

SUBURBAN RETROFIT: SIMULATED APPLICATION OF SPRAWL REPAIR ON
ORLANDO'S MOST PROMISING EDGE CITY

By

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To Alex

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TABLE OF CONTENTS

	<u>page</u>
ACKNOWLEDGMENTS.....	4
LIST OF TABLES.....	8
LIST OF FIGURES.....	9
LIST OF ABBREVIATIONS.....	11
ABSTRACT.....	12
CHAPTER	
1 INTRODUCTION.....	14
The Problem With Sprawl.....	14
Method for Repair and Evaluation.....	16
Anticipated Result.....	16
Organization.....	17
2 LITERATURE REVIEW.....	18
Assessment of Spatial Features.....	19
Automobile Dependency Caused by Lack of Connectivity.....	20
Separation of Uses With Limited Housing Types.....	22
Low-Density Development.....	24
Lack of Nodes.....	25
Lack of Acknowledgement of the Public Realm.....	26
Concluding Assessment.....	28
Policy and Other Factors That Have Promoted Suburban Development.....	28
Changes in Transportation Technology.....	28
Well-Meaning, Poorly Executed Development Policies.....	31
Cultural Context: Culture of Consumption; Widening Wealth Divide.....	38
3 METHODOLOGY.....	45
Study Area Selection.....	45
Sprawl Repair Method.....	48
Street Network Design.....	50
Land Use Intensity.....	51
Land Use Pattern.....	51
Summary.....	54
4 FINDINGS AND RESULTS.....	56

Pre-Design Assessment	56
Repair at the Regional Scale	58
Step One: Determine Sprawl Repair Domains	59
Step Two: Delineate Preservation and Reservation Areas.....	60
Step Three: Prioritizing Commercial and Employment Nodes.....	61
Step Four: Prioritize Potential Transit and Infrastructure Networks	62
Step Five and Step Six: Redundant and Recommendations.....	62
Step Seven: Assemble the Sector Map	63
Repair at the Community Scale	63
Repair at the Block Scale.....	68
Site-Specific Obstacles	70
Post-Design Assessment.....	72
Summary	73
5 DISCUSSION	109
Analysis of Quantitative Measures of Urban Form.....	109
Analysis of Method	113
Implementation: Overcoming Obstacles	115
Voter Willingness to Raise Taxes for Smart Growth Policies	117
Excuse me? Your Eminent Domain is Showing.....	119
The Rise of Private Nonprofit Land Trusts and Public Land Acquisition Programs.....	119
Special Districts and Private Governance as a Means to Transition to a Regional Structure	121
Form-Based Codes: A Tool for Implementation.....	124
Summary	127
6 CONCLUSION.....	129
Opportunities for Future Research.....	129
The Kumbaya Approach	131
Concluding Thought: Growing Awareness.....	132
LIST OF REFERENCES	133
BIOGRAPHICAL SKETCH.....	138

LIST OF TABLES

<u>Table</u>		<u>page</u>
2-1	Characteristics of sprawl.	42
4-1	Quantitative measures of urban form.	74

LIST OF FIGURES

<u>Figure</u>	<u>page</u>
4-1 Regional study area.....	75
4-2 Sprawl repair domain.....	76
4-3 Preservation and reservation areas at the regional scale.....	77
4-4 Preservation and reservation areas at the community scale	78
4-5 Commercial and employment nodes at the regional scale	79
4-6 Commercial and employment nodes at the community scale.....	80
4-7 Transit and infrastructure networks at the regional scale	81
4-8 Transit and infrastructure networks at the community scale.....	82
4-9 Sector map at regional scale.....	83
4-10 Sector map at the community scale.....	84
4-11 Community study area.....	85
4-12 Deficiencies of a multifamily subdivision: Single building use and type	86
4-13 Deficiencies of a multifamily subdivision: Lack of walkable block structure	87
4-14 Deficiencies of a multifamily subdivision: Lack of walkable block structure	88
4-15 Deficiencies of a multifamily subdivision: Dispersed and exposed parking	89
4-16 Dispersed and exposed parking	90
4-17 Dispersed and exposed parking	91
4-18 Deficiencies of a multifamily subdivision: Residual open space	92
4-19 Residual open space: Underutilized neighborhood park	93
4-20 East Orange Neighborhood Park.....	94
4-21 Intervention: Figure ground.....	95
4-22 Intervention for a multifamily subdivision: Introduce new building types and mixed uses.	96

