Spring 2015

Meeting in the middle: Organizing sustainability goals To redevelop Jacksonville, Florida suburbs

James Robert Reynolds II

R·I·T

Meeting in the middle

Organizing sustainability goals
To redevelop Jacksonville, Florida suburbs

By
James Robert Reynolds II

A thesis submitted in partial fulfillment of the requirements
for the degree of masters of architecture

Department of Architecture
Golisano Institute for Sustainability

Rochester Institute of Technology
Rochester, New York
Spring 2015

Committee Approval

Jules Chiavaroli Date
Associate Professor
Department of Architecture
Thesis Chair

Dr. Roger Chen Date
Associate Professor
Golisano Institute for Sustainability
Thesis Advisor

Mary Scipioni Date
Adjunct Professor
Department of Architecture
Thesis Advisor

Preface

The suburbs are often the critique of planners, designers, and architects that see it as gluttonous land consumption. Furthermore, that the US housing market is an outdated machine for making placeless, uninteresting spaces for humans to live in. Being raised in both Phoenix, Arizona and Jacksonville, Florida (two common case studies in sprawl) I called it home.

The main factor that drove me to choose the topic of suburban retrofitting was how intrepid the United States has been in redeveloping its urban spaces from vacant factories and buildings into dense, walkable, profitable areas with high quality of life. This adapting of existing building stock to solve larger sustainability problems faced by current populations could be exactly what the suburbs need to create more vibrant, diverse, resilient communities.

The following thesis project was completed in partial fulfillment of a Master of Architecture degree at Rochester Institute of Technology.

Abstract

The United States is at a developmental turning point in how it grows, responds to the housing needs of its existing citizens, and utilizes its existing infrastructure. Since 1945, population has doubled, however land use has increased by nearly 400%. This indicates that we are developing at lower densities, which have been shown to increase the environmental, social, and economic costs of development due to infrastructure construction, operations and maintenance, transportation use, and lifestyle.

Jacksonville, Florida is spatially the largest city in the USA, and most populated in Florida. Due to the wide array of foreclosed and vacant houses in nearly every suburban community within the city, this thesis explores how adaptive reuse projects can use these lots to increase density, unit variety, and limit new infrastructure construction. This framework will then be made into a comprehensive design for a community housing building fitting into the context of a suburban neighborhood.

This thesis demonstrates how a designer can utilize the top down and bottom up organizational methods to help attain a more complete understanding of context and overall goal project goals. By condensing large scale sustainability goals into measurable outcomes, and understanding how the specific context will respond to implementation, sustainability can be realized with appropriate design.

Contents

1.0 Implementing Sustainability

1.0 Implementing Sustainability

Sustainability is an often contested topic that many people find they support, but few people can agree upon a definition for. (Dobson) Before moving into a project about sustainable suburban redevelopment, it would be best to describe my definition of sustainability, and how I will be organizing my research. For the scope of this thesis, I will be using the definition of "Development that meets the needs of the present without compromising the ability for future generations to meet their own needs." (Brundtland) I would like to clarify that this definition will be used not to frame my research, but will act as a general guideline to be refined by my research.

The purpose of this investigation is to develop an idea of what problems and opportunities exist for sustainable development in suburban Jacksonville. Utilizing a combination of two organizational strategies known as the top down and bottom up approach, I will propose a simple framework for organizing research, identifying problems, and implementing change. I will begin by defining both the top down and bottom up methodology, and then discuss the place of the designer in implementation

It is of paramount importance politicians, planners, designers, and the public understand their roles in implementing large-scale sustainability initiatives. Due to what is considered a "political climate of inaction" (Dirix) Investigating more ways to involve the general public into the implementation process can give them a vested interest in success, and help to provide detailed feedback for large scale policy decisions. This multi-level interaction has proven in numerous instances to make sustainable development and land use more successful in attaining its goals. (Klint)

1.1 Top down method

The top down method is a simple organizational framework that allows someone to identify an overall goal, divide it into smaller components, and create a list of actionable items to attain the overall goal. The main purpose of this approach is to simplify a complex problem into measurable solutions. (Rohilla) As it is used in sustainability, the top-down method reviews existing systems, and develops prescriptive measures for the continued sustainment of that system. (Klint) Using the aforementioned Brundtland definition as an origin point, the top-down method begins as an understanding of what

future generations needs will be, quantifying those needs, and making changes to ensure those needs are met. Top down methodology tends to be intent oriented. (Poortinga)

Example: *Goal – Keep my boat floating*

Problem – I have several holes in my boat

Solution – Reduce holes in boat

Detail – Large holes patched with duct tape
Detail – my socks need changing

In the example, holes are used as an indicator for overall floating success. When applied to sustainability, indicators (metrics) are usually chosen to begin to evaluate the overall impact of implementation over time. The use of metrics is an important tool for communicating the intended purpose of the solution, and evaluating its success or failure.

1.2 Bottom up method

In the bottom up approach, large selections of details are grouped based on similarities to form a more generalized understanding of their makeup. These generalized systems are then evaluated, and goals determined for solving the overall problem. In sustainability, the bottom up method starts by using community members, stakeholders, and contextual research to better specify what prescriptive measures to take. Using the Brundtland definition again, this involves starting at the needs of current generations, and finding ways to ensure they are attained. Often, these problems involve complex political and social situations. (Klint) Bottom up methodology tends towards being impact oriented. (Poortinga)

Example: *Detail - I am getting wet*
Detail - My boat is sinking
Detail - Water is entering my boat

Problem – My boat has holes in it

Goal – Keep boat floating

Solution – Reduce holes in boat

In this example, details relating to the immediate situation were grouped together to find a commonality. In this case, it was a problem with water entering the boat. This common problem leads to a generalized goal of stopping the boat from sinking. While it does not address all of the details (I am still wet), it does address the general problem at hand.

1.3 Limitations and designers

These two methods, when used in isolation, have been proven to be imperfect methods for evaluating and planning for sustainable design.
The Top down approach is incredibly versatile, as it can be scaled in complexity and focus based on the problem at hand. The drawback is that these solutions can often be far divorced from their implementation, making a solution seem imposed because of lack of scope. (Pereira) Long range sustainable planning has in some cases caused larger environmental problems due to lack of understanding on the implementation level. (Fraser)

The bottom up approach is also not without its faults. As sometimes one can't see the forest for the trees, dealing with the bottom up approach can lead to feedback loops where details not relevant to overall goal or implementation are still deemed important. In one case study, planners worked with local communities to choose their own sustainability indicators, a process that made the planning take a year longer than expected. (Klint)

As both the top-down and bottom-up approaches lead to solutions that can be implemented, it must be noted that often times the goals and solutions are not similar or compatible in any way, especially when dealing with extremely complex problems at large scales. With this in mind, it is suggested that using both methodologies will reveal both the overall goal (top down) and understanding of the context well enough to successfully implement (bottom up). As a designer, finding solutions to large scale environmental problems requires a win-win solution to solving local social/economic issues preventing success. (Fraser)

2.0 A Top-Down Approach to the Suburbs

2.0 A Top down approach to the suburbs

Now that a methodology for gathering and synthesizing research has been established, the next phase will be a general review of the US suburbs from large scale. That will then lead to the creation of indicator(s) for evaluating existing conditions and prescriptive solutions for implementing change.

Between 1990 and 2010, the United States increased its housing stock by 23% from 106,283,000 units to 130,599,000 housing units. Of the current housing stock, 57.3% are lived in by the owner, and 27.2% are rental units, with the remainder either vacant (10.5%) or seasonal (3.5%). Of the total dwelling units, 63% are single family detached units, 25% are apartments of various sizes .05% are townhomes, and .06% are mobile homes. The median square footage for single family detached homes in the US is 1700 square feet, with the median year of construction as 1974. (U.S. Census) This means that the majority of the US housing stock consists of detached, single family homes in which the person living inside owns the property.

Between 1945 and 2007, land defined as urban increased by 403% in the United States, increasing from 15,012,000 acres to 60,562,000 acres. The most urban growth occurred in Arizona (2497%), Nevada (1317%), Maryland (874%), Delaware (869%), Alaska (797%), and Florida (790%). As a region, the Southeast (South Carolina, Georgia, Florida, Alabama) grew the most by 695%, and the Northern Plains (N. Dakota, S. Dakota, Nebraska, Kansas) grew the least, by 244%. (USDA)

On July 1st, 1945, the US had a population of 139.93 million, which increased to 301.2 million by 2007. This is a 215.3% increase in population, occurring alongside a 403% increase in land use. This correlation between population size and growth indicates a drop in average land use density from 9.3 heads/acre in 1945 to 5 heads/acre in 2007. While the land use and density of areas is subject to complex changes over time, the above calculations are sufficient to indicate that from 1945 to 2007 the density of our urban developments was reduced by nearly half. The average size of housing in the United States also increased by 55%, from 900sf in 1945 - to 2000sf currently. The array of low density single family housing spreading from our metropolitan regions in the US has been termed as urban sprawl. (Frey) In conclusion, the sprawl paradigm has created a development pattern over the last 70 years that has decreased our overall development density by 53%.

2.1 Effects of sprawl

As we continue to build less centralized, low density communities full of single family housing, we all communally pay an environmental, social, and economic cost for our land consumption. As land use density decreases, there is an increase in length in roadways, electrical, water, and wastewater infrastructure needed. (Müller) This translates to higher costs both economically, and environmentally. Our aging US infrastructure has a D+ rating from the American Society for Civil Engineers, with a large amount of projected infrastructure repairs needed in upcoming years. This is compounded by the fact that US spending on infrastructure has decreased since 2008. (Kelly et.al.)

An important land use pattern associated with urban/metropolitan sprawl is the concept of "leapfrogging." (Williams) This is when new development can only occur on land increasingly further from existing infrastructure, causing growth to occur only at the perimeter. These regions, when far enough away from their urban cores, become "exurban." As of 2014, 40% of metropolitan populations reside within perimeter areas defined as exurban. The development footprint of US is on average 5 times bigger than in developing countries due to the embodied energy of its infrastructure. (Muller)

2.2 Roadways and automobile use

Co2 emissions from the embodied energy of materials, construction, and maintenance of an urban highway are 3,500 tons per lane/mile. When vehicle use is added, with assumed constant population growth, each mile of roadway in the US increases Co2 emissions by 100,000 tons over a 50 year period. (Williams-Derry) A new four-lane road costs roughly $4-$6 million per mile as well, giving significant economic cost to leapfrog suburban development. (Forest Service) Roadway construction is typically funded either by a developer, or a municipal government. It should be noted that suburban residents drive an average of 30% more than urban counterparts (Kahn), and the average US total household energy expenditure is 45.7% travel. (Sungwon)

Using an adapted quality of life index, indicators such as the importance of family, health, and safety, were found to have a positive correlation with increased VMT. (Poortinga) A spatial analysis of the US found that distance from urban center related to an increase in VMT, and that 1 out of every 10 dollars is spent on something related to transportation. (Williams-Derry) As suburban growth occurs, roadway construction and automobile use increase the environmental impact of development.

2.3 Electricity use

Suburban homeowners pay more for and use more electricity than those in urban environments. (Lexington) A study of all US cities with populations over 100,000 revealed suburban residents pay more for the distribution and generation of electricity, with a correlation between increased density and decreased electricity costs. (Chernick) The increased distance from existing power generation means additional transmission loses, and the need for more power utility construction. It should be noted that the environmental footprint and emissions related to power generation vary from locations across the US, with pollution ranging from low (hydro power) to high (coal power). Other impacts from electricity use and transmission lines include land clearing, relocation of communities, landscape modification, and electromagnetic fields. (Aldana) A behavioral study indicated a strong correlation between value of personal property and increased suburban energy use. (Poortinga)

2.4 Water and wastewater

Wastewater studies in Cleveland and Chicago have indicated that as density decreases, the cost of construction, operations, and maintenance of water and wastewater infrastructure increase per household. (NRDC) This development of infrastructure includes land clearing, alteration of habitats, and community relocation. As population increases, using more water becomes inevitable – however the increase in suburban water use due to watering of lawns has caused considerable environmental concern. (American pub.) Suburban water use remains higher than urban averages, with increased runoff, pollution, and use. (Cleugh et. al)

2.5 Land use

The environmental impacts of our sprawling land use are still being found. Annually, about 1 million acres of farmland are lost to development in the US. Although out of the scope of this exploration, this increases the emissions from the transportation of imported food. (Soule) The tendency towards sprawling development means wilderness and open space have decreased by 45.5 million acres in the past 70 years. As the wilderness is not traded or economically represented, we often have no indicators of the benefits the natural ecosystem provide. These benefits are referred to as “ecosystem services,” and refer to detoxification of waste, regulation of climate, air and water

purification, soil fertility, etc. (Ecosystem) These services are often taken for granted, such as in California, where natural groundwater desalination can no longer keep up the need of people in the region. Here, development occurred without an understanding of the impact to environmental services. (Council)

It should be noted that indicators for environmental services are still being explored by economists and ecologists. While sprawling development may decrease storm water filtration compared to the natural environment, sprawl in many ways can benefit from integration into these services. (Ecosystem)

2.6 The case for density – Top down goal

The low density development known as sprawl has, for the past 70 years, increased the environmental footprint of life for a majority of suburban citizens. The main impacts of sprawl can be associated directly to the low density of development. Household energy use, VMT, water use, and land consumption have been found to decrease as density increases. This is in large part to the embodied energy of infrastructure as well as behavior factors. (Williams-Derry)

If the suburbs were to attempt at limiting the environmental effects of sprawl, the most direct way to do so would be to only permit new construction on previously developed sites with access to existing infrastructure. As development will no longer occur on greenfield sites, the construction of new water, waste, electricity, and transportation infrastructure would be eliminated for new development. Previously developed sites would then become denser, as developers find new ways to reuse existing spaces.

2.7 Top-down limitations

As the top down approach utilized an overview of the United States suburbs as a whole, the conclusion to increase density and use only sites with existing infrastructure is based only on a generalized understanding of sprawl within the US. This approach, while able to make a difference in the environmental impact of new development, does not address existing densities in specific cities, or socio-political and economic land use restrictions imposed at local levels.

Increasing density is also not able to solve all of the environmental problems associated with sprawl. For instance, while VMT was found to decrease overall when density was added to existing suburban areas, trip number remained the same – trips were only reduced based on proximity to urban cores. This means exurban areas may not necessarily benefit from reduced VMT or trips without the inclusion of local neighborhood centers and highly connected roads and sidewalks. In this same study, density caused an increase of air pollution and traffic congestion within neighborhoods, however adjacent traffic remained relatively unchanged. (Williams-Derry)

It should also be noted that by making a goal like universally increasing density only on previously developed land with infrastructure, little attention is placed on details like existing land use density, neighborhood character, site use, and a wide array of other contextual subjects that may impact the overall success. Moving forward, an analysis of the bottom up approach will help to inform a decision as to how to best implement a project to meet the top-down sustainability goal.

3.0 A Bottom Up approach to the Suburbs

3.0 A Bottom up approach to the suburbs

Now that the top-down goal of developing only on previously developed sites with existing infrastructure has been found, the bottom up approach will be used to help determine the suitability of this specific goal in relation to the context of Jacksonville Florida. Here, a brief history of Jacksonville Florida, its neighborhoods, existing housing conditions, and demographics will be analyzed for trends, opportunities, and problems. These will then be layered onto the top-down density goals to see where exists the biggest opportunity for redevelopment. Due to the complex and interconnected nature of society, economics, and history, there may be some overlap in the analysis of these datapoints.

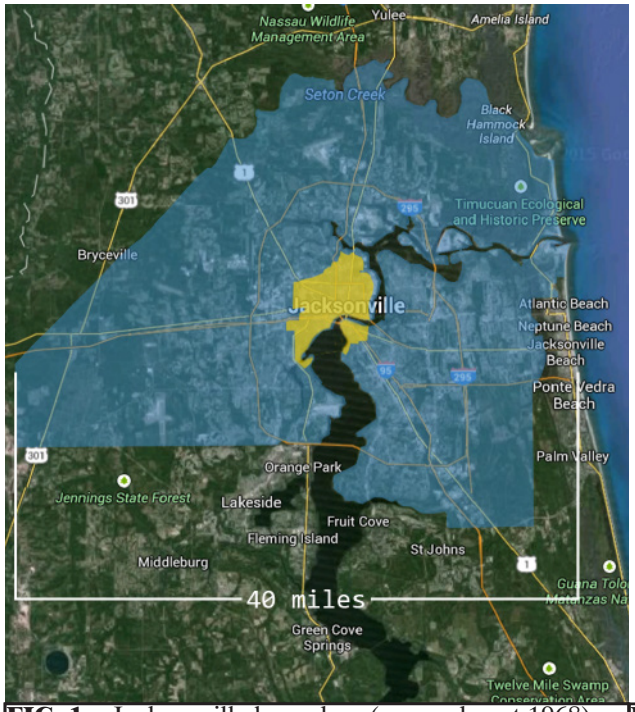


FIG. 1 – Jacksonville boundary (pre and post 1968)

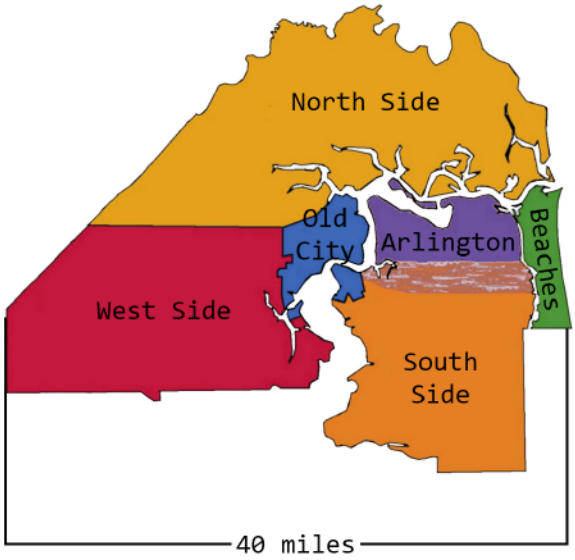


FIG. 2 – Jacksonville vernacular areas

3.1 Jacksonville History

Beginning in the late 1800's as a small British settlement known as Cowford, Jacksonville started as a small farming town that supported an active cattle trade. The original boundary of the city envelopes what is now downtown, with the original suburban plats still used as residential neighborhoods today. During a large fire in 1901, a majority of the town was totally destroyed and spurred a building boom in the early 1900s, which attracted tourism from the North and Midwest. (Dennis)

In the 1920s, due to an abundance of warm weather, cheap labor, and exotic locals, Jacksonville became home to a booming cinema industry comprised of New Yorkers that wanted a place to work during the winter. In the 1940s, the City experienced a large influx due to the inclusion of a naval air station and another naval port. (Davis) During the 50s and 60s, like much of America, it experienced a massive development of single family housing. After consolidating with Duval County in 1968, Jacksonville became and still has the largest land area of any city in the United States. Today, it is home of over a million residents, making it the biggest municipal population in Florida. (Fleming)

Due to the geography and proximity to the trade winds, Jacksonville is well situated to avoid most hurricanes, a trait that well serves it today as a main logistical stop for overseas shipping and distribution. (Jacksonville)

3.1.1 An overview of the neighborhoods

Jacksonville Florida consists of six distinct vernacular areas with their own characteristics and demographics spanning from the Atlantic Ocean to nearly 40 miles inland with rural, suburban, and urban characteristics. Jacksonville is also home of over 500 different neighborhoods due to its massive size. Three of the vernacular areas are named after their direction from the Inner city, the Northside, Southside, and Westside. On the East of the inner city between there are two additional areas. Arlington sits adjacent to the downtown core, and acts as a corridor connecting downtown to the Beaches area. It should be noted that Arlington and Southside actually have no consistent definition of their boundaries, and development and building show no clearly defined borders between any of the neighborhoods. (Dennis)

Each of these individual vernacular areas have multiple commercial cores that serve the residents, with little incentive for residents to make the sometimes hour long commute across the city to other neighborhoods or areas. Due to this fact, residents of Jacksonville tend to identify with their vernacular area as home, with little movement into other neighborhoods or areas. (Fleming)

3.1.2 Housing stock and market forces

Jacksonville's housing stock is comprised of 337,775 individual units, with a 28.87% majority built after 1999. (Jacksonville Housing Statistics) Of the existing housing

stock, 61.2% are occupied by their owners, with 33.21% of the housing stock being rented. This is consistent with the changes in demand for housing stock. Between 2000-2009, demand for rental property dropped significantly before a massive increase after 2010. (NFAR)

Jacksonville's overall housing stock is younger than the national average, with 6% more rental units than national average. The majority of these rental units are located along the coast, which has 46% of the total. The remainder of the region has an average rental rate at 15%. Suburban home sales get an average 92.5% return value on homes and 93.5% value for condos/townhomes. This small increase is consistent with the slightly higher demand for apartments in Jacksonville. Of the homes available on the market, new construction and previously owned homes have relatively equal market shares, with ~4 month supply of both. (NFAR)

In metropolitan areas, Baby Boomers make up an average of 70% of the suburban populations. Interestingly, baby boomers and whites are the only populations increasing within inner cities. This is consistent with baby boomers looking to downsize their housing units. In Jacksonville, the inner city increased its overall rental unit stock by 10.5%, twice as much as the national average. (Frey)

3.2 Demographic Changes

The United States is at a developmental turning point in how it grows, and responds to the housing needs of its existing citizens. Since 1990, populations in metropolitan America grew from 82% to 86% suburban. (Cox) The continued growth of the suburbs means that not only do the majority of Americans live there, but that the demographics of the suburbs are changing substantially as well.

