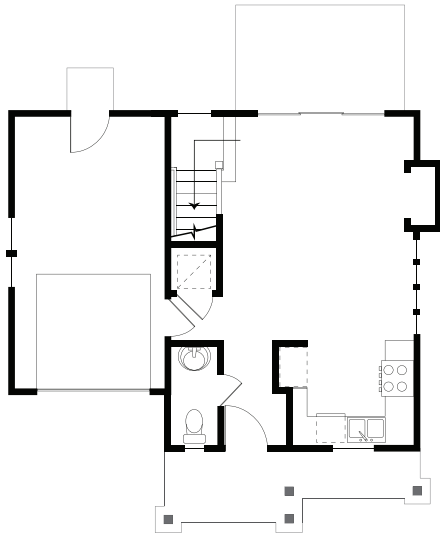
Figure 4.24 Search by style

Metrics	
Size	803 sqft
Stories	2
Bedrooms	2
Bathrooms	1.5

Table 4.10 Perspective Home Metrics

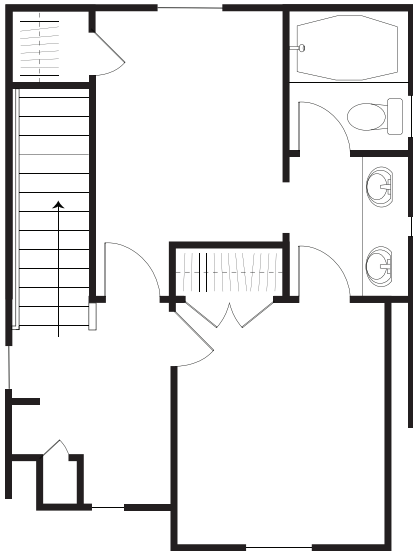


Figure 4.25 Perspective view of example home



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Figure 4.26 Main floor plan view of example home

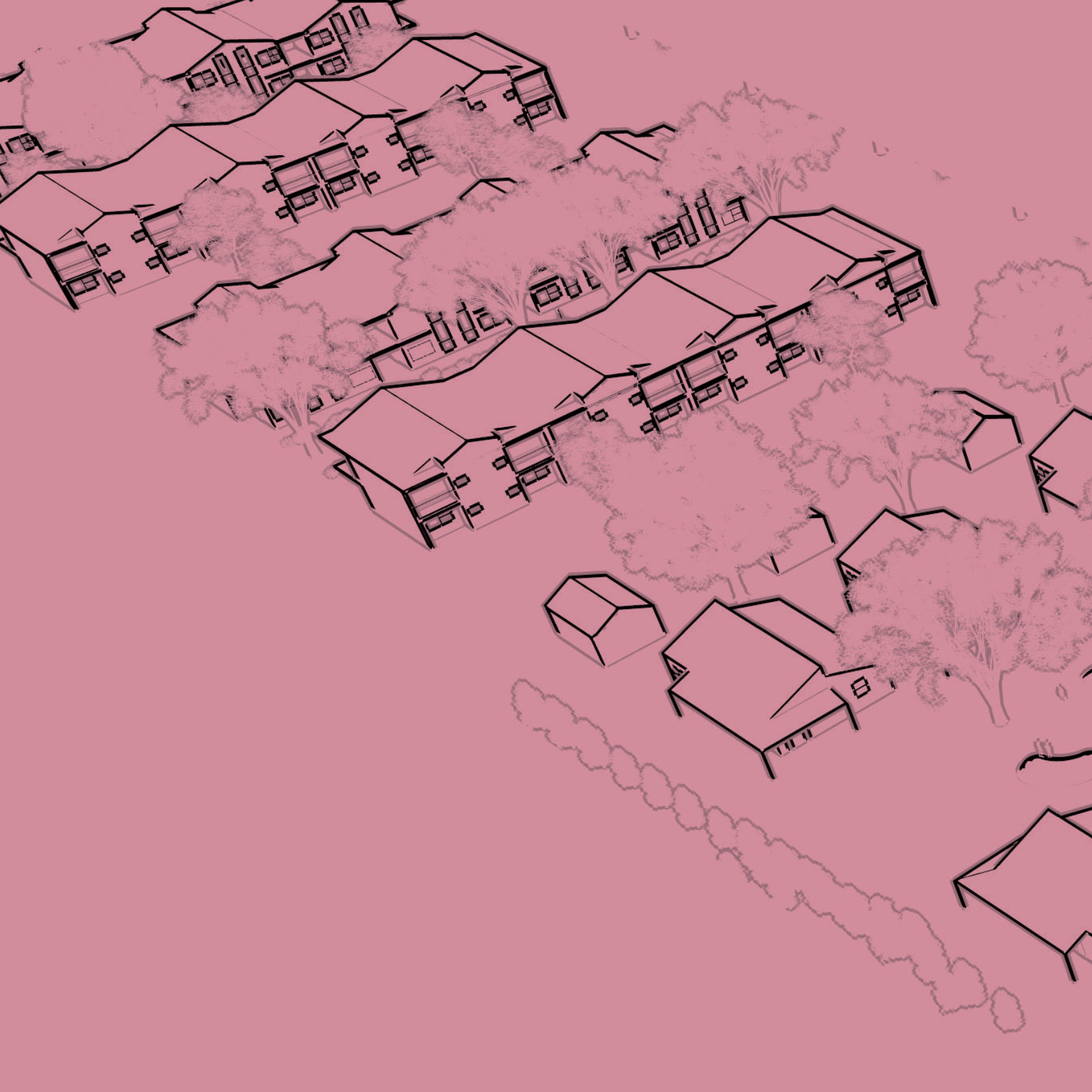


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Figure 4.27 Second floor plan view of example home



Figure 4.28 Illustrative plan view of example home



An aerial, isometric view of a suburban neighborhood. The scene includes several houses of varying sizes, some with multiple stories and others as smaller cottages. There are numerous trees of different shapes and sizes scattered throughout the landscape. The entire scene is rendered in a light pink color scheme. Overlaid on the center of the image is a large, bold, black number '05' with a distressed, textured appearance.

05

ANALYZE

Site Selection

As previously stated in the literature, site selection is an essential part of creating affordable housing developments. Oftentimes 'affordable communities' are placed on marginal land or in disinvested communities, but this does not always need to be the case. To the right, one can see general areas where affordable housing and more expensive housing exist within Manhattan. It is not impossible to put a low-income community within what has already been established as a high-end community but there can sometimes be cultural or social issues that arise. In addition, high end communities are often put on land with a higher development cost. The following maps depict housing development patterns correlated to topography and floodplains.

The data presented in Figure 5.1 is from the Riley County GIS database. Each parcel contains associated data about the parcels including the total assessed building value as of 2021. The data have been split into two categories, parcels with buildings values below 245,000 and buildings values above 245,000. Figure 5.2 is a manual generalization of Figure 5.1 of where housing types are clustered. The assessed value is typically less than the market value.

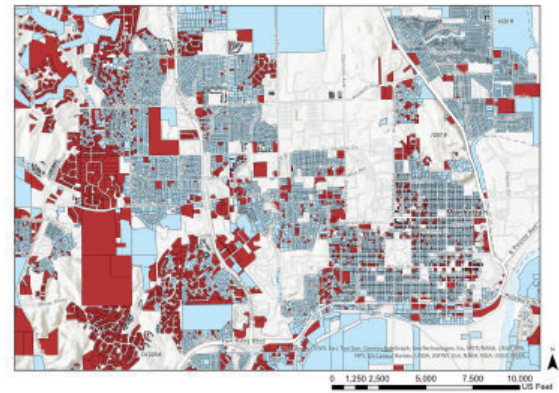


Figure 5.1 Base for affordable housing locational analysis

Manhattan Current Affordable Housing Neighborhoods

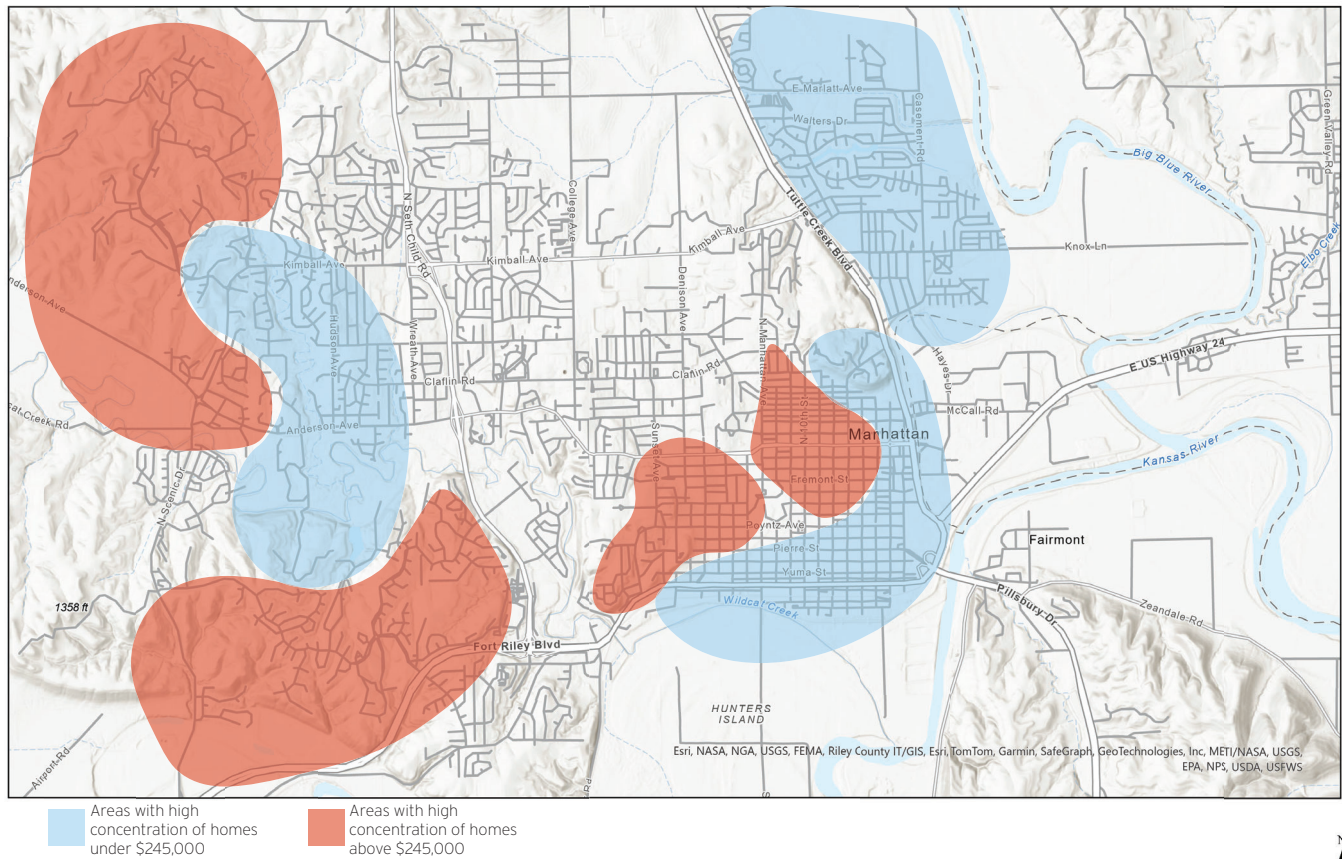


Figure 5.1 General analysis of Manhattan's existing affordable housing locations

0 1,250 2,500 5,000 7,500 10,000 US Feet

Affordable Land

To better understand affordable land, it is important to understand both where and why land is expensive in the city. The map to the right lays out where land has the highest cost per acre. Expensive land is generally concentrated around areas of commerce and large institutions like Kansas State University. The cost of this land is inflated due to the desire of students to live close to the University. There are also swaths of expensive land parcels along and nearby large commercial corridors like Pontz Street, Moro Street, and Fort Riley Boulevard. This land has been inflated in value due to its proximity to economic corridors. Conversely, less desirable land due to proximity to floodplains, nuisance areas, or isolation is generally less expensive. While this land may be more desirable related to housing affordability, problems exist due to lack of walkability and community connectedness.

The data presented in Figures 5.3 from the Riley County GIS database. Each parcel contains data about the parcels including the land value as of 2021. The land value has been normalized to yield cost/area. Figure 5.4 is of high cost land locations.

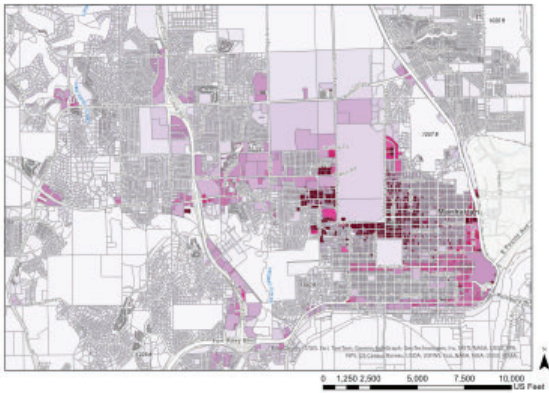


Figure 5.1 Base for land cost analysis

Manhattan Current Expensive Land Regions

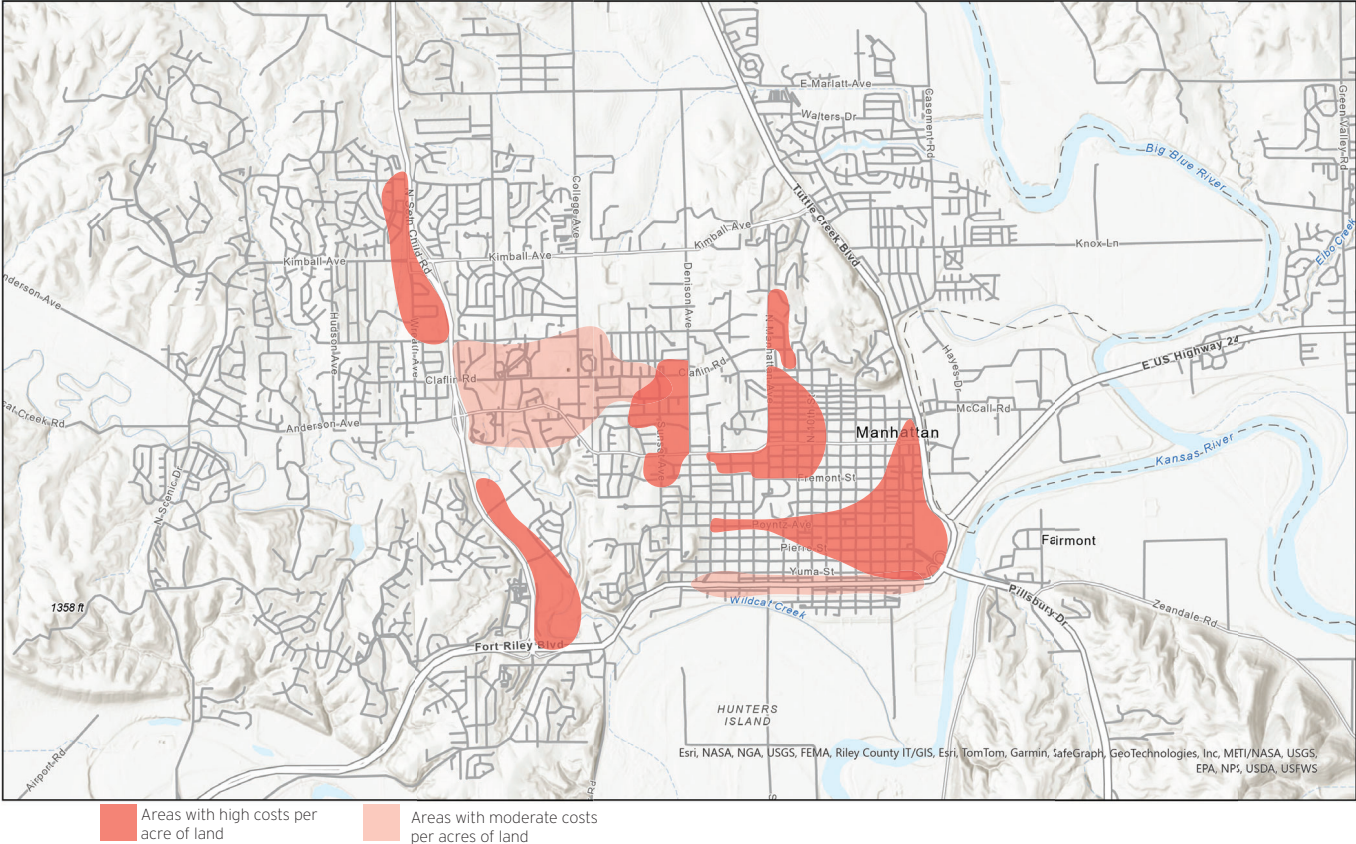
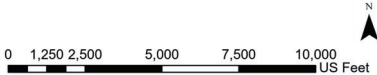


Figure 5.1 General analysis of high land cost areas in Manhattan



Affordable Housing and Floodplains

As one can see in the map to the right there is overlap with both affordable housing communities and high-end housing communities. It is important to note though that there is a larger and more consistent overlap between affordable housing and the floodplain areas. One can see that the majority of the large affordable community in the north-east corner of the map is within a large floodplain and there is a considerable amount of floodplain in the community directly to the south. However, to the west, it is possible to locate an affordable community that lies outside the floodplain.

The data presented in Figure 5.5 is derived from the Riley County GIS database. Using Figure 5.2 in which an analysis of where high cost housing and low cost housing is situated within Manhattan, a composite was made with the 100 year floodplain and 200 year floodplain. This data has been overlapped to draw conclusions about how floodplains and low cost housing interact.

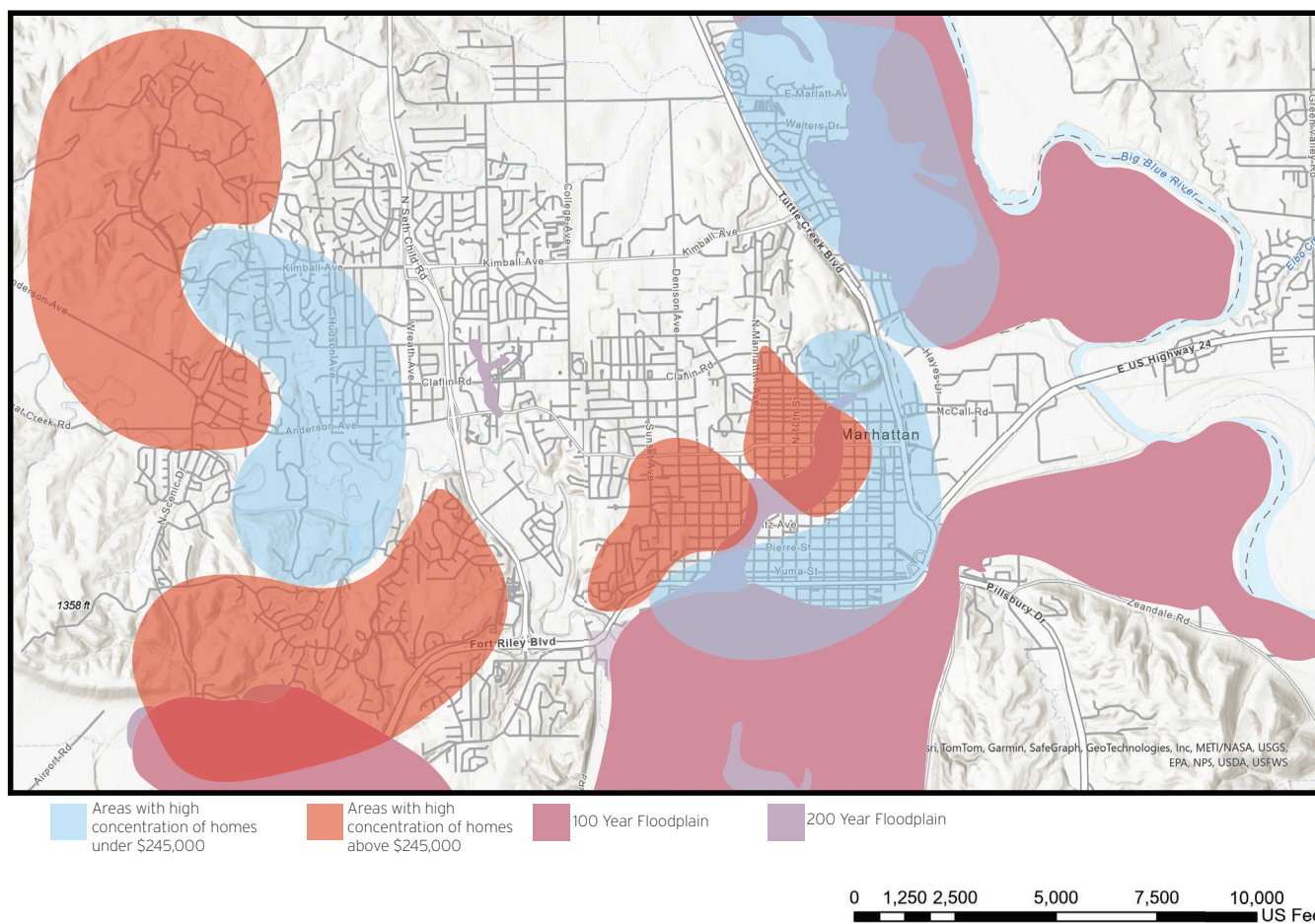


Figure 5.1 An exploration of the overlaps between affordable housing and existing floodplains

Site Infrastructure

As evidenced by the literature, site infrastructure additions can have a large effect on the overall cost of site development. It is easier to lower the costs of infrastructure placement when infrastructure is already in place nearby or exists on site. This makes infill development or development on rehabilitated sites attractive. In addition to picking sites with established infrastructure, designers can use housing clusters to reduce the overall amount of supporting infrastructure extensions.

Precedent Infrastructure

Limiting the extent or form of infrastructure has been demonstrated in multiple different ways in the case studies that have been presented. Some developments like the El Paso community or Rain Garden community used existing sites and renovated them for affordable housing, meaning much of the infrastructure was already in place in these locations. Other case studies like the Chandler Boulevard community or the Fort Peck houses focused on infill sites. These projects are located on sites surrounded by existing infrastructure, even when on-site utilities have not yet been developed. Overall, the case studies demonstrate that being closer to existing utilities is more optimal for reducing housing development costs.

Manhattan Infrastructure

Manhattan has a strong existing infrastructure system. There is some private infrastructure on the Kansas State University Campus depicted by large gaps in the center of the Manhattan infrastructure maps. There are dense patches of existing infrastructure in the southeast portion of the map along with the northeast community of Northview. Less dense infrastructure installations can be seen in the neighborhoods surrounding Seth Childs Road. Overall, it appears that Manhattan may be ideal for infill or redevelopment projects. As previously observed in the literature, even though rural land is less expensive to acquire for new development, the lower cost is offset by higher infrastructure installation costs.

The data presented in Figure 5.6 and 5.7 are derived from the Riley County GIS database.

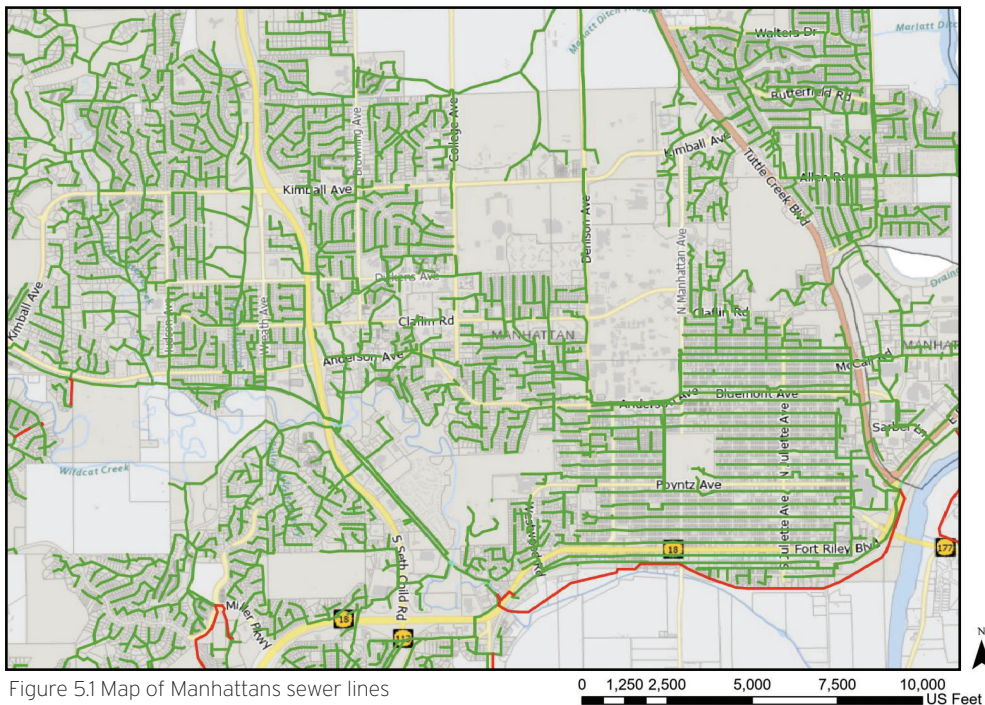


Figure 5.1 Map of Manhattans sewer lines

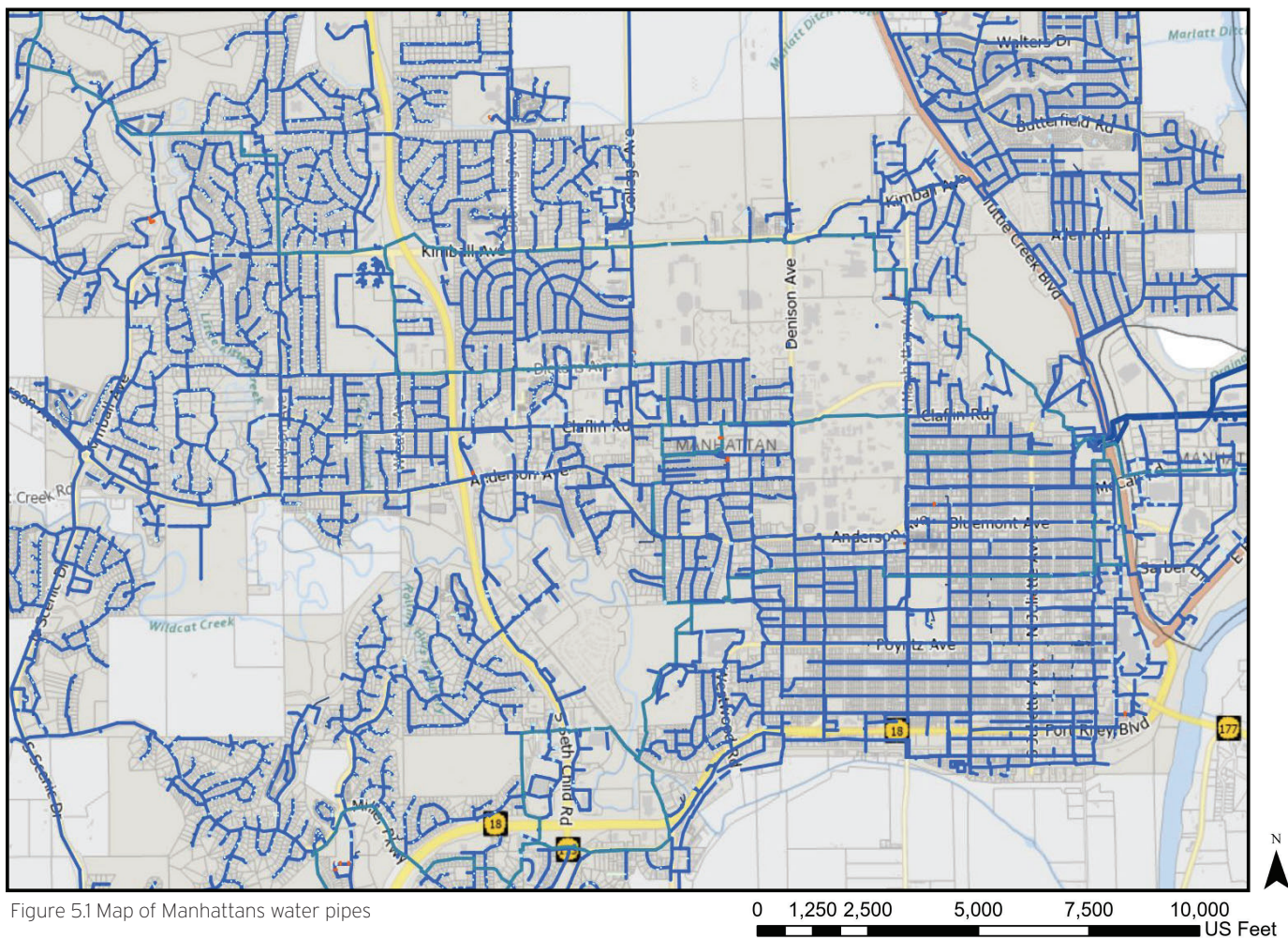


Figure 5.1 Map of Manhattans water pipes

Site Design Factors

As discussed in the literature, site design plays a large role in the overall cost of housing. Most site design influences are derived from the case studies and precedents laid out in the previous chapter. However, one thing that must be assessed during financial and housing data collection is the average costs of homes and the cost of contributing house components. The price of a home within this project will be determined heavily by the average cost per square foot of housing in Manhattan. It is important to acknowledge that there are many material and construction changes that can be made to a house to lower its cost per square foot. However, these changes are outside the scope of landscape architecture.