4-23	Intervention for a multifamily subdivision: Connect and repair thoroughfares.....	97
4-24	Intervention for a multifamily subdivision: Rationalize parking.....	98
4-25	Intervention for a multifamily subdivision: Define open and civic spaces.....	99
4-26	Intervention for a multifamily subdivision: Integrate local food production	100
4-27	Synthesis.....	101
4-28	Repair at the block scale	102
4-29	Drive-through at the Orange County Public Library.....	103
4-30	Public space at library.	104
4-31	Public space at library: Detail view.	105
4-32	Pedestrian promenade	106
4-33	Southeast corner of study area.....	107
4-34	Southwest corner of study area.....	108

LIST OF ABBREVIATIONS

BID	business improvement district
DOT	Department of Transportation
FBC	form-based codes
FGDL	Florida Geographic Data Library
FHA	Federal Housing Authority
FTP	file transfer protocol
GIS	Geographic Information System
HOA	homeowner's association
Labins	Land Boundary Information system
MFR	multifamily residential
NHUC	National Highway Users Conference
POD	pedestrian-oriented development
SFR	single-family residential
SSZEA	Standard State Zoning Enabling Act
TDR	transfer of development rights
TOD	transit-oriented development
UCF	University of Central Florida
UF	University of Florida
UGB	urban growth boundary

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Sprawl - specifically the suburban form - is a significant threat to sustainable development efforts. In order for society to work its way out of the present cycle of ecological damage, policies and strategies will have to work within the existing systems. Changes in the way Americans consume space and other resources are imperative for a sustainable future.

A review of definitions present in current literature resulted in the conclusion made by others seeking to define sprawl – there is not a firm definition. While no exact definition has been established, common themes have been identified in literature about sprawl. Automobile dependency, lack of connectivity, separation of uses with limited housing typologies, low-density development, lack of nodes, and the disintegration of the public realm have all encouraged the excessive use of resources resulting in damage to the Earth's ecosystem. These characteristics of the pattern of land development that is sprawl, suburban sprawl, urban sprawl, suburbia, or suburbanization are analyzed for their impact to sustainability.

This thesis investigates what specific urban design elements can be used to retrofit suburban communities and how they can be applied to achieve more sustainable development patterns. Sprawl repair is executed at multiple scales including the regional, community, and block scale. A community-level analysis method is conducted prior to and following redesign to analyze whether this re-design was successful in reducing the unsustainable characteristics of sprawl. At the conclusion of this research, the result is a simulation of retrofitting the typical suburban community with the application of a real method for correcting the deficiencies of sprawl. The goal is to produce evidence – in the form of a simulated redesign – for the viability of applying a method for suburban retrofitting, and provide guidance for development decisions related to the evolution of this residential structure into a more sustainable community.

CHAPTER 1 INTRODUCTION

As Americans become more aware of the dangers and difficulties of the ubiquitous suburban development, access to mass transit and closer proximity to necessary services will dominate market demand. A change in suburban structure needs to be addressed. This research will examine the weaknesses of the suburban structure and seek to understand what factors have contributed to the persistence of suburbia. The main objective of this research is to address the task of how suburbia can be redesigned and adapted for a more environmentally conscious future.

The Problem With Sprawl

Sustainability is defined in various forms as “meeting the needs of the present without compromising the ability of future generations to meet their own needs” (World Commission on Environment and Development 1987 quoted in Frumkin 2010: 473; Dunham-Jones and Williamson 2009). The most fundamental need of future generations is health. Just as buildings can be deemed sick buildings that impact health of its users, our biosphere can be deemed healthy or sick and has the ability to significantly impact the health of the population.