What is often considered racially homogenized, the US suburbs contain the majority of all racial, ethnic, and age groups. Growing to nearly 40% in the last decade, residents aged 45+ constitute a large population within the suburbs. Another growing demographic is non-married couples, and people living alone.

In 2008, non-families became the majority household occupancy type, which is consistent with baby boomers staying in their single family homes due to the stagnant marketplace, and millennials choosing to rent. The typical suburban neighborhood consists more

of aging baby boomers and rental units than the families most of the housing stock was built for. (Frey) Suburban poor also grew in population by 25%, with 1/3rd of the country's poor living in the suburbs. (Hall)

Classified as a "mid-size magnet" city, Jacksonville is characterized by high growth, low diversity, and low educational attainment. It also has an older population than many other US metropolitan areas, and is primarily dependent on automobiles due to its size. (Frey)

3.2.1 Age

The U.S. population consists of 79,478,000 people who are 55+ years, making them 25.7% of the overall population. Looking at the ages of US household ownership, The two largest age groups are people 50-54 (10.4% overall population) and people 75+ (10.1% overall population). (U.S. Census) In Jacksonville, the 55-65 year old population increased by 50% from 2000-2010, meaning that soon, baby boomers will be reaching the putative retirement age. (Frey) Aging baby boomers are more likely to move into smaller apartment units in denser urban cores, and are also motivated to live in close proximity to their children. (Kelly)

Millennial populations are now larger and significantly more diverse than baby boomers thanks to immigration, which increased dramatically between 1990 and 2000. Millennial populations are also more likely to be renters by choice, mainly due to increased debt from education. (Kelly) Time will determine in the next decade if millennials choose to move back into the suburbs most of them grew up in, but early projections indicate they will be looking for smaller unit sizes and proximity to neighborhood centers and services. (NFAR)

3.2.2 Race & Ethnicity

US metropolitan cities and their outlying suburban areas contain 68% of the US non-white population, with 74% of the black population, 80% of the Hispanic population, and 88% of Asian populations. With the majority of nonwhites living in the suburbs, they look incredibly different to millennials than they did to baby boomers. In fact, in

part to the rapid immigration of the 90s, in 2008 the under 18 population became the first in US history to be majority nonwhite. Compared to baby boomers that are roughly 1/3 nonwhite, there is a distinct difference in racial and ethnic diversity in the United States.

In Jacksonville, racial and ethnic diversity is characterized as being lower than national average, with a roughly 65% white population, a 29% black population, and 2.7% Asian. The city remains segregated in several areas however, with the majority of blacks living within close proximity to the urban core. (U.S. Census) This historically was the black part of town up until the civil rights movement of the 1960s, with a distinct array of black owned businesses, neighborhoods, and services that continue to thrive today. (Fleming)

3.2.3 Income

In Jacksonville, the median household income is $48,500, which is slightly higher than the national average by 6%. (U.S. Census) When adjusted for inflation, US households lost over $2,000 annually between 1999 and 2008, which marks the first time in history real median household income decreased. Jacksonville fared significantly worse than national average, with a decrease in median income of nearly $9,000 since the year 2000. (Frey) The main occupations include sales, office and admin support (29%), management, business, and finance (14.4%), and production, transportation, and materials moving (10.67%). Healthcare and construction also are major employers in the region. (7.97% & 8.42%)

Lower income residents tend to disproportionately live in rental housing in the urban core, but trends since 2000 have seen significant movement of the poor into the suburbs. Now, about 1/3 of the nation's poor reside there. Low income and middle income wages decreased since 2000 by 8% and 4% respectively. (Frey) It has been predicted that the impending retirement of the nations baby boomer population will revitalize the economy, allowing Millennials to move into the workforce into higher paying jobs. (NFAR)

3.2.4 Foreclosures

Due to the impact of the recession on Median household income in the suburbs, low income residents living in the suburbs were disproportionately affected by foreclosures in Jacksonville. Between 2005 and 2009, foreclosures increased from 1% to 4.6% on standard loans, and 3.3% to 15.6% on subprime loans. In minority populations, the subprime default rate was increased to 18%. These practices destabilized minority neighborhoods across the US by creating higher amounts of unit turnover. The immense profits generated by the housing boom came at the expense of poor minorities, creating holes and low priced units within existing neighborhoods. (Rugh)

Foreclosed homes have been shown in heavily saturated areas to bring down overall market price by up to 1%. This is increased if the property is in disrepair, or abandoned. In Jacksonville, there are 5,272 foreclosed homes on the market, many of which are selling for below market price. These practices cause a perception that adjacent unit values are lower than market value in a neighborhood, causing homeowners to stay in their aging suburban homes waiting for the market to come around so they can break even. (NFAR)

3.3 The case for unit variety – Bottom-up goal

As the Jacksonville suburbs continue to change demographically after the recession, specific trends in the use of housing stock and population movement indicate to me that there is a need for increased unit variety within the suburbs. The following will break down implications from the analysis of each demographic section.

Age – Baby Boomers looking for smaller unit sizes will encourage development of smaller suburban units, as they will want to age with their children nearby and stay in their current neighborhoods. Millennials are also more inclined to rent, due to cultural and economic reasons.

Race – Jacksonville is a rather segregated city compared to many other metro areas, however its suburban features have no physical characteristics that prevent integration. Minority areas with clusters of foreclosed property offer large scale development opportunities.

Income – As low income residents are more likely to have their homes foreclosed, they represent a segment of the population hit hardest in the recession. Coupled with the reduction in overall household income and low wages, it is logical that renting is becoming more desired. This is consistent with the increase of rental unit demand in Jacksonville since 2009.

Foreclosures – The 5,272 foreclosed houses represent 1.6% of the housing stock, with higher concentrations in lower income areas. These homes bring down overall unit value, but provide opportunity for low-sales and offer redevelopment potential.

ter analyzing the trends in suburban growth within Jacksonville, an overall demand for smaller rental units within the suburbs was identified. Foreclosed houses could act as an opportunity for redevelopment within existing suburbs, as they offer several units to select from in most neighborhoods. These rental units would be able to satisfy the demand from baby boomers, millennials, and the suburban poor looking for lower rents but still seeking suburban neighborhood living.

3.3.1 Bottom-up limitations

The bottom-up analysis of Jacksonville, and its comparison to major US metropolitan areas to identify market forces has some major limitations when it comes to sustainable development. For one, the drivers of development in the area are primarily based on economic and social conditions, with little mention of sustainability or environmental problems. Although my analysis did uncover many opportunities for future development, local sustainability initiatives were not represented as a market force.

When increasing unit variety in the suburbs by adding more rental property, there are many preconceptions that rental units or multi-unit residential will impact market value of existing homes. (NFAR) Due to this, special care must be given to the context of the site and its features to ensure a proper fit. While this is primarily the work of the designer/architect, it should be considered of paramount importance when proceeding.

4.0 Meeting in the Middle

4.0 Meeting in the middle

The top-down and bottom-up approach have been utilized to determine an overall sustainability goal and understand the market forces existing in suburban Jacksonville, Florida. An analysis of both conditions can now reveal overlap, and provide insight into what sort of programming and redevelopment can occur to satisfy both demands.

1 Suburban sprawl is unsustainable

- High cost of development (environmental & economic)
- Loss of ecosystem services (environmental & economic)
- Increased energy consumption (environmental & economic)
- Increase in overall VMT (Environmental & Social)

2 Overall relationship

- Density can decrease development costs
- Density can increase some ecosystem services
- Density reduces energy consumption
- Density reduces overall VMT

3 Top-Down goal

- Redevelop previously constructed lots with infrastructure
- **IMPLEMENTATION – PROGRAMMING**

3 Bottom-up goal

- Increase the number of suburban rental properties

2 Overall relationship

- Rentals are smaller
- Rentals are in higher demand

1 Social and Market forces

- Boomers want smaller housing
- Boomers want to be near their children
- Millennials are renting by choice
- Rental properties are in high demand
- Numerous foreclosed homes
- Residents want to increase home values

If redevelopment were to occur only on lots with access to existing infrastructure, the surplus of foreclosed homes represents an opportunity for a developer to acquire land available in nearly every community within the Jacksonville Metro area. This would

allow density and rental properties to be distributed evenly throughout the area based on localized demand and market forces. These rentals have two main target markets – baby boomers trying to downsize their housing but still live in their communities, and millennials that want to retain a suburban identity while renting without having to share amenities with housemates like the shower, kitchen, etc.
Redeveloping foreclosed homes into multi-unit rentals would meet the requirements of both the top down and bottom up goals. Moving forward, it is important that indicators/ metrics are chosen to evaluate the capacity of the current housing stock.

4.1 Metrics

The project's success in achieving the goals of (1) increasing density, (2) developing on existing infrastructure, and (3) increasing suburban rental units will be determined using the following metrics:

Density – units per acre before and after development can give an insight into the possible density improvements available in existing communities.

Building units / acre

Site access to infrastructure - a binary metric based on the following yes-no questions:

Yes – No Site access to electricity?
Yes – No Site access to water/waste?
Yes – No Site access to roadways?

Variety – The Simpson diversity index measures the probability two randomly selected housing types will be of differing types. (USGBC)

Score = 1 - Σ (n/N)2

n = total dwelling units in single category
N = Total number of dwelling units in all categories

4.2 Evaluating the impact

As indicated previously, increasing density remains an important method in reducing our land consumption, utilizing existing infrastructure more effectively, and reducing development costs. If the 5,272 foreclosed single family homes throughout Jacksonville were converted into two suburban apartment units, Jacksonville would increase its unit

density from .706 units/acre to .717 units/acre, a 1.5% increase in overall density. If each lot were developed into four apartment units, the density would increase to .74 units/acre, an increase in overall land density of 5%. These foreclosed units are assumed to have access to existing infrastructure.

Units per foreclosed lot	Overall increase in density
X1	0%
X2	1.5%
X3	3.2%
X4	4.9%
X5	6.3%
X6	7.9%

If the rental percentage in Jacksonville housing stock were to be assessed before and after this hypothetical redevelopment, it would change in the following ways.

Units per foreclosed lot	Rental%
No change	33.21%
X1	34.7%
X2	36.3%
X3	37.9%
X4	39.4%
X5	41%
X6	42.6%

While it is unrealistic to assume the uniform redevelopment of the entire foreclosed housing stock present in Jacksonville, it is evident through this preliminary analysis that it can be used as a method to increase overall density, as well as provide an increase in suburban rental units to meet the housing demand from present and projected future markets. While overall impact is promising, the localized effect of these changes at the neighborhood level will provide a better indication of its effect on communities.

The following three selections were chosen to provide a look at redevelopment impact across different Jacksonville Vernacular areas. The selections were chosen to provide a cross section of different housing stock ages, densities, and foreclosed housing percentage.

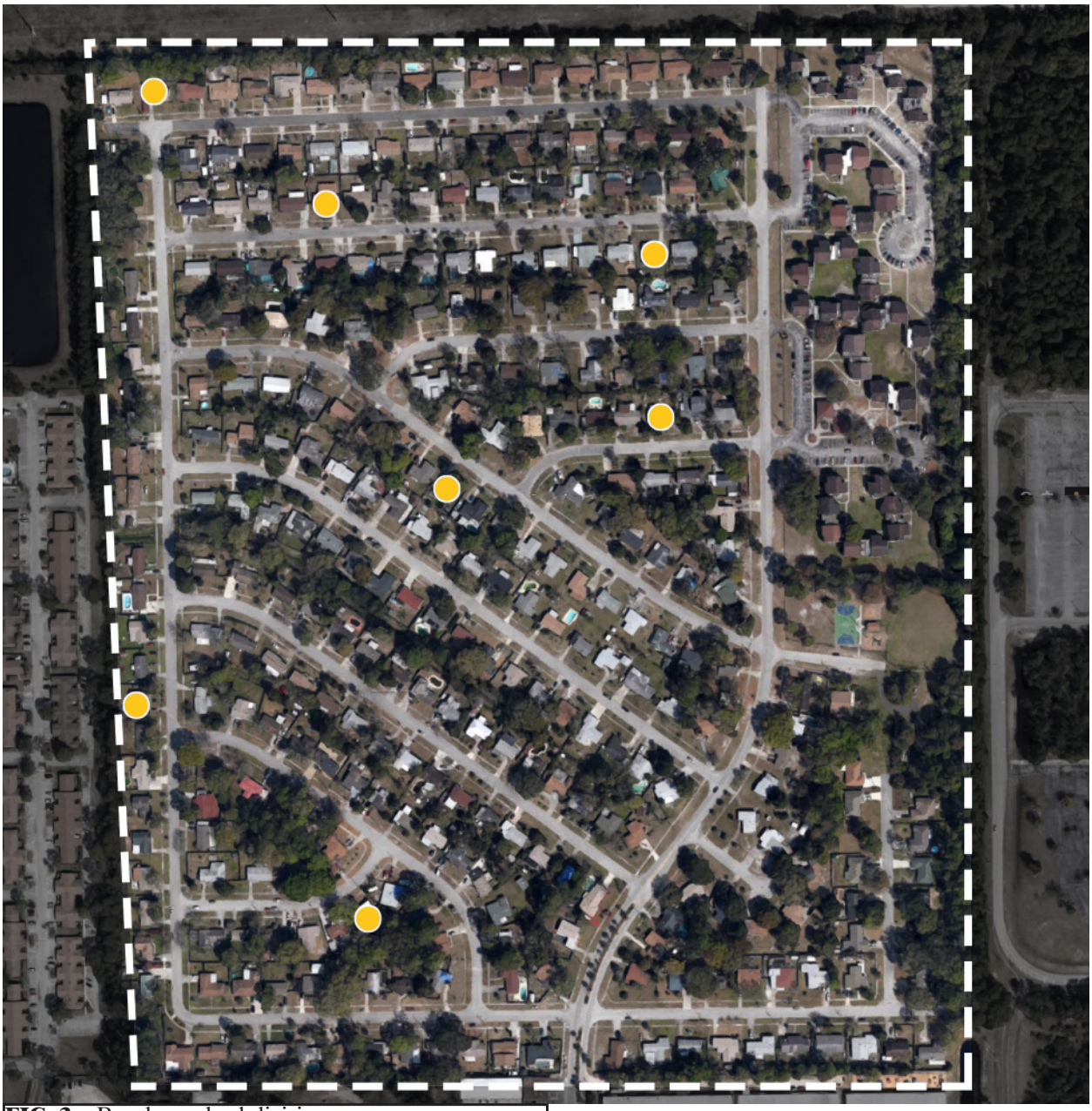


FIG. 3 – Beachwood subdivision

4.2.1 Beachwood

This Beachwood suburban development was built in 1960 and is located West of Florida State College at Jacksonville's South campus. The housing stock consists mainly of houses of 1000sf to 1800sf with low pitched roofs and small lawns. The proposed foreclosed lots, if developed into four units each, would be able to offset the construction of a 32 unit condo.

Existing housing stock:
224 large detached residential
78 small detached residential
144 large duplex or townhouse — 446 total units

Proposed additions:
28 small accessory dwelling units (x4 per lot)

Existing SDI score:
.613

Existing Density:
4.2 units/acre

Proposed SDI score:
.66 (+8%)

Proposed Density:
4.56 units/acre (+ 8.5%)

32-unit condos not built:
1 condo not built

FIG. 4 – Crabapple Cove

4.2.2 Crabapple Cove

Crabapple cove is a small suburban community that was developed between 1989 and 1991. The houses are large, with the size ranging from 1500sf to 2100sf. The community is located at the end of a major North-South arterial road, and is in close proximity to a park, retail, and a power distribution facility. Developing this community would offset the creation of one level of a large 32 unit condo.

Existing housing stock
55 large detached residential

Proposed additions:
12 small accessory dwelling units (x4 per lot)

Existing SDI score:
.99

Existing Density:
3.92 units/acre

Proposed SDI score:
.409 (+59%)

Proposed Density:
5.5 units/acre (+40%)

32-unit condos not built:
1 floor not built

FIG. 5 – 1-8th street downtown

4.2.3 1-8th street Downtown

This is one of the original neighborhoods of Jacksonville, with homes dating back to 1890 in some cases. This neighborhood has high street connectivity by using a traditional grid pattern. If lots were developed into 4-unit apartment buildings, the construction of 4.25 large 32-unit condo buildings would be offset. This area was hit harder than average from the recession, with low income residents and high numbers of foreclosed units.

Existing Housing Stock
54 small duplex or townhouse
412 small detached residential
223 large detached residential — 687 total units

Proposed additions:
136 small accessory dwelling units (x4 per lot)

Existing SDI score:
.53

Existing Density:
4.29 units/acre

Proposed SDI score:
.646 (+16%)

Proposed Density:
5.14 units/acre (+17%)

32-unit condos not built:
4.25 condos not built

4.3 Outcomes

As evidenced by the three selected communities, opportunity for increasing density and unit variety increased the most where the number of foreclosed units was high. In the case of Crabapple Cove, overall unit density and variety increased by 40% and 59% respectively, indicating the most impact can occur in areas that are the most homogenized in housing type. As the suburbs are primarily dependent on automobile use, evaluating neighborhoods as individual areas connected by roadways can help to identify community effects.