Housing Typologies

As previously stated in the index set in the Manhattan Housing Report, the target prices for housing are as listed below:

Extreme Low Income Home: \$61,000

Very Low Income Home: \$123,000

Low Income Home: \$164,000

Moderate Income Home: \$245,000

High Income Home: +\$500,000

These categories can be translated into home design types and estimates for the average cost per square foot. Approximate home sizes can be calculated by taking the targeted total house cost divided by the prototype cost per square foot figure. The house typologies themselves will be further directed by the case studies to come.

Zillow Market Analysis

As previously mentioned a market analysis was conducted using Zillow for both owned home’s for sale and rental homes. These market analysis snapshots where taken during one month and were analyzed for size and cost. For the rental units there was also an analysis of the bedrooms available in each unit. This Zillow data were used multiple times throughout the project and were essential to understanding local market conditions. Data from Zillow that were later analyzed can be seen in Figures 5.30 and 5.31.

	3995	3433	1.163705214	8	499.375
	3300	2000	1.65	6	550
	2750	2944	0.9341032609	6	458.3333333
	2495	3345	0.7458893871	7	356.4285714
	2300	3000	0.7666666667	4	575
	2295	3128	0.7336956522	6	382.5
	2250	1478	1.52232747	3	750
	2200	1850	1.189189189	3	733.3333333
	2195	2856	0.768557423	6	365.8333333
	2195	2000	1.0975	7	313.5714286
	2150	2076	1.035645472	3	716.6666667
	2000	3168	0.6313131313	5	400
	2000	1600	1.25	2	1000
	1992	2444	0.8150572831	6	332
	1950	2299	0.8481948673	6	325
	1900	3972	0.4783484391	5	380

Figure 5.1 Data for rental housing

749,000	3483.72093	215
725,000	3372.093023	215
650,000	3095.238095	210
611,144	2966.718447	206
610,000	3034.825871	201
529,900	2731.443299	194
525,000	2822.580645	186
493,000	2693.989071	183
469,900	2581.868132	182
450,000	2486.187845	181
445,000	2500	178
440,000	2514.285714	175
439,000	2567.251462	171
435,000	2573.964497	169
430,000	2590.361446	166
429,900	2621.341463	164
429,500	2651.234568	162

Figure 5.1 Data for housing for sale

Local Cost Per Square Foot

Cost per square foot is an essential number to understand when evaluating Manhattan's housing market. It is important to note that while there is an average cost per square foot this number can be subject to change based on many factors of design. Most relevant to this project is the fact that smaller houses typically have a larger cost per square foot. The heat map shown to the right summarizes data from the Manhattan market snapshot taken from Zillow in December of 2023. This data has been analyzed to show the relationship between the cost of housing and the cost per square foot of housing. Much of the housing falls right below 400,000 dollars and the highest diversity of housing cost per square foot falls between 200,000 and 300,000 dollars. The average cost per square foot is 138 dollars.

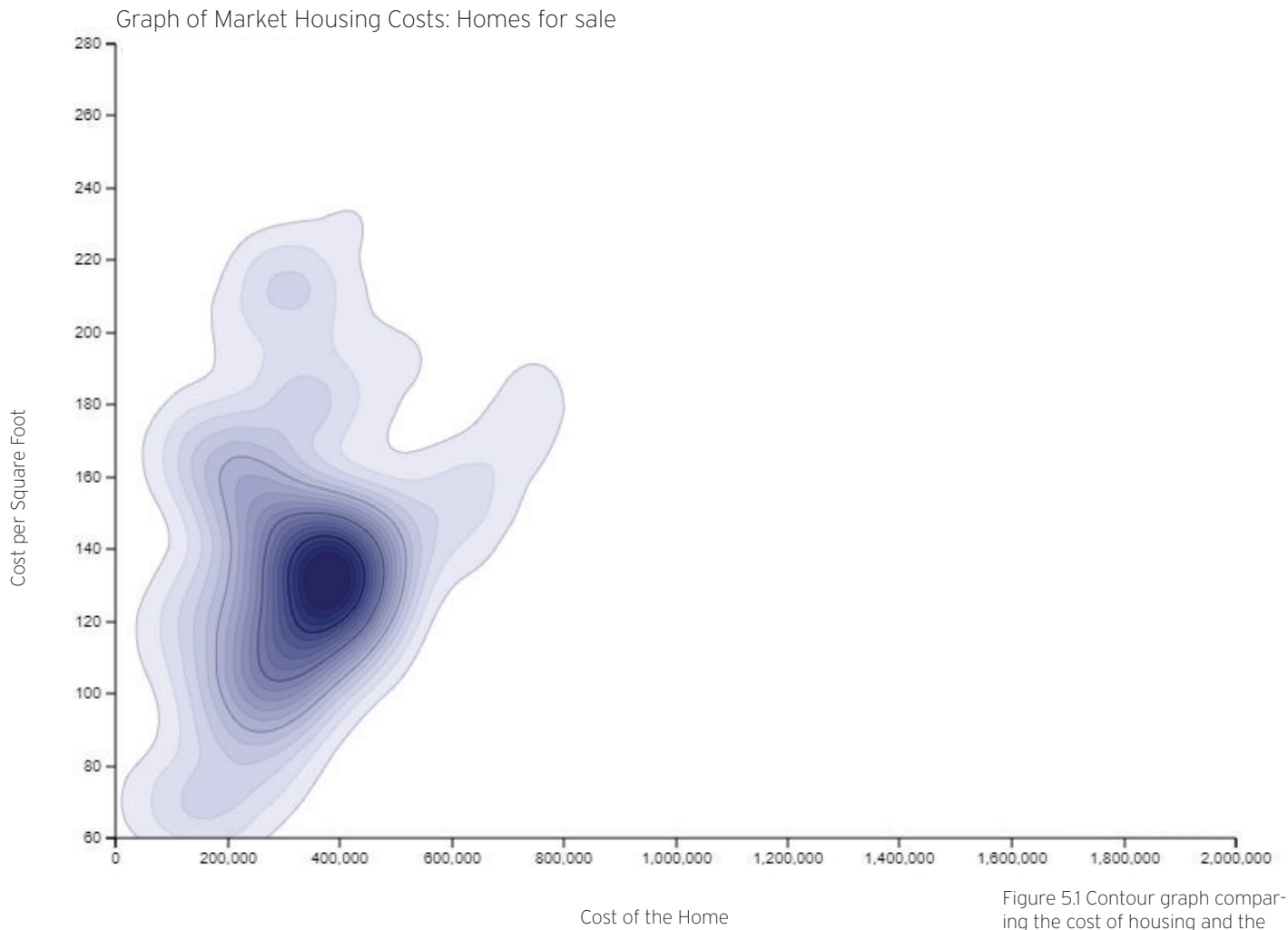


Figure 5.1 Contour graph comparing the cost of housing and the cost per square foot for housing in Manhattan, Kansas

Local Housing Size

The housing market shows that there is a very limited amount of available housing stock that falls within the “extreme low” to “moderate” income categories with the majority of housing falling within the “high” income category. Figure 5.12 represents data from the Manhattan market snapshot taken from Zillow in December of 2023. The data shows that most of the available housing supply is skewed towards higher income residents. However it is important to note that there is still a variety of housing sizes in almost all income categories.

Graph of Market Housing Costs: Homes for sale

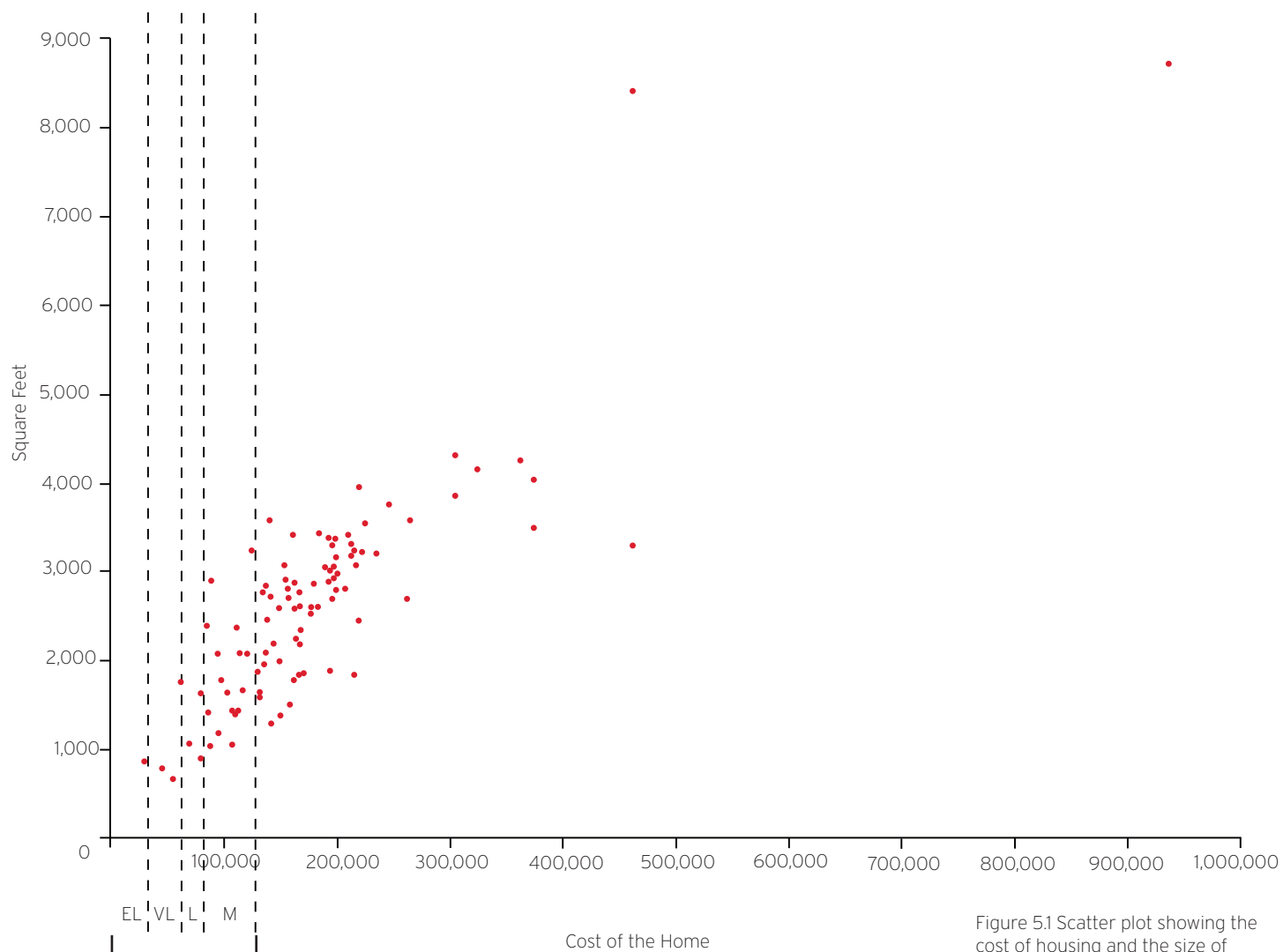


Figure 5.1 Scatter plot showing the cost of housing and the size of housing in Manhattan, Kansas

Local Rental Prices

The rental market is very different from the housing market within Manhattan. There is a more even distribution of rental units over the income categories. The majority of houses have 3 to 4 bedrooms with the average cost per bedroom being 475 dollars. The widest variety of cost per square foot is in rental units that cost just below 2,000 dollars a month. Figure 5.13 represents a heat map of the data from the Manhattan market snapshot for renting which was taken from Zillow and Apartments.com in February 2024. On average rental units cost one dollar per square foot.

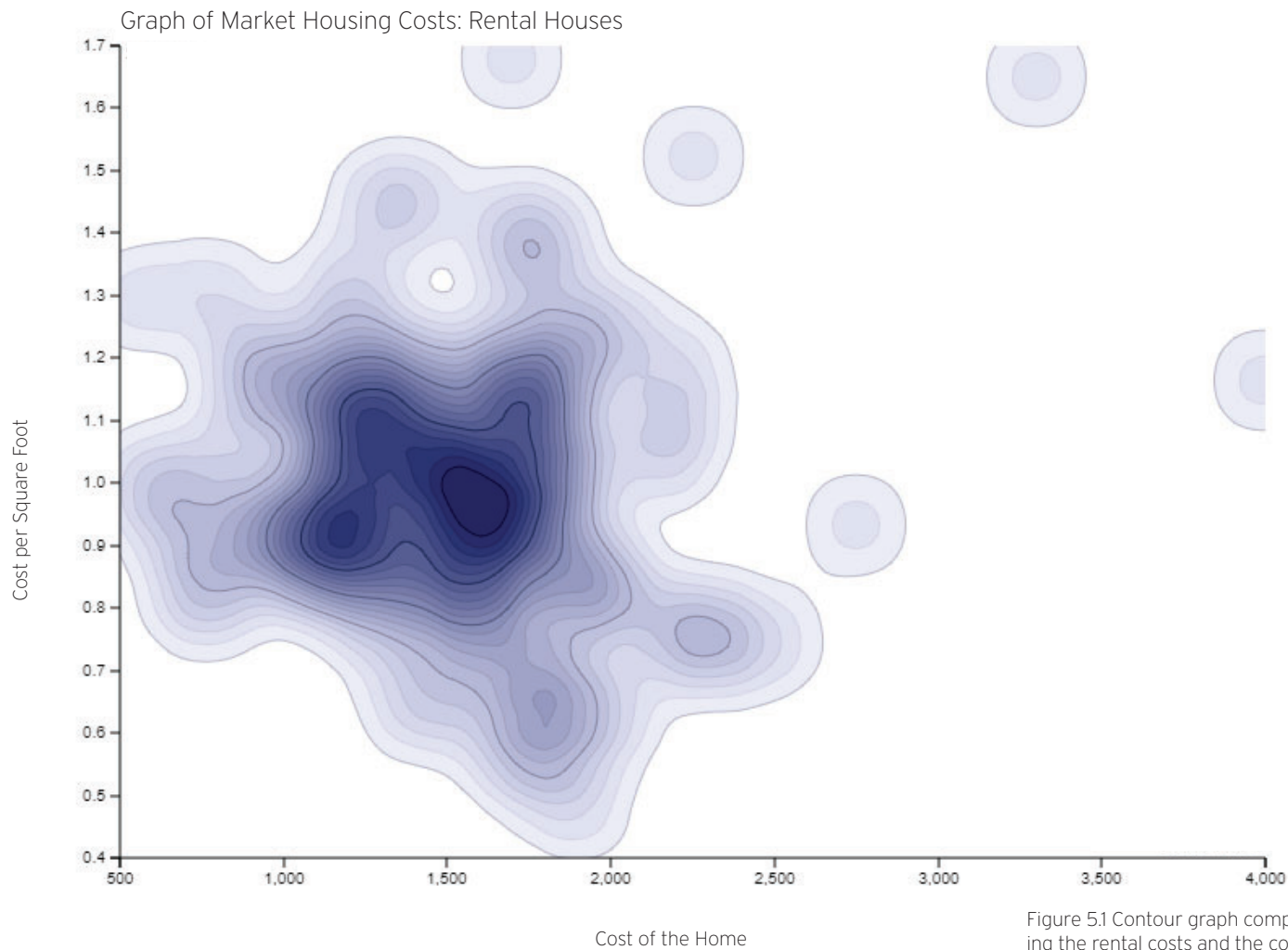


Figure 5.1 Contour graph comparing the rental costs and the cost per square foot for rental units in Manhattan, Kansas

Local Smaller Rental Houses

The current housing market shows that there are no rental houses available in the “extreme low” income category. The majority of the rental units fall within the “moderate” income category. Overall rental costs are directly correlated with the size of houses and there are more rental units in each income bracket minus the “extreme low” income categories. As a house gets larger, the rent increases. The data is from the Manhattan rental market snapshot for renting taken from Zillow and Apartments.com in February 2024. As expected, rental homes are more available for lower income residents and owned homes are generally financially out of reach.

Graph of Market Housing Costs: Rental Houses

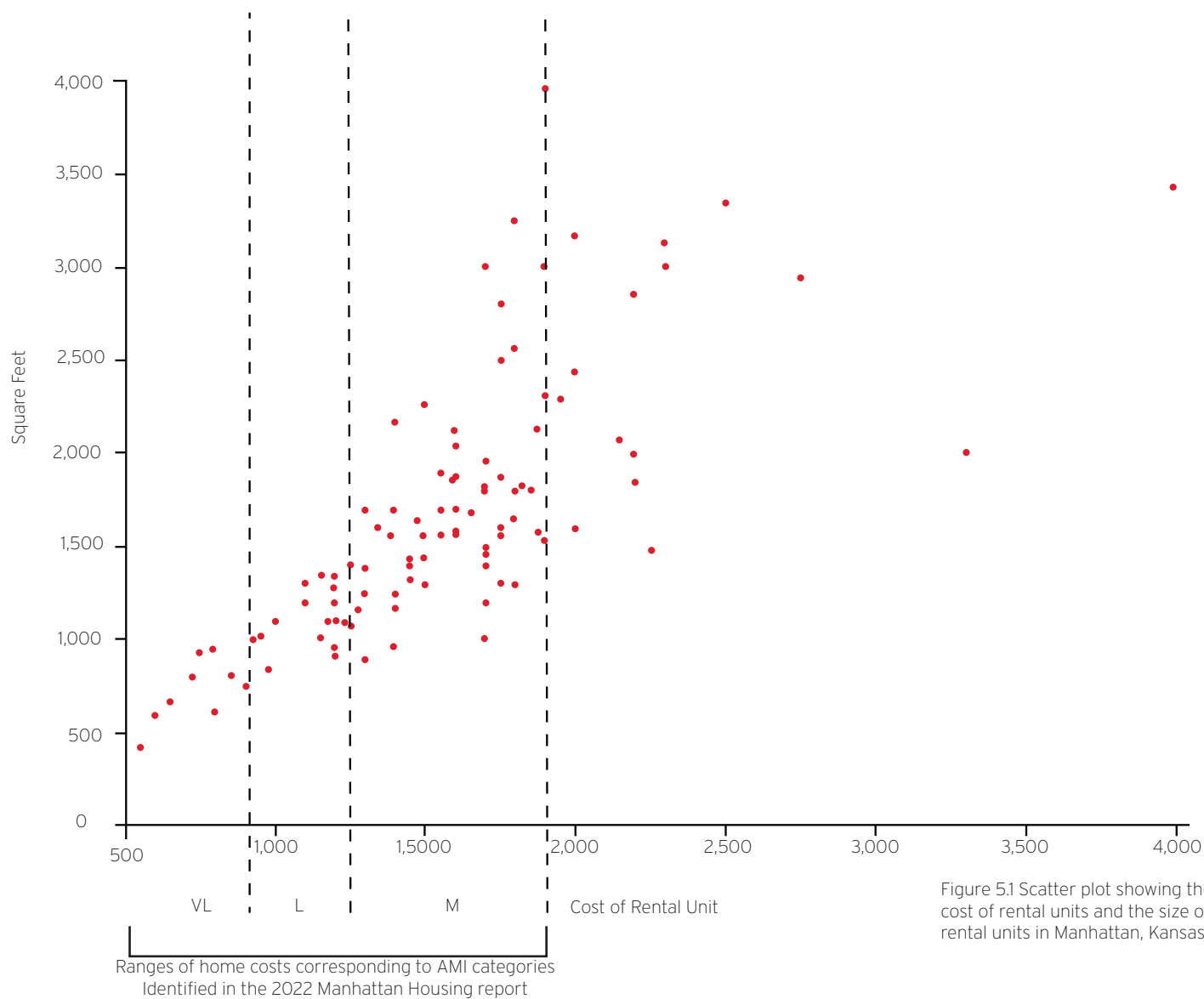


Figure 5.1 Scatter plot showing the cost of rental units and the size of rental units in Manhattan, Kansas

Housing Budgets

Up until this point the cost of housing was discussed in terms of what the City of Manhattan had deemed 'affordable' for each income bracket. The income categories have also been defined by the City of Manhattan as seen in Figure 5.15. However, there will be an assessment of what each income bracket can afford which differ from the original assessment of Manhattan. This difference between the city's original analysis of housing affordability and the updated estimates in this report show how difficult it is for low income individuals to become homeowners. The difference between the original numbers in the city's report and the numbers in this report reflect the inclusion of insurance and taxes within rental and ownership budgets. Supplemental housing costs were derived from census data which was put through an online take home income calculator (<https://smartasset.com/taxes/kansas-property-tax-calculator>) and city averages for utilities, property taxes and insurances.

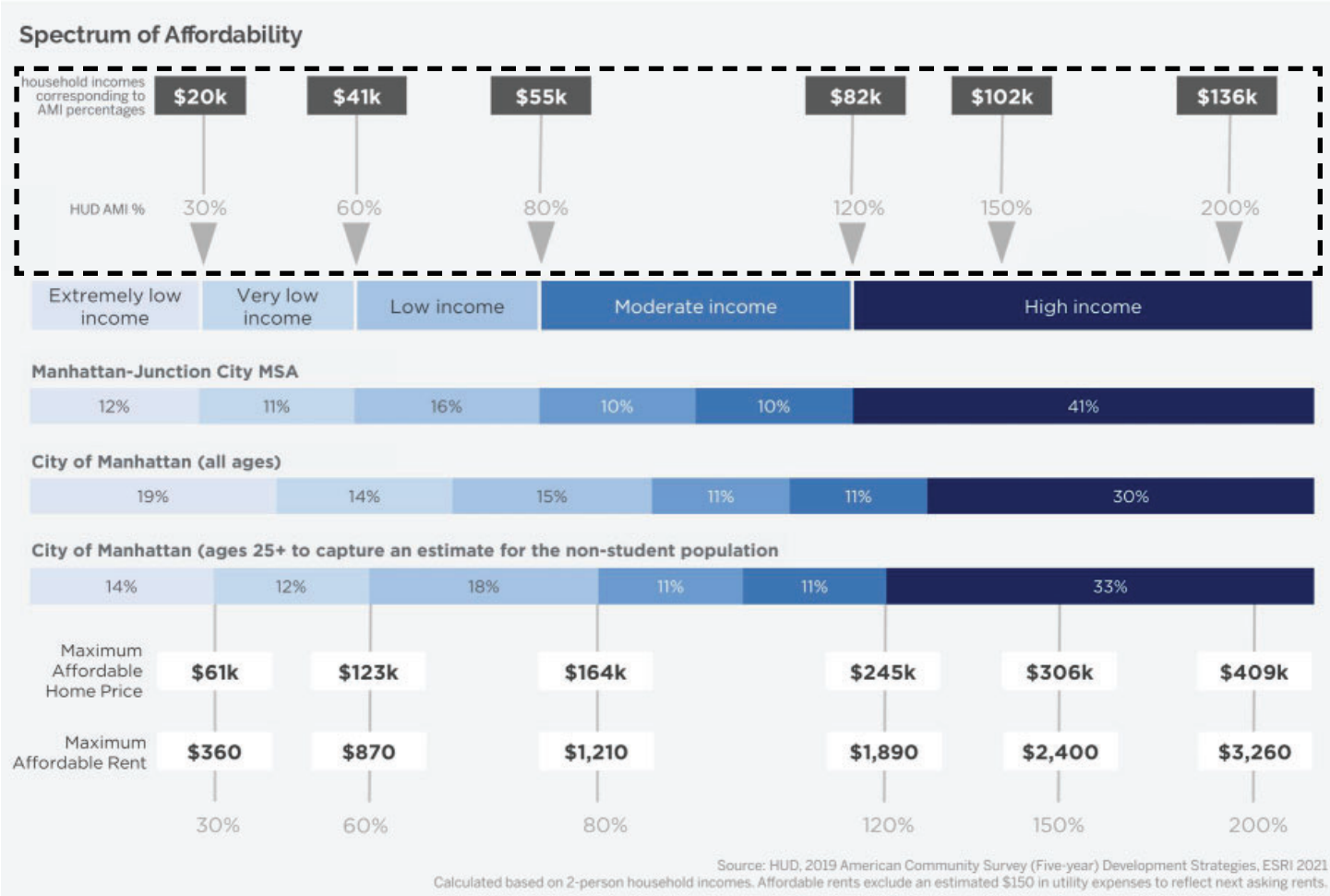


Figure 5.1 City housing analysis report, income distribution

Monthly Housing Budget

An individuals housing budget should not exceed 30% of their monthly income. To calculate an accurate monthly housing budget the yearly income pretax was divided by 12. Then there was a take home pay evaluation done with the help of the online Smartasset Kansas Income Calculator, Figure 5.39. Then this number, monthly income post tax was multiplied by 0.3 to get 30% of the monthly take home income.