The health of the Earth - Homo sapiens' habitat - impacts human health in ways our species is just now discovering (Frumkin 2010). Because “[i]t is hard to deny our human temptation to see this one species [humans] as ‘on the main line’ of evolution, the others as supporting cast, walk-on parts, sidelined cameos,” people forget that we are animals and we require a habitat to survive (Dawkins 2004, 6). Just as “[a] living creature is always in the business of surviving in its own environment,” humans need to be concerned about the survival of our species (Dawkins 2004, 5). Without recognizing

its own role in the planet's ecosystem, the organism is destroying its own habitat with suburban sprawl, a particular urban morphology.

Sprawl developments strain the food supply, invading agricultural land required for growing crops and raising livestock (Mandelker 2008; Frumkin 2010; Tachieva 2010). Water quality can be impacted by development through pollutants in stormwater runoff, leaking underground tanks (including septic systems and gasoline storage tanks), and vehicle emissions that contaminate surface water - all related to the automobile-dominant pattern that is sprawl (Frumkin et al. 2004). Air quality can be impacted by vehicular emissions which release carbon dioxide (CO₂), carbon monoxide (CO), nitrogen oxides (NO_x), sulfur oxides (SO_x), volatile organic compounds (VOCs), and lead and metal particulates into the air increasing mortality and threatening respiratory health (Frumkin et al. 2004). Additionally, nitrogen oxides (NO_x) and VOCs combine to form ozone that affects the planet's ability to regulate its climate (Frumkin et al. 2004). Water purification requires pervious surface, which enables rainwater to naturally cleanse itself as it percolates back to the groundwater supply (Frumkin et al. 2004). The expansion of road networks and the massive parking lots necessary for automobile transit characteristic of sprawl disrupt the water purification and waste treatment cycles leading to dangers of water supply contamination (Frumkin 2010).

Dunham-Jones and Williamson (2009, 3) have posited that “[t]he global urgency of reducing greenhouse gases provides the latest and most time-sensitive imperative for reshaping sprawl development patterns, for areas that now foster the largest per capita carbon footprints into more sustainable, less auto-dependent places.” Additionally, issues related to national security and economic security have been linked to vehicle

dependency and low-density development. With increased focus on green living, younger generations are already more aware of environmental issues and will demand communities that take into account minimizing environmental impact. In order to prevent a suburban wasteland from forming as citizens leave for more dense and centrally located areas, these existing developments must be transformed into communities that respond to contemporary needs. By understanding adverse affects and the persistence of suburban structure, this research aims to approach adapting suburbia to correct existing deficiencies of suburban morphology and to respond to housing needs of a contemporary population.

Method for Repair and Evaluation

The goal of this research is to investigate what specific urban design elements can be used to retrofit suburban communities and how they can be applied to achieve more sustainable development patterns. The method used to address the damaging features of sprawl will be that of Tachieva's Sprawl Repair Manual. This method will execute sprawl repair at multiple scales including regional, community, and block scale. The neighborhood-level analysis method as detailed in *Measuring Patterns of Urban Development: New Intelligence for the War on Sprawl* by Knaap, Song, and Nedovic-Budic (2007) will be executed prior to and following redesign. The study concludes with an analysis of whether this re-design was successful in reducing the unsustainable characteristics of sprawl.

Anticipated Result

The result at the conclusion of this research is a simulation of retrofitting the typical suburban community with the application of a real method for correcting the deficiencies of sprawl. The goal is to produce evidence – in the form of a simulated redesign – for

the viability of applying a method for suburban retrofitting and provide guidance for development decisions related to the evolution of this residential structure into a more sustainable community.