Now that the methodology has been tested as effective on both the local and regional levels, a site can be chosen to develop a comprehensive design for a unit that redevelops a foreclosed home on existing infrastructure into rental units.

5.0 Choosing a Site

5.0 Choosing a site

To encourage residents to decrease their VMT, a site was chosen that would connect residents to as many amenities as possible within walking, biking, and driving distance. (USGBC) Using the existing development of commercial rental properties as a rough guide, properties near existing development hotspots were considered prime investment locations.

FIG. 6 – Site Adjacencies

The site 12504 Ash Harbor Drive was chosen due to its proximity to existing commercial development and amenities. As indicated in the overview, the site exists directly adjacent to a two lane bicycle corridor along Kernan Blvd. This North-south road connects the site to two commercial cores with retail, food, and grocery stores. The St. Johns Town Center is located to the west, with over 30 different retail stores of varying sizes, grocery, and restaurant options. The quality and safety of the bicycling corridor is high, with new pavement, 8 foot lanes going both ways, and barrier from the high speed roadway. While proximity to bicycle lanes does not guarantee bicycle use, this proximity to multiple centers with diverse uses and services means residents will keep trips short and localized, regardless of modality.

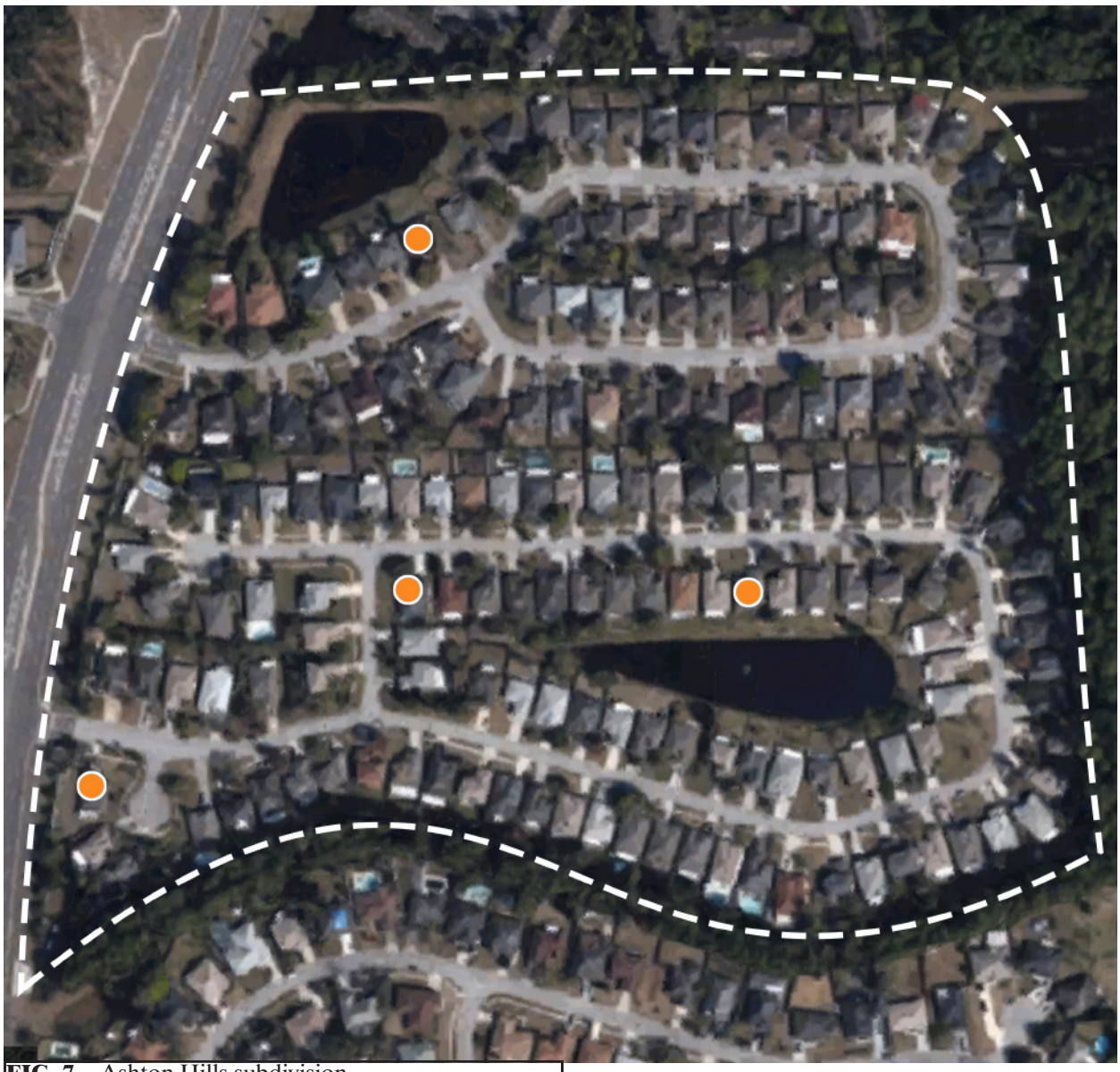


FIG. 7 – Ashton Hills subdivision

Existing Housing Stock:
36 small detached residential
148 large detached residential 184 total units

Proposed additions:
16 small accessory dwelling units (x4 per lot)

Existing SDI score:
.392

Existing Density:
4.51 units/acre

Proposed SDI score:
.415 (+6%)

Proposed Density:
5 units/acre (+11%)

32-unit condos not built:
.5 condos not built

5.1 Zoning and code review

Now that a high priority site has been chosen based on its proximity to commercial cores and its neighborhood impact, a review of the zoning code is required to ensure the proposed use would be compatible with the programming goals.

5.2 Evaluating allowable uses

The existing site is located in a Low Density Residential zone, which has the allowances for the following uses: (Florida)

- Single-family dwellings.
- Foster care homes.
- Family day care homes meeting Part 4 performance standards
- Community residential homes of six or fewer residents meeting Part 4

Based on the allowable uses, low density residential zoning won't allow for multi-unit apartment buildings. Foster homes would not meet the criteria for enhancing unit variety or density, leaving only community residential homes of six or fewer residents as an option. Community residential home is defined by the building code as the following: (Florida)

"Community residential home" means a dwelling unit licensed to serve residents who are clients of the Department of Elderly Affairs, the Agency for Persons with Disabilities, the Department of Juvenile Justice, or the Department of Children and Family Services or licensed by the Agency for Health Care Administration which provides a living environment for 7 to 14 unrelated residents who operate as the functional equivalent of a family, including such supervision and care by supportive staff as may be necessary to meet the physical, emotional, and social needs of the residents."

FIG. 8 – Site Zoning

During the bottom-up analysis, it was decided to develop more rental units to provide for the increased demand from baby boomers and millennials. After review of the zoning code however, millennials were omitted from programming as they are not clients of the Department of Elderly Affairs. However, due to the large aging population in Jacksonville that resides in the suburbs and is looking for downsizing options, community residential seems like an effective solution. (NFAR)

The department of elderly affairs provides definitions of what residents are permitted in a community residential home, with allowances for aging in place.

> "Aging in place" means remaining in a non-institutional living environment, despite the physical or mental changes that may occur in a person who is aging. For aging in place to occur, needed services are added, increased, or adjusted to compensate for a person's physical or mental changes." (Florida)

Provided that the home does not include over six occupants, it is permitted by code if it meets the requirements set forth by the US Agency for Health Care Administration as an assisted living facility for someone aging in place.

> "An assisted living facility (ALF) is designed to provide personal care services in the least restrictive and most home-like environment. These facilities can range in size from one resident to several hundred and may offer a wide variety of personal and nursing services designed specifically to meet an individual's personal needs. Facilities are licensed to provide routine personal care services under a "Standard" license, or more specific services under the authority of "Specialty" licenses. ALFs meeting the requirements for a Standard license may also qualify for specialty licenses. The purpose of "Specialty Licenses" is to allow individuals to "age in place" in familiar surroundings that can adequately and safely meet their continuing healthcare needs." (AHCA)

The AHCA requires an ECC specialty license to operate an assisted living facility with aging in place residents. To attain this license for aging in place, the following requirements must be met.

- Limited nursing services and assessments
- Total help with bathing, dressing, grooming and toileting
- Measurement and recording of vital signs and weight
- Dietary management, including special diets, monitoring nutrition, food, and fluid intake
- Supervise residents with dementia and/or cognitive impairments
- Provide or arrange for rehabilitative services
- Provide escort services to medical appointments

As an ECC license from the AHCA is all that is required to meet the building code requirements for the property, there are no provisions in the requirements that would prevent including separated, or multi-unit configurations. An ECC specialty license also only requires limited nursing services, which does not require on site staffing but can. (US AHCA)

5.3 Case Studies

It should be noted that every community in the US has examples of residents aging in place in their homes, with little to no physical characteristics delineating them from other residences. As residents begin to age, they often begin with small upgrades to their homes (ramps, non-slip surfaces, walk-in baths, etc.) to assist in the transition. While these improvements help with the overall accessibility of the unit, other services such as transportation and household maintenance soon become an issue. While meeting accessibility requirements is mandatory for all critical care facilities, what makes aging in place possible is more about the services provided to residences outside the home. The most successful model for helping residents age in place is the village model. (Gleckman)

5.3.1 The village model

The village model refers to groups of like-minded seniors that create intentional communities for aging in place. These communities can be existing locations that are adapted to suit aging needs, or they can be newly constructed. The first elder village model was created in Beacon Hill, Boston in 2001. A cluster of 11 aging families within close proximity made the choice not to become dependent on their children or leave their historic brownstone community. This led to the group forming a non-for-profit that would pay for the supporting services required by the aging community. The services provided are typically funded through private (membership fees) and public (grants and subsidies) means. (Gleckman)

5.3.2 Tier 1

Of the numerous villages that exist throughout the US and abroad, there tend to be three tiers of service members will receive, depending on individual need and location. The first tier are communities that are serviced only by community volunteers, and equates to a system of work exchange. These communities tend to develop in small, closely knit groups that can provide for one another from within. (BP&E) An example would be a situation where elderly residents provide food for a community meal once a week, and in return have transportation to medical appointments or lawn care services performed for free. These types of informally organized structures offer numerous social benefits, as they allow aging residents to still offer their skills to others while staying in their communities. A negative aspect of this approach is that the elderly must be able to offer some good or service to receive care, demanding a certain level of activity and mobility from residents. There is also no medical support offered or funded by the community, meaning residents must provide their own healthcare. While there is little hard evidence to support this claim, this first tier is widely regarded as the most common way elderly residents manage their own roles within their communities. (Gleckman)

5.3.3 Tier 2

The second tier of services combines volunteer community services with membership fees for aging residents, allowing for more specialized care to be given to them. In many cases, these fees are low due to government and charity subsidy. Often, medical services for members of the village is reduced significantly, and doctors referred by the village. The inclusion of membership fees allow specialists to be hired specifically for different residents based on their medical and social needs. Often, volunteers will organize grocery trips and community events while hired staff will coordinate medical care and facilities/grounds keeping. This approach is widely considered the most appropriate for aging in place, as it combines public and private aspects that assure quality care and community interaction.

5.3.4 Tier 3

The third tier of service is entirely paid for by membership fees and is based on a comprehensive care plan for residents based on their individual needs. Volunteers play a very small role in these types of communities. These types of villages tend to occur in places where elderly residents far outnumber younger ones, requiring more volunteer care than is available or feasible. In these communities, organizations (or developers) can provide value by referring

residents to approved doctors, organizing group medical visits, and setting up activities for members. This tier offers the most likely scenario a private land developer could choose, as it can provide a stead stream of income from residents if medical and community considerations are made in the planning and design of the neighborhood. (Kelly)

In Jacksonville, there exist several facilities that take medical insurance to provide space and accessible accomodation to aging residents in existing single family homes. These units normally have a nurse or provider living on site 24/7 to assist with basic resident needs. As seen in Figure 10, this facility specializes in alzheimers care within a suburban single family home.

FIG. 9 – Beacon Hill elder village, Boston, MA

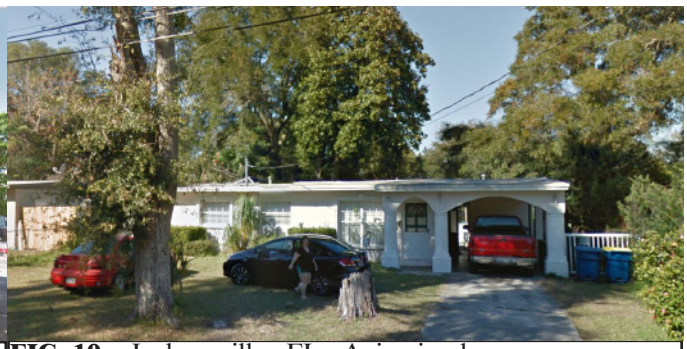


FIG. 10 – Jacksonville, FL - Aging in place

5.3.5 Conclusion

In terms of architectural style and form, the homes that comprise elder villages have no distinct characteristics that distinguish them from other private residences. They are usually comprised of several adjacent homes that share medical and social services between residences. The main aspect that attracts residents to this arrangement is that it requires no change -- users remain in the same home and collectively manage their aging as a group.

5.4 Finalized Programming

The permissible uses in Low Density Residential zoning limited the possible impact for this new rental unit by only allowing them to serve seniors looking to age in place. While 70& of seniors reside in the suburbs, making them a big market segment, local zoning acted as a barrier to implementing the full intention of the sustainability goals. This becomes a good example of how regional and local data can be used to identify problems and solutions, but regulation can halt implementation. It is my decision not to try to achieve a variance, as it is my goal to assess the limitations of the Top-Down and Bottom-up approach when used to

design and program future development.

Moving forward, my vision for the project is to create a variety of aging in place units within the redevelopment. As I am only allowed a maximum of six occupants, I am choosing to design (2) two bedroom units and (2) studio units so that those wishing to age in place can do so with or without their spouse or care-giver. This also provides space in two of the units for a full-time care-giver, if the need arises during operation. The site is also located near a small river, with a 1% flooding potential each year. Assisted living facilities must be able to provide accommodation for the elderly in case of flooding or hurricanes, and provide backup power for medical equipment.

5.5 Overall Development Goals

My vision for this project is to redevelop an existing suburban single-family home into community residential housing with 4 individual units. To enhance the surrounding community, site design will enhance existing features to provide a safer pedestrian environment. The design of the units will resemble a single family home, and act as a background building to ensure continuity with the existing housing typologies. The goals are as follows:

- Respect existing typologies (be a background building)
- Optimize existing site features towards safety, sustainability
- Provide community space for aging in place resident use
- Reuse existing building shell (architectural interest)
- Add something beautiful and low maintenance
- Must be flood resilient – provide provisions for disaster

6.0 Design Process

6.0 Design process

Now that a site was chosen and programming decided, the process of taking an existing suburban home and converting it into a 4 unit community residential home could begin. This began with a phase of drawing ideas for growth, and thinking about ways to add space to existing units. In these early sketches, explorations into massing configurations and space adjacencies were being examined. In wanting to respect the original building and how it met the outside, I placed a strong emphasis on the existing entry portal of the front door. By maintaining its function as the entryway into the interior corridor, the illusion of only one entry/ unit can be maintained.

When looking for typologies for what sort of room additions are most common and used in Florida, I discovered that most houses in the area had additions to their homes in the form of a screened in patio or glassed in sun room. These "Florida Rooms" are a common way for homes to expand their square footage, and experience a transitional space between the inside and outside environments. Due to the capacity for nature to supplement the healing process, this typology seemed relevant for the project. (Ecotherapy)

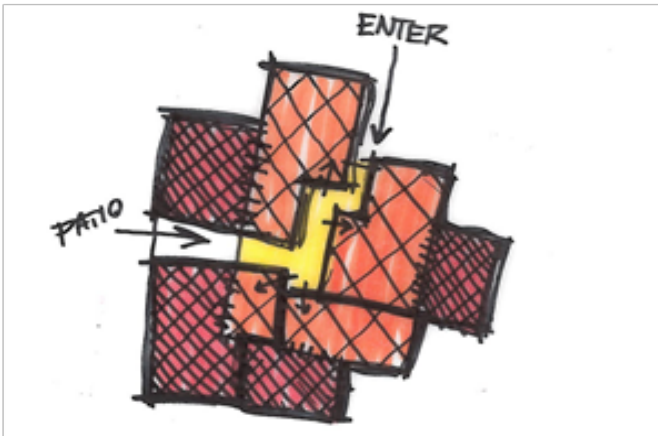


FIG. 11 – Design Parti

Indicated in Orange, the existing building is supplemented by the addition of new structure, indicated in red. These new structures extend the square footage, and provide an enclosed and conditioned space that resembles a screened in patio. This also leads to opportunities for enhancing natural aesthetics later

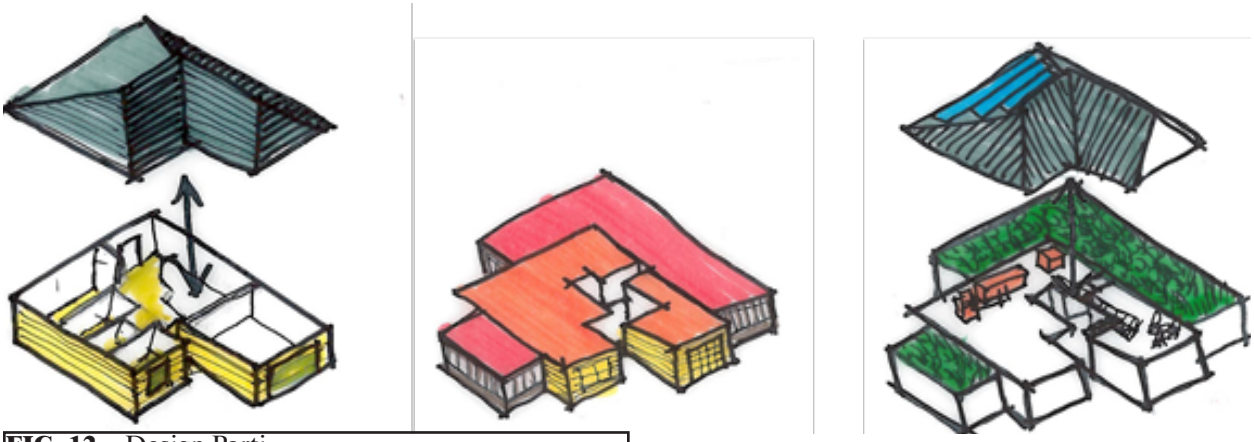


FIG. 12 – Design Parti

After preliminary layouts were assigned for each of the four units, the roof was removed and a general massing was created for the building. In this massing, the old footprint is represented in orange and the new footprint in red. At this point, a highly insulated green roof was chosen to cover the new additions, and a highly insulated roof with a plywood finish selected for the existing footprint roof. This plywood finish roof would allow for access to the emergency flood shelter, HVAC unit, and solar panel batteries, along with emergency medical supplies and food/water. To pay respect to the former roofline, a nearly identically roof shape was chosen to cover the second level. This secondary roof also shades the inner corridor, creating comfortable and shaded space, and acting as a double skin from solar heat gain to the building envelope.