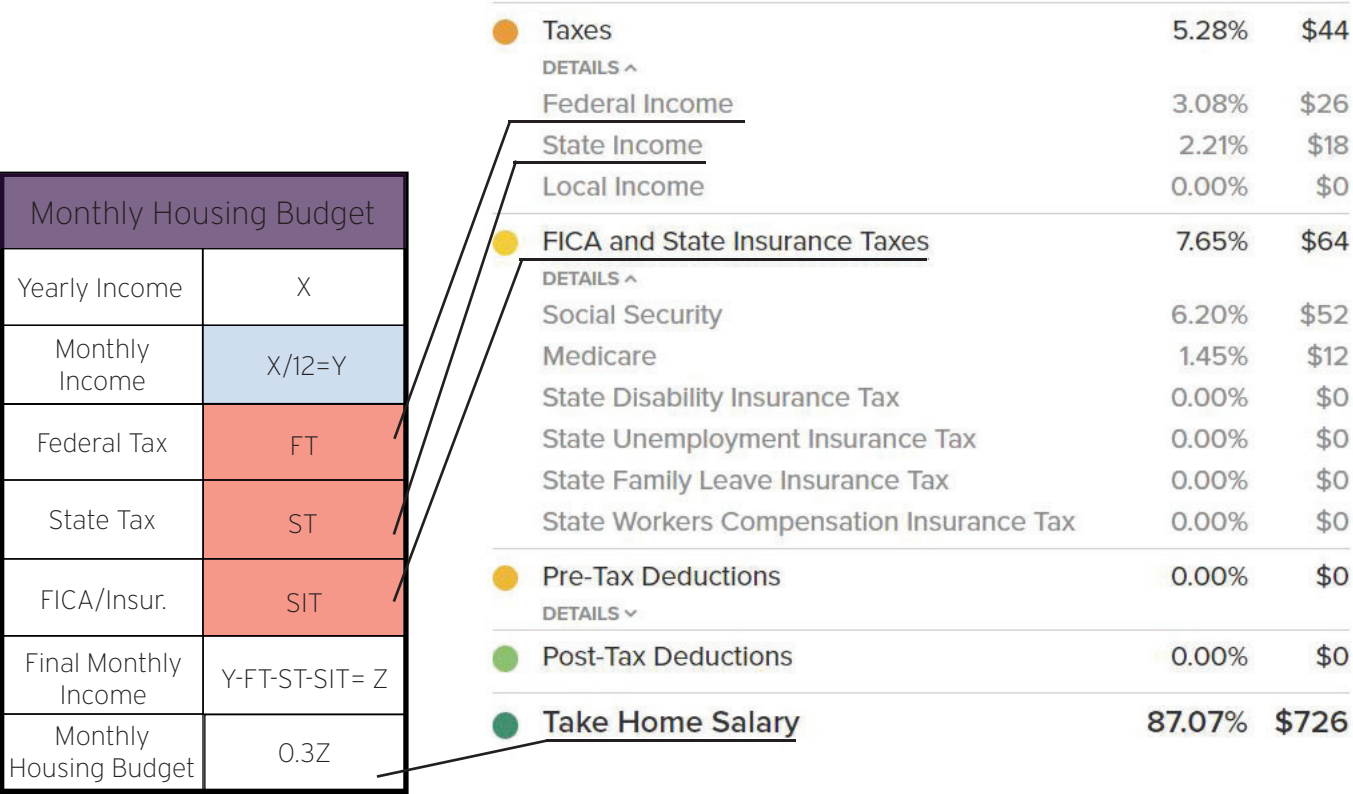


Table 5.1 Monthly housing budget calculations

Figure 5.1 Smartassest take home pay calculator (<https://smartasset.com/taxes/kansas-property-tax-calculator>)

Monthly Housing Budget: Rental

After finding the available monthly housing budget for each income level there was two additional numbers were derived. The monthly rental budget being one of those numbers. The adjusted monthly rental budget was found by taking the monthly housing budget and subtracting the average costs of utilities and renters insurance. These costs fall under housing costs so they should not be added on top of the 30% housing budget instead they should be subtracted. The final number shows how expensive of a rental unit each individual could afford without spending more than 30% of their monthly income post-tax on housing. It is important to note that rental insurance is also subject to change based on credit ratings which could make it more expensive for those who have had their credit affected by previous income instability. Renters insurance numbers and monthly utility numbers came from reported local averages (Barton, Charlie. 2024; Metz, Jason. 2024).

Monthly Rental Budget	
Monthly Housing Budget	Z
Utilities	U
Renters Insurance	RI
Adj. Monthly Rental Budget	$Z-U-RI$

Table 5.2 Monthly rental budget calculations

Monthly Housing Budget: Mortgage

The monthly mortgage budget was found by taking the monthly housing budget and subtracting the additional costs of homeownership including property tax and home insurance. Property tax is a sliding scale number based on the appraised value of a home. The online Smartasset tool was used to estimate the home insurance. The monthly mortgage was also transformed further to understand how large of a mortgage one could take out with the monthly rate that was affordable to each income categories. An online mortgage calculator was used to assist with these estimations.

Monthly Mortgage Budget	
Monthly Housing Budget	Z
Utilities	U
Property Tax	PT
Home Insurance	HI
Monthly Mortgage Budget	Z-U-PT-HI
Adj. Total Loan Qualification	Q

Table 5.3 Monthly mortgage budget calculations

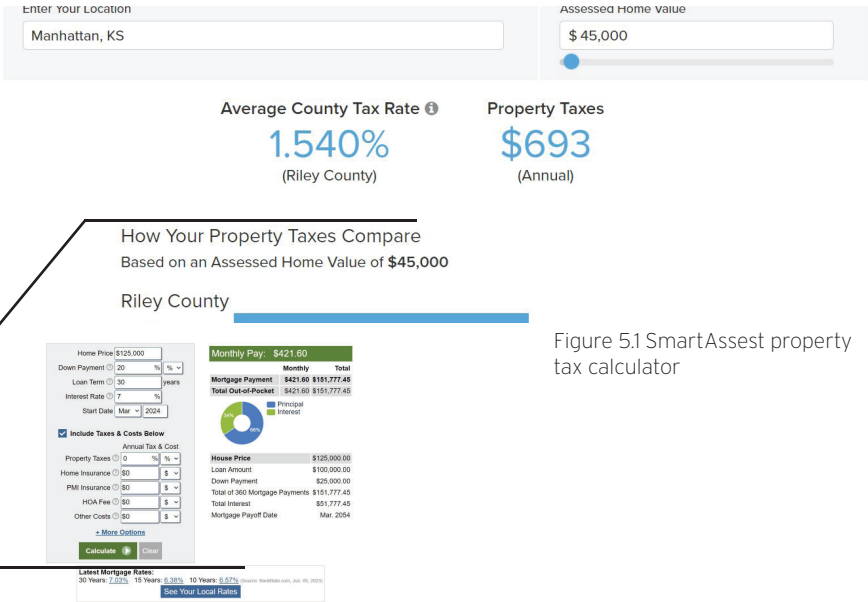


Figure 5.1 Mortgage Calculator snapshot

Figure 5.1 SmartAssest property tax calculator

Housing Monthly Budgets Estimates

Housing monthly budgets for both rent or loan payments have been based on the porition of ones monthly income that should be used towards housing. In the past few pages the methods have been laid out for how these monthly cost estimations have been made. It is important to find the most accurate monthly budget for each income category so that housing selections and site layouts to come are suitable.

Income Bracket Housing Budget Summary				
	Extreme Low Income	Very Low Income	Low Income	Moderate Income
Monthly Rental Budget	\$17	\$414	\$675	\$1,120
Monthly Mortgage Budget	-\$119	\$261	\$477	\$912

Table 5.4 Summary of all income brackets monthly rental and mortgage budgets

Housing Monthly Budget Estimates

Extreme Low Income

Extreme Low-Income individuals fall below 30% area median income which means within Manhattan their monthly take home pay after taxes is 1,451 dollars. All individuals within this tax category will qualify for housing assistance discussed earlier. The tables below show how much someone would be able to pay towards rent or mortgage each month, making it clear that designing housing for extremely low-income individuals is not possible without supplemental financial assistance.

Monthly Housing Budget	
Yearly Income	20,000
Monthly Income	1,677
Federal Tax	51
State Tax	37
FICA/Insur.	128
Final Monthly Income	1,451
Adj. Monthly Housing Budget	435

Table 5.5 Extreme low income housing budget calculations

Monthly Rental Budget	
Monthly Housing Budget	435
Utilities	268
Renters Insurance	150
Monthly Rental Budget	17

Table 5.6 Extreme low income rental budget calculations

Monthly Mortgage Budget	
Monthly Housing Budget	435
Utilities	268
Property Tax	40
Home Insurance	246
Monthly Mortgage Budget	-119

Table 5.7 Extreme low income mortgage budget calculations



Section 8 Assistance Needed



Home Ownership

Very Low Income

Very Low-Income individuals fall below 60% area median income which means within Manhattan their monthly take home pay after taxes is 2,774 dollars. All individuals within this tax category will qualify for housing assistance discussed earlier. The tables below show how much someone would be able to pay towards rent or mortgage each month, making it clear that designing housing for these very low-income individuals is not possible without supplemental section 8 financial assistance.

Monthly Housing Budget	
Yearly Income	41,000
Monthly Income	3,417
Federal Tax	253
State Tax	129
FICA/Insur.	261
Final Monthly Income	2,774
Monthly Housing Budget	832

Table 5.8 Very low income housing budget calculations

Monthly Rental Budget	
Monthly Housing Budget	832
Utilities	268
Renters Insurance	150
Monthly Rental Budget	414

Table 5.9 Very low income rental budget calculations

Monthly Mortgage Budget	
Monthly Housing Budget	832
Utilities	268
Property Tax	57
Home Insurance	246
Monthly Mortgage Budget	261
Total Loan Qualification	46,000

Table 5.10 Very low income mortgage budget calculations

☒ Section 8 Assistance Needed

☐ Home Ownership

Housing Monthly Budget Estimates

Low Income

Low-Income individuals fall below 80% area median income which means within Manhattan their monthly take home pay after taxes is 3,643 dollars. All individuals within this tax bracket will qualify for housing assistance discussed earlier. The tables below show how much someone would be able to pay towards rent or mortgage a month, making it clear that designing housing for these low-income individuals is not possible without supplemental Section 8 financial assistance.

Monthly Housing Budget	
Yearly Income	55,000
Monthly Income	4,583
Federal Tax	393
State Tax	196
FICA/Insur.	351
Final Monthly Income	3,643
Monthly Housing Budget	1,093

Table 5.11 Low income housing budget calculations

Monthly Rental Budget	
Monthly Housing Budget	1093
Utilities	268
Renters Insurance	150
Monthly Rental Budget	675

Table 5.12 Low income rental budget calculations

Monthly Mortgage Budget	
Monthly Housing Budget	1,093
Utilities	220
Property Tax	150
Home Insurance	246
Monthly Mortgage Budget	477
Total Loan Budget Qualification	75,000

Table 5.13 Low income mortgage budget calculations

 Section 8 Assistance Needed

 Home Ownership

Moderate Income

Moderate Income individuals fall below 120% area median income which means within Manhattan their monthly take home pay after taxes is 5,128 dollars. Individuals within this tax bracket do not qualify for housing assistance. The tables below show how much someone would be able to pay towards rent or mortgage each month. It is possible to rent the housing in Figure X.

Monthly Housing Budget	
Yearly Income	82,000
Monthly Income	6,833
Federal Tax	858
State Tax	324
FICA/Insur.	523
Final Monthly Income	5,128
Monthly Housing Budget	1,538

Table 5.14 Moderate income housing budget calculations

Monthly Rental Budget	
Monthly Housing Budget	1,538
Utilities	268
Renters Insurance	150
Monthly Rental Budget	1,120

Table 5.15 Moderate income rental budget calculations

Monthly Mortgage Budget	
Monthly Housing Budget	1,538
Utilities	220
Property Tax	160
Home Insurance	246
Monthly Mortgage Budget	912
Total Loan Budget Qualification	143,000

Table 5.16 Moderate income mortgage budget calculations

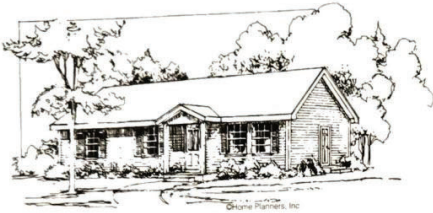
☒ Section 8 Assistance Needed

☒ Home Ownership

Housing Types

The housing design's that are used throughout this report were houses produced by architecture students through a previous studio project with Associate Professor Micheal Gibson at Kansas State University. These homes had their costs estimated through the RSMeans guidebook, Figure 5.19, a common tool used for development analysis. The cost for rental was determined by the rentals market assessed in the Manhattan market snapshot taken in February of 2024 as perviously explained in detail.

- Mass produced from stock plans
 - Single family – 1 full bath, 1 kitchen
 - No basement
 - Asphalt shingles on roof
 - Hot air heat
 - Gypsum wallboard interior finishes
 - Materials and workmanship are sufficient to meet codes
- Note: The illustration shown may contain some optional components (for example garages and/or fireplaces) whose costs are shown in the modifications, adjustments, & alternatives below or at the end of the square foot section.



Base cost per square foot of living area

Exterior Wall	Living Area									
	600	800	1000	1200	1400	1600	1800	2000	2400	3200
Wood Siding - Wood Frame	171.55	154.75	142.85	132.60	123.80	118.20	115.50	111.65	104.20	95.00
Brick Veneer - Wood Frame	182.15	164.25	151.45	140.35	130.90	124.85	121.90	117.60	109.70	103.90
Stucco on Wood Frame	162.30	146.50	135.35	125.85	117.70	112.45	110.00	106.45	99.45	90.90
Painted Concrete Block	164.15	148.10	136.85	127.15	118.90	113.65	111.10	107.45	100.40	93.30
Finished Basement, Add	40.70	38.70	37.30	36.00	34.90	34.25	33.85	33.30	32.50	31.90
Unfinished Basement, Add	15.75	14.20	13.05	12.05	11.20	10.70	10.40	10.00	9.35	8.45

Modifications

- Add to the total cost**
- Upgrade Kitchen Cabinets \$ + 1307
 - Solid Surface Countertops + 959
 - Full Bath - including plumbing, wall and floor finishes + 6437
 - Half Bath - including plumbing, wall and floor finishes + 3702
 - One Car Attached Garage + 17,501
 - One Car Detached Garage + 22,185
 - Fireplace & Chimney + 7767

Adjustments

- For multi-family - add to total cost**
- Additional Kitchen \$ + 6259
 - Additional Bath + 6437
 - Additional Entry & Exit + 2104
 - Separate Heating + 1690

Alternatives

- Add to or deduct from the cost per square foot of living area**
- Composition Roll Roofing - 1.25
 - Cedar Shake Roof + 6.15
 - Upgrade Walls and Ceilings to Skim Coat Plaster + .91
 - Upgrade Ceilings to Textured Finish + .66
 - Air Conditioning, in Heating Ductwork + 4.88
 - In Separate Ductwork + 7.40
 - Heating Systems, Hot Water + 1.68
 - Heat Pump + .71
 - Electric Heat - 3.25
 - Not Heated - 3.19

Additional upgrades or components

- Kitchen Cabinets & Countertops 94
- Bathroom Vanities 94
- Fireplaces & Chimneys 94
- Windows, Skylights & Dormers 94



		Cost Per Square Foot Of Living Area			% of Total (rounded)
		Mat.	Inst.	Total	
1	Site Work		2.40	2.40	1.9%
2	Foundation	7.87	8.59	16.46	13.1%
3	Framing	8.96	8.63	17.59	14.0%
4	Exterior Walls	15.53	8.12	23.65	18.8%
5	Roofing	2.59	2.83	5.42	4.3%
6	Interiors	12.74	13.75	26.49	21.0%
7	Specialties	3.70	1.17	4.87	3.9%
8	Mechanical	5.00	4.08	9.08	7.2%
9	Electrical	1.20	2.25	3.45	2.7%
10	Overhead				

Figure 5.1 RSMeans guidebook example photo



Figure 5.1 Perspective of housing type A

Housing Type A							
Building Price*	\$140,000		Stories	1 Story		Bathrooms	1.5 Bathrooms
Size	1033 Sqft		Bedrooms	3 Bedrooms		Garage	Detached

Table 5.17 Metrics for housing type A

*Estimated from RSMeans



Figure 5.1 Perspective of housing type B

Housing Type B							
Building Price*	\$233,224		Stories	1 Story		Bathrooms	2 Bathrooms
Size	1260 Sqft		Bedrooms	4 Bedrooms		Garage	Detached

Table 5.18 Metrics for housing type B

*Estimated from RSMeans



Figure 5.1 Perspective of housing type C

Housing Type C							
Building Price*	\$144,000		Stories	1 Story		Bathrooms	2 Bathrooms
Size	1224 Sqft		Bedrooms	3 Bedrooms		Garage	Carport

Table 5.19 Metrics for housing type C

*Estimated from RSMeans



Figure 5.1 Perspective of housing type D

Housing Type D (Duplex - 2Du)**							
Building Price*	\$69,135		Stories	2 Stories		Bathrooms	2.5 Bathrooms
Size	1257 Sqft		Bedrooms	3 Bedrooms		Garages	Parking Lot

Table 5.20 Metrics for housing type D

*Estimated from RSMeans

**Metrics per dwelling units

Residential Layout Modules

The residential layout modules presented below are building blocks for more efficient site design. They all have different outcomes when they are used and each situation should be evaluated individually before implementing any of the modules presented below. The majority of the modules will increase density. In addition to increasing density some modules can add to the feeling of community a site can have or decreasing the use of utilities by careful housing placement. All modules have strengths and weaknesses that should be considered in an larger overall design.

Courtyard Clusters

The 'Courtyard' module is a housing formation that more efficiently uses front yard space by having the front yards all face a larger shared space. All garages are backloaded or there is shared parking on site. This module is based on the precedents, Cottages on Greene and the El Paisano Green Community.

Metrics	
Size of Site	2.8 Acres
Impervious Surface	40%
Housing Units	14 Units
Density	6 DU/Ac

Table 5.21 Metrics for the Courtyard Cluster Prototype with a wide courtyard



Figure 5.1 Perspective of a wide courtyard between houses

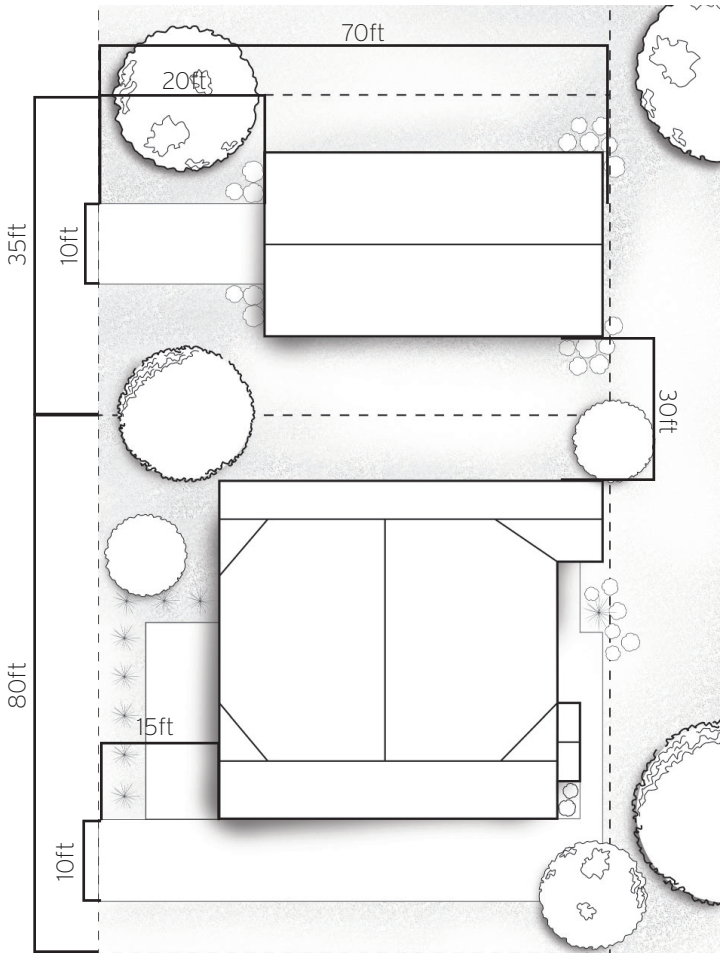


Figure 5.1 Plan view of lots with dimensions

Cluster - 100' wide Courtyard



Figure 5.1 Illustrative plan view of courtyard cluster with a wide courtyard

Metrics	
Size of Site	2.2 Acres
Impervious Surface	60%
Housing Units	11 Units
Density	5 DU/Ac

Table 5.22 Metrics for the Courtyard Cluster with a medium wide courtyard between houses



Figure 5.1 Perspective of a medium wide courtyard between houses

Cluster - 71' wide Courtyard



Figure 5.1 Illustrative plan view of a courtyard cluster with a medium wide courtyard

Courtyard Clusters: Housing Type A



Figure 5.1 Illustrative plan of housing type A within a courtyard cluster formation

Metrics	
Size of Site	2 Acres
Impervious Surface	45%
Housing Units	10 Units
Density	5 DU/Ac
Housing sqft	1033 sqft

Table 5.23 Metrics for housing type A courtyard cluster development

Courtyard Clusters: Housing Type B



Figure 5.1 Illustrative plan view of housing type B within a courtyard cluster formation

Metrics	
Size of Site	2 Acres
Impervious Surface	45%
Housing Units	4 Units
Density	2 DU/Ac
Housing sqft	4 Units

Table 5.24 Metrics for housing type B courtyard cluster development

Courtyard Clusters: Housing Type C



Figure 5.1 Illustrative plan of housing type C within a courtyard cluster formation

Metrics	
Size of Site	2 Acres
Impervious Surface	42%
Housing Units	12 Units
Density	6 DU/Ac
Housing sqft	1224 sqft

Table 5.25 Metrics for housing type C courtyard cluster development

Courtyard Clusters: Housing Type D



Figure 5.1 Illustrative plan view of housing type D within a courtyard cluster formation

Metrics	
Size of Site	2 Acres
Impervious Surface	55%
Housing Units	30 Units
Density	15 DU/Ac
Housing sqft	1257 sqft

Table 5.26 Metrics for housing type D courtyard cluster development

Eyebrow Layouts

Eyebrow communities traditionally extend off of a collector street in areas in which topography or vegetation allow for small clusters of developments. They are most often used in cluster developments within traditional development patterns. Eyebrow layouts reduce utilities because they are placed close to the main roads where utilities are typically routed. Each eyebrow layout is unique because the purpose is to fill a portion of the larger site that cannot be filled with any other layout. That being said it is hard to compare eyebrow layouts like the project compares other layouts. For the purposes of this section there will be an example of each housing type in a different style of eyebrow layout.



Figure 5.1 Illustrative plan view of housing type A in an eyebrow layout



Figure 5.1 Illustrative plan view of housing type C in an eyebrow layout



Figure 5.1 Illustrative plan view of housing type D in an Eyebrow layout



Figure 5.1 Illustrative plan view of housing type B in an eyebrow development

Eyebrow Layout: Housing Type A



Figure 5.1 An enlarged illustrative plan view of housing type A in an eyebrow layout

Metrics	
Size of Site	3.5 Acres
Impervious Surface	31%
Housing Units	9 Units
Density	2.5 DU/Ac
Housing sqft	1033 sqft

Table 5.27 Metrics for housing type A's eyebrow layout



Figure 5.1 Perspective view of housing A in an eyebrow layout

Eyebrow Layout: Housing Type B



Figure 5.1 An enlarged illustrative plan view of housing type B in an eyebrow layout



Figure 5.1 Perspective one of housing B in an eyebrow layout

Metrics	
Size of Site	2.88 Acres
Impervious Surface	29%
Housing Units	10 Units
Density	3.4 DU/Ac
Housing sqft	1260 sqft

Table 5.28 Metrics for housing type B's eyebrow layout



Figure 5.1 Perspective two of housing B in an eyebrow layout

Eyebrow Layout: Housing Type C



Figure 5.1 An enlarged illustrative plan view of housing type C in an eyebrow layout

Metrics	
Size of Site	1.6 Acres
Impervious Surface	24%
Housing Units	6 Units
Density	3.75 DU/Ac
Housing sqft	1224 sqft

Table 5.29 Metrics for housing type C's eyebrow layout



Figure 5.1 Perspective of housing C in an eyebrow layout

Eyebrow Layout: Housing Type D



Figure 5.1 An enlarged illustrative plan view of housing type D in an eyebrow layout

Metrics	
Size of Site	1.8 Acres
Impervious Surface	53%
Housing Units	24 Units
Density	13.3 DU/Ac
Housing sqft	1257 sqft

Table 5.30 Metrics for housing type D's eyebrow layout



Figure 5.1 Perspective of housing D in an eyebrow layout

Zero-Lot Line Configurations

The ‘Zero-Lot Lines’ approach to housing layouts is where each house is shifted to align with the property line to combine two narrow side yards on either side of a home into a single larger side yard on one side. Separation privacy is sometimes enhanced through coordinated architecture between adjacent homes. This approach is very traditional in the sense that all houses line a single collector street with most of them having garages that face towards the street.

Metrics	
Size of Site	4.4 Acres
Impervious Surface	49%
Housing Units	24 Units
Density	5.4 DU/Ac

Table 5.31 Metrics for the zero lot lines prototype with rear detached garages



Figure 5.1 Perspective of zero lot line housing community with rear detached garages

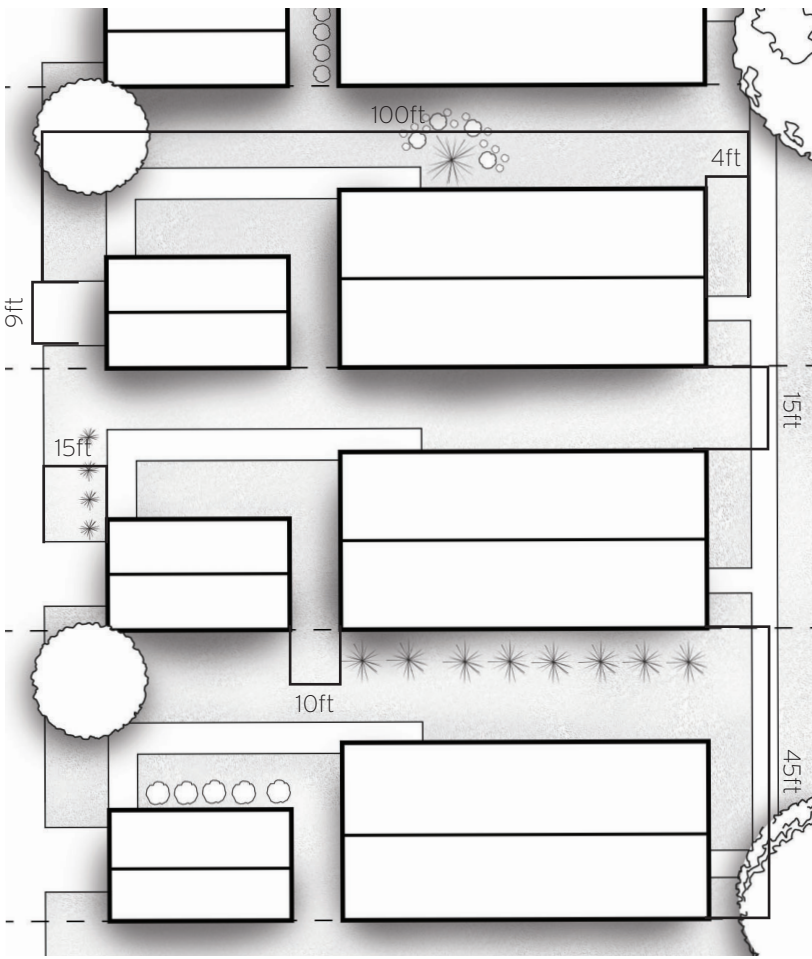


Figure 5.1 Plan view of lots with rear detached garages with dimensions

NTS

Zero-Lot Line Prototype: Housing Type A (Detached Garages)



Figure 5.1 Illustrative plan view of the zero lot lines prototype with rear detached garages

Metrics	
Size of Site	4.6 Acres
Impervious Surface	37%
Housing Units	32 Units
Density	6.9 DU/Ac

Table 5.32 Metrics for the zero lot lines prototype with front detached garages



Figure 5.1 Perspective of zero lot line housing community with front detached garages

Housing Type A: Front Attached Garage Variation



Figure 5.1 Illustrative plan view of zero lot lines prototype with front detached garages

NTS

Zero-Lot Line Prototype: Housing Type A (Mixed Garage Types)



Figure 5.1 Illustrative plan view of both zero lot lines prototype

Zero Lot Lines: Housing Type A



Figure 5.1 Illustrative plan of housing type A with zero lot lines NTS

Metrics	
Size of Site	2 Acres
Impervious Surface	37%
Housing Units	10 Units
Density	5 DU/Ac
Housing sqft	1033 sqft

Table 5.33 Metrics for housing type A with zero lot lines

Zero Lot Lines: Housing Type B



Figure 5.1 Illustrative plan of housing type B with zero lot lines NTS

Metrics	
Size of Site	2 Acres
Impervious Surface	43%
Housing Units	12 Units
Density	6 DU/Ac
Housing sqft	1260 sqft

Table 5.34 Metrics for housing type B with zero lot lines

Zero Lot Lines: Housing Type C

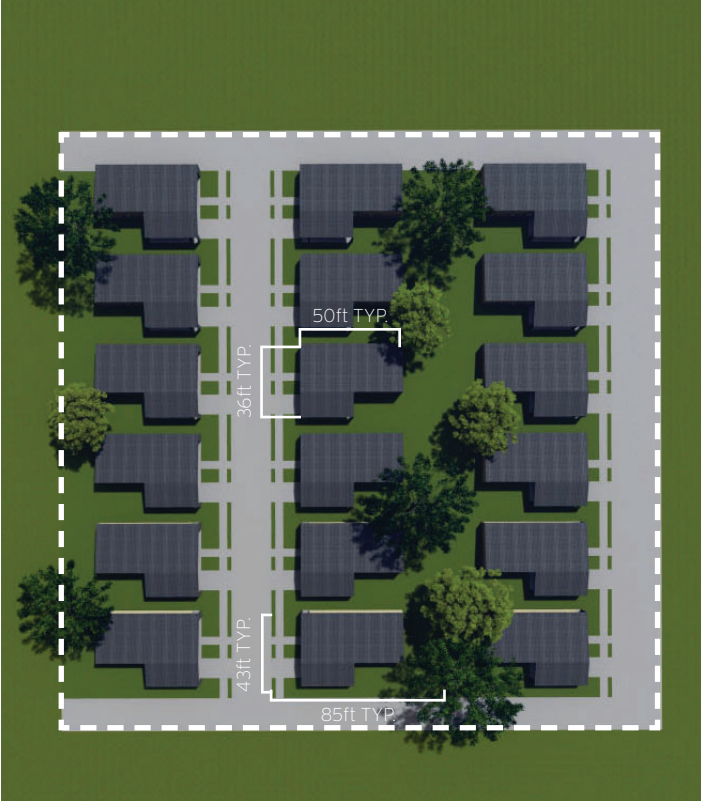


Figure 5.1 Illustrative plan of housing type C with zero lot lines

Metrics	
Size of Site	2 Acres
Impervious Surface	39%
Housing Units	18 Units
Density	9 DU/Ac
Housing sqft	1224 sqft

Table 5.35 Metrics for housing type C with zero lot lines

Zero Lot Lines: Housing Type D



Figure 5.1 Illustrative plan of housing type D with zero lot lines

Metrics	
Size of Site	2 Acres
Impervious Surface	26%
Housing Units	48 Units
Density	24 DU/Ac
Housing sqft	1257 sqft

Table 5.36 Metrics for housing type D with zero lot lines

Z-Lot Configurations

The Z-lot house layout is a variation of the zero-lot line style. The difference is there is a shift in the property line towards the middle of each lot. Using the Z-Lot approach allows for more windows on the sides of houses. There is more room between houses that allows opportunities to increase privacy. Z-Lots do not work with a townhouse model due to the fact that townhouses are often attached. The Z-lots focus on a separation between houses as opposed to Zero lot lines which can accommodate townhomes.