Organization

This thesis includes five chapters. The problem of suburban sprawl is explored in Chapter 1. Literature defining sprawl, identifying its spatial characteristics, and discussing policy and other factors that have contributed to suburban development are reviewed. Chapter 2 presents the study area selected for redesign and the methodology used for the application of sprawl repair. Findings and results are covered in Chapter 3 with evaluation and urban techniques used for redesign for each scale investigated. Chapter 4 discusses application issues, including site-specific obstacles encountered during the design process and an analysis of the sprawl repair method. This chapter also includes discussion of obstacles to implementation and the potential of the form-based code as a tool for sprawl repair implementation. Chapter 5 concludes this thesis with a discussion of what was accomplished with the study and recommendations for further research.

CHAPTER 2 LITERATURE REVIEW

Wheeler (2004, 25) discusses the debate between those with faith in technology for achieving a sustainable future and those who “believe that sustainable development is fundamentally incompatible with current capitalist economic structures, attitudes, and lifestyles.” A balance of both perspectives will be the best path forward - using technology to understand and remedy environmental damage and a revision of attitudes concerning American society’s relationship with the natural world. While it may seem noncommittal, it is unrealistic to expect the political, cultural, and economic context to completely change in order to progress development in a manner that is less detrimental to the state of the natural world. Planning and development are incremental, and in order for society to work its way out of the present cycle of ecological damage, policies and strategies will have to work within the existing systems. While it may be preferable to begin with a clean slate, this research is interested in conclusions that can inform real applications. That being said, changes in the way Americans consume space and other resources are imperative for any natural or technological system to function properly. Sprawl - specifically the suburban form - is a significant threat to sustainable development efforts.

This literature review will define sustainable development and sprawl in terms of the goals of this thesis. Next, the main characteristics of the sprawl morphology found are summarized, and the negative environmental impact resulting from these features will be discussed. The political and cultural factors that have enabled the suburban morphology to exist will conclude.

Assessment of Spatial Features

Wheeler's (2004, 24) preferred definition of sustainability is as follows:

"Sustainable development is development that improves the long-term health of human and ecological systems." This definition exhibits a balance between preserving ecosystems and the process of continually moving toward healthier human and natural communities" (2004, 24). For the same reasons, this paper uses his definition to frame sustainable goals. Sprawl has been defined as an example, an aesthetic definition, the cause of an unwanted externality, a consequence, a pattern of land development, or a process (Galster et al. 2001). For the purposes of this study, which is intended to respond to the negative characteristics of the sprawl morphology, the definition used will indicate a pattern of land development. The definition that most clearly explains the focus of this research is:

Sprawl (whether characterized as urban or suburban) is a form of urbanization distinguished by leapfrog patterns of development, commercial strips, low density, separated land uses, automobile dominance, and a minimum of public open space. (Gillham 2002, 8)

A review of definitions present in current literature resulted in the conclusion made by others seeking to define sprawl – this is not a firm definition (Table 2-1). While no exact definition has been established, common themes have been identified in literature about sprawl. The pattern of land development that is sprawl, suburban sprawl, urban sprawl, suburbia, or suburbanization is identified by the following characteristics that are analyzed for their impact to sustainability per Wheeler's preferred definition above:

- automobile dependency caused by lack of connectivity
- separation of uses with limited housing types
- low-density development
- lack of nodes
- lack of acknowledgement of the public realm