6.1 Sustainability Features

While the preliminary programming of the site was the product of top down and bottom up sustainability analysis, the design and operations of the building itself also has been suited to reduce the environmental impact of the redevelopment. The following methods were used to reduce environmental impacts, and increase social and economic gains.

6.2 HVAC optimization

The HVAC system present for the existing home is rated at 4 tons, with an estimated annual cost of $4,049.76 to operate. During analysis of the cooling load, it was determined that the existing envelope had several deficiencies that were lowering the performance of the building. The sliding glass door in the back of the house contributed significantly to the heat gain, being south facing and unprotected by exterior coating or shade.

As the new addition envelope is in large part made of windows, finding a way to capture the aesthetics of the "Florida room" while optimizing the environmental response to the sun became a goal for the design. The problem with windows is that they have higher transmission losses and solar gain. To better protect the interior from solar gain, bamboo blinds were added to the exterior of the windows to shade them by 80%. Vegetation in planting beds around the windows also adds another layer of shadow, giving the glass within the building a SHGC of only .1. This protecting of the new windows, along with specifying they be air sealed and be R-5, allowed for the projections to indicate a 5% reduction in annual cooling load. This means that although the building square footage has increased by 40%, the improvements in envelope require no larger sizing of the 4 ton HVAC system.

6.3 Structural reuse

To reduce the construction costs associated with the redevelopment, 82% of the existing CMU walls within the structure were used in the new buildout. The existing concrete slab was also retained to reduce cost, as well as the existing HVAC unit.

HVAC unit cost - $2,959.00
CMU cost – (1574sf) x ($9.47/sf) = $14,905.00
Slab cost – (2,210sf) x (5.67/sf) = $12,530.00
Overall savings - $30,394.00 (RS Means)

6.4 Solar Panels and flood resilience

With an optimum year set tilt angle of 24° for Jacksonville Florida, 720 square feet of the south facing roof are covered with an array of 15% efficient solar panels. With the information based on the solar heat gain factor and thermal lag from the heating and cooling load calculations, the following calculation will determine the efficiency of the array.

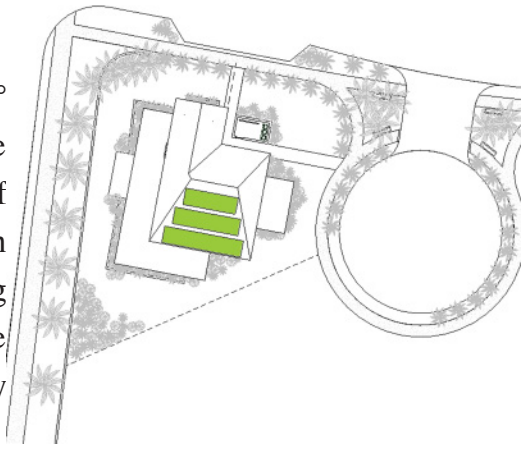


FIG. 13 – Solar array

(720 sf) x (SHGF 191) x (TLF .83) x (.15 efficiency) = 17121.4 btu/hr
17121.4 btu/hr = 5.175 kw/hr
(5.175 kw/hr) x (5.49 peak sun hrs/day) x (365 days/year) = 10,369 kw/yr
(10,369 kw/yr) x ($.119/hr) = $1,238.47 potential savings

An average of roughly 28kw a day is generated from the solar array, resulting in an annual savings of $1,238. This power generation will be stored in batteries as a backup power system for the units to keep them operational during the event of a power outage. The battery storage for the solar panels is located next to the air conditioning unit on the second level of the building. This location ensures that the systems remain online during flooding situations without problems in operation. A small outpatient medical facility uses 1.67kw/sf annually on equipment, which would result in 12.35 kw/day used for primary medical functions. (EPA) This minimum energy requirement for resident health is more than met by the 28kw/day produced by the solar panels – meaning health and safety needs will be met during a flood as required by FEMA of all assisted living facilities.

6.5 Site safety and enhancing networks

The existing bicycle network on nearby Kernan Blvd. represents an opportunity for residents to exercise or travel to nearby amenities. To provide reasonable accommodation for residents and their visiting families, an oversized bicycle storage area is located on site near the entrance of the building. The cul-de-sac located adjacent to the property has the potential to be used as a community open space, however currently the radius

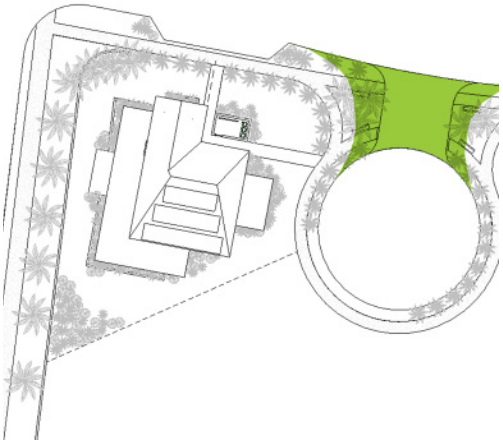


FIG. 14 – Site enhancements

of the entry road is at 40', allowing for high speed turns from the entry of the neighborhood. To prevent this, the entrance has been downsized to a 10' radius, forcing cars to slow down into the would-be community space. This entry way is also now a raised crosswalk, giving yet another indication that this is a pedestrian environment first and foremost.

To encourage the use of this new cul-de-sac space, natural surveillance is increased by providing pedestrian benches at the entry of the space. These can be used by elderly residents or nearby families to sit and watch their children play within the space. This space could be used by elderly residents to interact or watch their younger family members during visits. To help give visual cues to this new separation of community space from the roadway, arrays of native cabbage palm trees are used.

6.6 Ride sharing

Due to the complex occupancy needs of this type of community housing, the driving needs and ability of the residents may vary greatly. As the nature of this design is to enhance the community aspects of an assisted living facility while still maintaining some level of privacy and ownership, two ride share vehicles are provided for residents to utilize based on their needs and ability.

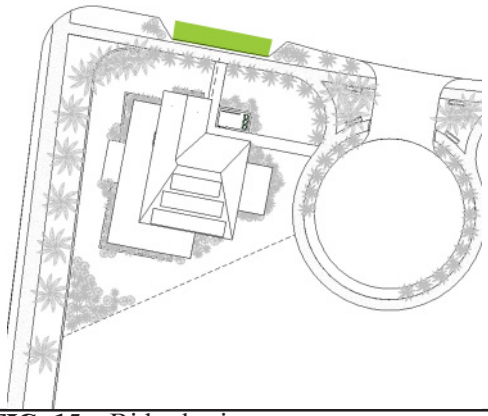


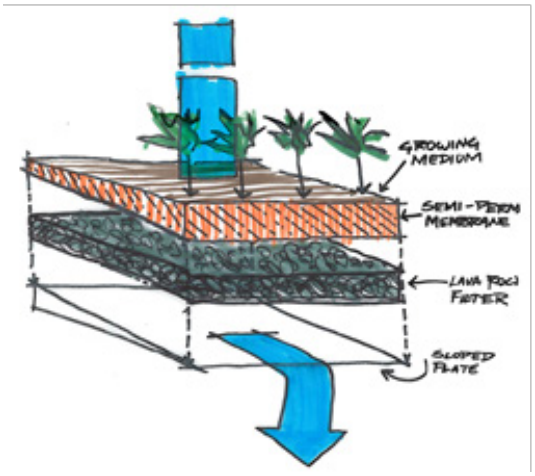
FIG. 15 – Ride sharing

6.7 Reduction of storm water runoff

To reduce the storm water runoff from the building, a complex system of conveyance was used to maximize the amount of water retained for plants. This design uses two techniques to utilize the water for native plants on site, with the green roof being modified similarly to a hydroponic system. The rainfall on the aluminum roof is routed into a series of gutters, routes the rainfall onto the top of the green roof. This water filters through a growing medium filled with native grasses,

through a semi-permeable membrane, and into a gravel filter. This filter allows the water to freely move down a sloped drainage plate that pours this water into a raised planting bed with native palms and grasses. This raised bed also utilizes an emergency drainage conveyance system in case groundwater levels reach an unsafe height, although this system would be rendered useless if a flood were to occur.

The existing site is graded so that the home is at a high point on the property, with a low point in the back corner of the lot. I added hearty native palms and grasses in this low point to capitalize on water and reduce erosion/sedimentation of the nearby stream.



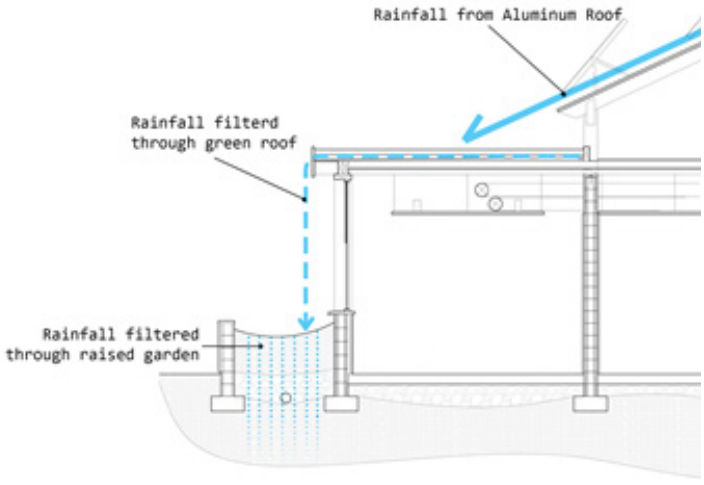


FIG. 16 – Green roof concept & section

7.0 Comprehensive Design

City of Jacksonville, FL Zoning review

12504 Ash Harbor Drive, Jacksonville, FL 32224

Lot setbacks *(RLD sec. D, F)*		
Orientation	Existing	Setback
North	100 ft	25 ft
East	75.5 ft	7.5 ft
West	146.33 ft	10 ft
South	121.5 ft	7.5 ft

Permitted uses and structures *(RLD sec. A, B, C)*	
Zone:	RLD-100A Residential Low Density
Allowed use:	Single family dwellings, townhomes, foster care homes, family day care community residential homes of six or fewer residents, churches
Proposed use:	*community residential home of six or fewer residents*

Lot coverage *(RLD sec. E)*		
Existing	Proposed	Allowable
19% (2181 sf)	31% (3650 sf)	40% (4790 sf)

Maximum Height *(RLD sec. G)*		
Existing	Proposed	Allowable
20' - 0"	25' - 0"	35' - 0"

Green space *(RLD sec. H)*		
Existing	Proposed	Allowable
81% (9795 sf)	75% (8982 s	N/A

Florida Residential Building Code Analysis

Scope R101.2	
Scope:	construction, *alteration*, movement, enlargement, replacement, repair, equipment, use and occupancy, location, removal and demolition of detached one- and two-family dwellings and townhouses not more than three stories high.

Design Criteria R301										
Ground Snow Load	Wind Design		Seismic Design Category	Damage from			Winter Design Temp	Flood Hazards	Air Freezing Index	Mean Annual Temp
	Speed (mph)	Vult (mph)		Weathering	Frost line depth	Termites				
N/A	130 mph	26	N/A	Negligible	N/A	Very Heavy	32°	High Risk	N/A	N/A

Fire Resistant Construction R302					
Exterior Wall Elements		Minimum Fire Resistance Rating	Minimum Fire Separation	Flame Spread Index	Smoke-dev. Index
Walls	Fire Resistance Rated	1 hour rated	0 Feet	< 200	< 450
	Not rated	0 hours	3 feet		
Projections	Fire Resistance Rated	1 hourt rated (underside)	2 feet	< 200	< 450
	Not rated	0 hours	3 feet		
Openings in walls	Fire Resistance Rated	N/A	N/A	< 200	< 450
	Not rated	0 hours	3 feet		
Penetrations	Fire Resistance Rated	Minimum 6in dia.	< 3 feet	< 200	< 450
	Not rated	N/A	3 feet		
Notes:	All units bust have individual smoke and Co2 detection systems.				

Plumbing R306 & R307				
Item	Existing	Proposed	Total proposed	Allowed
Bathrooms	2 per dwelling	1 per bedroom	6 bathrooms	1 per dwelling unit
Kitchen	1 per dwelling	1 per dwelling	4 kitchens	1 per dwelling unit
Sewage disposal	6 bath, 2 kitch	3 bath, 1 kitch	12 bath, 4 kitchen	all fixtures connected to sewer
Water supply	6 bath, 2 kitch	3 bath, 1 kitch	12 bath, 4 kitchen	All fixtures hot and cold

Glazing R308	
Item	Provisions:
Identification	Each pane must bear safety d
Louvers/jalousi	3/16" min thickness, 48" max.
Skylights	15° min slope,
Materials	tempered, heat strengthened, c

Egress R311				
Item	Existing	Proposed	Total Proposed	Required
Exit	2 per dwelling	1 per dwelling	4 exterior exits total	1 per dwelling unit
Egress doors	32in x 78in	36in x 84in	4 36in x 84in	32in x 78in min.
Landings	1 per door	1 per door	4 total landings	required at each door
Screen/storm do	1 screen door	1 screen per un	4 screen doors	Allowed over all doors
Hallways	36 in	48 in	N/A	36in minimum
Stairs	N/A	36 in width	1 stair	36in minimum
Stair illumination	N/A	N/A	1fc	1 fc at center treads

ADA requirements		
Items	Proposed	Required
Units	4	1
Entrances	36"	36"
Routes	1	1
Ramps	none	2% slope
Hall Dia.	48"	40"
Bathroom radi	36"	30"
interior door	32"	32"

Zoning and Building Code Analysis

Scale: N/A

James Reynolds
Comprehensive Design

7.1

SITE PLAN
Scale: 1” = 10’-0”

Overall Site Plan
Scale: 1” = 20’-0”

James Reynolds
Comprehensive Design

7.2

Egress R311				
Item	Existing	Proposed	Total Proposed	Required
Exit	2 per dwelling	1 per dwelling	4 exterior exits total	1 per dwelling unit
Egress doors	32in x 78in	36in x 84in	4 36in x 84in	32in x 78in min.
Landings	1 per door	1 per door	4 total landings	required at each door
Screen/storm do	1 screen door	1 screen per u	4 screen doors	Allowed over all doors
Hallways	36 in	48 in	N/A	36in minimum
Stairs	N/A	36 in width	1 stair	36in minimum
Stair illuminatior	N/A	1fc	1fc	1 fc at center treads

ADA requirements		
Items	Proposed	Required
Units	4	1
Entrances	36"	36"
Routes	1	1
Ramps	none	2% slope
Hall Dia.	48"	40"
Bathroom radi	36"	30"
interior door	32"	32"

32” wide typ.

36” radius typ

D R

W D

D R

R D

R

N

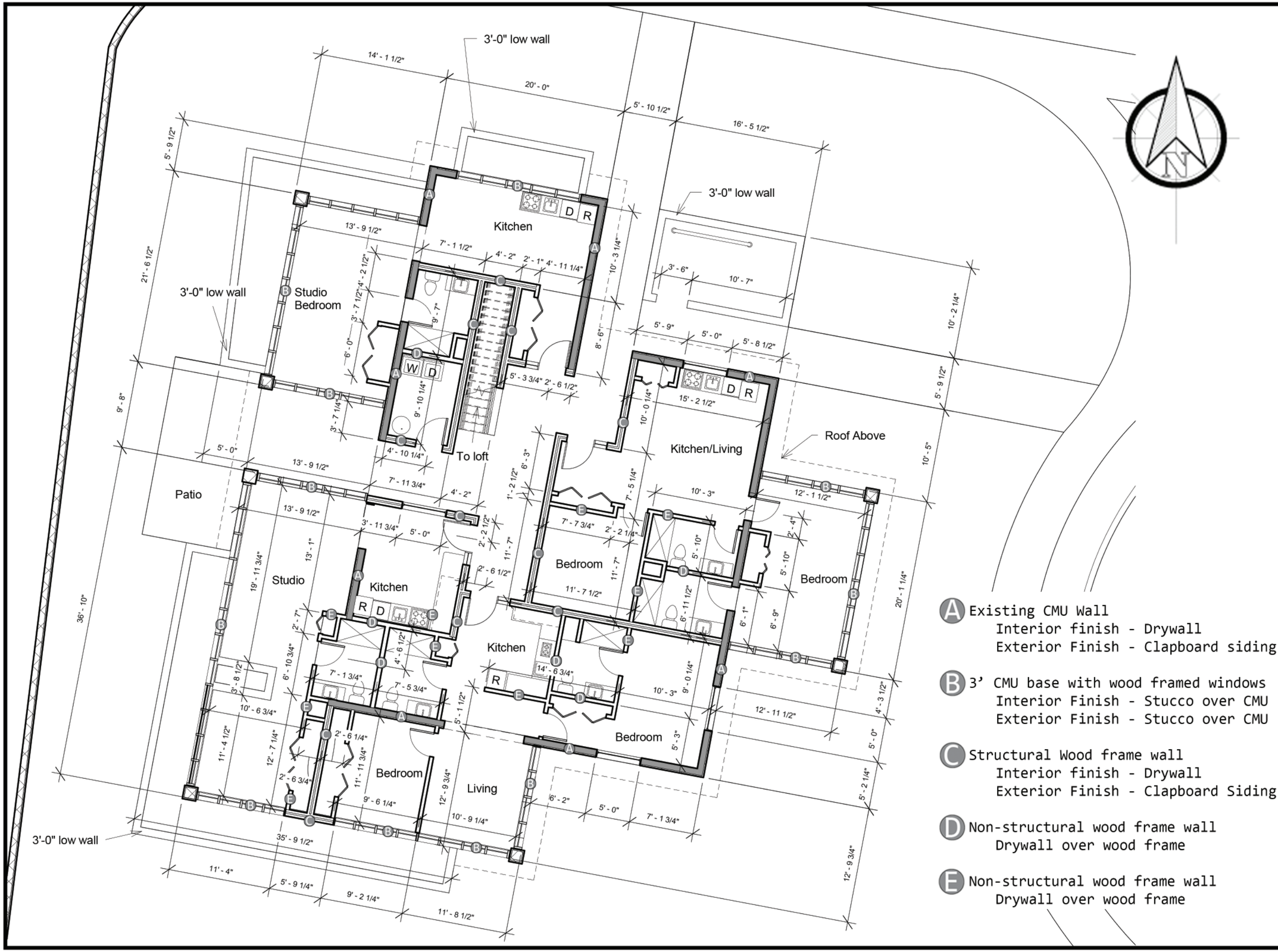
Accessibility Plan

Scale: 1” = 10’-0”

James Reynolds

Comprehensive Design

7.3



A Existing CMU Wall
Interior finish - Drywall
Exterior Finish - Clapboard siding

B 3’ CMU base with wood framed windows
Interior Finish - Stucco over CMU
Exterior Finish - Stucco over CMU

C Structural Wood frame wall
Interior finish - Drywall
Exterior Finish - Clapboard Siding

D Non-structural wood frame wall
Drywall over wood frame

E Non-structural wood frame wall
Drywall over wood frame

Floor Plan
Scale: 1” = 10’-0”