Z-Lot: Housing Type A



Figure 5.1 Illustrative plan view of housing type A in a Z-lot configuration

NTS

Z-Lot: Housing Type B



Figure 5.1 Illustrative plan view of housing type B in a Z-lot configuration

NTS

Z-Lot: Housing Type C



Figure 5.1 Illustrative plan view of of housing type C in a Z-lot configuration

NTS

Z-Lot: Housing Type A



Figure 5.1 An enlarged illustrative plan view of housing type A in a Z-Lot configuration

NTS

Metrics	
Size of Site	2 Acres
Impervious Surface	51%
Housing Units	24 Units
Density	12 DU/Ac
Housing sqft	1033 sqft

Table 5.37 Metrics for housing type A's Z-Lot configuration



Figure 5.1 Perspective of housing A in a Z-Lot configuration

Z-Lot: Housing Type B



Figure 5.1 An enlarged illustrative plan view of housing type B in a Z-Lot configuration

NTS

Metrics	
Size of Site	2 Acres
Impervious Surface	56%
Housing Units	18 Units
Density	9 DU/Ac
Housing sqft	1260 sqft

Table 5.38 Metrics for housing type B's Z-Lot configuration



Figure 5.1 Perspective of housing B in a Z-Lot configuration

Z-Lot: Housing Type C



Figure 5.1 An enlarged illustrative plan view of housing type B in a Z-Lot configuration NTS

Metrics	
Size of Site	2 Acres
Impervious Surface	49%
Housing Units	18 Units
Density	9 DU/Ac
Housing sqft	1224 sqft

Table 5.39 Metrics for housing type B's Z-Lot configuration



Figure 5.1 Perspective of housing B in a Z-Lot configuration

Modular Conclusion Table

Assumptions

Site Improvement Cost/Ac: \$132,405 (Neighborhood comparable, Appendix C)

Income Categories	Loan Qualf.
Very Low Income	\$46,000
Low Income	\$75,000
Moderate Income	\$143,000

Housing Layout Modules							
Module Type	Module Size (Ac)	Dwelling Units (Du)	Density (Du/Ac)	Housing Type	Bldg Cost	Site improvement cost/Du*	Total Cost To Finance
Courtyard Clusters	2	10	5	Type A (w/ Detached Garage**)	\$160,000	\$26,481	\$186,481
	2	8	4	Type B (w/ Detached Garage**)	\$253,224	\$33,101	\$286,325
	2	12	6	Type C (w/ Carport)	\$144,000	\$22,068	\$166,068
	2	30	15	Type D (No Garage)	\$69,135	\$8,827	\$77,962
Eyebrow Layout	3.5	9	2.6	Type A (w/ Attached Garage**)	\$160,000	\$51,491	\$211,491
	2.9	10	3.4	Type B (w/ Detached Garage**)	\$253,224	\$38,397	\$291,621
	1.6	6	3.8	Type C (w/ Carport)	\$144,000	\$35,308	\$179,308
	1.8	24	13.3	Type D (No Garage)	\$69,135	\$9,930	\$79,065

Table 5.40 Modular conclusion table 1

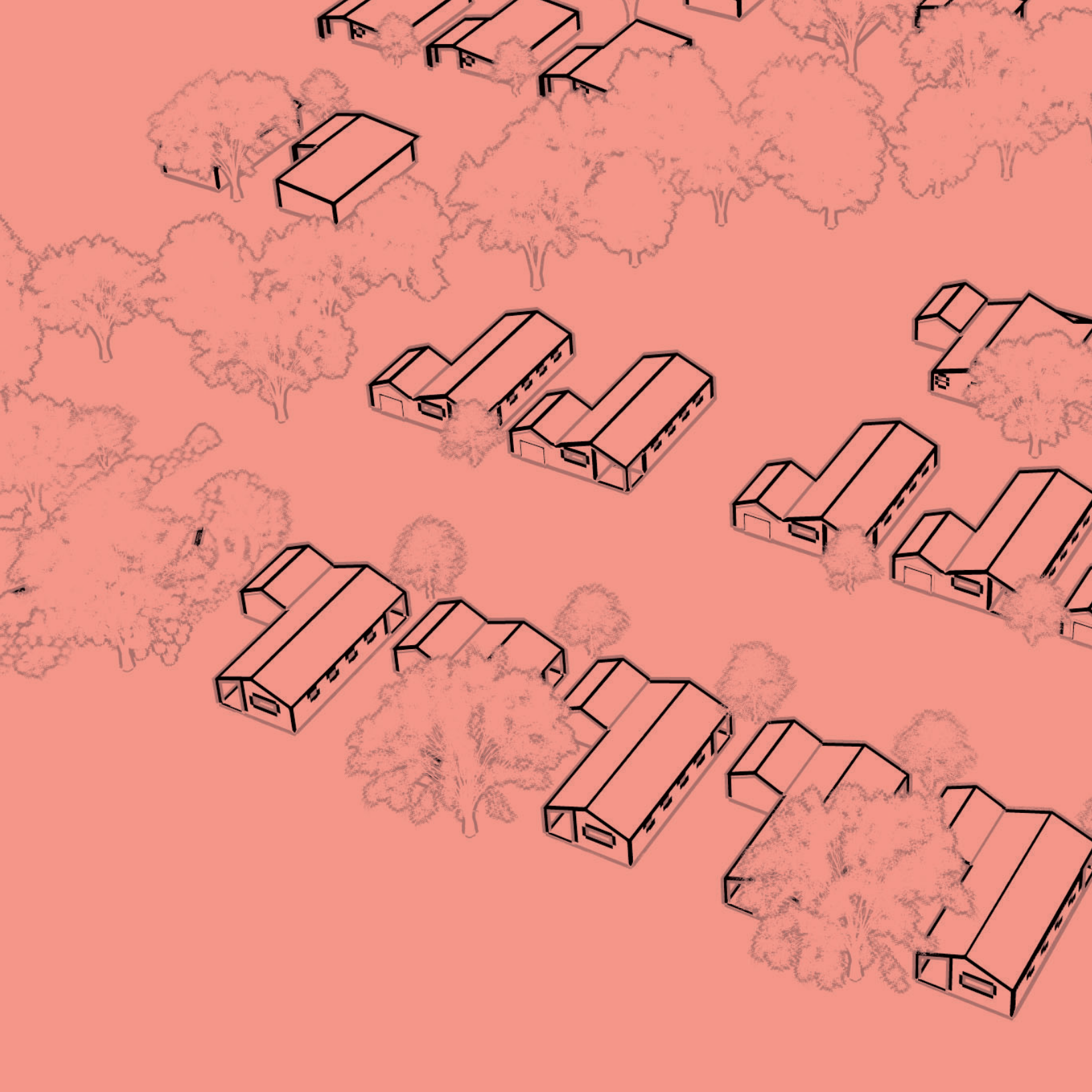
Housing Layout Modules Cont.

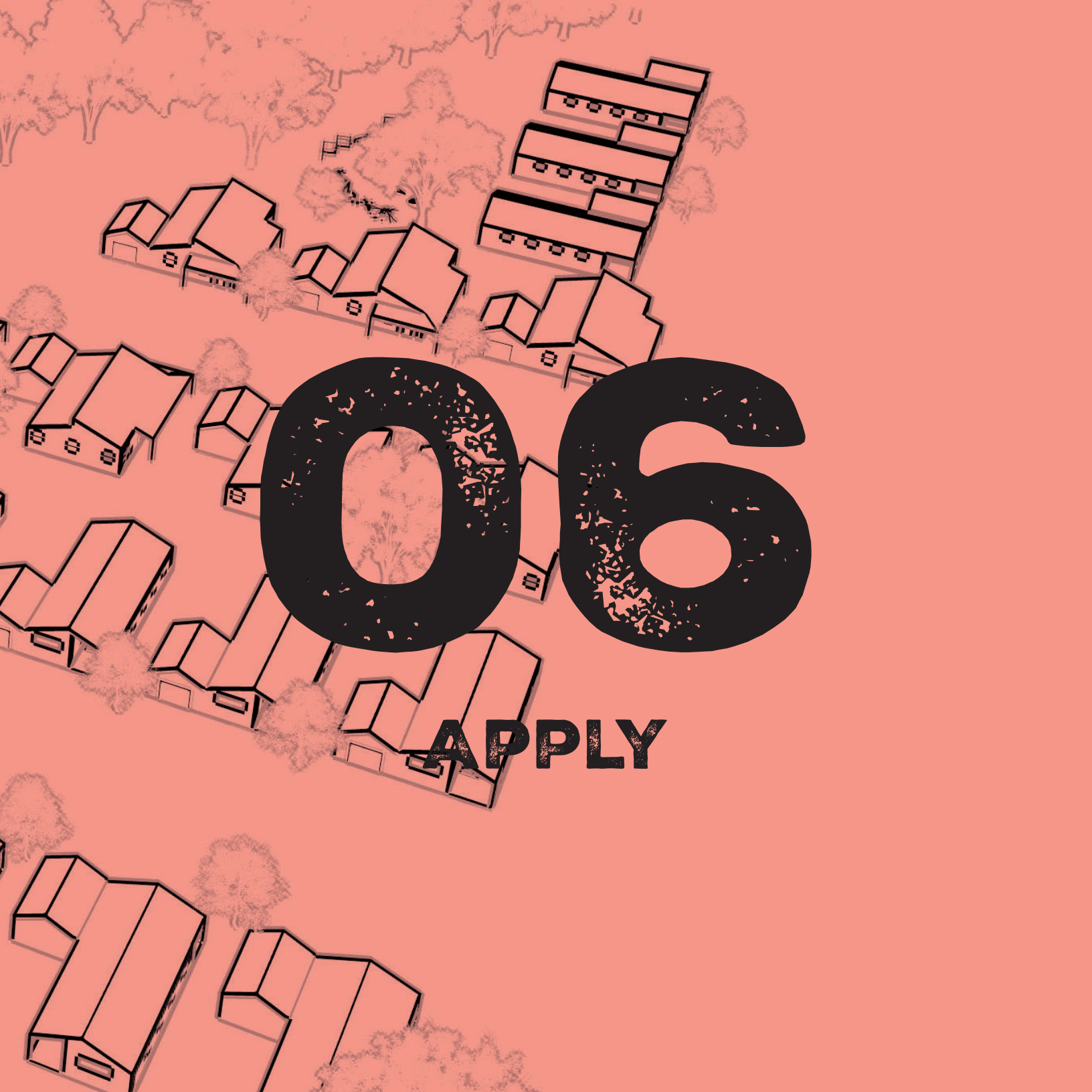
Module Type	Module Size (Ac)	Dwelling Units (Du)	Density (Du/Ac)	Housing Type	Bldg Cost	Site improvement cost/Du*	Total Cost To Finance
Zero Lot Lines	2	10	5	Type A (w/ Attached Garage**)	\$160,000	\$26,481	\$186,481
	2	12	6	Type B (w/ Detached Garage**)	\$253,224	\$22,068	\$275,292
	2	18	9	Type C (w/ Carport)	\$144,000	\$14,712	\$158,712
	2	48	24	Type D (No Garage)	\$69,135	\$5,517	\$74,652
Z-Lots	2	24	12	Type A (No Garage)	\$140,000	\$11,034	\$151,034
	2	18	9	Type B (No Garage)	\$233,224	\$14,712	\$247,936
	2	18	9	Type C (w/ Carport)	\$144,000	\$14,712	\$158,712

Table 5.41 Modular conclusion table 2

*Site Improvement Cost/DU = Site Improvement Cost/Ac x Acres / DUs

**Adding garages to housing types A and B adds \$20,000 to the total build cost



An aerial, isometric illustration of a suburban neighborhood. The houses are drawn with black outlines and are scattered across the frame. Some houses have small, stylized trees in front of them. The background is a solid light pink color. The overall style is clean and modern.

06

APPLY

Site Design

Efficient site design is important for creating affordable housing which has been shown through the literature review, case studies, and precedents reviewed in the earlier chapters of this report. In this chapter there will be an exploration of site design on two different local sites. For each site, selection rationale is provided along with an analysis of existing nearby infrastructure supporting site development. Site designs based on the existing developments in Manhattan and the Manhattan city code are then presented. Finally, three different site alternatives are presented. This exploration is essential for demonstrating that the tools discussed in the Analyze chapter are applicable to Manhattan. Figure 6.1 shows a detailed map of how the site design was approached.

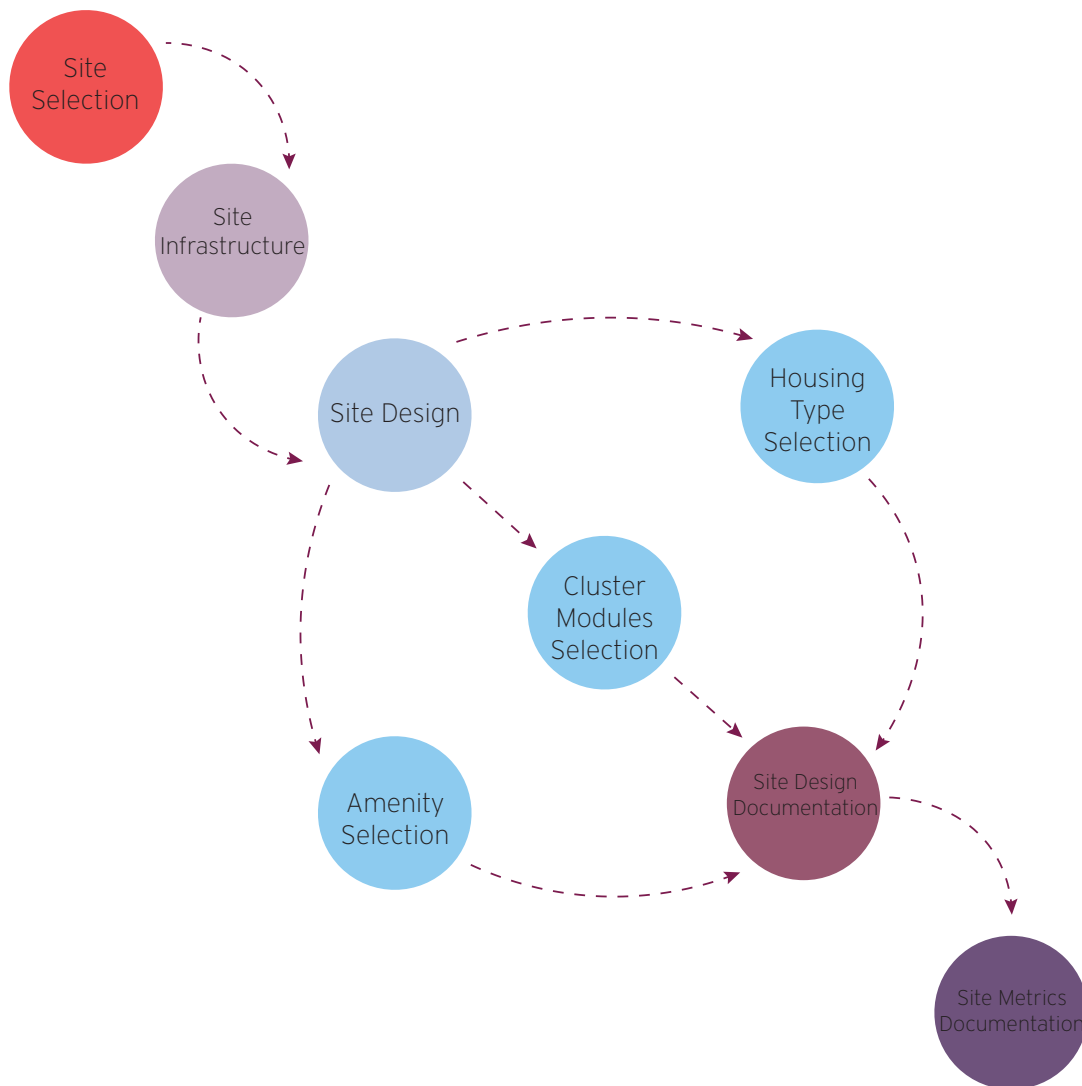


Figure 6.1 Site design sequence

Site One

Site One Selection

This site was selected due to its location within a traditionally affordable neighborhood in east Manhattan in addition to being an infill project. Infill projects as discussed in the literature, case studies, and precedents can help reduce the cost of development due to utilizing existing surrounding infrastructure as seen in Figure X. The site is flat with a narrow, linear configuration. It will require minimal earthwork which will also help reduce the cost of development. The site resides within a 200-year floodplain and will require additional flood insurance for homeowners in addition to some site design interventions to reduce flooding potential.

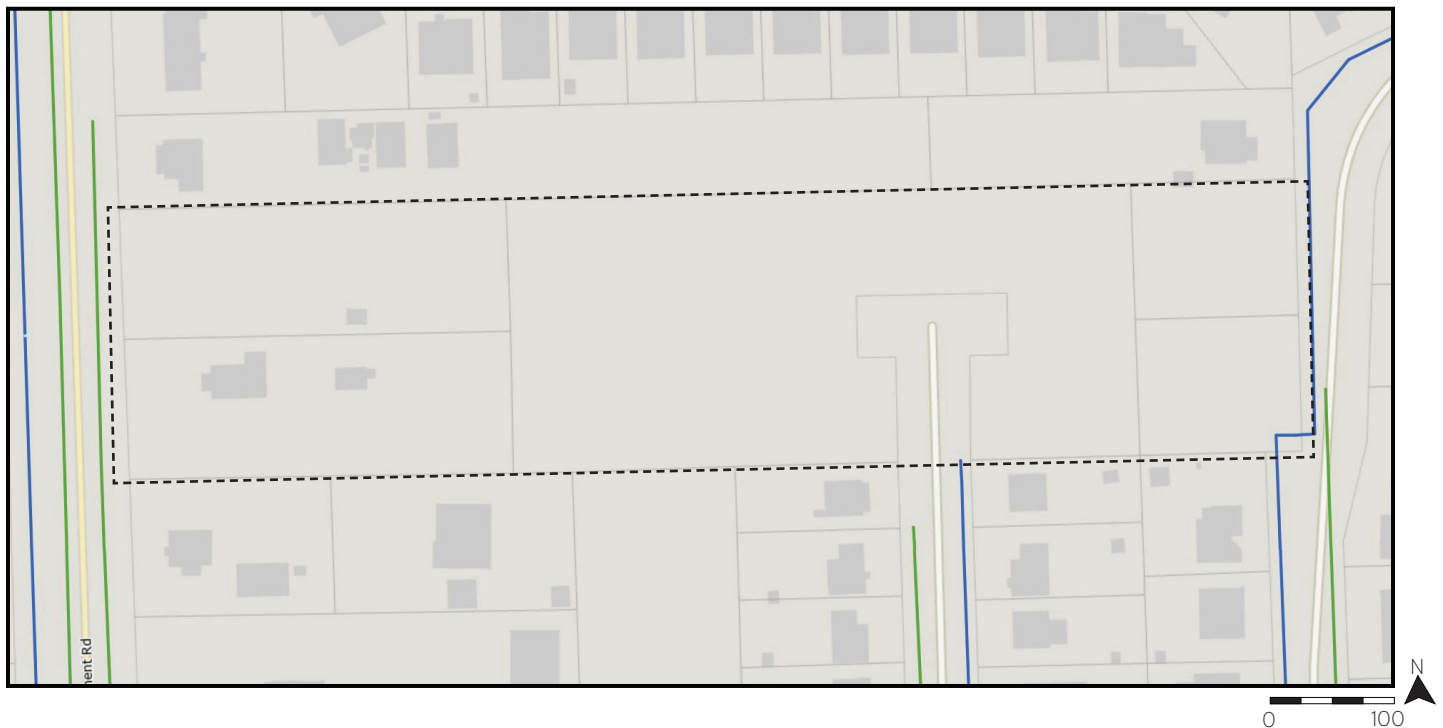


Figure 6.1 Site one infrastructure conditions

Figure 6.1 Current affordable housing and floodplain with site one

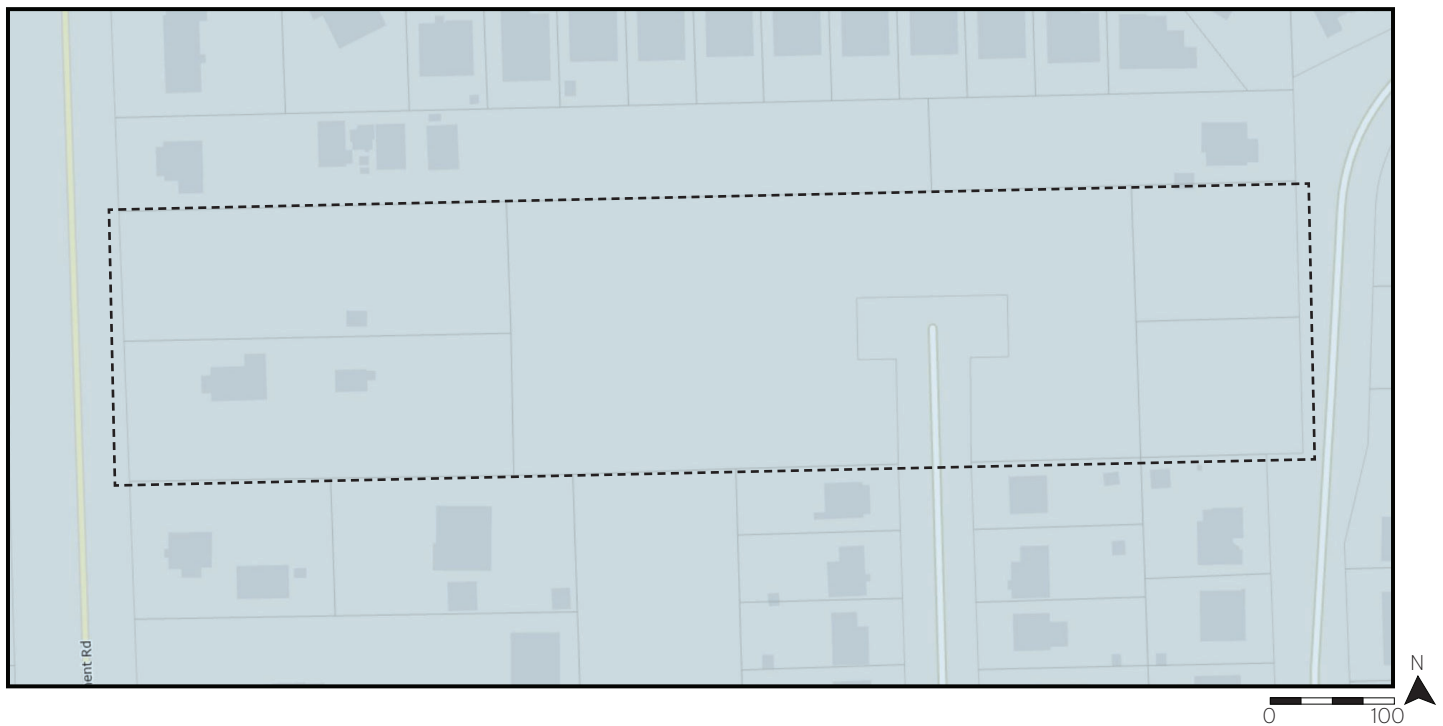
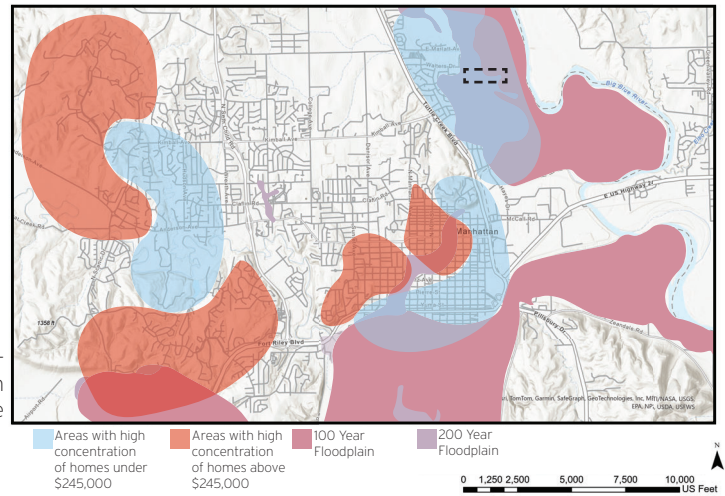


Figure 6.1 Site one affordability and floodplain conditions

Cost Estimations

For site design one, an estimate was made on the cost of both the land and the infrastructure improvements needed for the community to come up with the overall cost of development. This estimate was made using averages pulled from surrounding parcels. Each surrounding parcel has both land value and improvement values that have been assessed and put into a city database. In Figure X one can see the area that has been averaged to find these numbers. This number can be divided by unit to see how much each unit would cost in total. It is important to note that the cost of rental is not subject to change dramatically because it is reflective of market conditions. The price of homeownership can be effected by this though.

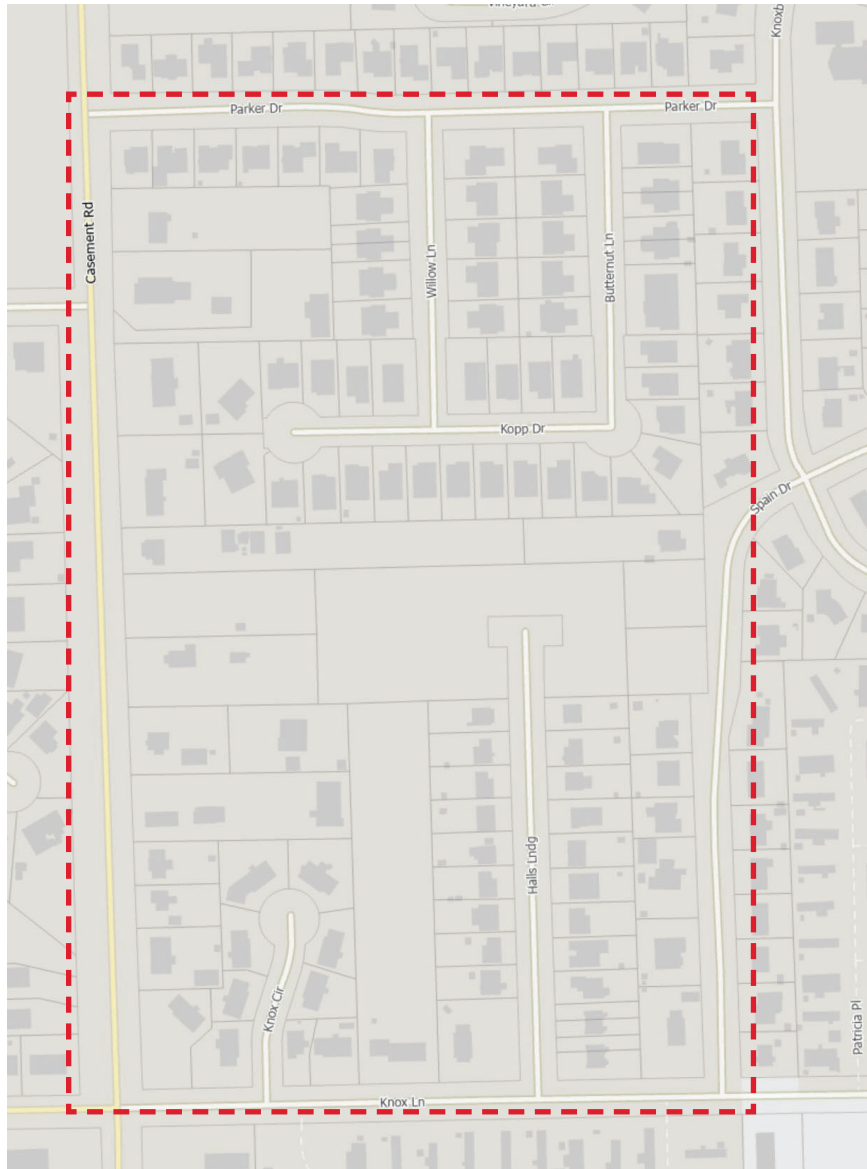


Figure 6.1 Boundary for averaging area

NTS

Traditional Layout

The site design presented in Figures 6.6-6.8 are a reflection of typical site development within Manhattan Kansas. The houses on the site are 3,000 square feet which approximate the average size of homes currently on the market. The lots are traditionally laid out with equal side yards and have been sized to meet the requirements of the Manhattan City Code which requires that the house take up no more than 35% of the lot. Each lot has a garage and driveway which is typical of Manhattan's current development. There is a round-about used at the end of the site because connecting to Casement, the road west of the site, is ill-advised.

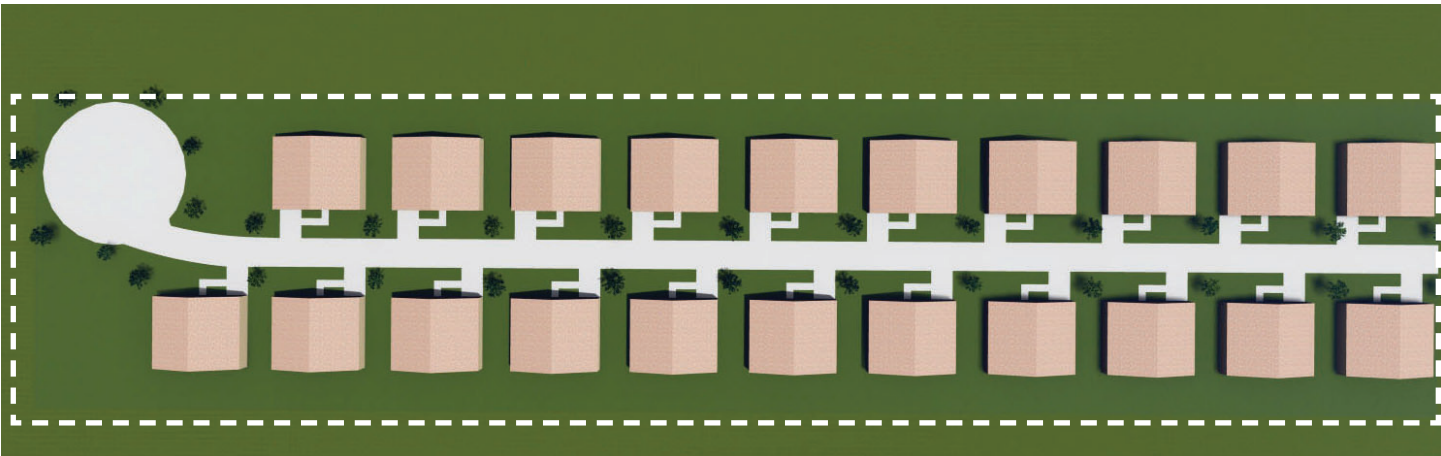


Figure 6.1 Illustrative plan view of a traditional site design of site one

NTS

Metrics							
Size	5 acres		Housing Units	21 units		Housing Sqft	3,000 sqft
Impervious Surface	45%		Density	4.2 DU/ac		Road Length	994'
Gross Land and Infrastructure Costs	\$619,248*		Gross Housing Construction Costs	\$6,300,000**		Avg. Cost per Lot for Overall Development	\$329,488**

Table 6.1 Metrics from the traditional site design of site one

*See Appendix C

**See Appendix D

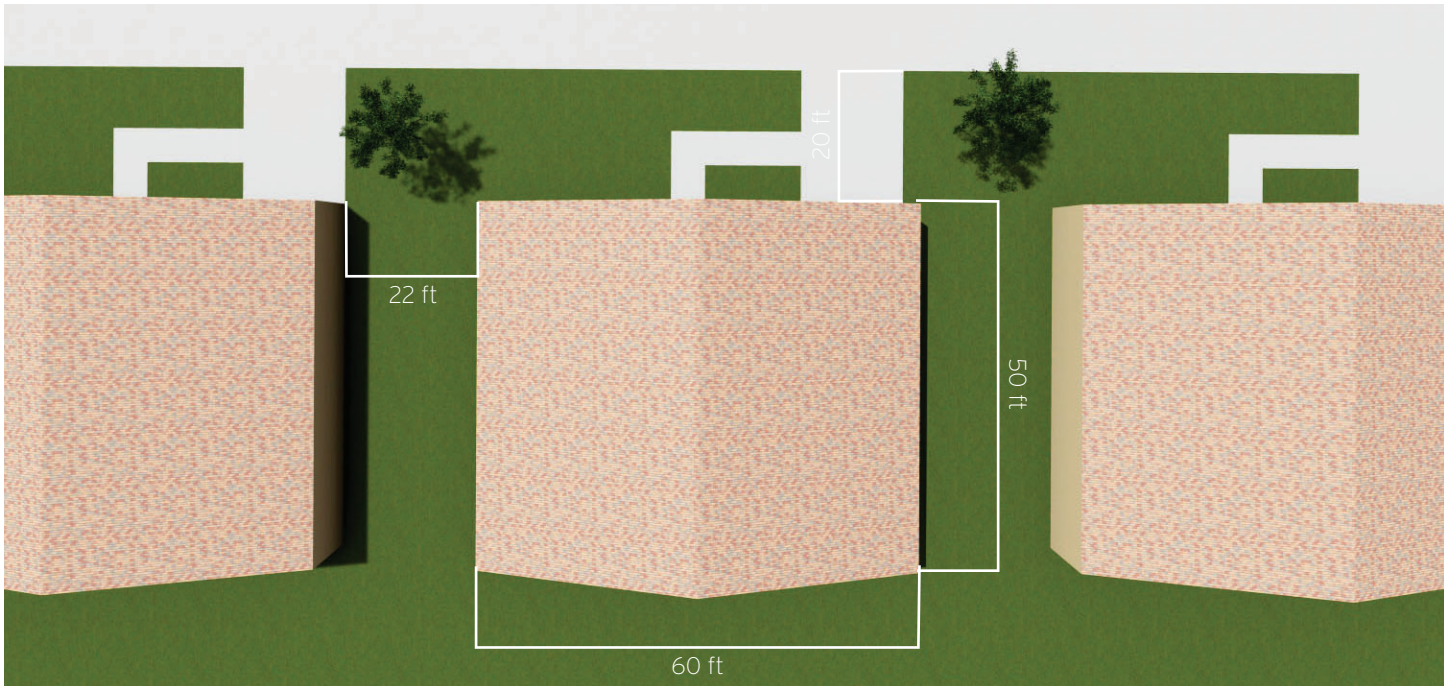


Figure 6.1 Enlargement of traditional housing on site one with dimensions

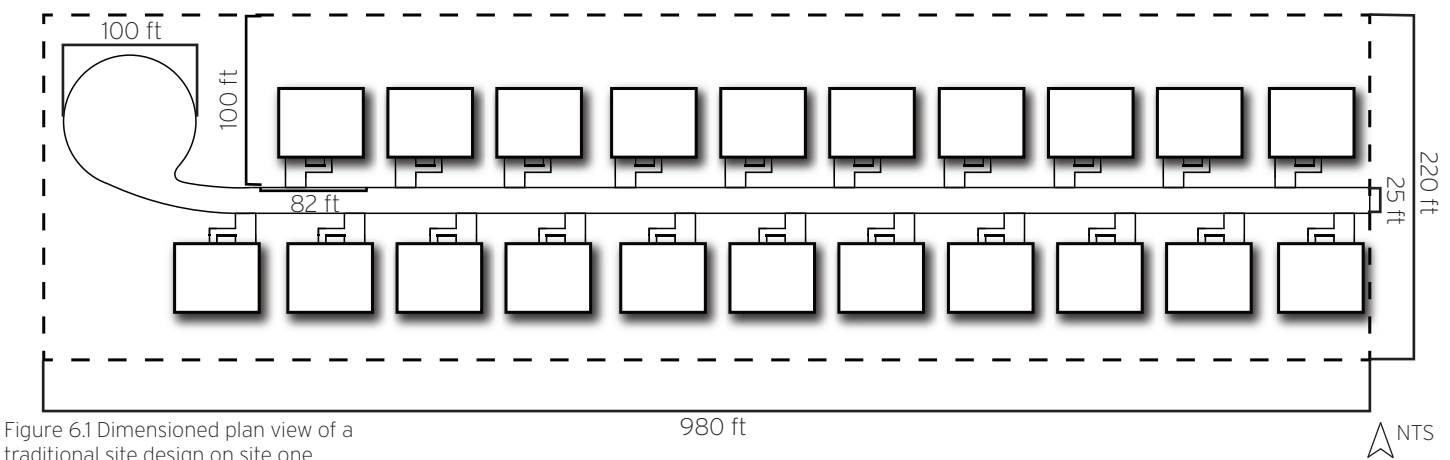


Figure 6.1 Dimensioned plan view of a traditional site design on site one

Site One: Layout One

This site design is influenced by the zero-lot line modules and the use of an eyebrow layout to maximize site utilization. This design prioritizes density. The housing styles follow the configurations seen in the Analyze chapter. Housing options support individuals falling within the Moderate to Extremely Low income categories. Houses can be rented or owned as previously stated in the Analyze chapter. In addition, houses could be rent-to-own if managed by a Co-Op or CLT as explained in the Background chapter.



Figure 6.1 Illustrative plan view of the first site design of site one



Metrics					
Size	5 acres		Housing Units	36 units	Housing Sqft Unit A: 1033 Unit B: 1,260
Impervious Surface	48%		Density	7.2 DU/ac	Road Length 1310'
Gross Land and Infrastructure Costs	\$619,248*		Gross Housing Construction Costs	\$6,319,334**	Avg. Cost per Lot for Overall Development \$175,537**

Table 6.2 Metrics from the first site design of site one

*See Appendix C

**See Appendix D

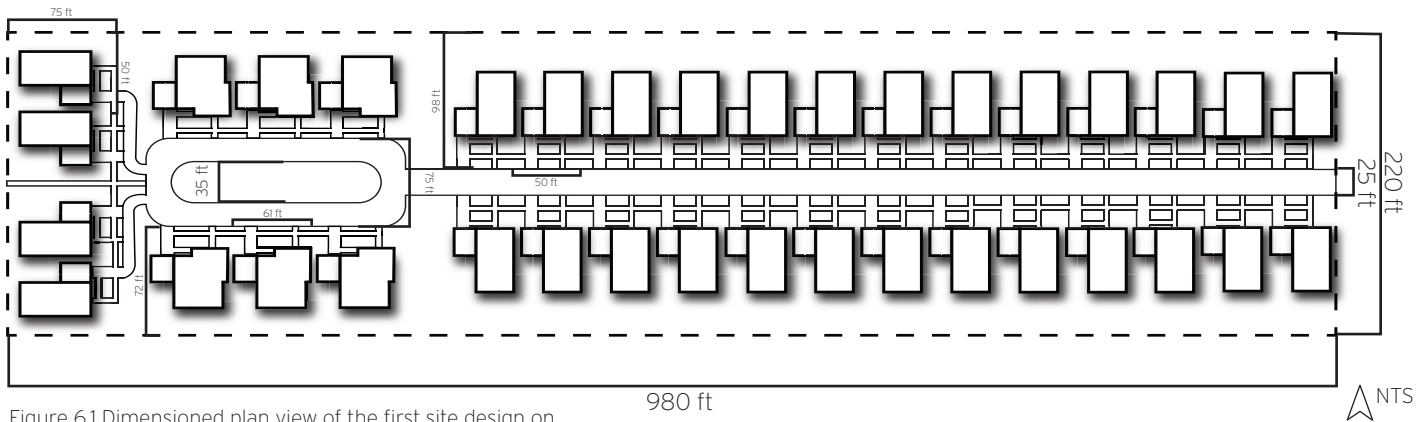


Figure 6.1 Dimensioned plan view of the first site design on site one

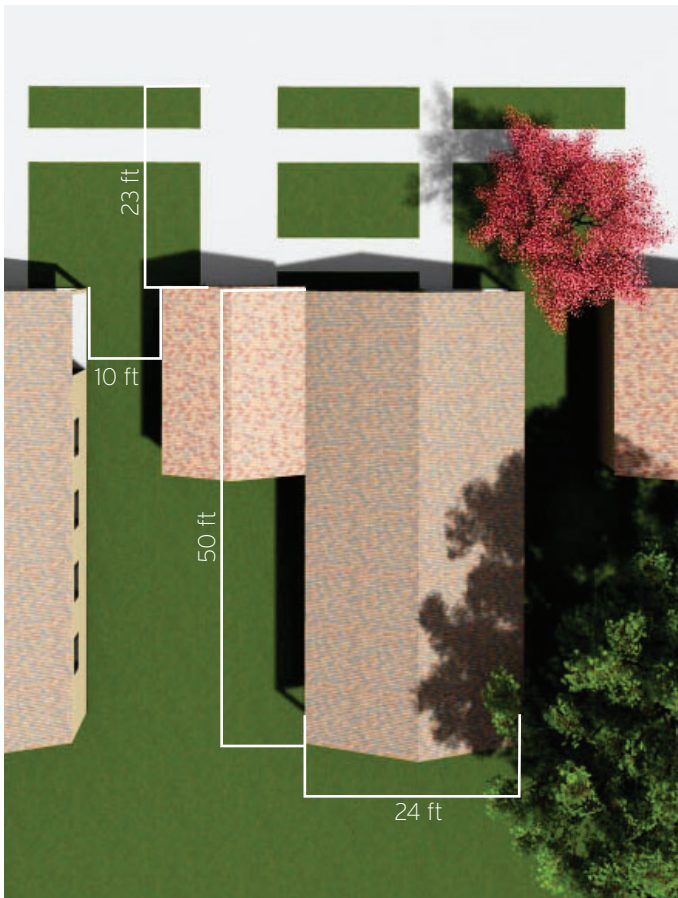


Figure 6.1 Enlargement of housing type A on the first site design on site one with dimensions



Figure 6.1 Perspective view of the first site design featuring housing type B



Figure 6.1 Perspective view of the first site design featuring housing type A



Figure 6.1 Perspective view of the first site design featuring the courtyard at the west end of the site



Figure 6.1 Perspective view of the first site design featuring the walkway to Casement Road

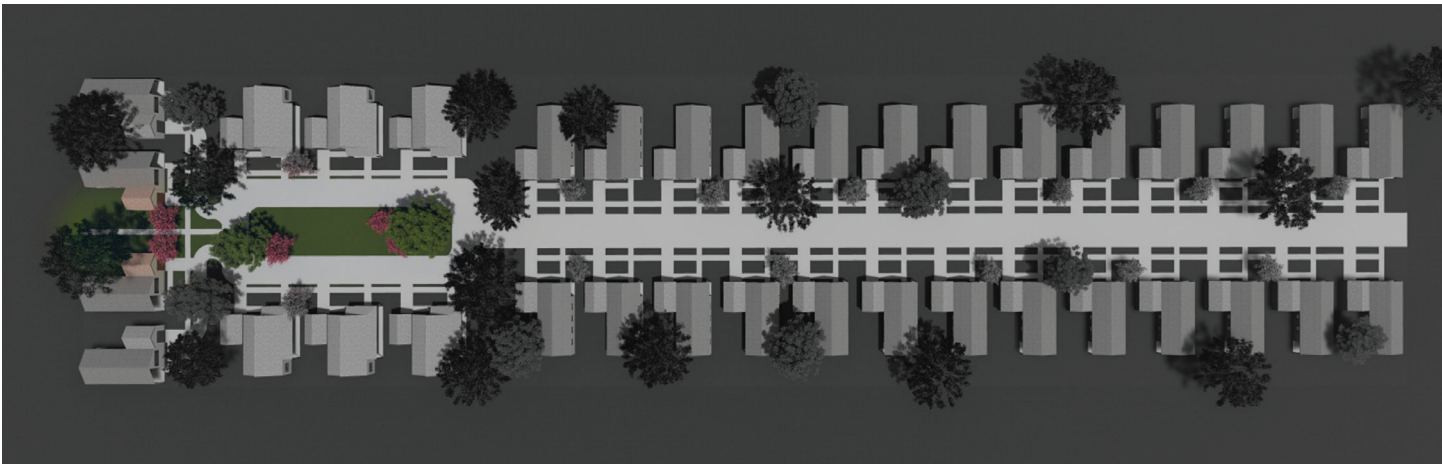


Figure 6.1 Illustrative plan view of the first site design of site one highlighting the amenities available on the site



Site Infrastructure

The road length on this site is significant which can raise the cost of development; however, it allows for the site to function without the use of Casement Road. There is also the implementation of an eyebrow layout that reduces infrastructure costs by tightly clustering houses.

Site Design

The site design as previously stated is based around creating a high-density site. The houses are tightly arranged using zero-lot lines and an eyebrow layout at the end of the site. The houses all have attached garages which reduce large portions of the site being concrete. There are two small courtyards present in the eyebrow layout at the end. In addition, there is a sidewalk connecting the site to Casement Road.



Figure 6.1 Perspective view of the first site design featuring housing type A highlighting the zero-lot lines

Site One: Layout Two

This site design is influenced by the courtyard cluster modules. This design prioritizes shared amenity spaces and housing variety. The housing styles follow the configurations seen in the Analyze chapter. Housing options support individuals that fall within the Moderate to Extremely Low income categories who want to rent in addition to homes that individuals in the Moderate income category can buy. In addition, houses could be rent-to-own if managed by a Co-Op or CLT as explained in the Background chapter.



Figure 6.1 Illustrative plan view of the second site design of site one

NTS

Metrics							
Size	5 acres		Housing Units	44 units		Housing Sqft	Unit B: 1,260 Unit C: 1,224 Unit D: 1,257
Impervious Surface	53%		Density	8.8 DU/ac		Road Length	1800'
Gross Land and Infrastructure Costs	\$619,248*		Gross Housing Construction Costs	\$4,595,664**		Avg. Cost per Lot for Overall Development	\$104,446**

Table 6.3 Metrics from the second site design of site one

*See Appendix C

**See Appendix D

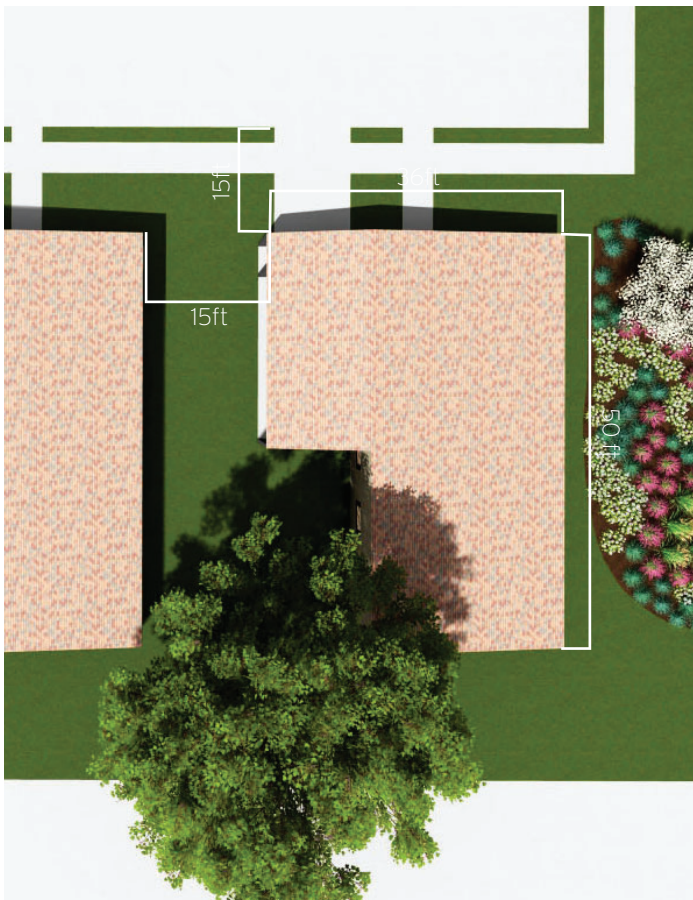
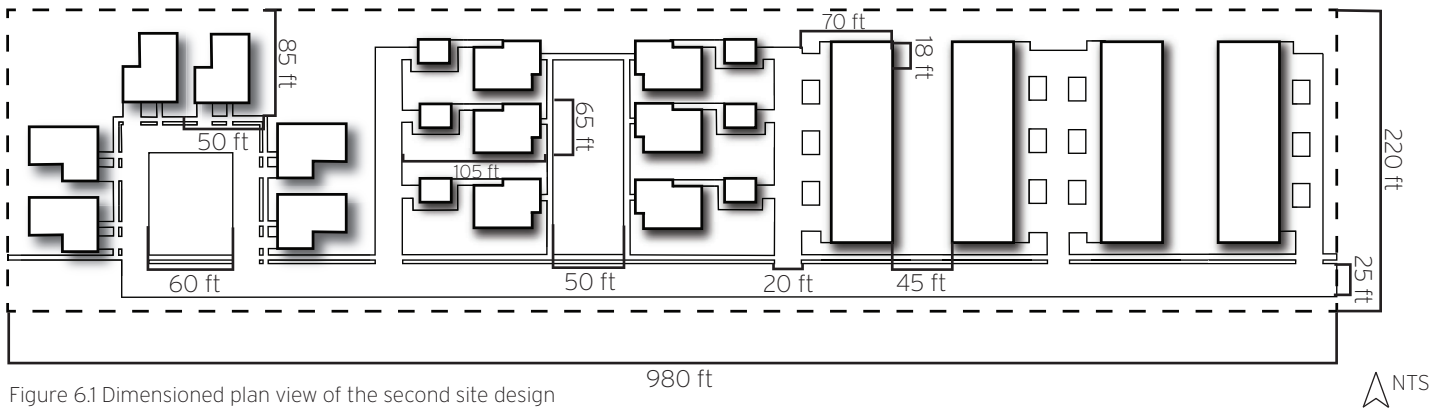




Figure 6.1 Perspective view of the second site design featuring the pollinator garden at the west end of the site



Figure 6.1 Perspective view of the second site design featuring the natural playground in the center of the site

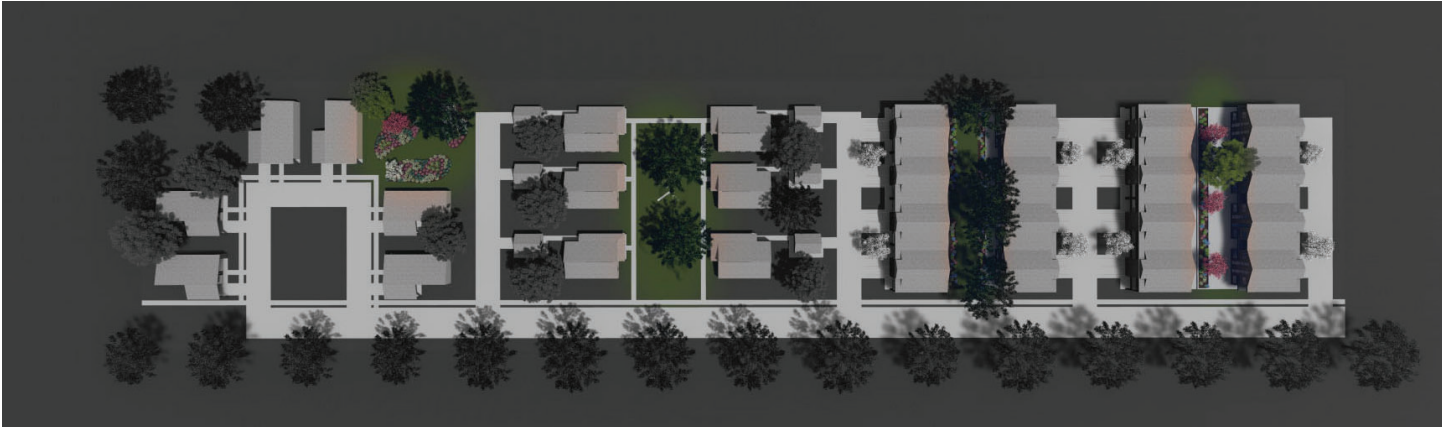


Figure 6.1 Illustrative plan view of the second site design of site one highlighting the amenities available on the site



Site Infrastructure

The road length on this site is significant which can raise the cost of development; however, it allows for the site to function without the use of Casement Road. The site is designed around courtyard layouts that reduce infrastructure lengths.

Site Design

The site design as previously stated is based around creating a large variety of amenity spaces. The houses are arranged with courtyard clusters to maximize shared open space. The majority of houses have garages or carports; however, the townhomes have connected exterior parking spots. There is a pollinator garden on the west end of the site. A large earthen playground is located in the center of the site and open spaces created between each set of townhomes.



Figure 6.1 Perspective view of the second site design featuring housing type D

Site One: Layout Three

This site design is influenced by the courtyard cluster modules. This design prioritizes reducing overall road length by using shared parking lots. The housing styles used where the houses that can be seen on in the Analyze chapter. There are housing options on this site for individuals that fall within the moderate to extremely low income brackets. Houses can be rented or owned as previously stated in the Analyze chapter. In addition, houses could be rent-to-own if managed by a Co-Op or CLT as explained in the background chapter.