James Reynolds
Comprehensive Design

7.4

Window Schedule

Count	Description	Type	Width	Height	Construction type	Manufacturer	Model	Comments
4	Double Hung w/ trim	Exterior	5' - 0"	6' - 0"	Wood frame with aluminum sheathing	Andersen	100 series	Windows in existing footprint
69	Single Pane w/trim	Exterior	2' - 6"	6' - 9"	Wood frame with aluminum sheathing	Andersen	400 series flexframe polygon s	Windows in additions
4	Single pane w/trim	Exterior	1' - 2"	7' - 6"	Aluminum framing with waterproofing	Floodsafe	custom size	

Door Schedule

Count	Description	Type	Width	Height	Construction type	Manufacturer	Model	Comments
5	waterproof ext doors	Exterior	3' - 0"	7' - 6"	Wood with aluminum sheathing	Floodsafe	Residential Gold	Floodproof door
9	Interior doors	Interior	2' - 8"	7' - 0"	wood panel door	Simpson	82 Ovolo sticking	
6	Large closet	Interior	6' - 0"	7' - 0"	Double bifold closet door	Simpson	43 Bifold	
3	small closet	Interior	3' - 0"	7' - 0"	Bifold closet door	Simpson	43 Bifold	

Finish Schedule

Unit	Room name	Floor Material	Type	Ceiling Material	Type	Wall Material	Type
A	Kitchen	Concrete	Rock Salt Finish	Drywall	Hawk and Trowel	Drywall	Smooth Finish
A	Bathroom	Concrete	Rock Salt Finish	Drywall	Hawk and Trowel	Drywall	Smooth Finish
A	Bedroom	Hardwood	Oak plank	Drywall	Hawk and Trowel	Drywall	Smooth Finish
A	Utilities	Concrete	Rock Salt Finish	Drywall	Hawk and Trowel	Drywall	Smooth Finish
B	Kitchen/Living	Concrete	Rock Salt Finish	Drywall	Hawk and Trowel	Drywall	Smooth Finish
B	Bedroom	Concrete	Rock Salt Finish	Drywall	Hawk and Trowel	Drywall	Smooth Finish
B	Bathroom	Concrete	Rock Salt Finish	Drywall	Hawk and Trowel	Drywall	Smooth Finish
B	M. Bedroom	Hardwood	Oak plank	Drywall	Hawk and Trowel	Drywall	Smooth Finish
B	M. Bath	Concrete	Rock Salt Finish	Drywall	Hawk and Trowel	Drywall	Smooth Finish
C	Kitchen	Concrete	Rock Salt Finish	Drywall	Hawk and Trowel	Drywall	Smooth Finish
C	Living Room	Hardwood	Oak plank	Drywall	Hawk and Trowel	Drywall	Smooth Finish
C	Bathroom	Concrete	Rock Salt Finish	Drywall	Hawk and Trowel	Drywall	Smooth Finish
C	Bedroom	Hardwood	Oak plank	Drywall	Hawk and Trowel	Drywall	Smooth Finish
C	M. Bedroom	Concrete	Rock Salt Finish	Drywall	Hawk and Trowel	Drywall	Smooth Finish
C	M. Bath	Concrete	Rock Salt Finish	Drywall	Hawk and Trowel	Drywall	Smooth Finish
D	Kitchen	Concrete	Rock Salt Finish	Drywall	Hawk and Trowel	Drywall	Smooth Finish
D	Bedroom/Living	Hardwood	Oak plank	Drywall	Hawk and Trowel	Drywall	Smooth Finish
D	Bathroom	Concrete	Rock Salt Finish	Drywall	Hawk and Trowel	Drywall	Smooth Finish

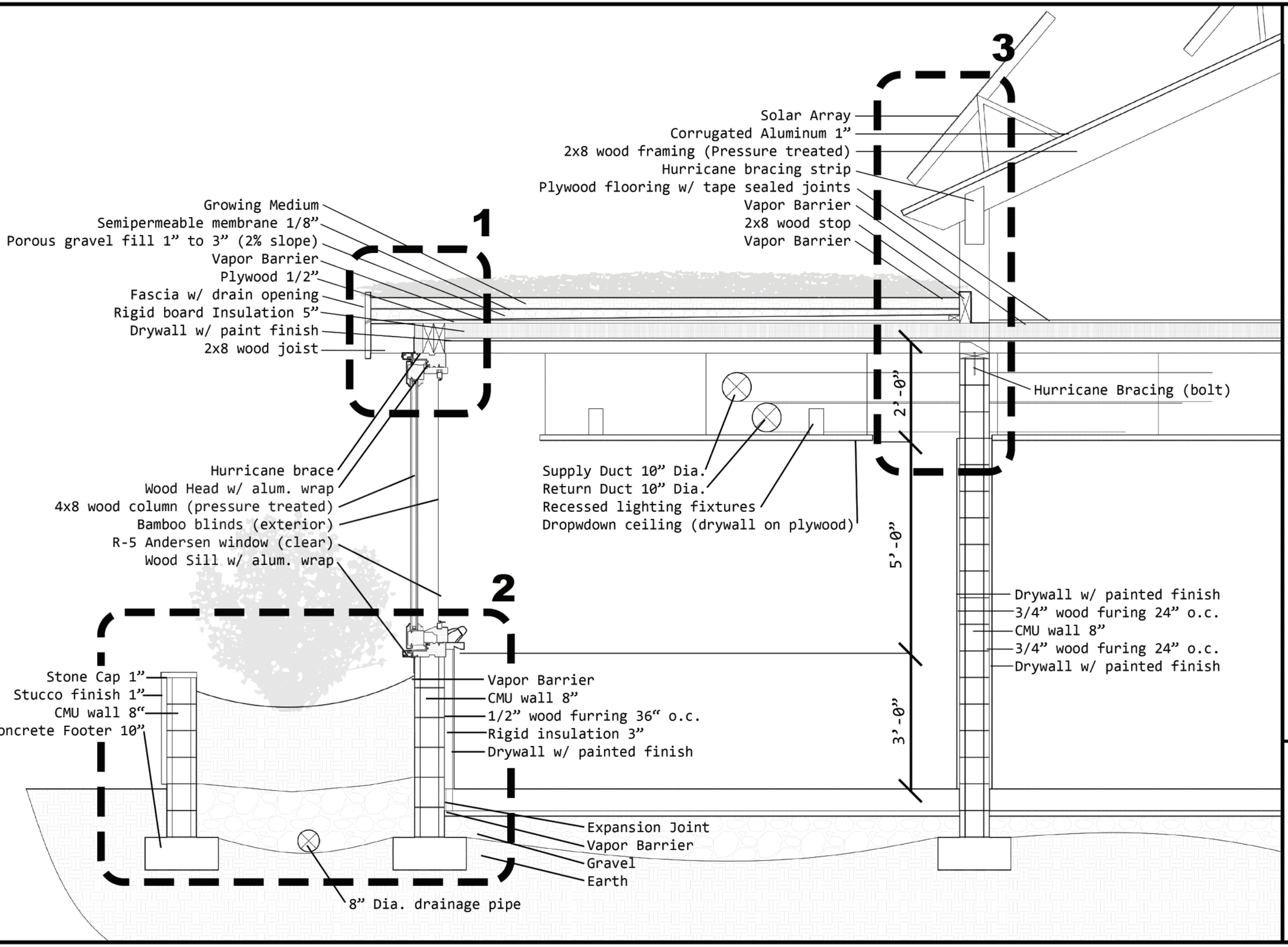
Door and Window Schedule

Scale: N/A

James Reynolds

Comprehensive Design

7.5



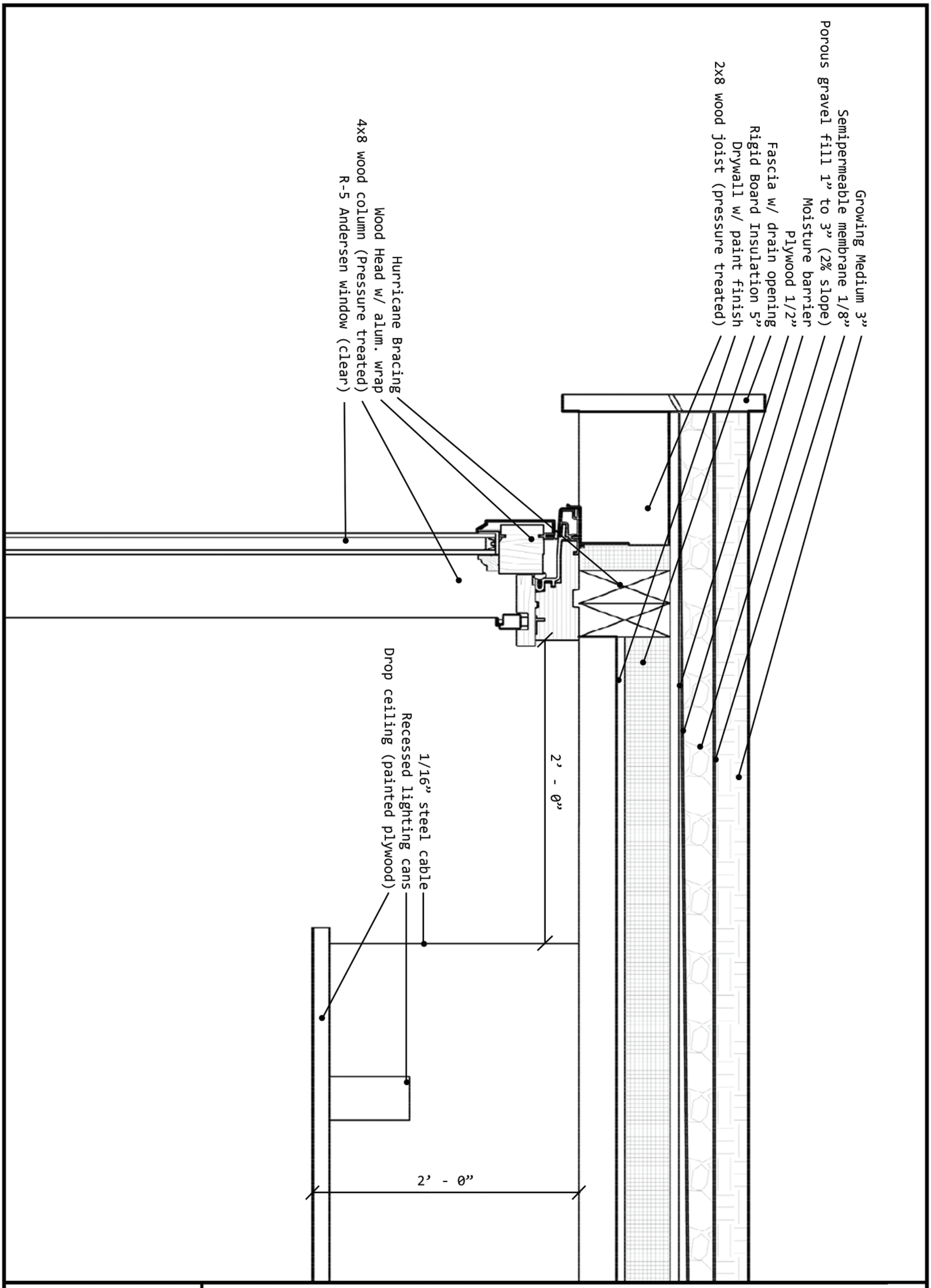
General Wall Section

Scale: 1” = 2’-0”