Figure 6.1 Illustrative plan view of the third site design of site one

NTS

Metrics							
Size	5 acres		Housing Units	50 units		Housing Sqft	Unit A: 1,033 Unit B: 1,260 Unit D: 1,257
Impervious Surface	53%		Density	10 DU/ac		Road Length	711'
Gross Land and Infrastructure Costs	\$619,248*		Gross Housing Construction Costs	\$5,478,112**		Cost per Lot for Overall Development	\$109,562**

Table 6.4 Metrics from the third site design of site one

*See Appendix C

**See Appendix D

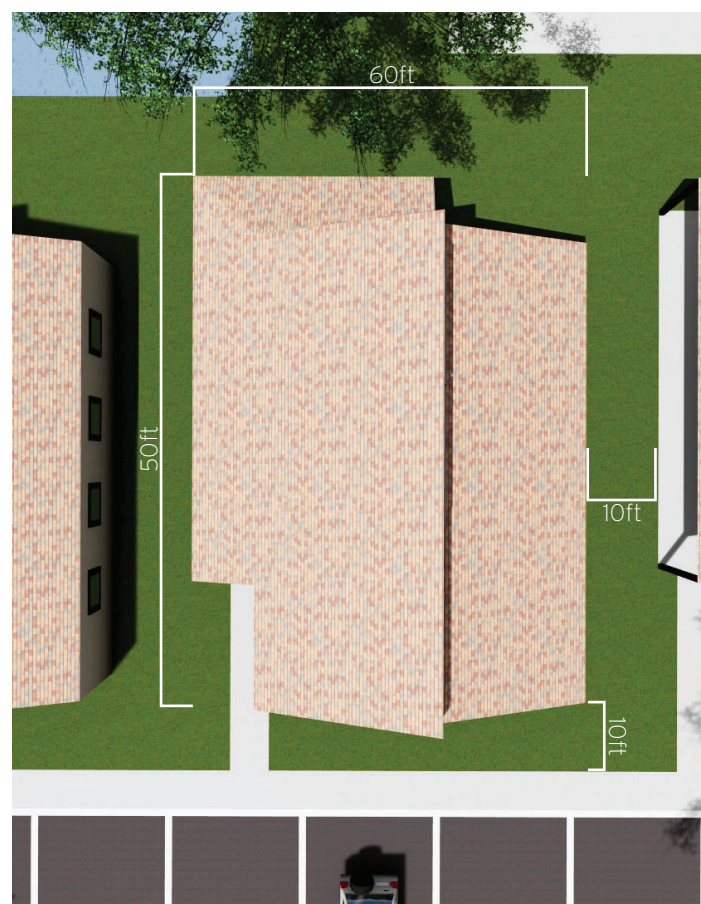
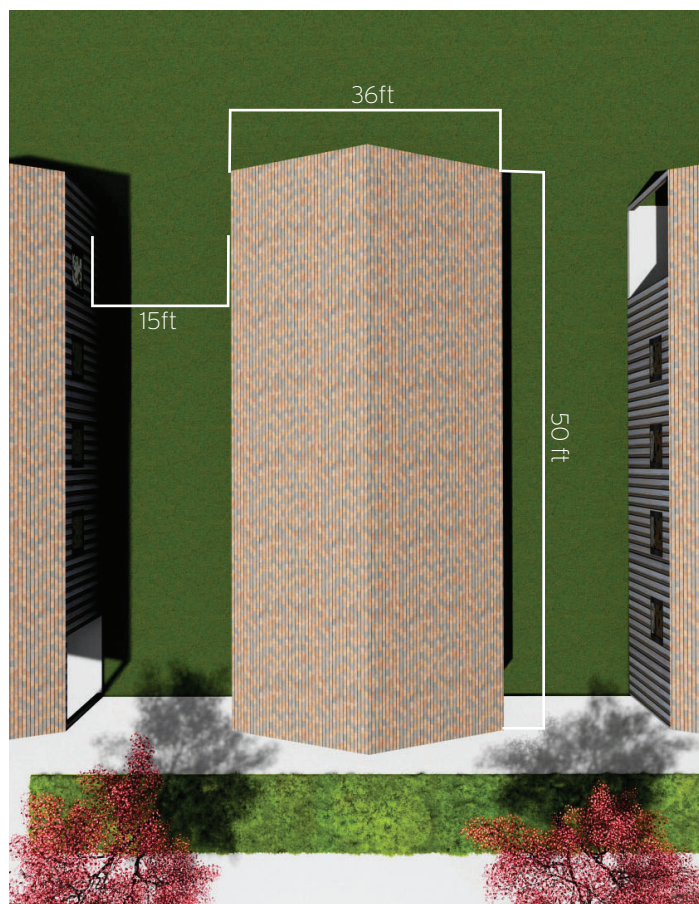
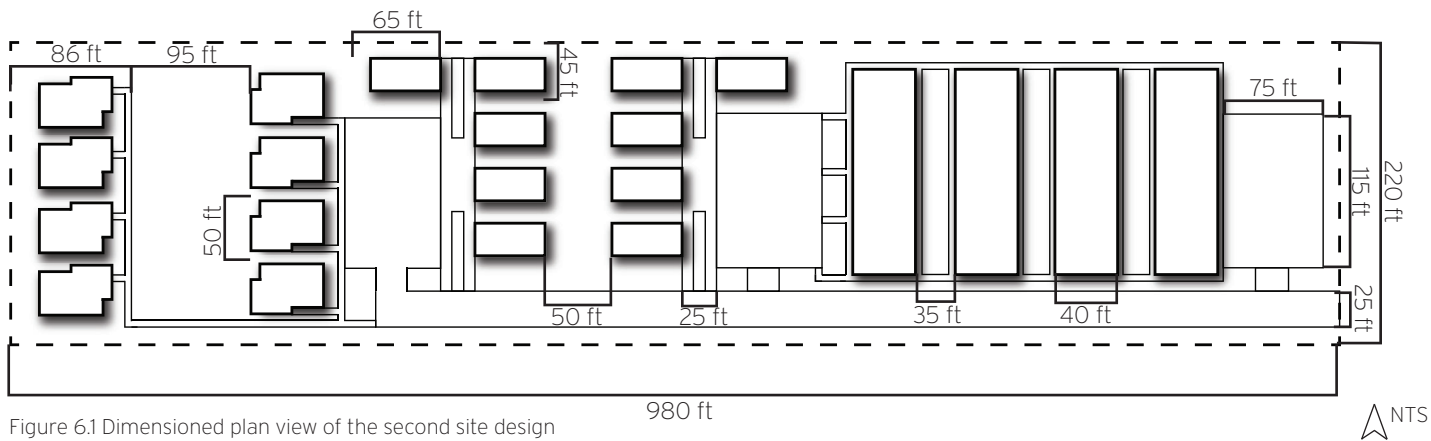




Figure 6.1 Perspective view of the third site design featuring one of the three linear parks between the townhouses



Figure 6.1 Perspective view of the third site design featuring the playground on the west end of the site



Figure 6.1 Illustrative plan view of the third site design of site one highlighting the amenities available on the site

Site Infrastructure

The road length on this site is limited which could lower the cost of development; however, there are large parking lots that are necessary to meet parking requirements. The site uses the courtyard cluster layouts that could reduce the cost of laying utilities as well.

Site Design

The site design as previously stated is based around wanting to reduce overall road length. This has led to the creation of courtyard clusters that have shared amenities and shared parking areas. The townhomes all have a linear park that functions as their 'front yard'. The middle courtyard cluster features a large shared lawn in addition to being bordered by promenade spaces. The west most courtyard cluster has a playground and pavilion available to all residents.



Figure 6.1 Perspective view of the third site design featuring one of the two promenades

Site One: Conclusions

The first site has a narrow shape that makes it unique. This shape size makes it easier to argue for unique site layout approaches because the traditional site layout approach has a very low density. The site per Manhattan zoning should be developed to 7 du/ac density which is impossible with a traditional site layout approach. With more time the design could've been developed to include more stromwater management devices to assist with the sites placement within a floodplain

Assumptions

Site Improvement Cost/Ac: \$132,405 (Neighborhood comparable, Appendix C)

Income Categories	Loan Qualf.
Very Low Income	\$46,000
Low Income	\$75,000
Moderate Income	\$143,000

Housing Layout Modules							
Layout	Module Size (Ac)	Dwelling Units (Du)	Density (Du/Ac)	Housing Type	Bldg Cost	Site improvement cost/Du*	Total Cost To Finance
Traditional	5	21	4.2	Traditional (w/ Attached Garage)	\$450,000***	\$32,333	\$482,333
Layout One	4	30		Type A (w/ Detached Garage**)	\$160,000	\$17,654	\$177,654
	1	6		Type B (w/ Detached Garage**)	\$253,224	\$22,067	\$275,291
Site Totals	5	36	7.2		\$5,599,334	\$619,248	\$6,218,582

Table 6.5 Site one conclusion Table 1

Housing Layout Modules							
Layout	Module Size (Ac)	Dwelling Units (Du)	Density (Du/Ac)	Housing Type	Bldg Cost	Site improvement cost/Du*	Total Cost To Finance
Layout Two	1.5	6		Type B (w/ Detached Garage**)	\$253,224	\$33,101	\$286,325
	1.5	6		Type C (w/ Carport)	\$144,000	\$33,101	\$177,101
	2	32		Type D (No Garage)	\$69,135	\$8,275	\$77,410
Site Totals	5	44	8.8		\$4,796,544	\$619,248	\$5,415,792
Layout Three	1.5	10		Type A (No Garage)	\$140,000	\$19,860	\$159,860
	1.5	8		Type B (No Garage)	\$233,224	\$24,826	\$258,050
	2	32		Type D (No Garage)	\$69,135	\$8,275	\$77,410
Site Totals	5	50	10		\$5,478,112	\$619,248	\$6,097,360

Table 6.6 Site one conclusion Table 2

*Site Improvement Cost/DU = Site Improvement Cost/Ac x Acres / DUs

**Adding garages to housing types A and B adds \$20,000 to the total build cost

***Cost estimated based off of 2022 RSMeans guidebook

Site Two

Site Two Selection

This site in Pottawatomie county was selected due to its location within an area of projected future residential growth as identified by planning officials. Some of the conditions on the site are not as conducive for affordable housing as the first site presented but affordable housing can still be implemented on a range of sites. This site has more topographic relief than the first site. There is a large drainageway that runs through the site which should be preserved to maintain its function.

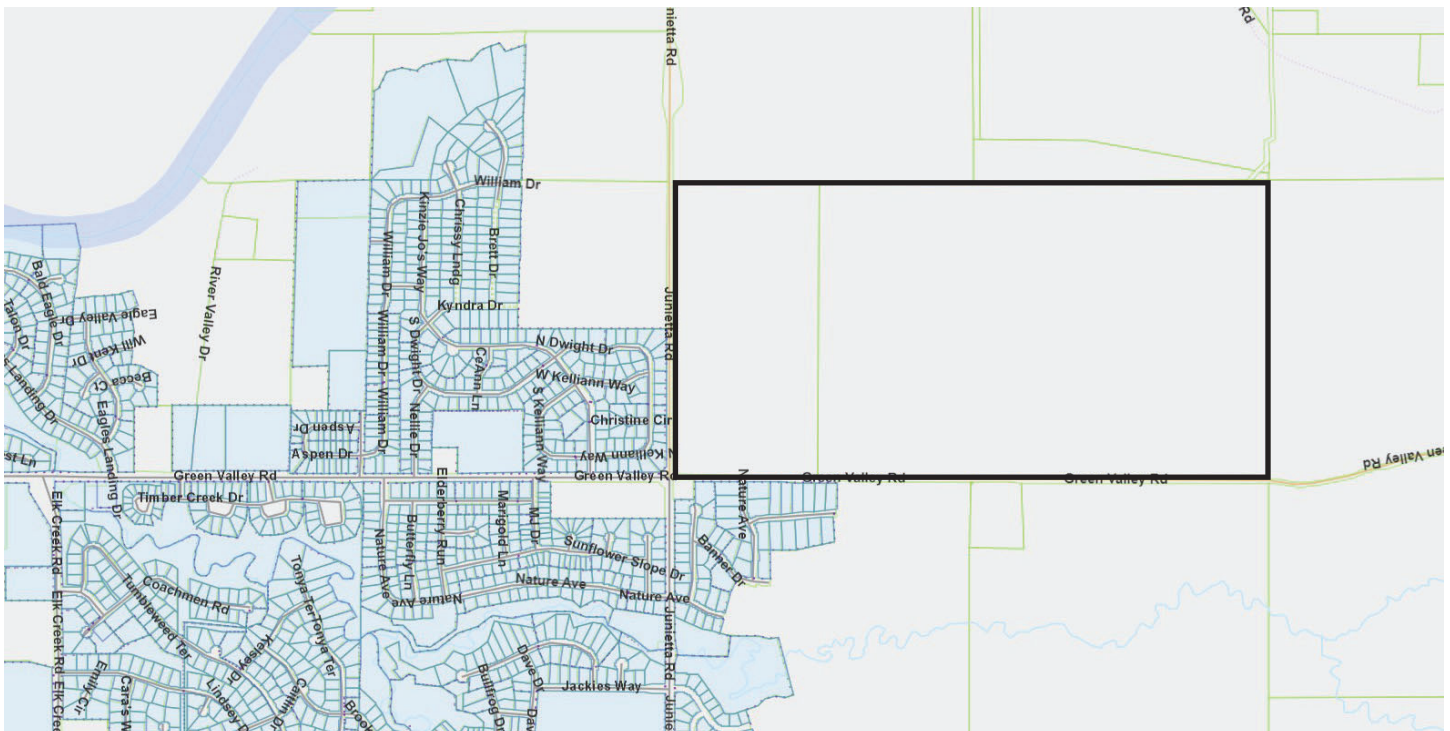


Figure 6.1 Site two proximity to development diagram

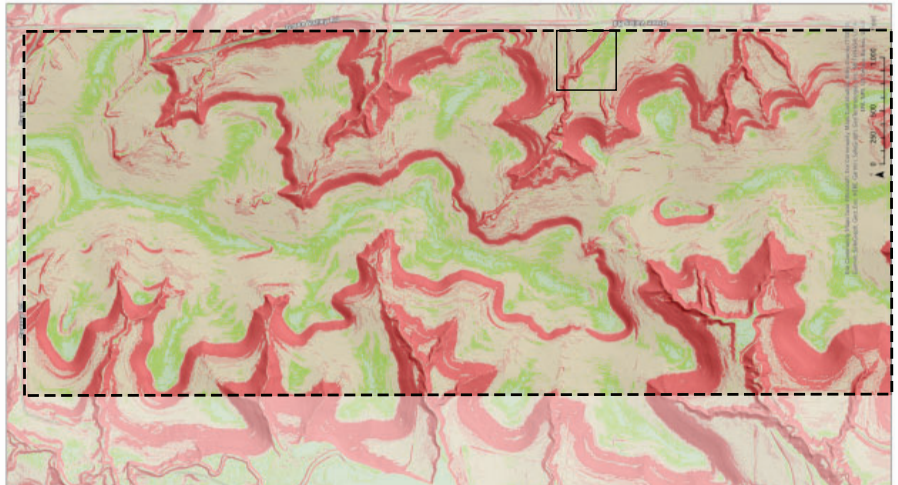


Figure 6.1 Site two topography conditions

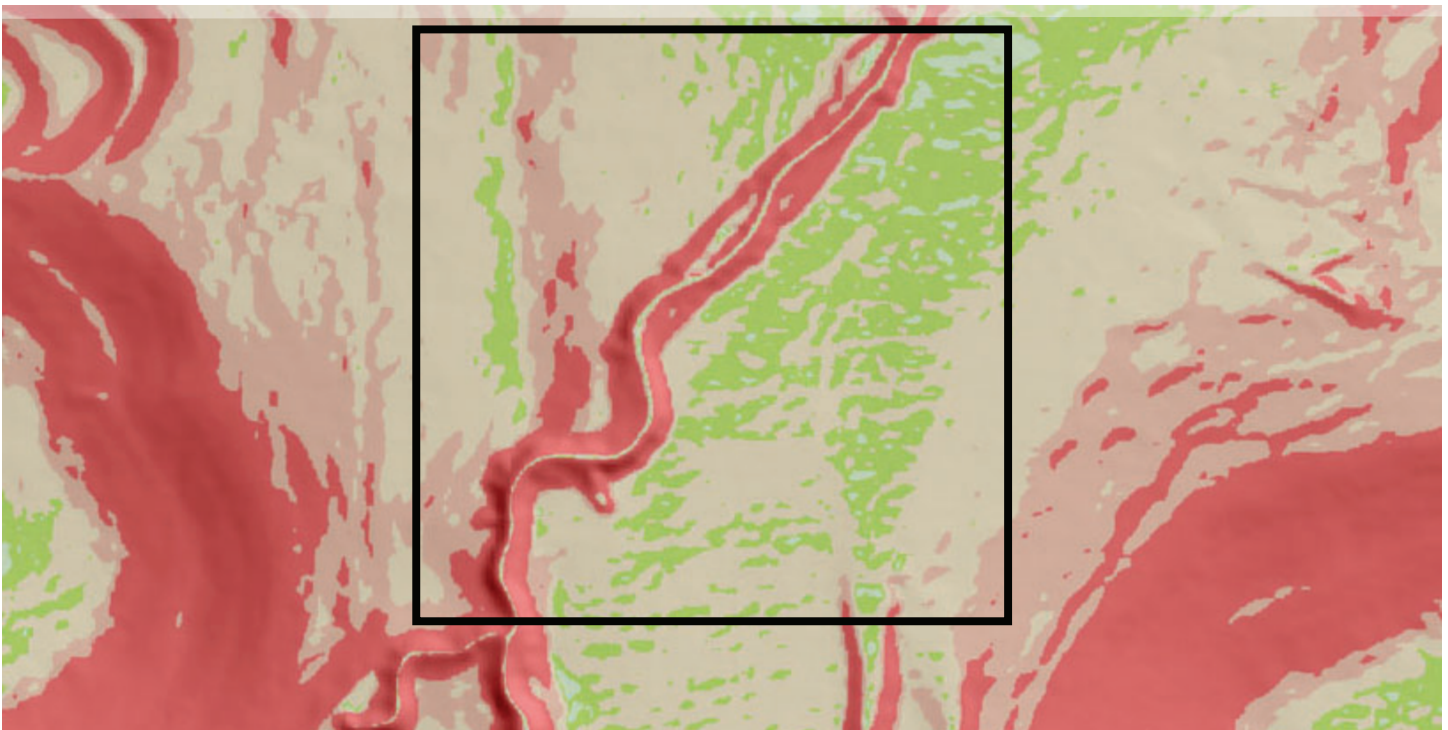


Figure 6.1 Site two enlarged topography conditions

Traditional Layout

This site reflects typical site development found within Manhattan, Kansas. The houses on the site are 3,000 square feet which approximates the average size of homes currently on the market in Manhattan, Kansas. The lots are traditionally laid out with equal side yards and have been sized to meet the requirements of the Manhattan City Code which require that the house take up no more than 35% of the lot. Each lot has a garage and driveway which is typical of Manhattan’s current development. There cannot be development in the middle of the site due to extreme slopes that are not allowed to be developed under Manhattan’s code.



Figure 6.1 Illustrative plan view of a traditional site design of site two

Metrics							
Size	8.2 acres		Housing Units	23 units		Parking	One Garage
Impervious Surface	38%		Density	2.8 DU/ac		Road Length	2356'

Table 6.7 Metrics from the traditional site design of site two

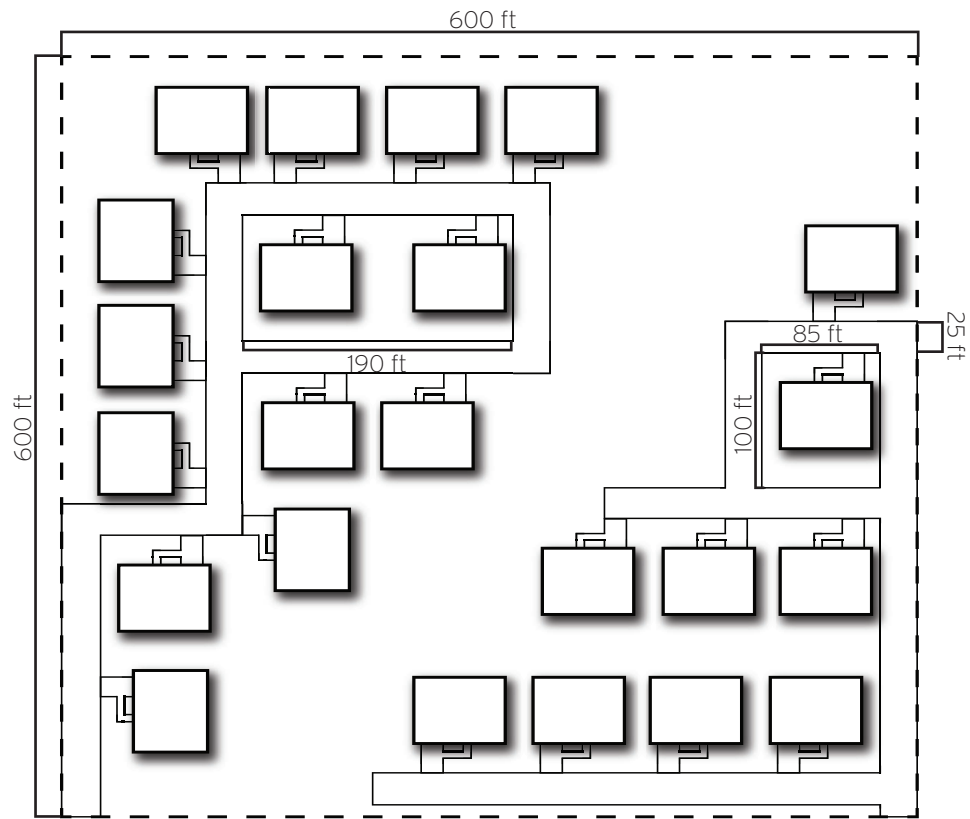


Figure 6.1 Dimensioned plan view of a traditional site design on site two

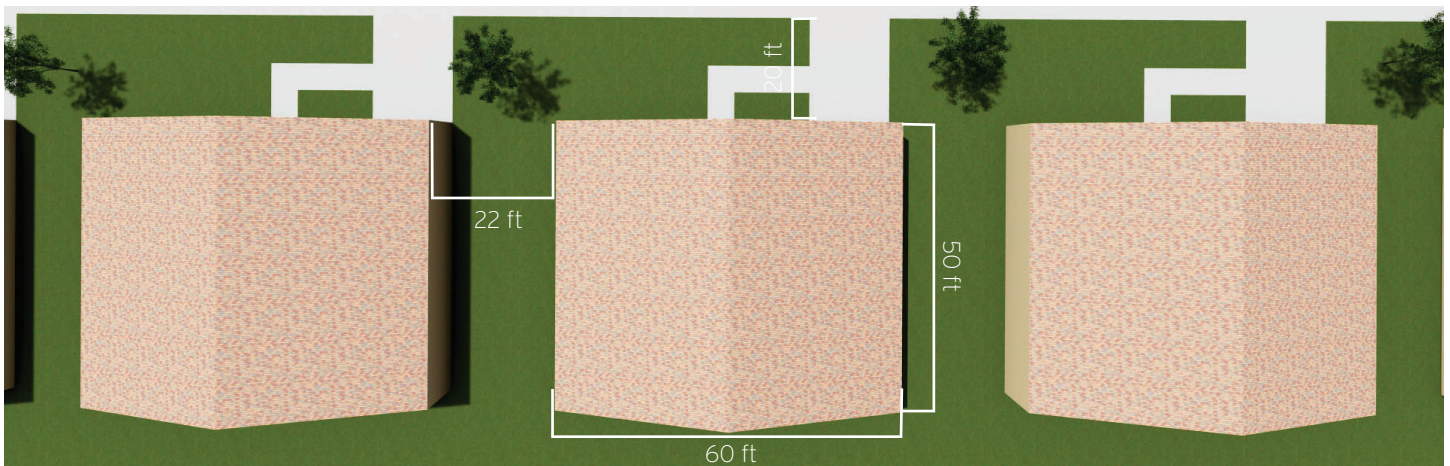


Figure 6.1 Enlargement of traditional housing on site two with dimensions

Site Two: Layout One

This site design is influenced primarily by the courtyard cluster modules presented in the Analyze chapter. This design prioritizes reducing road lengths and creating shared open spaces. The housing styles utilize the configurations seen in the Analyze chapter. There are housing options on this site for individuals that fall within the Moderate to Extremely Low income categories. Houses can be rented or owned as previously stated in the Analyze chapter. In addition, houses could be rent-to-own if managed by a Co-Op or CLT as explained in the Background chapter.



Figure 6.1 Illustrative plan view of the first site design of site two

Metrics							
Size	8.2 acres		Housing Units	74 units		Parking	Shared Detached Parking
Impervious Surface	40%		Density	9 DU/ac		Road Length	1246'

Table 6.8 Metrics from the first site design of site two

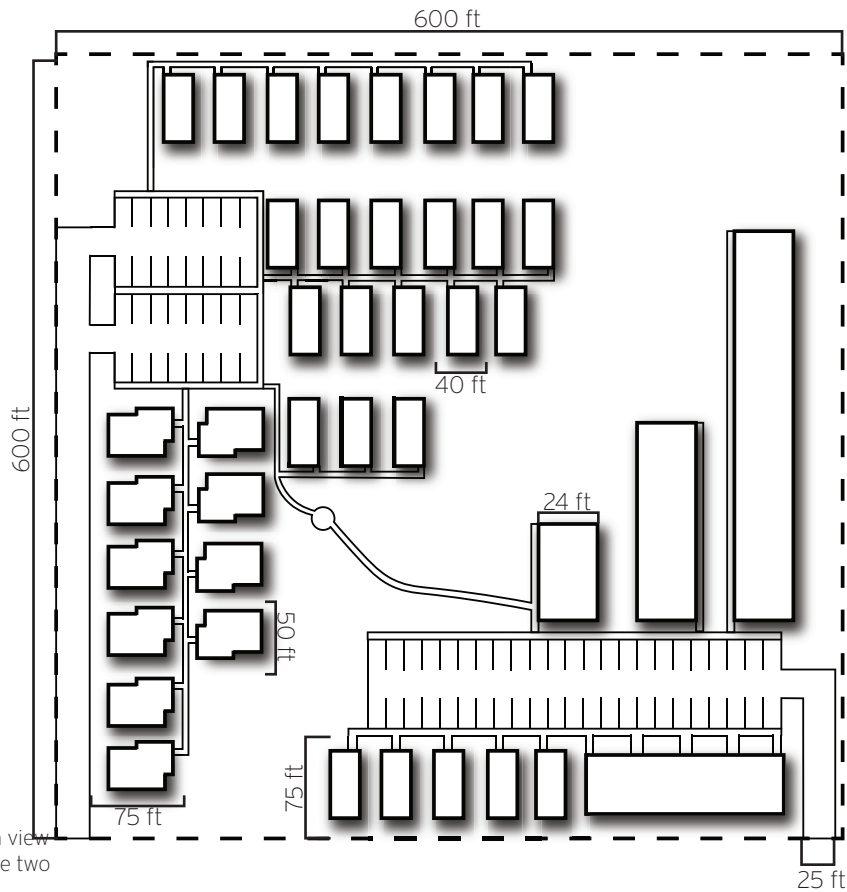


Figure 6.1 Dimensioned plan view of the first site design on site two

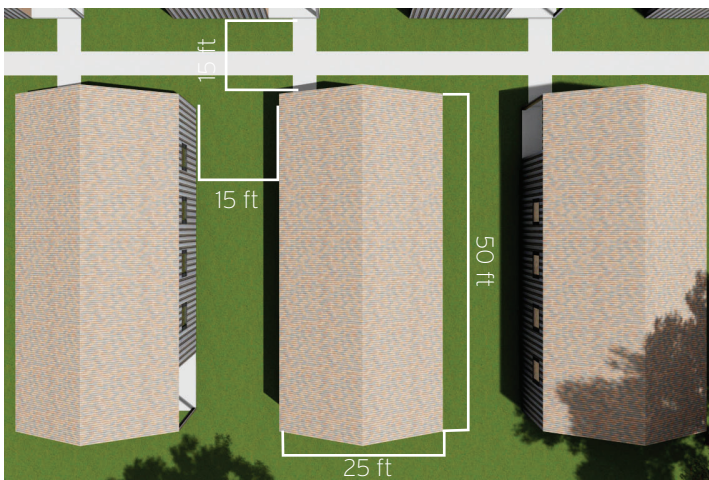


Figure 6.1 Enlargement of housing type C on the first site design on site two with dimensions



Figure 6.1 Enlargement of housing type A on the first site design on site two with dimensions



Figure 6.1 Perspective view of the first site design featuring the linear pollinator garden at the north end of the site



Figure 6.1 Illustrative plan view of the first site design of site two highlighting the amenities available on the site



Figure 6.1 Perspective view of the first site design featuring the boardwalk over the drainage channel on site

Site Infrastructure

The road length on this site has been significantly reduced, which will lower the cost of development. However, large parking lots will be provided to accommodate residents and guests. A footbridge will incrementally add to development costs, but it will connect the east and west sides of the site.