James Reynolds

Comprehensive Design

7.6



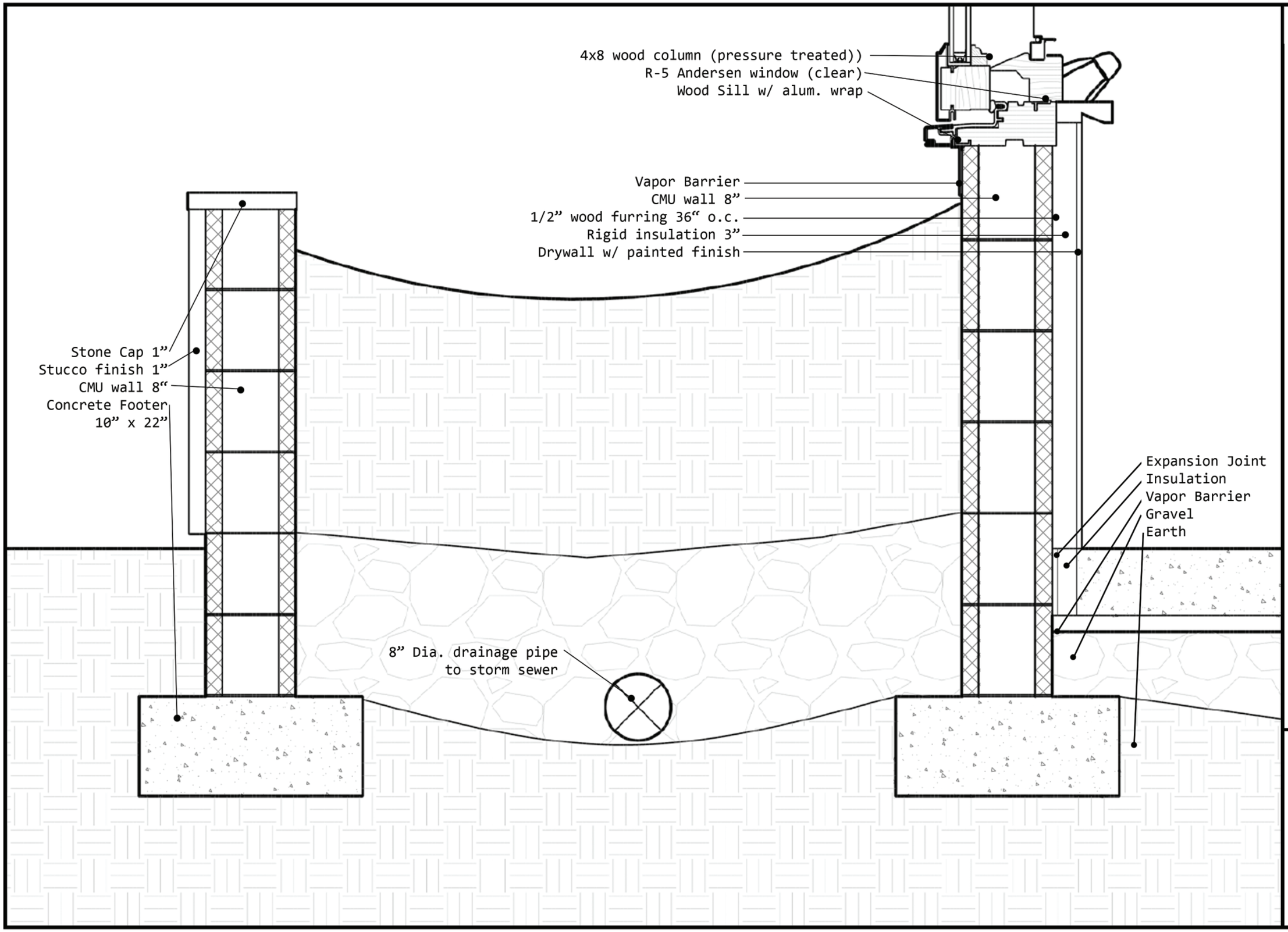
7.6.1

Callout 1

Scale: 1-1/2” = 1’-0

James Reynolds

Comprehensive Design



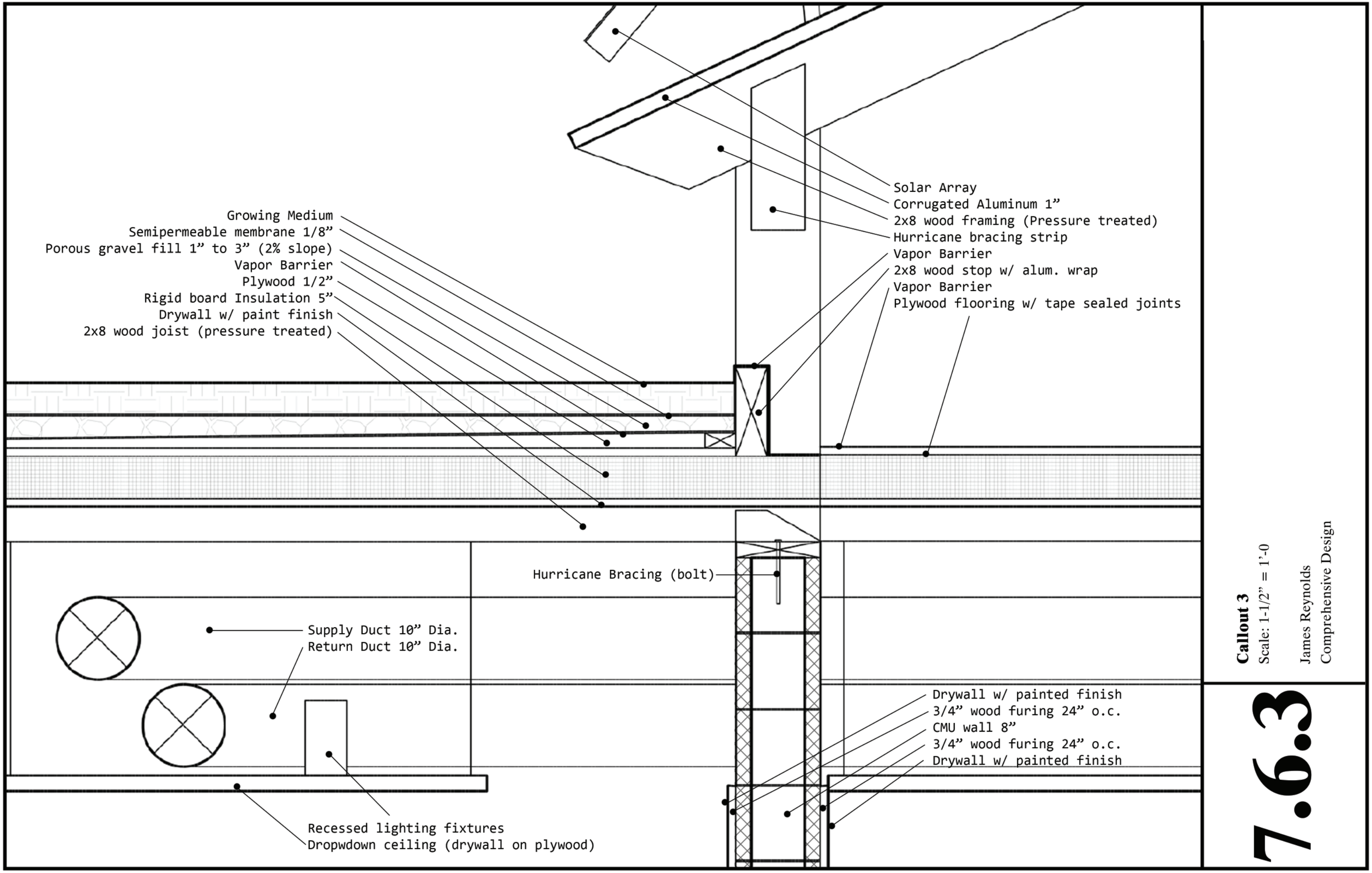
Callout 2

Scale: 1-1/2” = 1’-0

James Reynolds

Comprehensive Design

7.6.2



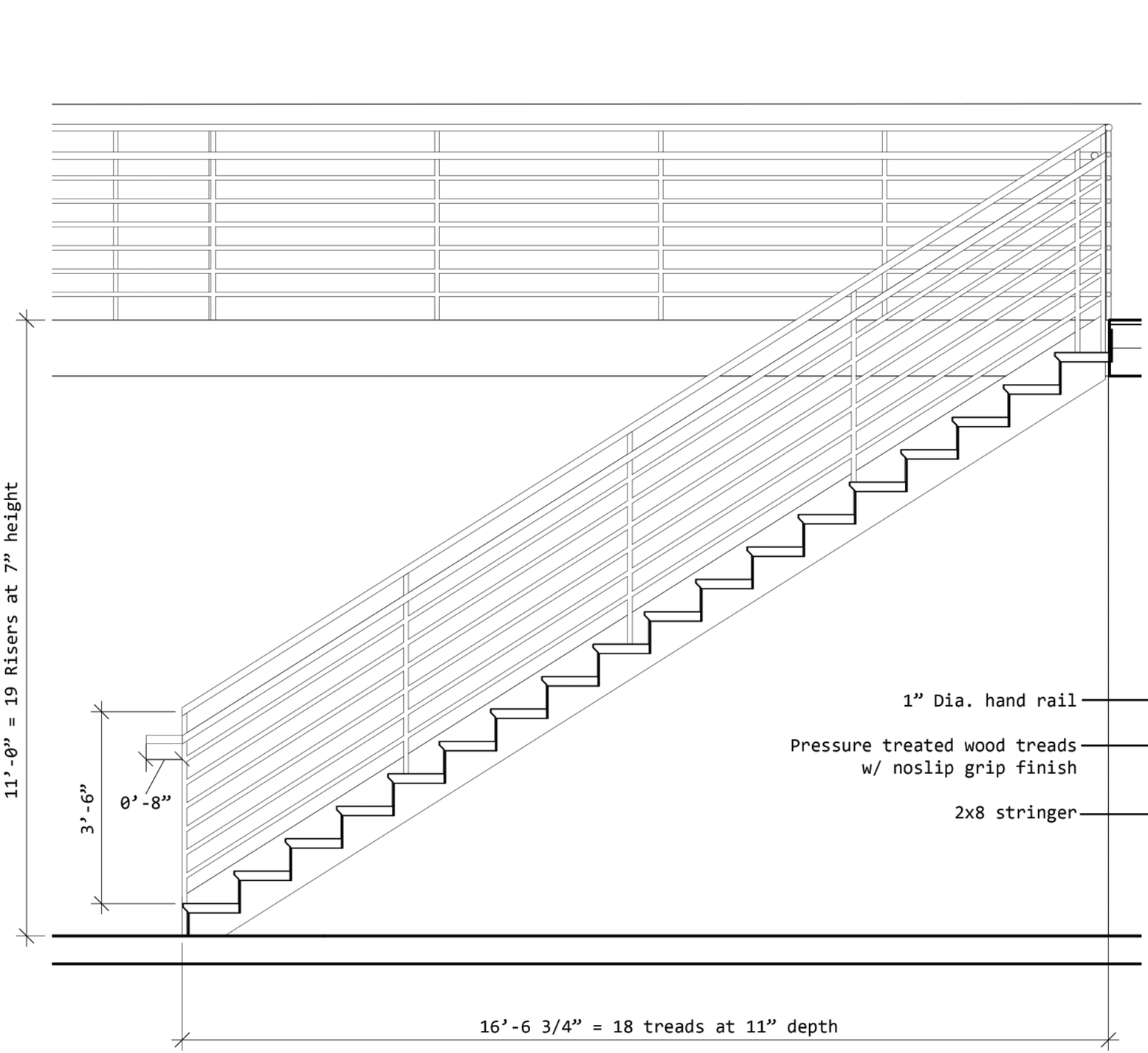
Callout 3

Scale: 1-1/2” = 1’-0

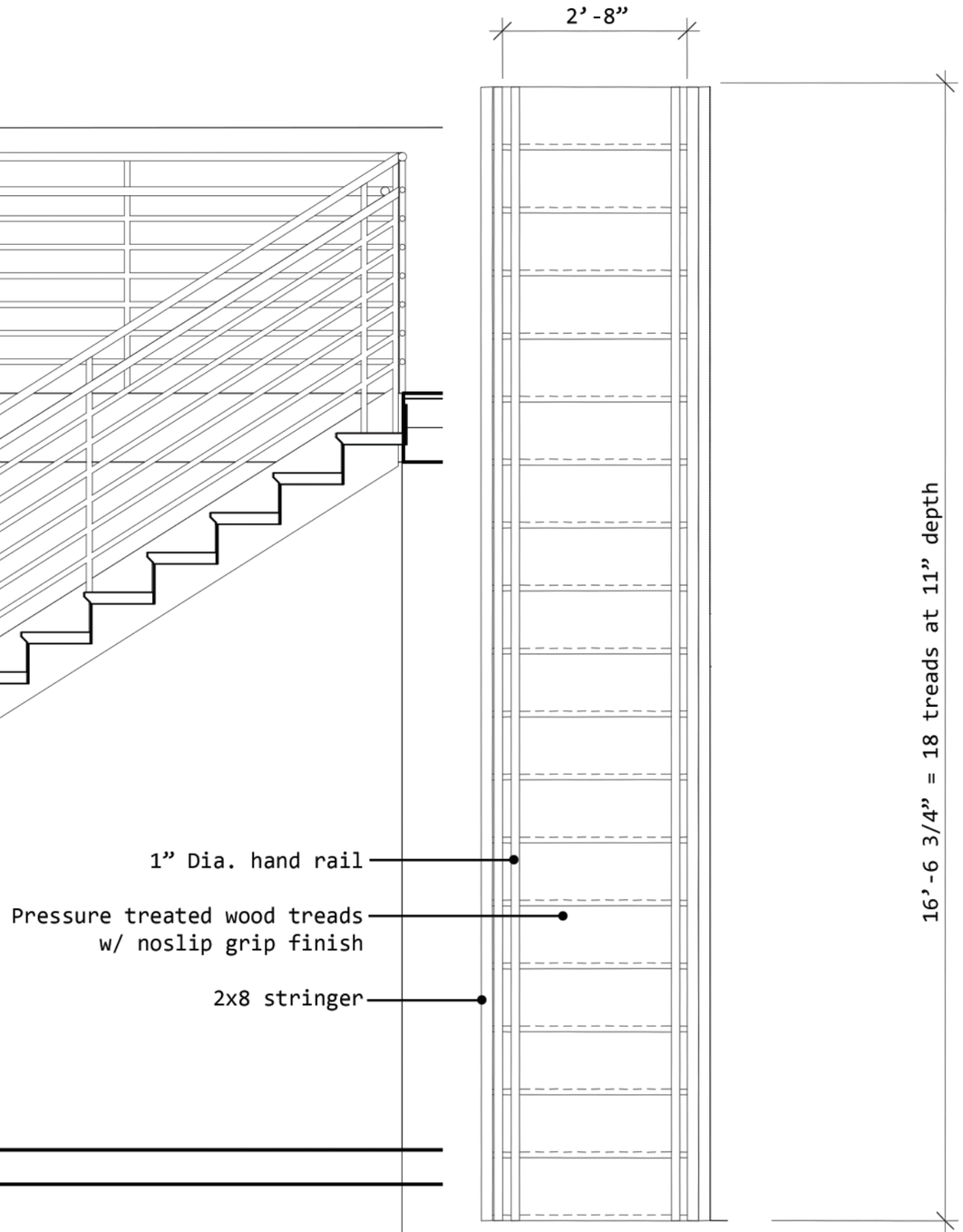
James Reynolds

Comprehensive Design

7.6.3



Stair Elevation



Stair Plan

Stair Detail
Scale: 1/2” = 1’-0

James Reynolds
Comprehensive Design

7.7

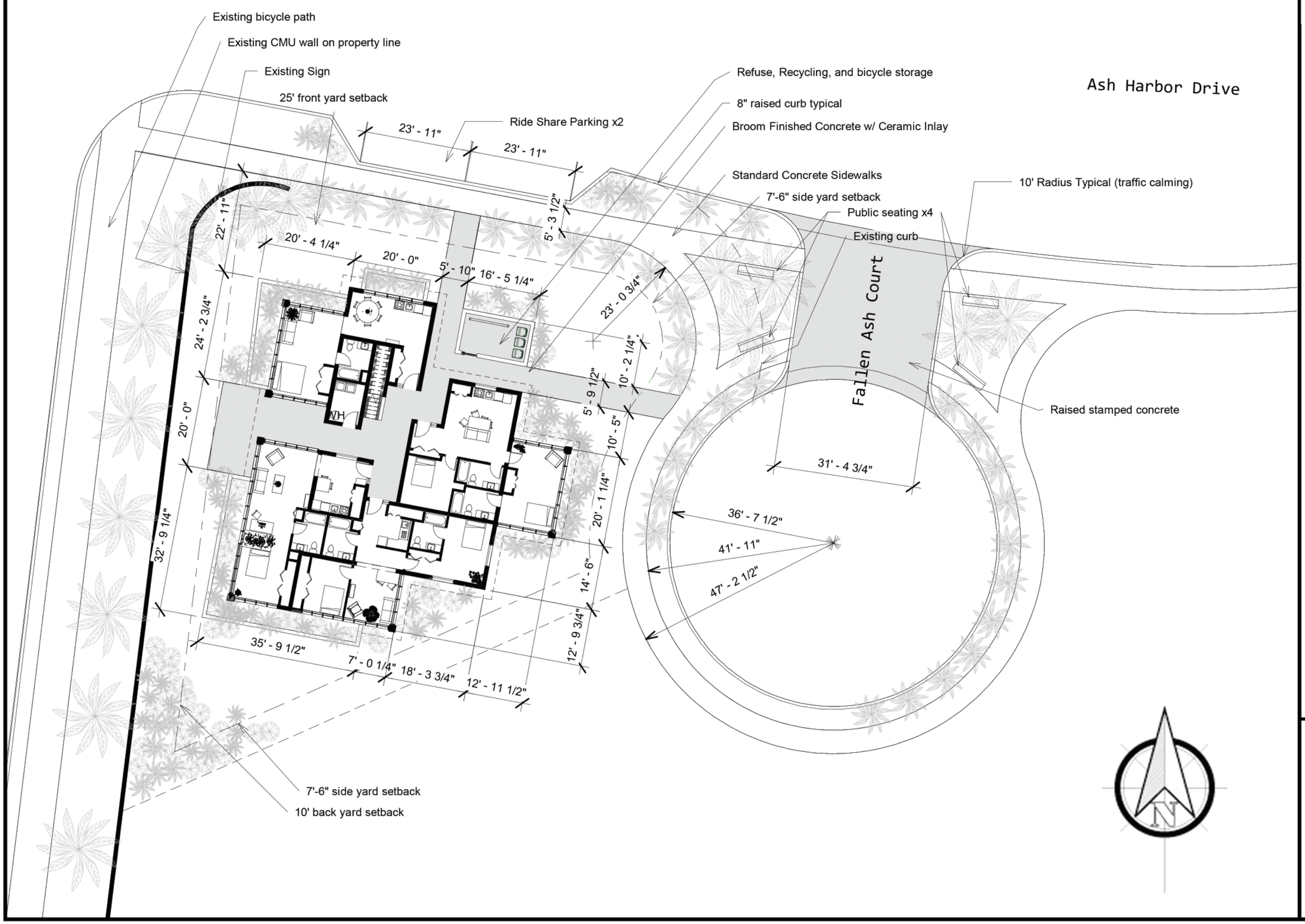
7.8

Reflected Ceiling Plan

Scale: 1" = 10'- 0"

James Reynolds

Comprehensive Design



Site Improvement Plan

Scale: 1" = 20' - 0"

James Reynolds
Comprehensive Design

7.9

Parking buffer

Wiregrass x2
Florida Gamma Grass x3
Needle Palm x2
Dwarf Palmetto x2

Natural Planting Matrix 2

Florida Gamma Grass x2
Dwarf Palmetto x3
Dutchman's Pipe Vine (on window)

TOTAL PLANTING ADDITIONS

Palms
Cabbage Palms x32
Needle Palms x42
Dwarf Palmetto x 35

Grasses
Wiregrass x 31
Florida Gamma Grass x 38

Vines
Dutchman's Pipe x 3
Trumpet Flower x 1

Existing Royal Palm Array x10

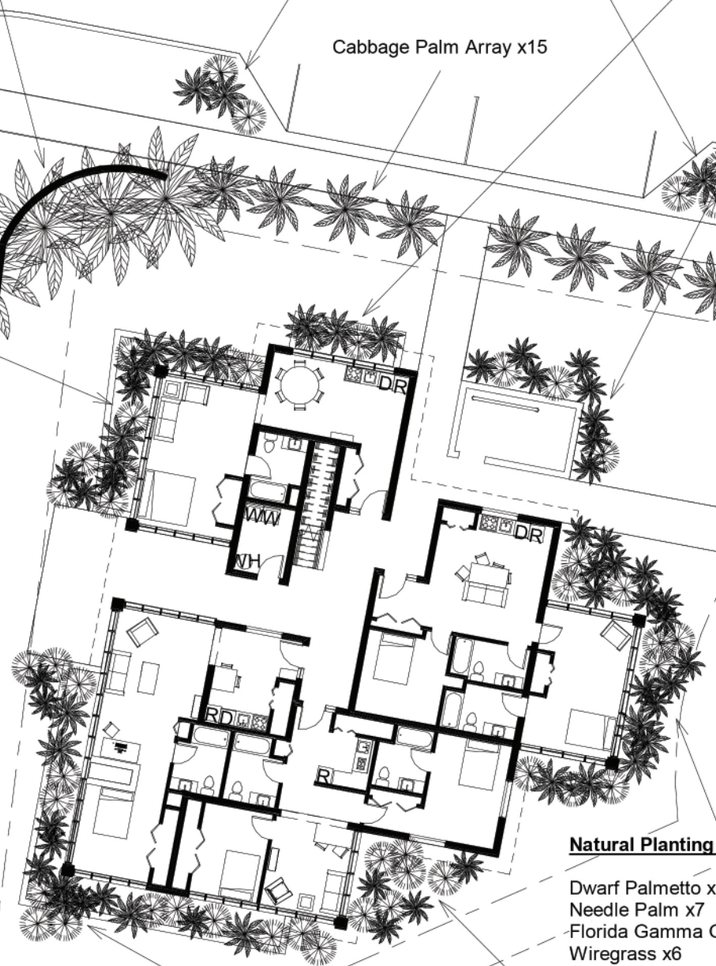
Cabbage Palm Array x15

Natural Planting Matrix 3

Florida Gamma Grass x3
Dwarf Palmetto x8

Natural Planting Matrix 1

Dwarf Palmetto x6
Needle Palm x4
Wiregrass x5
Florida Gamma Grass x5
Dutchman's Pipe Vine (on window)



Existing Royal Palm x5

Cabbage Palm Array x17

Natural Planting Matrix 4

Dwarf Palmetto x11
Needle Palm x7
Florida Gamma Grass x4
Wiregrass x6
Dutchmans Pipe Vine (on window)

Natural Planting Matrix 5

Needle Palm x8
Dwarf Palmetto x5
Florida Gamma Grass x8
Wiregrass x6
Trumpet Flower Vine (on window)

Natural Planting Matrix 6

Florida Gamma Grass x2
Wiregrass x4
Needle Palms x4

Natural Planting Matrix 7

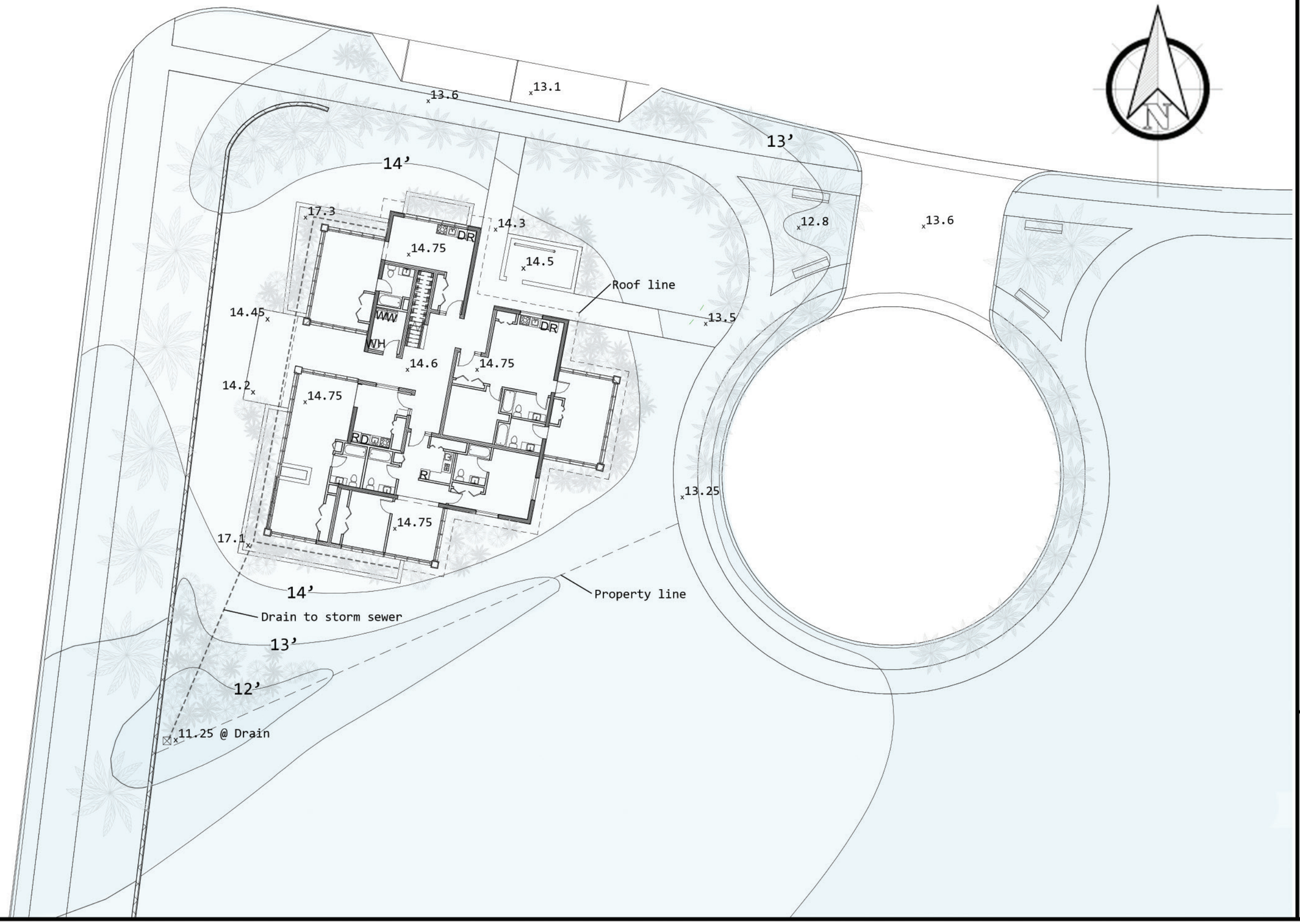
Florida Gamma Grass x13
Wiregrass x8
Needle Palms x17

N

Landscaping Plan
Scale: 1" = 20'- 0"

James Reynolds
Comprehensive Design

7.10



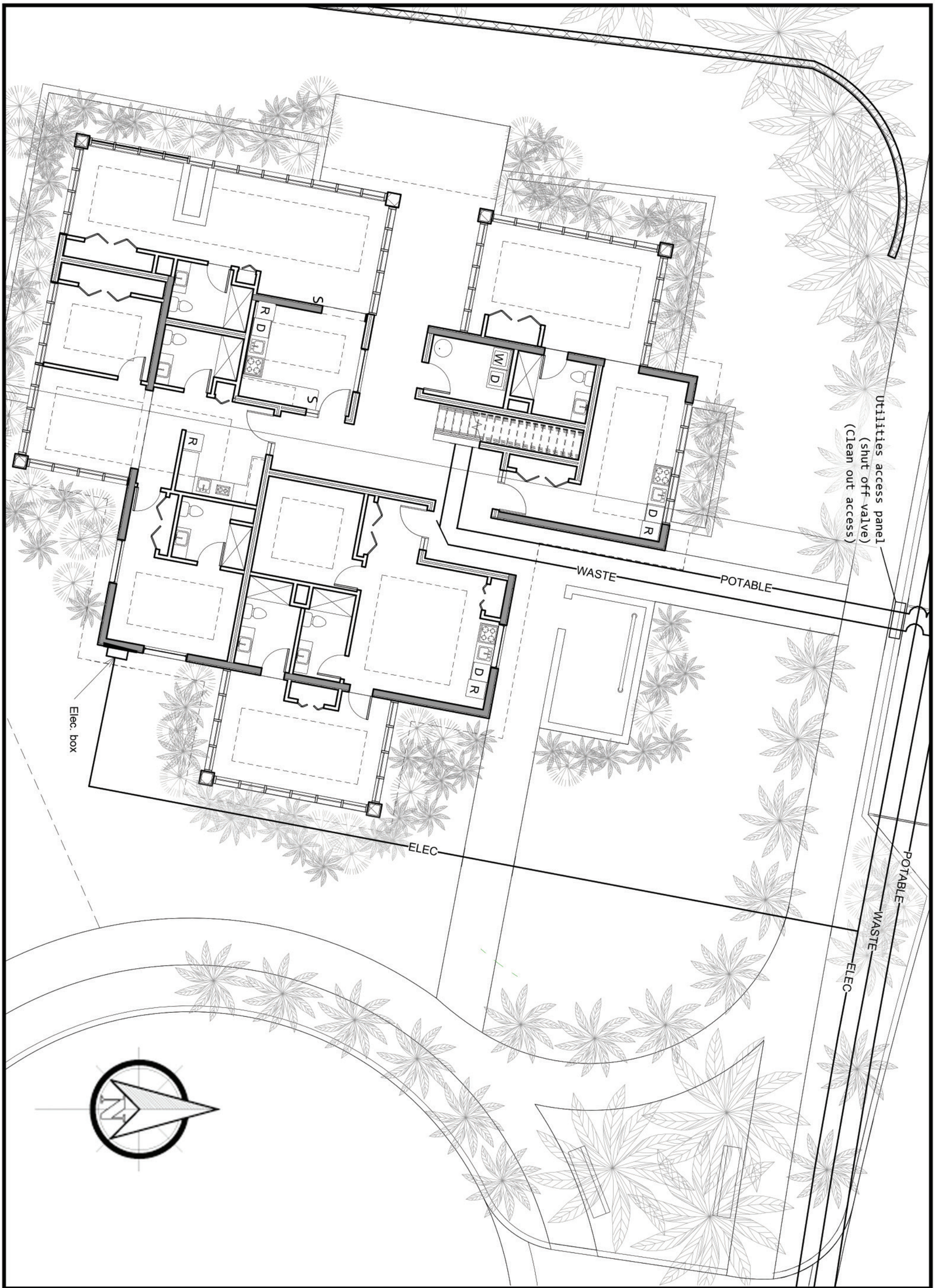
Grading and Stormwater

Scale: 1” = 20’- 0”

James Reynolds

Comprehensive Design

7.11

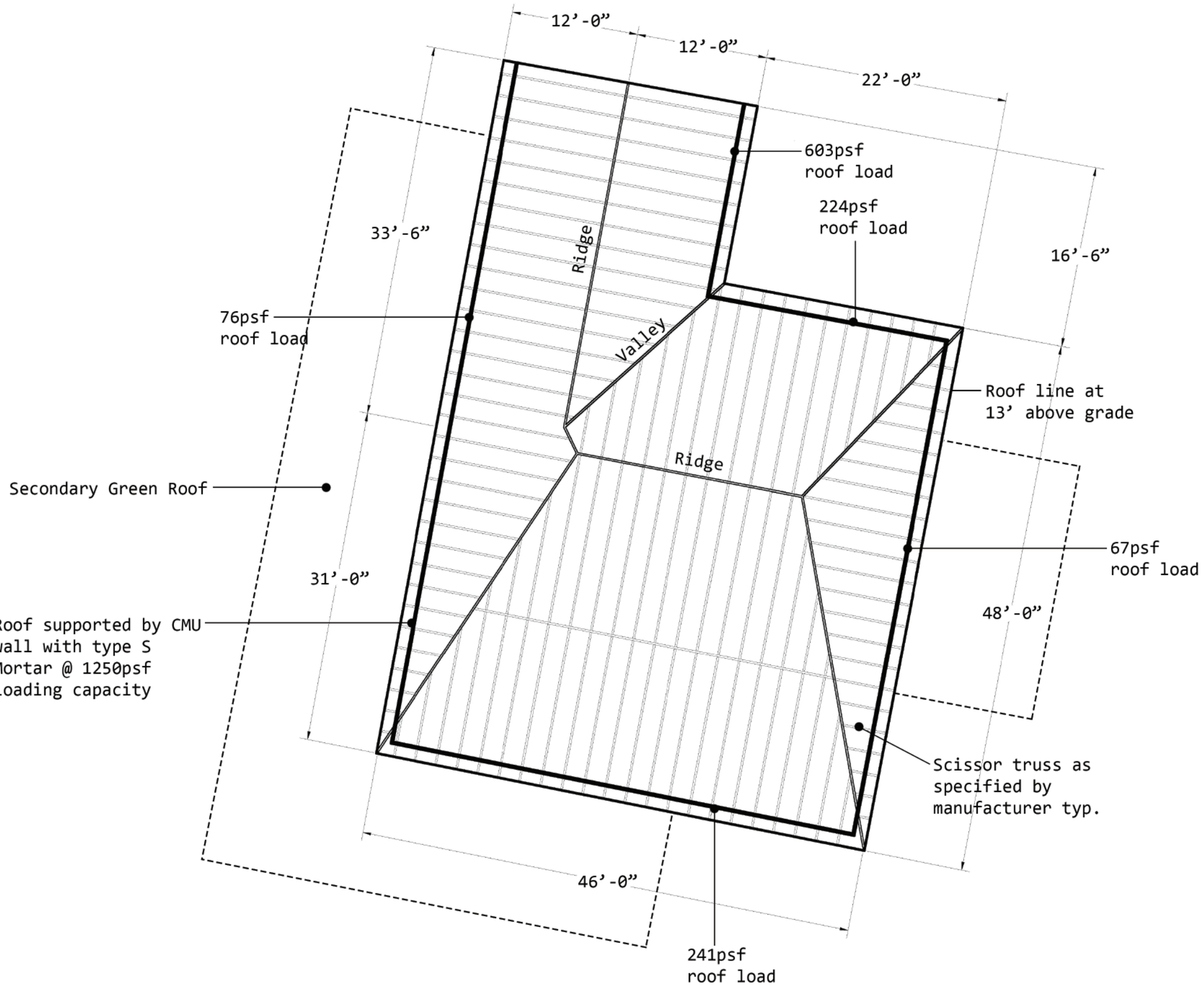


7.12

Site Utility Plan

Scale: 1” = 10’- 0”

James Reynolds
Comprehensive Design



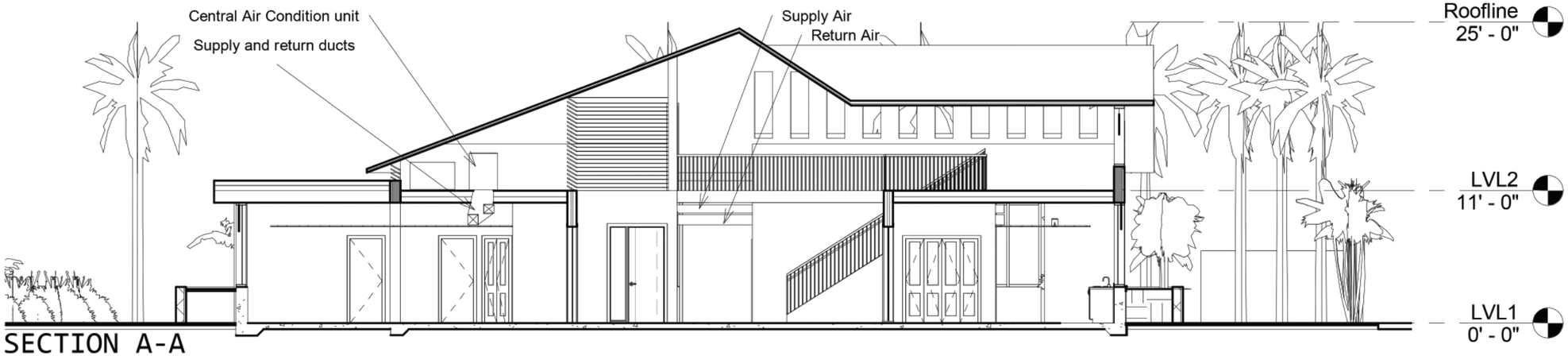
Roof Framing Plan

Scale: 1” = 10’- 0”

James Reynolds

Comprehensive Design

7.13



SECTION A-A

Existing Cooling Load

Floor area 2,210 Volume
Peak Load July Time 12:00 hrs of operation 24

CONDITIONS	DB	WB	% RH	DP	HUM Ratio
Outdoor	92		90		
Room	70		40		
Difference	32		50		

SENSIBLE LOADS — TOTAL 45,113.6

Solar

EXPOSURE	Area	SHGF	SC	TLF	BTUH (w)	
North	21	128	1	0.89	2,392.3	
South	86	191	1	0.83	13,633.6	
East	21	134	1	0.27	759.8	TOTAL
West	-	134	1	0.17	-	16,786

← South exposure through back patio door very high

Transmission

Item	EXP.	AREA	Delta T	U-value	TLF	BTUH (w)	
Glass	N/A	128	32	0.9	1	3,686	
Net Wall	N	389	32	0.328	0.6	2,450	
	S	330	32	0.328	0.3	1,039	
	E	410	32	0.328	0.35	1,506	
	W	600	32	0.328	0.35	2,204	
							TOTAL
Roof	N/A	2,700	32	0.083	0.36	2,582	13,467

← Clear single pane glass
← CMU walls - R3.5
← Roof attached to structure -- R12

O.A

	CFM/ft2	Constant	Delta T		Subtotal	
INFILTRATION	18	1.08	32		636.2	TOTAL
VENTILATION	90	1.08	32		3,110.4	3,747

Internal Heat

		People	Metblc Rate	BSF	Diversity	BTUH (w)
People		4	400	1	1	1,600

	Const.	Watts	Ballast	BSF	Diversity	BTUH (w)	
Lights	3.4	2,210	1	1	1	7,514.0	
Equipt	3.4						
Appliances	3.4					2,000.0	TOTAL
Other	3.4					0	11,114

← Assumed 1 watt per sq. ft.

LATENT LOADS — TOTAL 632

	People	Heat Gain	Diversity		BTUH (w)	
PEOPLE	4	155	0.8		496.0	
APPLIANCES						TOTAL
OUTSIDE AIR	4	50	0.68		136.0	632

TOTAL LOAD (Sensible & Latent) 45,746

Existing 4 ton unit

TOTAL LOAD	Conversion to kWh	Annual cooling hrs.	cost per kWh	ANNUAL COOLING COST ESTIMATE
45,746	13.406	2636	$0.11	$ 4,049.76

Proposed Cooling Load

Floor area 2,700 Volume
Peak Load July Time 12:00 hrs of operation 24

CONDITIONS	DB	WB	% RH	DP	HUM Ratio
Outdoor	92		90		
Room	70		40		
Difference	32		50		

SENSIBLE LOADS — TOTAL 42,662.9

Solar

EXPOSURE	Area	SHGF	SC	TLF	BTUH (w)	
North	420	128	0.1	0.89	4,784.6	
South	434	191	0.1	0.83	6,880.2	
East	266	134	0.1	0.27	962.4	TOTAL
West	406	134	0.1	0.17	924.9	13,552

← SC .1 for exterior bamboo shades and vines
← Reduced solar gains by 20% (added 1200% glazing)

Transmission

Item	EXP.	AREA	Delta T	U-value	TLF	BTUH (w)	
Glass	N/A	1,526	32	0.2	1	9,766	
Net Wall	N	330	32	0.05	0.6	317	
	S	336	32	0.05	0.3	161	
	E	319	32	0.05	0.35	179	
	W	234	32	0.05	0.35	131	
							TOTAL
Roof	N/A	2,700	32	0.03	0.36	933	11,487

← R-5 windows to reduce transmission through glass
← R-20 walls with 3 inches insulation in 2x6 stud wall 24in O.C.
← R-36 Roof (vegetated roof or 5" insulation in 2x8 rafters 24in O.C.
← Reduced Transmission through walls by 15%

O.A

	CFM/ft2	Constant	Delta T		Subtotal	
INFILTRATION	27	1.08	32		933.1	TOTAL
VENTILATION	90	1.08	32		3,110.4	4,044

← Increased Ventilation needs due to increased residents

Internal Heat

		People	Metblc Rat	BSF	Diversity	BTUH (w)
People		6	400	1	1	2,400

	Const.	Watts	Ballast	BSF	Diversity	BTUH (w)	
Lights	3.4	2,700	1	1	1	9,180.0	
Equipt	3.4						
Appliances	3.4					2,000.0	TOTAL
Other	3.4					0	13,580

LATENT LOADS — TOTAL 948

	People	Heat Gain	Diversity		BTUH (w)	
PEOPLE	6	155	0.8		744.0	
APPLIANCES						TOTAL
OUTSIDE AIR	6	50	0.68		204.0	948

TOTAL LOAD (Sensible & Latent) 43,611

← Reduced overall Cooling Load by 5% - can still use existing HVAC system

TOTAL LOAD	Conversion to kWh	Annual cooling hrs.	cost per kWh	ANNUAL COOLING COST ESTIMATE
43,611	12.781	2636	$0.11	$ 3,860.96

HVAC calculations and Section

Scale: 1" = 10'- 0"

James Reynolds

Comprehensive Design

7.14

7.15

HVAC Plan

Scale: 1" = 10'- 0"

James Reynolds

Comprehensive Design

Notes:

All smoke detectors also detect CO

Typical switch height at 36” from finish floor

POTABLE

WASTE

ELEC

POTABLE

WASTE

ELEC

light/motion sensor activated

Counter plugs @ 36” typ.

Elec. box

	Electrical switchbox	S	Single Pole Switch
S_3	Three-Way Switch		SinglePlex Receptacle
	Duplex Receptacle	WP	Duplex Receptacle WP= Waterproof
GFCI	GFCI Duplex Receptacle	*	Isolated Ground Receptacle
	Switched Receptacle		FourPlex Four Gang Receptacle
	240-Volt Receptacle	PC	Ceiling Mounted Light Fixture PC= Pullchain
	Wall-Mounted Light Fixture	R	Recessed Light Fixture
WP	Weatherproof Light Fixture		Fluorescent Light Fixture
C=	Ceiling Fan		Combination Light & Fan
VF	Power Vent Fan	2	Electric Motor Number=HP
SD	Smoke Detector		Circuit Breaker
	Telephone Jack	T	Doorbell Transformer
	Doorbell Pushbutton		Ground

Electrical Plan

Scale: 1” = 10’- 0”

James Reynolds
Comprehensive Design

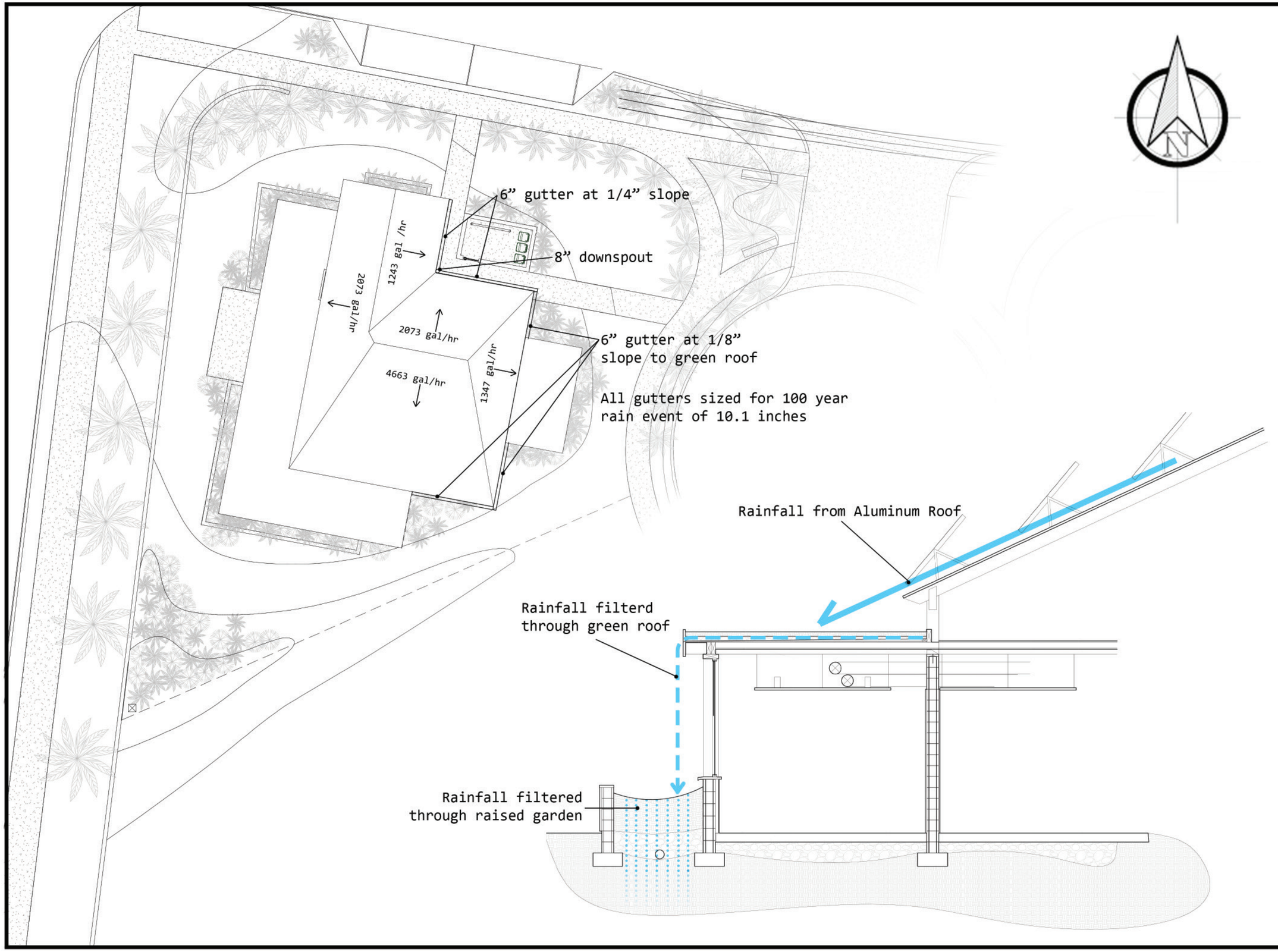
7.16

7.17

Waste and Water

Scale: 1” = 10’- 0”

James Reynolds
Comprehensive Design



Roof Drainage and Gutters

Scale: 1” = 10’- 0”

James Reynolds

Comprehensive Design

7.18

Smoke/CO detector typ.