Site Design

The site design as previously stated will reduce road lengths by using shared parking lots. This allows the houses to be tightly arranged on the rest of the site and creates long courtyard communities. These courtyards serve as linear amenities encouraging movement throughout the site.



Figure 6.1 Birdseye perspective view of the first site design featuring the linear pollinator garden at the north end of the site

Site Two: Layout Two

The site design is influenced by the courtyard cluster modules. This design prioritizes creating connections through the site. The road that connects both east and west sides of the site would increase the cost of development but be better for the creation of community on site. The housing styles used can be seen in the Analyze chapter. There are housing options on this site for individuals that fall within the Moderate to Extremely Low income categories. Houses can be rented or owned as previously stated in the Analyze chapter. In addition houses could be rent-to-own if managed by a Co-Op or CLT as explained in the Background chapter.



Figure 6.1 Illustrative plan view of the second site design of site two

Metrics							
Size	8.2 acres		Housing Units	55 units		Parking	Street Parking and Attached Garages
Impervious Surface	30%		Density	6.7 DU/ac		Road Length	1440'

Table 6.9 Metrics from the second site design of site two

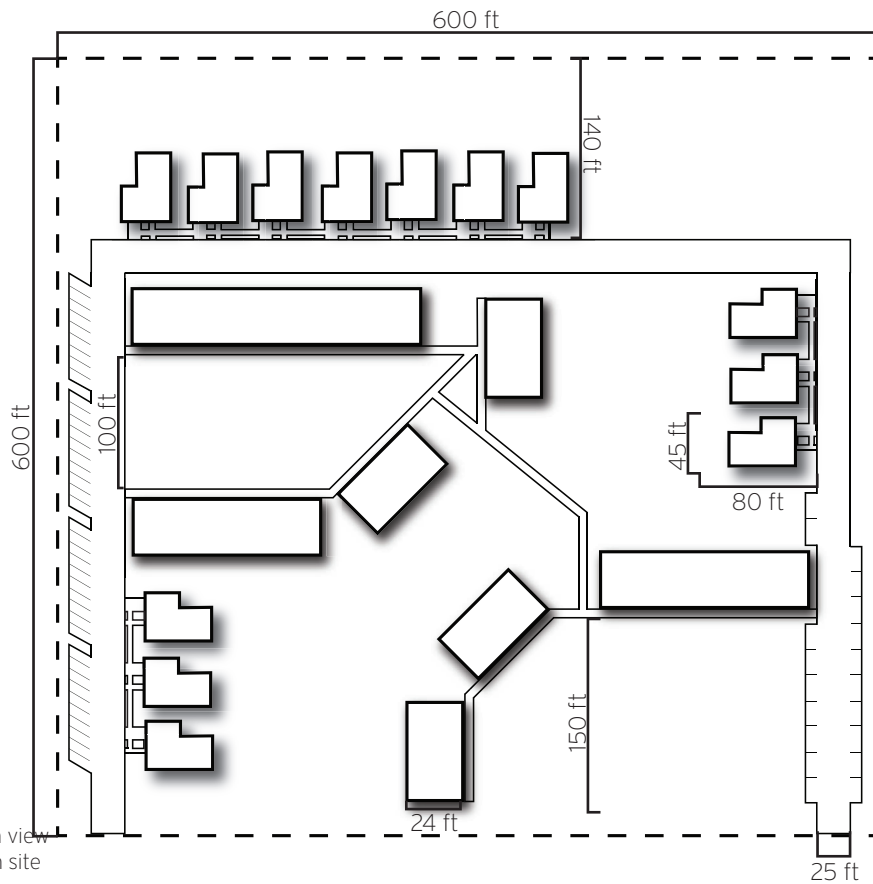


Figure 6.1 Dimensioned plan view of the second site design on site two

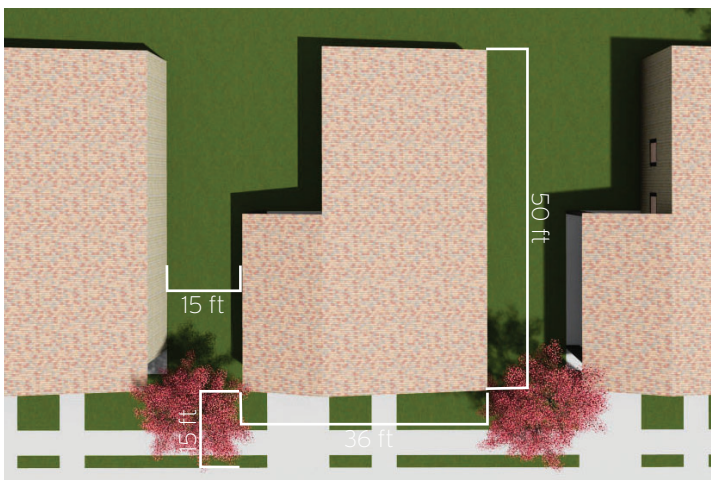


Figure 6.1 Enlargement of housing type C on the second site design on site two with dimensions



Figure 6.1 Perspective of housing type D used in the second site design of the second site



Figure 6.1 Perspective view of the second site design featuring the hammock grove on the east side of the site



Figure 6.1 Illustrative plan view of the second site design of site two highlighting the amenities available on the site



Figure 6.1 Perspective view of the second site design featuring the natural earthen playground on the west side of the site

Site Infrastructure

The road length on this site is significant which can raise the cost of development however it allows for individuals that live in this neighborhood to access both sides of the site. There are no large parking lots reducing the use of extra concrete.

Site Design

There are amenities provided on site in the pockets between development and undevelopable areas. All of the houses have garages or carports. There is a pollinator garden on the north end of the site. A large natural playground in the center of the site.



Figure 6.1 Perspective view of the second site design featuring the bridge between both sides of the site

Site Two: Layout Three

The site design presented in pages X through X has been influenced primarily by the zero-lot line modules presented in the Analyze chapter. This design prioritizes the use of attached garages to increase the value of the homes. The housing styles use configurations presented on pages X, X and X in the Analyze chapter. Housing options on this site are intended for individuals that fall within the Moderate to Extremely low income categories. Houses can be rented or owned as previously stated in the Analyze chapter. In addition, houses could be rent-to-own if managed by a Co-Op or CLT as explained in the Background chapter.



Figure 6.1 Illustrative plan view of the third site design of site two

Metrics							
Size	8.2 acres		Housing Units	41 units		Parking	One Garage
Impervious Surface	40%		Density	5 DU/ac		Road Length	2448'

Table 6.10 Metrics from the third site design of site two

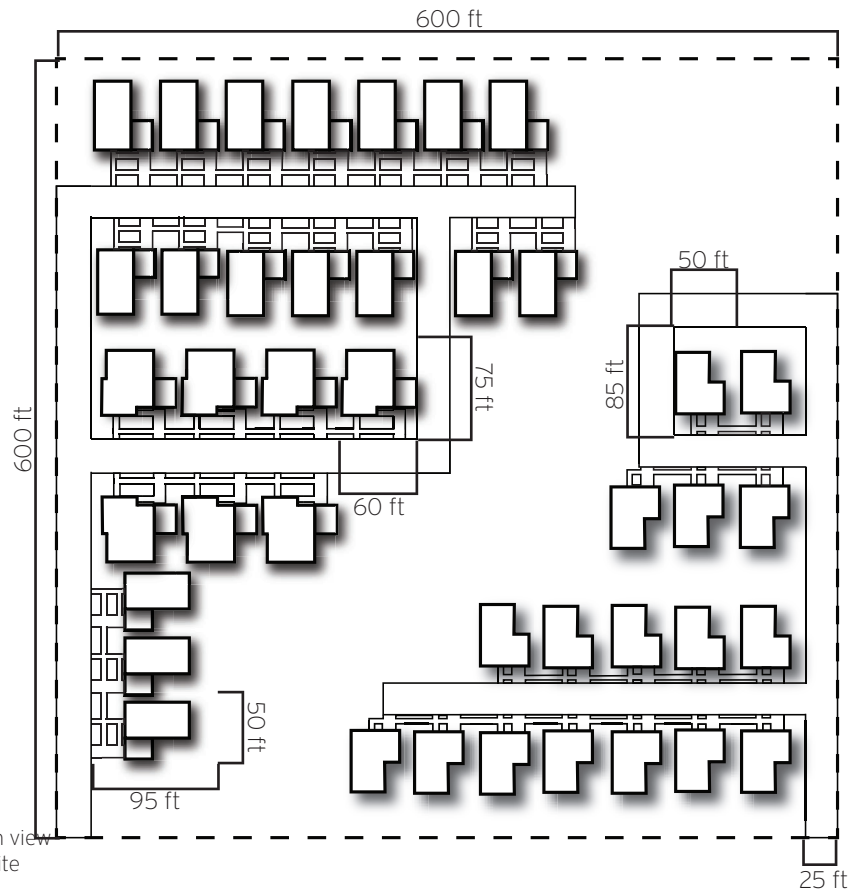


Figure 6.1 Dimensioned plan view of the third site design on site two

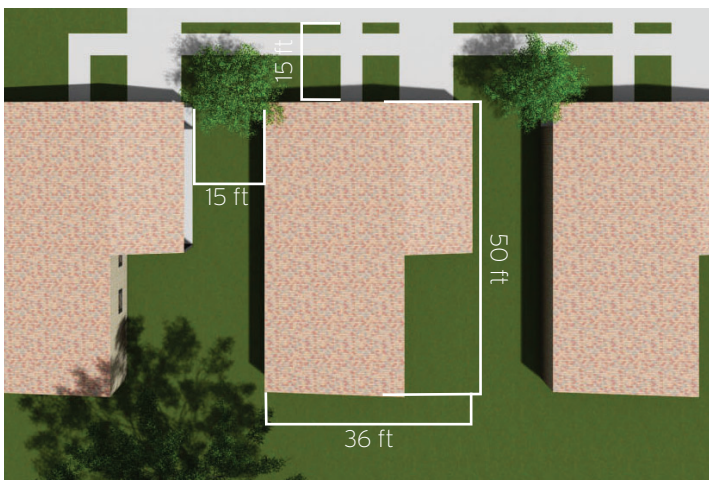


Figure 6.1 Enlargement of housing type C on the third site design on site two with dimensions

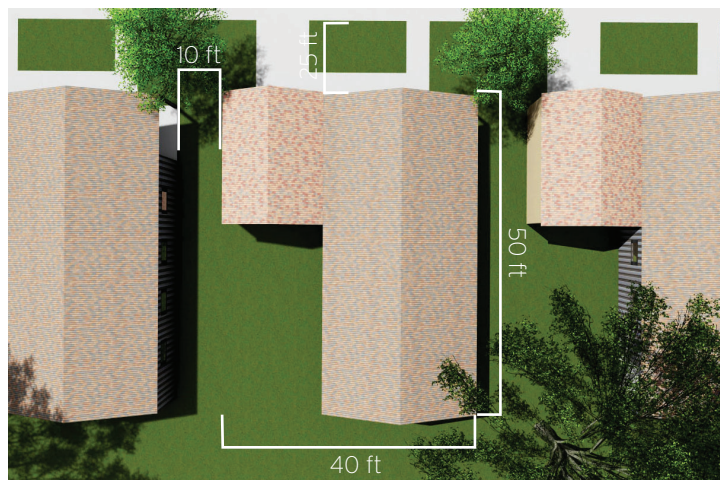


Figure 6.1 Enlargement of housing type A on the third site design on site two with dimensions



Figure 6.1 Perspective view of the third site design featuring the pollinator garden at the north end of the site



Figure 6.1 Illustrative plan view of the third site design of site two highlighting the amenities available on the site



Figure 6.1 Perspective view of the third site design featuring the natural playground in the center of the site

Site Infrastructure

The road length on this site is significant which can raise the cost of development; however, it allows for the site to offer attached garages for each home. There is also no infrastructure through the steeply sloped areas of the site which would be expensive to develop.

Site Design

Amenities are provided on site in the pockets between development and undevelopable areas. All houses have garages or carports. There is a pollinator garden on the north end of the site and a large natural playground in the center of the site.



Figure 6.1 Birdseye perspective view of the third site design featuring the zero-lot lines homes and the natural playground

Site Two: Conclusions

The second site was more difficult to design and apply layouts to due to the drainage way through the center of the site. While this area was avoided in the majority of the designs if the design was being furthered it would be important to further engage with the drainage way. Further flooding studies could have been done to further the site designs presented as well. Overall the 'normalcy' of this site and its shape did not make site design or increasing density easier than the previous site.



Figure 6.1 Illustrative plan view of the first site design of site two for summary page



Figure 6.1 Illustrative plan view of the second site design of site two for summary page



Figure 6.1 Illustrative plan view of the third site design of site two for summary page



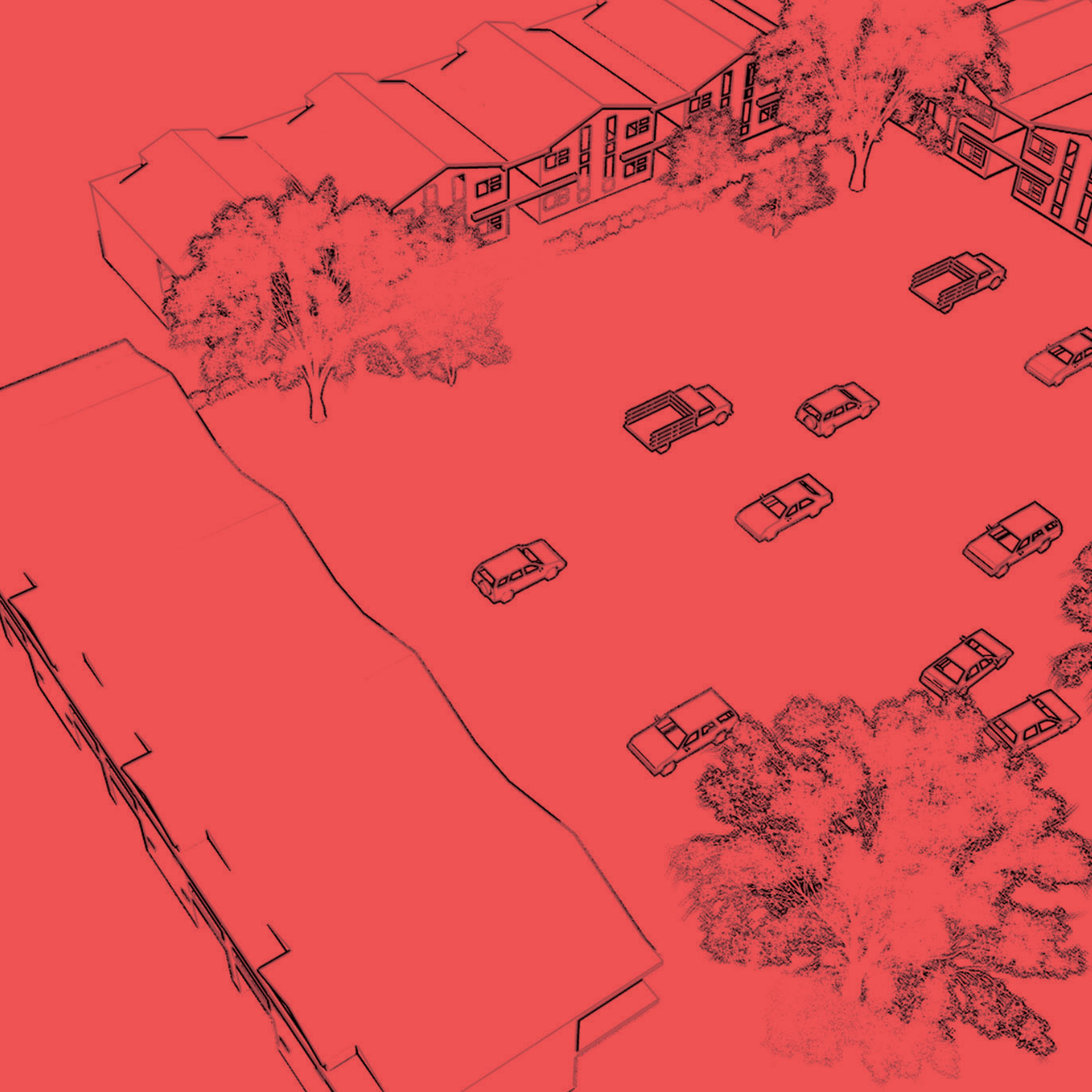
Figure 6.1 First site design of site two perspective for summary page



Figure 6.1 Second site design of site two perspective for summary page



Figure 6.1 Third site design of site two perspective for summary page



An aerial sketch of a residential neighborhood. It shows several houses with gabled roofs and multiple windows, arranged in a row. There are large, leafy trees interspersed among the houses. Two small cars are parked on a street in the lower left area. The entire sketch is rendered in a light, sketchy style with fine lines and some shading.

07

CONCLUSION

Summary of Findings

The major findings of this project should be the viability of affordable housing within Manhattan Kansas through the implementation of simple master planning techniques. Affordable housing currently seems unattainable in Manhattan due to a lack of diversity in the development process being implemented in Manhattan. Increasing density and adjusting code requirements such as building coverage requirements and side yard requirements can reduce the cost of development. There are many examples within the United States in which affordable housing was attained in conditions similar to Manhattan, Kansas. Landscape architects should advocate for master planning and creative site designs within affordable housing communities to increase density and create a strong sense-of-place.

Personal Reflection

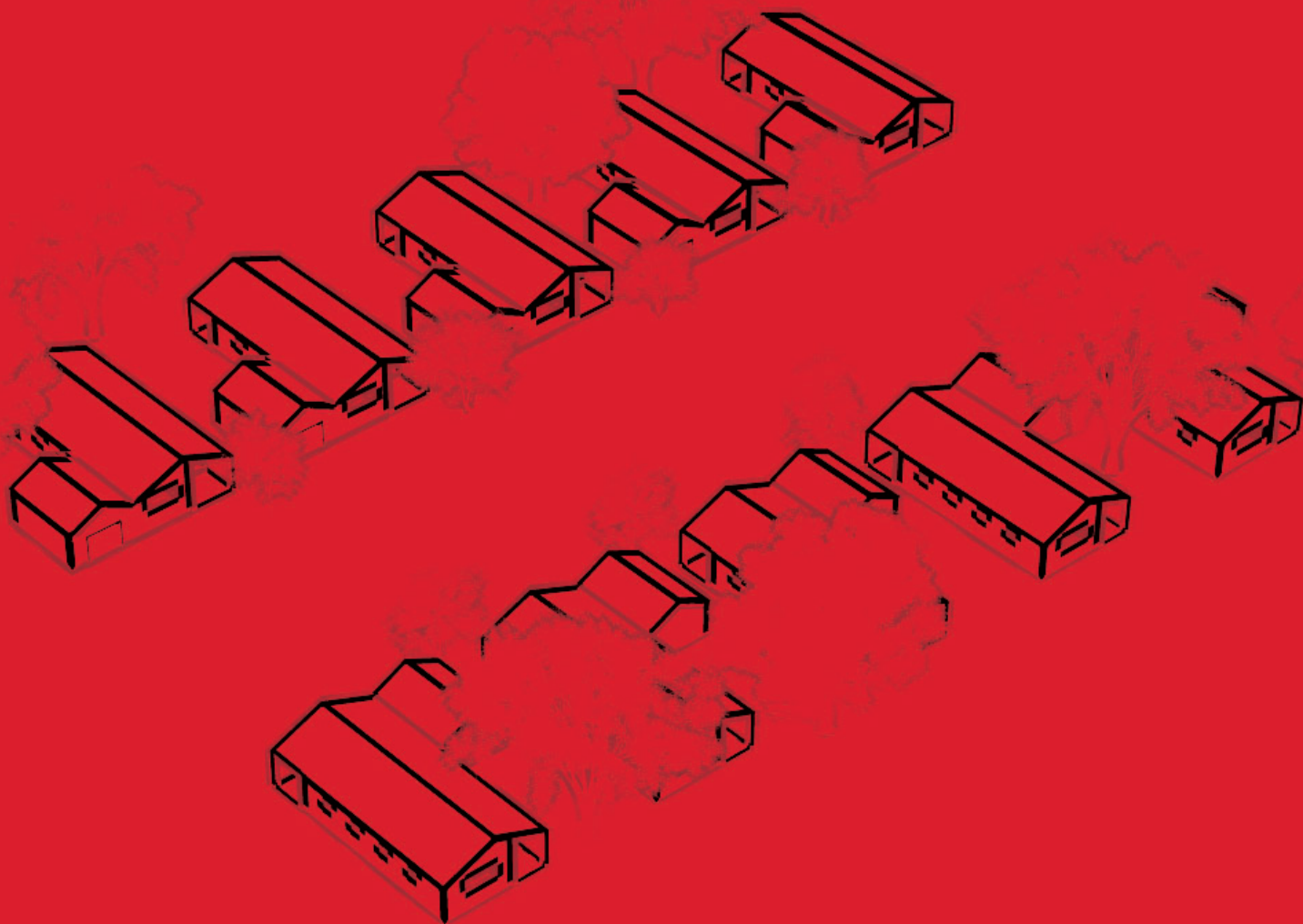
Reflecting on this project, and this year as a whole, has revealed the contributions that landscape architects can make towards the realization of more affordable housing. The exploration of precedents and the discussion with my committee opened my eyes to the importance of proper management when it comes to affordable housing. There are many ways in which affordable housing and residential housing as a whole can be improved through the involvement of landscape architects. Overall, this project has pulled together many lessons learned earlier in my education.

Limitations

The limitations within the study preceded include but are not limited to, time and access to data. With more time this study would have surveyed developers and individuals on their likelihood to employ any of the housing types, modules, or site layouts proposed in the study and be able to iterate based on these responses. Also with more time there could have been a deeper study on the desires of Manhattan citizens for their housing communities. This study could have even gone into surveying demographic groups like teachers or emergency responders that are often cited within the 'workforce housing' group. There was also a limit to the data that I was allowed to access to analyze the existing conditions of Manhattan. With parcel level income data there could have been more conclusions drawn on where those in need of affordable housing currently live.

Future Research

It is the goal of this study to encourage local site research and to assist current Kansas State University research. There is a desperate need in Manhattan for additional affordable housing and I would urge the Manhattan City Planning group to not just fill this need but to truly experiment with the type of experience they could provide for those in need of affordable housing. In addition to the Manhattan City Planners there is currently affordable housing research in progress by many individuals at Kansas State, including individuals advocating for the University itself to fund affordable housing for their staff. It is my hope that the synthesis of knowledge provided in this text can support their efforts.



END MATTER

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Figure 6.52 Paulson, Alyssa. 2024. Perspective view of the second site design featuring the hammock grove on the east side of the site. Digital Image

Figure 6.53 Paulson, Alyssa. 2024. Illustrative plan view of the second site design of site two highlighting the amenities available on the site. Digital Image

Figure 6.54 Paulson, Alyssa. 2024. Perspective view of the second site design featuring the natural earthen playground on the west side of the site. Digital Image

Figure 6.55 Paulson, Alyssa. 2024. Perspective view of the second site design featuring the bridge between both sides of the site. Digital Image

Figure 6.56 Paulson, Alyssa. 2024. Illustrative plan view of the third site design of site two. Digital Image

Figure 6.57 Paulson, Alyssa. 2024. Dimensioned plan view of the third site design on site two. Digital Image

Figure 6.58 Paulson, Alyssa. 2024. Enlargement of housing type C on the third site design on site two with dimensions. Digital Image

Figure 6.59 Paulson, Alyssa. 2024. Enlargement of housing type A on the third site design on site two with dimensions. Digital Image

Figure 6.60 Paulson, Alyssa. 2024. Perspective view of the third site design featuring the pollinator garden at the north end of the site. Digital Image

Figure 6.61 Paulson, Alyssa. 2024. Illustrative plan view of the third site design of site two highlighting the amenities available on the site. Digital Image

Figure 6.62 Paulson, Alyssa. 2024. Perspective view of the third site design featuring the natural playground in the center of the site. Digital Image

Figure 6.63 Paulson, Alyssa. 2024. Birdseye perspective view of the third site design featuring the zero-lot lines homes and the natural playground. Digital Image

Figure 6.64 Paulson, Alyssa. 2024. Illustrative plan view of the first site design of site two for summary page. Digital Image

Figure 6.65 Paulson, Alyssa. 2024. Illustrative plan view of the second site design of site two for summary page. Digital Image

Figure 6.66 Paulson, Alyssa. 2024. Illustrative plan view of the third site design of site two for summary page. Digital Image

Figure 6.67 Paulson, Alyssa. 2024. First site design of site two perspective for summary page. Digital Image

Figure 6.68 Paulson, Alyssa. 2024. Second site design of site two perspective for summary page. Digital Image

Figure 6.69 Paulson, Alyssa. 2024. Third site design of site two perspective for summary page. Digital Image

Appendix A

Rental Market Snapshot February 2024

Zillow. 2023. "For Rent, Manhattan, Kansas." Zillow. <https://www.zillow.com>

	Rental Cost	SQFT	\$/SQFT	Bedrooms	\$/Bed	Bathrooms
1	3995	3433	1.16	8	499	4
2	3300	2000	1.65	6	550	4
3	2750	2944	0.93	6	458	3
4	2495	3345	0.75	7	356	3.5
5	2300	3000	0.77	4	575	3
6	2295	3128	0.73	6	382	3
7	2250	1478	1.52	3	750	2
8	2200	1850	1.19	3	733	2.5
9	2195	2856	0.77	6	366	2
10	2195	2000	1.09	7	313	3
11	2150	2076	1.03	3	717	2
12	2000	3168	0.63	5	400	2
13	2000	1600	1.25	2	1000	2
14	1992	2444	0.82	6	332	3
15	1950	2299	0.84	6	325	2
16	1900	3972	0.47	5	380	5
17	1900	2310	0.82	4	475	2
18	1895	1540	1.23	5	379	2
19	1895	3000	0.63	4	474	3
20	1875	1575	1.19	3	625	2
21	1875	2133	0.87	4	469	3
22	1850	1804	1.02	4	463	2
23	1825	1824	1.00	4	456	3
24	1800	1800	1.00	4	450	3
25	1800	1300	1.38	2	900	2

	Rental Cost	SQFT	\$/SQFT	Bedrooms	\$/Bed	Bathrooms
26	1795	1651	1.09	3	599	2
27	1795	3250	0.55	3	599	2
28	1795	2572	0.70	5	359	2
29	1750	1600	1.09	3	583	2
30	1750	1305	1.34	4	437	2
31	1750	1873	0.93	3	583	2.5
32	1750	2800	0.62	5	350	3
33	1750	1561	1.12	4	437	2
34	1750	2500	0.70	4	437	2
35	1700	1400	1.21	4	425	2.5
36	1700	1963	0.87	4	425	2.5
37	1700	1454	1.17	4	425	2
38	1700	1200	1.41	2	850	1
39	1700	3000	0.57	2	850	2
40	1700	1500	1.13	4	425	2
41	1700	1485	1.14	4	425	2
42	1695	1009	1.68	3	565	2
43	1695	1800	0.94	4	424	2
44	1695	1816	0.93	3	565	2
45	1650	1684	0.98	5	330	2
46	1600	1575	1.01	4	400	2
47	1600	2043	0.79	4	400	2
48	1600	1700	0.94	5	320	2
49	1600	1557	1.03	4	400	2
50	1595	1875	0.85	4	399	2

Appendix A Cont.

Rental Market Snapshot February 2024

Zillow. 2023. "For Rent, Manhattan, Kansas." Zillow. <https://www.zillow.com>

	Rental Cost	SQFT	\$/SQFT	Bedrooms	\$/Bed	Bathrooms
51	1595	2119	0.75	4	399	2
52	1590	1865	0.85	3	530	2.5
53	1550	1560	0.99	3	517	2
54	1550	1700	0.91	4	388	2
55	1550	1898	0.81	3	517	2
56	1500	2264	0.66	2	750	3
57	1500	1296	1.16	3	500	2
58	1495	1439	1.04	4	374	1.5
59	1485	1558	0.96	3	498	2
60	1475	1642	0.90	3	491	2
61	1450	1436	1.00	3	483	2
62	1450	1320	1.10	4	362	1.5
63	1450	1400	1.03	4	362	2
64	1450	1400	1.04	3	483	2
65	1400	1166	1.20	3	467	1.5
66	1400	1247	1.12	3	467	2
67	1400	2170	0.64	4	350	3
68	1395	1700	0.82	4	349	2
69	1395	960	1.45	3	465	1
70	1385	1560	0.89	3	461	2
71	1337	1600	0.84	3	446	3
72	1300	900	1.44	2	650	1
73	1300	1382	0.94	4	325	2
74	1299	1700	0.76	3	433	2.5
75	1295	1252	1.03	4	324	2

	Rental Cost	SQFT	\$/SQFT	Bedrooms	\$/Bed	Bathrooms
76	1275	1160	1.10	3	425	1.5
77	1250	1082	1.15	3	417	2
78	1250	1065	1.17	3	417	1
79	1248	1400	0.89	3	416	2
80	1230	1088	1.13	3	410	1
81	1200	1200	1.00	3	400	2
82	1200	915	1.31	2	600	1
83	1200	1100	1.09	4	300	2
84	1195	1200	0.99	3	398	2
85	1195	1344	0.89	3	398	2
86	1195	1200	0.99	3	398	1
87	1195	1281	0.93	3	398	1
88	1195	950	1.26	2	597	2
89	1175	1100	1.07	3	392	1
90	1155	1345	0.86	3	385	2
91	1150	1012	1.14	2	575	1
92	1100	1304	0.84	4	275	1
93	1100	1202	0.92	3	367	2
94	1095	1200	0.91	2	548	2
95	999	1100	0.91	2	500	2
96	975	843	1.16	2	488	1
97	975	843	1.16	2	488	1
98	950	1013	0.94	2	475	1
99	925	1000	0.92	2	463	1.5
100	900	750	1.20	2	450	1

Appendix A Cont.

Rental Market Snapshot February 2024

Zillow. 2023. "For Rent, Manhattan, Kansas." Zillow. <https://www.zillow.com>

	Rental Cost	SQFT	\$/SQFT	Bedrooms	\$/Bed	Bathrooms
101	850	806	1.05	2	425	1
102	800	612	1.31	1	800	1
103	790	950	0.83	2	395	1
104	750	925	0.81	2	375	1
105	725	796	0.91	2	363	1
106	650	664	0.98	1	650	1
107	600	598	1.00	1	600	1
108	550	425	1.29	1	550	1

Average Rent

\$1,549

Average Cost per SQFT

\$1

Average Cost per Bedroom

\$475

Appendix B

Home Ownership Market Snapshot January 2024

Zillow. 2023. "For Rent, Manhattan, Kansas." Zillow. <https://www.zillow.com>

	Cost of Home	SQFT	\$/SQFT
1	1,875,000	6720	279
2	925,000	3970	233
3	925,000	4263	217
4	750,000	3488	215
5	749,000	3484	215
6	725,000	3372	215
7	650,000	3095	210
8	611,144	2966	206
9	610,000	3035	201
10	529,900	2731	194
11	525,000	2822	186
12	493,000	2694	183
13	469,900	2582	182
14	450,000	2486	181
15	445,000	2500	178
16	440,000	2514	175
17	439,000	2567	171
18	435,000	2574	169
19	430,000	2590	166
20	429,900	2621	164
21	429,500	2651	162
22	425,000	2673	159
23	420,000	2658	158
24	415,000	2627	158

Appendix B Cont.

Home Ownership Market Snapshot January 2024

Zillow. 2023. "For Rent, Manhattan, Kansas." Zillow. <https://www.zillow.com>

	Cost of Home	SQFT	\$/SQFT
25	399,999	2548	157
26	399,999	2564	156
27	399,000	2625	152
28	398,000	2618	152
29	395,000	2633	150
30	395,000	2669	148
31	395,000	2669	148
32	392,000	2667	147
33	390,000	2671	146
34	398,900	2688	145
35	385,000	2674	144
36	384,900	2692	143
37	379,000	2688	141
38	369,000	2617	141
39	365,000	2589	141
40	359,900	2571	140
41	355,000	2536	140
42	354,900	2535	140
43	354,900	2553	139
44	339,900	2463	138
45	339,000	2457	138
46	335,000	2463	136
47	335,000	2481	135
48	335,000	2481	135

Appendix B Cont.

Home Ownership Market Snapshot January 2024

Zillow. 2023. "For Rent, Manhattan, Kansas." Zillow. <https://www.zillow.com>

	Cost of Home	SQFT	\$/SQFT
49	335,000	2500	134
50	329,000	2474	133
51	327,000	2459	133
52	325,000	2462	132
53	324,900	2461	132
54	324,500	2477	131
55	317,500	2461	129
56	315,000	2442	129
57	314,900	2441	129
58	309,900	2421	128
59	305,000	2383	128
60	299,999	2361	127
61	299,000	2354	127
62	298,500	2369	126
63	289,000	2294	126
64	284,900	2261	126
65	282,500	2278	124
66	279,500	2272	123
67	279,000	2306	121
68	275,000	2273	121
69	275,000	2311	119
70	271,500	2301	118
71	269,000	2319	116
72	265,000	2304	115

Appendix B Cont.

Home Ownership Market Snapshot January 2024

Zillow. 2023. "For Rent, Manhattan, Kansas." Zillow. <https://www.zillow.com>

	Cost of Home	SQFT	\$/SQFT
73	265,000	2304	115
74	260,000	2261	115
75	250,000	2193	114
76	239,900	2123	113
77	235,000	2080	113
78	229,900	2053	112
79	225,000	2027	111
80	225,000	2045	110
81	221,500	2014	110
82	219,000	2009	109
83	215,000	1991	108
84	207,000	1953	106
85	195,000	1857	105
86	189,900	1918	99
87	189,000	1929	98
88	179,900	1855	97

Appendix B Cont.

Home Ownership Market Snapshot January 2024

Zillow. 2023. "For Rent, Manhattan, Kansas." Zillow. <https://www.zillow.com>

	Cost of Home	SQFT	\$/SQFT
89	177,000	1825	97
90	172,000	1810	95
91	170,000	1789	95
92	160,000	1758	91
93	159,900	2050	78
94	140,000	1818	77
95	124,690	1756	71
96	112,000	1577	71
97	92,000	1314	70
98	59,900	966	62

Average Cost of Home

\$363,784

Average Cost per SQFT

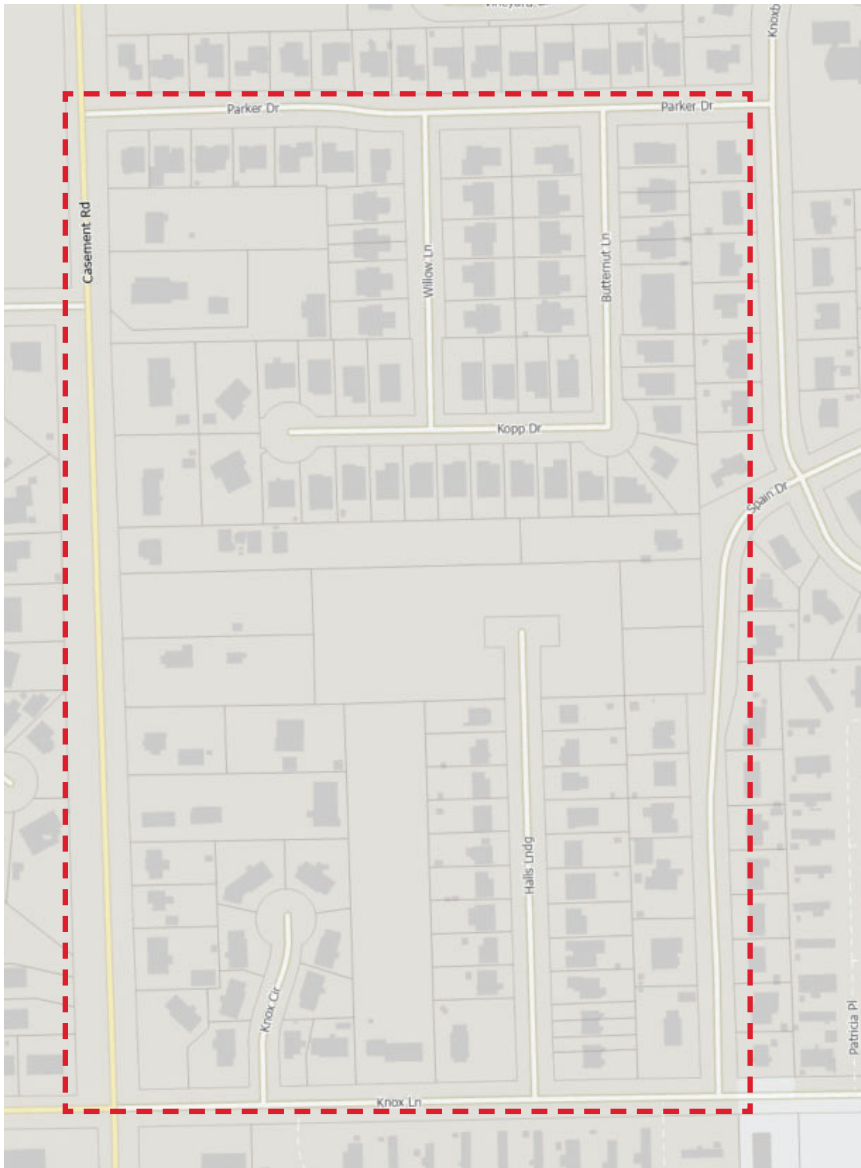
\$138

Appendix C

Site Infrastructure Cost Estimates

Riley County Community GIS Viewer. 2024.

Study Area



Improved Land Value Costs (Assessed & Market Rate)

Comparison Neighborhood

Location Bounds: Casement Rd (West), Parker Dr. (North), Spain Dr/Knoxberry Dr (East), and Knox Lane (South)

				City of Manhattan Assessed Value			
QuickRef ID	Street	Side	Area (Ac)	Land Value (LV) (2024)	LV/Ac (2024)	Building Value (BV) (2024)	Imp LV : BV
R6614	Parker Dr	South	0.15	\$24,460	\$163,067	\$176,880	0.14
R6613	Parker Dr	South	0.15	\$24,520	\$163,467	\$172,350	0.14
R6612	Parker Dr	South	0.15	\$24,540	\$163,600	\$169,300	0.14
R6611	Parker Dr	South	0.15	\$24,570	\$163,800	\$167,270	0.15
R6610	Parker Dr	South	0.15	\$24,570	\$163,800	\$172,670	0.14
R6609	Parker Dr	South	0.15	\$24,460	\$163,067	\$167,980	0.15
R6608	Willow Ln	West	1.15	\$24,630	\$21,417	\$141,270	0.17
R6607	Willow Ln	West	0.18	\$25,260	\$140,333	\$170,820	0.15
R6605	Willow Ln	West	0.19	\$22,870	\$120,368	\$98,290	0.23
R6606	Willow Ln	West	0.09	\$22,860	\$254,000	\$108,950	0.21
R6604	Willow Ln	West	0.19	\$25,260	\$132,947	\$170,820	0.15
R6603	Willow Ln	West	0.19	\$25,340	\$133,368	\$170,820	0.15
R6635	Kopp Dr	North	0.21	\$25,580	\$121,810	\$177,620	0.14
R6636	Kopp Dr	North	0.16	\$24,760	\$154,750	\$159,200	0.16
R6637	Kopp Dr	North	0.16	\$24,810	\$155,063	\$189,790	0.13
R6638	Kopp Dr	North	0.17	\$25,070	\$147,471	\$179,570	0.14
R304194	Kopp Dr	North	0.35	\$22,160	\$63,314	\$184,500	0.12
R6620	Kopp Dr	South	0.35	\$22,170	\$63,343	\$187,520	0.12
R6639	Kopp Dr	South	0.15	\$24,670	\$164,467	\$172,920	0.14
R6640	Kopp Dr	South	0.16	\$24,740	\$154,625	\$178,720	0.14
R6641	Kopp Dr	South	0.16	\$24,740	\$154,625	\$173,460	0.14
R6642	Kopp Dr	South	0.16	\$24,700	\$154,375	\$179,100	0.14
R6643	Kopp Dr	South	0.16	\$24,680	\$154,250	\$217,210	0.11
R6644	Kopp Dr	South	0.16	\$24,680	\$154,250	\$177,060	0.14
R6645	Kopp Dr	South	0.16	\$24,660	\$154,125	\$179,390	0.14

R6646	Kopp Dr	South	0.15	\$24,620	\$164,133	\$183,780	0.13
R6647	Kopp Dr	South	0.16	\$24,660	\$154,125	\$234,380	0.11
R6648	Kopp Dr	South	0.15	\$24,550	\$163,667	\$177,890	0.14
R6649	Kopp Dr	South	0.17	\$25,150	\$147,941	\$186,850	0.13
R6650	Butternut Ln	East	0.23	\$25,770	\$112,043	\$214,500	0.12
R6651	Butternut Ln	East	0.15	\$24,540	\$163,600	\$186,070	0.13
R6652	Butternut Ln	East	0.15	\$24,410	\$162,733	\$169,680	0.14
R6630	Butternut Ln	East	1.15	\$24,380	\$21,200	\$175,570	0.14
R6592	Butternut Ln	East	0.31	\$26,850	\$86,613	\$348,750	0.08
R6591	Butternut Ln	East	0.11	\$23,230	\$211,182	\$153,860	0.15
R6590	Butternut Ln	East	0.1	\$23,170	\$231,700	\$152,680	0.15

Avg. \$132,405

Project Parcel				City of Manhattan Assessed Value						
QuickRefID	Street	Side	Area (Ac)	Land Value (LV) (2024)	LV /Ac (2024)	Building Value (BV) (2024)	Imp LV : BV	Total Assessed Value (2024)	Zillow Market Value (2024)	
R310096	Casement Rd	East	0.76	\$27,490	\$36,171	\$380		\$27,870		
R6623	Casement Rd	East	0.82	\$28,380	\$34,610	\$108,520		\$136,900		
R310097	Halls Landing	North	2.31	\$35,850	\$15,519	\$0		\$35,850		
R310098	Spain Dr	West	0.34	\$22,050	\$64,853	\$0		\$22,050		
R310099	Spain Dr	West	0.33	\$22,030	\$66,758	\$0		\$22,030		
		Totals	4.56	\$135,800		\$108,900		\$244,700	\$191,000	
Total acres			4.56							
Assessed land value				\$135,800						
Estimated improved land value (assessed)				\$619,248						
(4.56 acres x \$132,405/ac)										
Improved land value per DU (21 units)				\$29,488						
Improved land value per DU (32 units)				\$19,352						
Estimated improved land value (Zillow MV)				\$650,210						
(\$619,248 x 1.05)										
Improved land value per DU (21 units)				\$30,962						
Improved land value per DU (32 units)				\$20,319						

Appendix D

Site One: Design One, Housing Costs Calculations

Gordian. 2022. "RSMeans Estimating Handbook". Greenville, South Carolina

Gross Housing Cost Calculations, Site One: Design One			
Housing Type	Units per Housing Type	Cost per Unit	Total Cost Per Housing Type
Housing Type A	30	\$160,000	\$4,800,000
Housing Type B	6	\$253,224	\$1,519,344
Totals			
	36		\$6,319,344

Appendix D Cont.

Site One: Design One, Housing Costs Calculations

Gordian. 2022. "RSMeans Estimating Handbook". Greenville, South Carolina

Gross Housing Cost Calculations, Site One: Design Two			
Housing Type	Units per Housing Type	Cost per Unit	Total Cost Per Housing Type
Housing Type B	6	\$253,224	\$1,519,344
Housing Type C	6	\$144,000	\$864,000
Housing Type D	32	\$69,135	\$2,212,320
Totals			
	44		\$4,595,664

Appendix D Cont.

Site One: Design One, Housing Costs Calculations

Gordian. 2022."RSMeans Estimating Handbook". Greenville, South Carolina

Gross Housing Cost Calculations, Site One: Design Three			
Housing Type	Units per Housing Type	Cost per Unit	Total Cost Per Housing Type
Housing Type A	10	\$140,000	\$1,400,000
Housing Type B	8	\$233,224	\$1,865,792
Housing Type D	32	\$69,135	\$2,212,320
Totals			
	50		\$5,478,112

Appendix E

House Plans Findings

House Plans. n.d. "Search Home Plans & Garage Plans - Houseplans.com." House Plans. 2024. <https://www.houseplans.com/search>.

\$245,000-200,00		
Solar Possibilities		
https://www.houseplans.com/plan/1576-square-foot-3-bedroom-2-bathroom-0-garage-modern-37840	1576 Square Feet	
https://www.houseplans.com/plan/1544-square-foot-3-bedrooms-2-bathroom-contemporary-house-plans-0-garage-2633	1544 Square Feet	
Narrow Lots		
https://www.houseplans.com/plan/1475-square-foot-3-bedroom-2-5-bathroom-1-garage-craftsman-traditional-sp216915	1475 Square Feet	
https://www.houseplans.com/plan/1489-square-foot-3-bedroom-2-bathroom-2-garage-modern-ranch-craftsman-39163	1489 Square Feet	
Three Bedrooms		
https://www.houseplans.com/plan/1697-square-foot-3-bedroom-2-bathroom-2-garage-farmhouse-cottage-country-sp267654	1697 Square Feet	

Appendix E Cont.

House Plan Findings

House Plans. n.d. "Search Home Plans & Garage Plans - Houseplans.com." House Plans. 2024. <https://www.houseplans.com/search>.

Three Bedrooms Continued		
https://www.houseplans.com/plan/3207-square-feet-3-bedroom-2-5-bathroom-2-garage-farmhouse-cottage-country-sp262612	1742 Square Feet	
https://www.houseplans.com/plan/1486-square-feet-3-bedroom-2-bathroom-2-garage-farmhouse-cottage-sp258436	1486 Square Feet	
https://www.houseplans.com/plan/1731-square-feet-3-bedroom-2-bathroom-2-garage-modern-contemporary-41361	1731 Square Feet	
https://www.houseplans.com/plan/1684-square-feet-3-bedroom-2-5-bathroom-2-garage-traditional-european-sp276436	1684 Square Feet	
Four Bedrooms		
https://www.houseplans.com/plan/1612-square-feet-4-bedroom-2-bathroom-0-garage-bungalow-country-farmhouse-european-sp325150	1612 Square Feet	

Appendix E Cont.

House Plans Findings

House Plans. n.d. "Search Home Plans & Garage Plans - Houseplans.com." House Plans. 2024. <https://www.houseplans.com/search>.

\$200,000-165,000		
Garage		
https://www.houseplans.com/plan/1718-square-feet-3-bedroom-2-bathroom-1-garage-contemporary-modern-sp264588	1251 Square Feet	
Solar Possibilities		
https://www.houseplans.com/plan/1768-square-feet-3-bedroom-2-bathroom-0-garage-country-farmhouse-sp264501	1400 Square Feet	
https://www.houseplans.com/plan/1209-square-feet-2-bedroom-1-bathroom-0-garage-modern-contemporary-cabin-sp289227	1209 Square Feet	
https://www.houseplans.com/plan/1296-square-feet-3-bedroom-1-bathroom-0-garage-contemporary-40052	1296 Square Feet	
Car Port		
https://www.houseplans.com/plan/1410-square-feet-3-bedroom-2-bathroom-0-garage-cabin-contemporary-modern-beach-sp284922	1410 Square Feet	

Appendix E Cont.

House Plan Findings

House Plans. n.d. "Search Home Plans & Garage Plans - Houseplans.com." House Plans. 2024. <https://www.houseplans.com/search>.

Narrow Lots		
https://www.houseplans.com/plan/1327-square-feet-3-bedroom-2-bathroom-2-garage-farmhouse-craftsman-bungalow-sp294604	1327 Square Feet	
https://www.houseplans.com/plan/1365-square-feet-3-bedroom-2-bathroom-2-garage-contemporary-modern-sp276722	1365 Square Feet	
https://www.houseplans.com/plan/1359-square-feet-3-bedroom-2-bathroom-2-garage-farmhouse-craftsman-ranch-modern-sp295521	1359 Square Feet	
Three Bedrooms		
https://www.houseplans.com/plan/1373-square-feet-3-bedroom-2-bathroom-2-garage-contemporary-craftsman-farmhouse-sp290978	1373 Square Feet	

Appendix E Cont.

House Plans Findings

House Plans. n.d. "Search Home Plans & Garage Plans - Houseplans.com." House Plans. 2024. <https://www.houseplans.com/search>.

\$165,000-125,000

Solar Possibilities

<https://www.houseplans.com/plan/1050-square-feet-2-bedroom-2-bathroom-0-garage-cabin-cottage-sp323457>

1050 Square Feet



<https://www.houseplans.com/plan/962-square-feet-1-bedroom-1-bathroom-0-garage-modern-sp300431>

962 Square Feet



Car Port

<https://www.houseplans.com/plan/900-square-feet-2-bedrooms-2-bathroom-country-house-plans-1-garage-32436>

900 Square Feet



<https://www.houseplans.com/plan/1174-square-feet-3-bedroom-2-bathroom-1-garage-traditional-sp291135>

1174 Square Feet



Narrow Lot

<https://www.houseplans.com/plan/1065-square-feet-3-bedroom-1-bathroom-0-garage-modern-38880>

1065 Square Feet



Appendix E Cont.

House Plan Findings

House Plans. n.d. "Search Home Plans & Garage Plans - Houseplans.com." House Plans. 2024. <https://www.houseplans.com/search>.

Two Bedrooms		
https://www.houseplans.com/plan/900-square-feet-2-bedroom-1-bathroom-1-garage-craftsman-farmhouse-sp257861	900 Square Feet	
https://www.houseplans.com/plan/1146-square-feet-2-bedroom-2-00-bathroom-2-garage-european-country-sp260022	1146 Square Feet	
Three Bedrooms		
https://www.houseplans.com/plan/1269-square-feet-3-bedroom-2-00-bathroom-2-garage-craftsman-ranch-country-sp257090	1269 Square Feet	
https://www.houseplans.com/plan/928-square-feet-2-bedroom-2-bathroom-2-garage-farmhouse-craftsman-ranch-cottage-sp268935	928 Square Feet	

Appendix E Cont.

House Plans Findings

House Plans. n.d. "Search Home Plans & Garage Plans - Houseplans.com." House Plans. 2024. <https://www.houseplans.com/search>.

\$125,000-60,000		
Garage		
https://www.houseplans.com/plan/525-square-feet-1-bedroom-1-bathroom-2-garage-farmhouse-southern-country-craftsman-sp299715	525 Square Feet	
https://www.houseplans.com/plan/572-square-feet-1-bedroom-1-bathroom-2-garage-farmhouse-southern-bungalow-traditional-sp295573	572 Square Feet	
https://www.houseplans.com/plan/632-square-feet-1-bedrooms-1-bathroom-traditional-house-plans-2-garage-6349	632 Square Feet	
https://www.houseplans.com/plan/652-square-feet-2-bedroom-1-5-bathroom-1-garage-cottage-cabin-craftsman-traditional-sp267858	803 Square Feet	
https://www.houseplans.com/plan/715-square-feet-2-bedroom-1-5-bathroom-2-garage-southern-contemporary-modern-sp302253	715 Square Feet	

Appendix E Cont.

House Plan Findings

House Plans. n.d. "Search Home Plans & Garage Plans - Houseplans.com." House Plans. 2024. <https://www.houseplans.com/search>.

Solar Possibilities		
https://www.houseplans.com/plan/442-square-feet-1-bedroom-1-bathroom-0-garage-contemporary-beach-sp317096	442 Square Feet	
Cart Port		
https://www.houseplans.com/plan/440-square-feet-1-bedroom-1-bathroom-0-garage-cabin-ranch-modern-farmhouse-41111	500 Square Feet	
https://www.houseplans.com/plan/900-square-feet-2-bedroom-1-bathroom-0-garage-ranch-cabin-country-farmhouse-sp257202	795 Square Feet	
https://www.houseplans.com/plan/864-square-feet-2-bedroom-2-00-bathroom-0-garage-contemporary-sp124325	864 Square Feet	
https://www.houseplans.com/plan/885-square-feet-2-bedroom-1-bathroom-1-garage-modern-sp270491	885 Square Feet	
Narrow Lots		
https://www.houseplans.com/plan/584-square-feet-1-bedroom-2-bathroom-0-garage-contemporary-39413	584 Square Feet	

Appendix E Cont.

House Plans Findings

House Plans. n.d. "Search Home Plans & Garage Plans - Houseplans.com." House Plans. 2024. <https://www.houseplans.com/search>.

Two Bedrooms

<https://www.houseplans.com/plan/480-square-feet-2-bedrooms-1-bathroom-beach-home-plans-0-garage-32887>

480 Square Feet



<https://www.houseplans.com/plan/631-square-feet-2-bedroom-1-00-bathroom-0-garage-contemporary-ranch-sp260048>

631 Square Feet



<https://www.houseplans.com/plan/682-square-feet-2-bedroom-1-bathroom-1-garage-modern-cabin-contemporary-sp299640>

682 Square Feet



Appendix E Cont.

House Plan Findings

House Plans. n.d. "Search Home Plans & Garage Plans - Houseplans.com." House Plans. 2024. <https://www.houseplans.com/search>.

\$60,000		
Garage		
https://www.houseplans.com/plan/350-square-feet-1-bedrooms-1-bathroom-traditional-house-plans-2-garage-33394	350 Square Feet	
https://www.houseplans.com/plan/362-square-feet-1-bedroom-1-bathroom-1-garage-bungalow-modern-cabin-beach-sp264344	362 Square Feet	
https://www.houseplans.com/plan/387-square-feet-1-bedrooms-1-bathroom-craftsman-home-plans-2-garage-30784	387 Square Feet	
Solar Possibilities		
https://www.houseplans.com/plan/261-square-feet-1-bedroom-1-bathroom-0-garage-modern-38480	261 Square Feet	

House Plans. n.d. "Search Home Plans & Garage Plans - Houseplans.com." House Plans. 2024. <https://www.houseplans.com/search>.

Car Port		
https://www.houseplans.com/plan/399-square-feet-1-bedroom-1-bathroom-0-garage-ranch-39373	399 Square Feet	
Narrow Lot		
https://www.houseplans.com/plan/399-square-feet-1-bedroom-1-bathroom-0-garage-contemporary-ranch-39427	399 Square Feet	
Tiny Homes		
https://www.houseplans.com/plan/395-square-feet-1-bedroom-1-bathroom-0-garage-cottage-ranch-country-sp125065	395 Square Feet	
https://www.houseplans.com/plan/284-square-feet-1-bedrooms-1-bathroom-bungalow-house-plans-0-garage-35190	284 Square Feet	
https://www.houseplans.com/plan/320-square-feet-1-bedrooms-1-bathroom-cottage-house-plans-0-garage-32884	320 Square Feet	