Fire extinguishers

Smoke/CO detector

Fire extinguishers

Smoke/CO detector

smoke/CO detector

A Interior walls between units
@ 2 hour fire rating typ.
1/4” gypsum wallboard
2x8 wood framing
5” rigid foam insulation
1/4” gypsum wallboard

B Interior partition walls
@ 1 hour fire rating typ.
1/8” gypsum wallboard
2x4 wood stud wall
1” rigid foam insulation
1/8” gypsum wallboard

Fire Safety
Scale: 1” = 10’- 0”

James Reynolds
Comprehensive Design

7.19

8.0 Visualizations

Interior Perspective

South Western View

South EasternView

9.0 Conclusion

9.0 Conclusion

The top down and bottom up method provide opportunities for designers to utilize systems level thinking by understanding global, regional, and local goals. While my goal of increasing density was compatible with the market forces revealed from the bottom up approach, local zoning restricted the implementation of a more versatile programming without age or ability restriction. The addition of multi-unit housing in the suburbs offers a great opportunity for investment in the future. (NFAR) Moving forward, I believe this design can demonstrate to communities that many misconceptions about multi-unit housing may be untrue.

By enhancing the existing pedestrian networks and showing how the aging can have their place in the neighborhood and community, there exists an opportunity to create cross-generational interaction and enhance the value provided by both young and old. The aging in place residents will have opportunities to commandeer a traffic calmed cul-de-sac, and provide a watchful eye over playing children, passers-by, and their families. While the original goal of this project had no intention of creating an assisted living facility, bounding myself to the constraints of both the methodology and zoning solved both problems in a creative way.

9.1 Feasibility

The feasibility of developing units for those wishing to age in place depends largely on several factors such as construction cost, operations and maintenance, and the management of how the spaces will be leased. These three considerations determine ultimately if a project will be profitable for a developer (or homeowner) to undertake.

9.2 Construction Cost

When adjusted for infrastructure costs, redevelopment of existing building stock offers lower overall economic and environmental costs. (Brennan et. al.) This makes redevelopment generally attractive as an option for developers looking to produce revenue from tenants or renters in existing areas with less effort and cost, accelerating the process. In the specific design, the existing footprint of the building was expanded

by roughly 800sf. When priced at $150 per square foot for new construction, with the addition of a new roof and solar array, the total costs ends up around $150,000 to rehabilitate the existing structure into an ADA compliant multi-unit apartment. This specific design called for a double skin roof to create a microclimate and utilized additional technology, however budget-minded suburban redevelopments could occur at a fraction of the cost if they were to incorporate alternative design features and have less constraint on flood resilience and occupant requirements.

There are many models for the development of aging in place homes, such as the "elder village," and standard assisted living/nursing home. There exist several tax incentives, varying by state, to provide money for developers looking to attain funding, as well as elderly citizens whom need assistance to afford aging in place housing options. In Florida, $7,042,734.00 was allocated just last year (2014) for the development of programs and incentives to communities redeveloping or planning for long term elderly care. (USDHUD) This money is used for programs such as identifying future at-risk communities, providing additional services to those whom are disabled, and subsidizing aging-in-place development. These grants are primarily awarded via the U.S. Department of Housing and Urban Development. The HUD Section 202 supportive housing for the elderly program provides capital investment into development without the need for repayment if future tenants are low income, and has a minimum of one 62+ aged occupant. (USDHUD)

Purchase of foreclosure:	*- 177,000.00*
Salvaged material savings:	*+ $30,394.00*
Renovation cost:	*- $150,000.00*
15% HUD grant assistance:	*+ $22,500.00*
TOTAL INVESTMENT:	*- $274,106.00*

9.3 Operations and maintenance

In the majority of single-family residential zoned communities, the continued operations and maintenance of households is the personal responsibility of homeowners. These rules are sometimes voluntarily enforced by home owners associations. This homeowner responsibility disappears when it comes to multi-unit buildings, which typically bill residents a small fee for maintenance such as painting,

yard trimming, grass mowing, gutter cleaning, etc. As this project is the conversion of a single family unit into a multi-unit structure, weekly yard maintenance and upkeep will be required to remain contextual to the surrounding neighborhood.
While the term “operations and maintenance” applies mainly to the built environment, it is used here to also refer to the aging in place residents as well. The Administration for community living states that the term “Aging in place” refers to elderly residents that may require assistance with household chores such as preparing food, cleaning, transportation, daily medical care, etc. These costs are often paid for by private medical insurance providers, and often aging-in-place facilities will have relationships with doctors and nurses specifically suited for the residents. (AOA) The new design accommodates two different units to allow for residents of differing levels of independence and lifestyles. For instance, a two bedroom unit could provide space for both an elderly occupant and a live-in nurse. Or, a live in nurse could have his own studio unit on the site for easy access to his patients. This flexibility only serves the occupants by allowing them multiple choices regarding their care.

To conclude, the weekly fee for a lawn-care specialist and an allowance for miscellaneous repairs or storm damage increases the operations and maintenance costs to a developer.

Annual lawncare fees:	- $2,400
Miscellaneous repairs:	- $2,000
TOTAL ANNUAL COST:	- $4,400

9.4 Unit Rental fees

With the total upfront investment of a developer reaching close to $275,000.00, units must be priced accordingly to achieve a return on investment in a reasonable amount of time. Due to the nature of most aging-in-place business models, accepting private long term insurance is the primary mode of payment by elderly residents. These costs equate to an average of $42,000 dollars a year, which is significantly less than the average cost of a unit in a nursing home at $87,000. (USDHUD) The problem with this number is that it provides an average cost with medical care provided. Based on an average rent for apartments in the vicinity of the site, studio apartments cost ~$850/month and two bedroom units ~$1000.

Upfront investment:	- $274,106.00
Annual rent profit:	+ $44,400.00
Annual operational fees:	- $4,400.00
TOTAL ROI:	274,106/40,000 = 6.85 Years

After a general assessment of the construction costs and rental profits, if rental prices are kept competitive with the area, a return of investment is inspected after close to seven years. If a developer can partner with a team of healthcare specialists and provide at home medical services to multiple units within a community using the same medical professionals, it would be possible to lower the return on investment. In this case, it is suggested that if a developer is to develop profitable aging-in-place developments, that it be done at a large scale so that operations can be streamlined and profit increased.

9.5 Future considerations

Additional considerations should be taken in future study to look into the feasibility of redeveloping suburban single-family neighborhoods to include a mix of multi-unit residential options. While studies that indicate the sustainability of increasing suburban density based on VMT and energy use to be effective, large scale suburban redevelopment has not been sufficiently studied due to it still being relatively novel, and against some zoning codes. If this aging-in-place redevelopment strategy were used in neighborhoods with large aging populations, it should be noted that these populations will decrease dramatically as they reach the end of their lives. If this model were applied to suit the current need for geriatric housing, it could become suburban multi-unit housing with the change of a zoning law – allowing it to serve a larger population of users (not just elderly people) and hit its sustainability goals more effectively.

10.0 References

10.1 List of Figures:

10.2 Works Cited:

Environmental Protection Agency. “Average Energy Use and Costs Throughout the United States.” Putting Energy into Profits. April 24, 2014. Accessed April 12, 215.

Dobson, Andrew, and Michael Jacobs. Fairness and Futurity Essays on Environmental Sustainability and Social Justice. Oxford: Oxford University Press, 1999.

World Commission on Environment and Development. 1987. Our common future. Oxford: Oxford University Press.

Rohilla Shalizi, Cosma . “Top down design - an introduction to statistical computing.” Reading, from University of Michagin, Ann Arbor Michigan, September 19, 2011.

Pereira, Luiz Carlos Bresser, and Jose Maravall. Economic Reforms in New Democracies: A Social-democratic Approach. Cambridge [England: Cambridge University Press, 1993.

U.S. Census. Statistical Abstract of the United States, 2012. Washington, D.C.: U.S. Census Bureau, 2011.

Muller, DB, G. Liu, AN Lovik, R. Modaresi, S. Pauliuk, FS Steinhoff, and H. Brattebo. 2013. Carbon emissions of infrastructure development. Environmental science & technology 47, (20): 11739-11746.

10K Research Marketing. "Annual Report on the Northeast Florida Housing Market."Northeast Florida Association of Realtors, 2015, 2-10. Accessed April 9, 2015. http://www.nefar.com/filebin/2014MktStatsAnnlRpt.pdf.

Kelly, Hugh F., and Andrew Warren. "The Changing Age Game." Emerging Trends in Real Estate - U.S. and Canada, 2014, 6-103.

"Ecosystem Services: Benefits Supplied to Human Societies by Natural Ecosystems." Issues in Ecology Number 2, no. Spring

Aldana, A. 2012. Environmental impact assessment (EIA) for electrical infrastructure. 2012 Sixth IEEE/PES Transmission and Distribution: Latin America Conference and Exposition (T&D-LA): 1-8.

Williams-Derry, Clark. "Increases in Greenhouse Gas Emissions from Highway Widening Projects." Sightline Research Backgrounder, 2007, 1-9.

Frey, William H. "The Five New Realities." State of Metropolitan America (2010): 23-34. Accessed April 9, 2015.

Rugh, Jacob, and Douglas Massey. "Racial Segregation and the American Foreclosure Crisis."American Social Review, no. October 1 (2011): 629-51.

Anonymous. "US Populations Racial and Ethnic Group Trends." Civil Rights Journal Fall 1999, no. 4 (1999): 36-40.

Poortinga, Wouter, Linda Steg, and Charles Vlek. "Values, Environmental Concern, and Environmental Behavior: A Study into Household Energy Use." Environment and Behavior36 (2004): 70.

Marique, AF, and S. Reiter. 2012. A method to evaluate the energy consumption of suburban neighborhoods. HVAC&R RESEARCH 18, (1-2): 88-99.

Böhringer, Christoph, and Thomas F. Rutherford. 2008. Combining bottom-up and top-down. Energy Economics 30, (2): 574-596.

Dirix, J., W. Peeters, J. Eyckmans, PT Jones, and S. Sterckx. 2013. Strengthening bottom-up and top-down climate governance. Climate policy 13, (3): 363-383.

Klint Jensen, K. 2010. Sustainability and uncertainty: Bottom-up and top-down approaches. Italian Journal of Animal Science 6, (1s): 853-855.

Fraser, Evan D. G., Andrew J. Dougill, Warren E Mabee, Mark Reed, and Patrick McAlpine. "Bottom up and Top Down: Analysis of Participatory Processes for Sustainability Indicator Identification as a Pathway to Community Empowerment and Sustainable Environmental Management." Journal of Environmental Management 78, no. 2006 (2006): 114-27.

Williamson, June. Designing Suburban Futures: New Models from Build a Better Burb. Washington, DC: Island, 2013. Print.

Swaback, Vernon D. The Creative Community: Designing for Life. Mulgrave, Vic.: Images Pub., 2003. Print.

Dunham-Jones, Ellen, and June Williamson. Retrofitting Suburbia: Urban Design Solutions for Redesigning Suburbs. Hoboken, NJ: John Wiley & Sons, 2009. Print.

Corbett, Judy, and Michael N. Corbett. Designing Sustainable Communities: Learning from Village Homes. Washington, D.C.: Island, 2000. Print.

Piedmont-Palladino, Susan, and Timothy Mennel. Green Community. Chicago: American Planning Association, 2009. Print.

Bell, Bryan, and Katie Wakeford. Expanding Architecture: Design as Activism. New York: Metropolis, 2008. Print.

Barton, Hugh. Sustainable Communities the Potential for Eco-neighbourhoods. London: Earthscan, 2000. Print.

Lafferty, William M. Sustainable Communities in Europe. London: Earthscan, 2001. Print.

Daniels, Thomas L., and Katherine Daniels. The Environmental Planning Handbook for Sustainable Communities and Regions. Chicago, IL: Planners, American Planning Association, 2003. Print.

Schneider, Keith. "Suburban Sprawl." Nieman Reports 50.4 (1996):9. ProQuest. Web. 25 Nov. 2014.

Omojaro, Peter A. "Energy Analysis for Onsite and Offsite Suburban Wastewater." Environment, Development and Sustainability13.3 (2011): 519-33. ProQuest. Web. 25 Nov. 2014.

Poortinga, W., L. Steg, and C. Vlek. "Values, Environmental Concern, and Environmental Behavior: A Study into Household Energy use." Environment & Behavior 36.1 (2004): 70-93. ProQuest. Web. 25 Nov. 2014.

United States. U.S. Department of Energy. EIA. Price Elasticities for Energy Use in Buildings of the United States. Comp. Department of Energy. N.p.: n.p., n.d. Print.

Chao, Liu, and Shen Qing. "An Empirical Analysis of the Influence of Urban Form on Household Travel and Energy Consumption."Computers, Environment and Urban Systems 35.5 (2011): 347-57. ProQuest. Web. 25 Nov. 2014.

Sovacool, Benjamin K. "Conceptualizing Urban Household Energy use: Climbing the "Energy Services Ladder"." Energy Policy 39.3 (2011): 1659. ProQuest. Web. 25 Nov. 2014.

Buliung, Ron N., and Pavlos S. Kanaroglou. "Urban Form and Household Activity-Travel Behavior." Growth and Change 37.2 (2006): 172-99. ProQuest. Web. 25 Nov. 2014.

Moriarty, Patrick. “Household Travel Time and Money Expenditures.” Road & Transport Research 11.4 (2002): 14. ProQuest. Web. 25 Nov. 2014.

Vringer, Kees, Theo Aalbers, and Kornelis Blok. “Household Energy Requirement and Value Patterns.” Energy Policy 35.1 (2007): 553. ProQuest. Web. 25 Nov. 2014.

Sungwon Lee, Bumsoo Lee, The influence of urban form on GHG emissions in the U.S. household sector, Energy Policy, Volume 68, May 2014, Pages 534-549, ISSN 0301-4215

Abrahamse, W., et al. “The Effect of Tailored Information, Goal Setting, and Tailored Feedback on Household Energy use, Energy-Related Behaviors, and Behavioral Antecedents.” Journal of Environmental Psychology 27.4 (2007): 265-76. ProQuest. Web. 25 Nov. 2014.

Nelson, Arthur C. “The Mass Market for Suburban Low-Density Development is Over.” The Urban Lawyer 44.4 (2012): 811-26.ProQuest. Web. 25 Nov. 2014.

Pandit, Ram, and David N. Laband. “Energy Savings from Tree Shade.” Ecological Economics 69.6 (2010): 1324-9. ProQuest.Web. 25 Nov. 2014.

Tombazis, A. N., and S. A. Preuss. “Design of Passive Solar Buildings in Urban Areas.” Solar Energy 70.3 (2001): 311. ProQuest.Web. 25 Nov. 2014.

Marique, Anne-Francoise, and Sigrid Reiter. “HVAC & R Research (JournalSeek).” HVAC & R Research (JournalSeek). University of Liege, Belgium, 15 Dec. 2010. Web. 25 Nov. 2014.

Cox, Wendell. “The Long Term: Metro America Goes From 82% to 86% Suburban Since 1990.” Newgeography.com. Demographia, 01 June 2014. Web. 25 Nov. 2014.

Hall, Matthew, and Barrett Lee. “How Diverse are US Suburbs?” Urban Studies 47.1 (2010): 3-28. ProQuest. Web. 25 Nov. 2014.

Nelder, Chris. “The Worst Way to Measure Energy Efficiency.” Slate Magazine. N.p., 21 Mar. 2013. Web. 25 Nov. 2014.

USGBC. Green Neighborhood Development: LEED Reference Guide for Neighborhood Development. Washington, DC: U.S. Green Building Council, 2009. Print. VER.4.

Castañeda, René Contreras. The Quest for Sustainable Communities: The Role of Performance Monitoring in the Planning, Design, and Certification of Sustainable Neighborhoods. N.p.: n.p., n.d. Print.

Berardi, Umberto. Sustainability Assessments of Urban Communities Through Rating Systems. Thesis. MA, Worchester Polytechnic Institute, n.d. Worchester: WPI, 2013. Academia.edu. Web. 25 Nov. 2014.

Council, National Research, and Committee on Advancing Desalination Technology. 2007. Desalination: A national perspectiveNational Academies Press.

American Public Television, Films Media Group, and Films for the Humanities & Sciences (Firm). 2011. Suburban america: Problems & promise. .

Cleugh, H. A., E. Bui, D. Simon, J. Xu, and V. G. Mitchell. “The Impact of Suburban Design on Water Use and Microclimate.” CSIRO Marine and Atmospheric Research, 2012.

Fleming, C. Seton. 1925. The history of jacksonville, florida. The Florida Historical Society Quarterly 4, (2): 96-96.

Davis,T.Frederick (Thomas Frederick). History of jacksonville, florida [electronic resource].

DENNIS, LADDIE. 1990. JACKSONVILLE: A city in touch with its past. The Globe and Mail (1936-Current)1990.

Northeast Florida Association of Realitors. “2014 Annual Report on the Northeast Florida Housing Market.” Association of Realtors Reports, January 8, 2015.

Jacksonville. 2013. The Hutchinson Encyclopedia.

Florida Senate. “419 Community Residential.” In Florida Statutes. 2011 ed. Florida Senate, 2011.

US Agency for Health Care Administration. “Assisted Living Facility.” Assisted Living Facility Requirements. January 1, 2014. Accessed April 11, 2015. http://ahca.myflorida.com/MCHQ/Health_Facility_Regulation/Assisted_Living/alf.shtml.

Ecotherapy: Healing with nature in mind.(book review). 2009. California Bookwatch.

U.S. Dept. of Housing and Urban Development. “Section 202 Supportive Housing for the Elderly Program.” Section 202 Supportive Housing for the Elderly Program. April 8, 2015. Accessed May 6, 2015.

Brennan, Maya, Amy Deora, Anker Heegaard, Albert Lee, Jeffrey Lubell, and Charlie Wilkins. “Comparing the Costs of New Construction and Acquisition-Rehab In Affordable Multifamily Rental Housing: Applying a New Methodology for Estimating Lifecycle Costs.” Center for Housing Policy. February 1, 2013. Accessed May 6, 2015.
Administration on Aging. “Community Innovations for Aging in Place.” Project Summaries. May 1, 2009. Accessed May 6, 2015.

Gleckman, Howard. “’Village’ Groups Help Seniors Remain in Their Homes as They Grow Older.” Washington Post. February 9, 2010. Accessed May 7, 2015.

Bureau of Planning & Evaluation. “Accomplishments of the Communities for a Lifetime Initiative.” Florida Department of Elderly Affairs. April 1, 2013. Accessed May 9, 2015.