Automobile Dependency Caused by Lack of Connectivity

Automobile dependency caused by a lack of transportation infrastructure connectivity and the associated lack of transportation choices is an oft-cited characteristic of sprawl (Ewing, Pendall, and Chen 2002; Gillham 2002; Squires 2002; Hayden 2004; Downs 2005; Knaap et al. 2007; Dunham-Jones and Williamson 2009; Filion 2010; Tachieva 2010). Suburban road networks are described as dendritic and poorly connected (Wheeler 2004; Dunham-Jones and Williamson 2009; Tachieva 2010). Trips that would have taken less time in a neighborhood laid out in a traditional grid pattern are lengthened considerably due to cul-de-sacs, courts, and curvilinear road patterns, making trips unnecessarily long and complex. This makes walking or bicycling less feasible, as exposure to the elements is not easily overcome at longer distances. Tachieva (2010, 57) and Hayden (2004, 8) include sprawl development patterns as exhibiting, respectively, “overscaled thoroughfares” and “wide highways” in reference to automobile dependency. Additionally, Dunham-Jones and Williamson (2009, x) describe suburban form as “[e]ntirely auto dependent, typically involving surface parking lots surrounding buildings.” These surface lots increase the separation of buildings, decreasing density. Ewing, Pendall, and Chen (2002, 3) defined this aspect of suburban morphology as “a network of roads marked by huge blocks and poor access,” emphasizing low connectivity.

The impact of automobile dependency on environmental health is extensive. Automobile dependency leads to consumption of large amounts of fossil fuels and other petroleum products. The burning of these resources produces emissions that are harmful to air and water quality. Air quality can be impacted by vehicular emissions that release carbon dioxide (CO₂), carbon monoxide (CO), nitrogen oxides (NO_x), sulfur

oxides (SO_x), volatile organic compounds (VOCs), and lead and metal particulates into the air increasing mortality and threatening respiratory health (Frumkin et al. 2004). Additionally, nitrogen oxides (NO_x) and VOCs combine to form ozone that affects the planet's ability to regulate its climate (Frumkin et al. 2004). Downs (2005, 367) discusses how “[w]orsening traffic congestion and air pollution caused by more intensive use of automotive vehicles for ground travel” also impedes non-emitting alternative modes of transit.

Water quality can be impacted by development through disrupting natural water processing systems and pollutants in stormwater runoff from vehicles that contaminate surface water (Frumkin et al. 2004). Infrastructure for vehicles - roads and large parking lots in front of Big Box retail - requires large amounts of impervious surfaces. This is detrimental to water supplies because natural water purification requires pervious surfaces, which enables rainwater to cleanse itself as it percolates back to the groundwater supply (Frumkin et al. 2004; Wheeler 2004; Gaston et al. 2010). Disruption in the water purification and waste treatment cycle can contaminate the water supply impacting disease regulation (Frumkin 2010). Stormwater runoff from increased roads, parking lots, and driveways impacts water quality in a number of ways. Increased levels of phosphates and nitrates can cause eutrophication within water bodies, killing many organisms (Gaston et al. 2010). The movement of sediment in storm surges causes erosion and stream channelization altering the ecology of waterways (Gaston et al. 2010). Automobile particulates derived from mechanical friction are deposited on roadways - pollution that eventually returns to the water system (Gaston et al. 2010). Infrastructure for automobiles result in diminished groundwater recharge and interrupts

the natural nutrient processing of water systems that exist to filter water returning it to a pure state. Strategies that factor in the cycling of water and air systems, and mitigate negative impacts of motor vehicle usage would improve suburban development dramatically.

Separation of Uses With Limited Housing Types

A main characteristic of sprawl is the separation of land uses, largely created by single-use zoning (Ewing, Pendall, and Chen 2002; Downs 2005; Dunham-Jones and Williamson 2009; Filion 2010). The limitation of housing types and "rigid land use specialization" is manifested in suburbia, a segment of sprawl development (Ewing, Pendall, and Chen 2002; Gillham 2002; Hayden 2004; Knaap et al. 2007; Dunham-Jones and Williamson 2009; Filion 2010). Beginning with the influential court case, *Village of Euclid v. Ambler Realty Co.* (272 U.S. 365 (1926); 297 F. 307,313-16 (N.D. Ohio 1924)), zoning was held a constitutional governmental power that is conducted in the interest of public health, safety, and welfare (Mandelker et al. 2008). While the initial intent was to prevent noxious uses from being located too closely to residential development, zoning has turned into a mechanism for sprawl.

Currently, suburbs are purely residential with large retail centers a drive away. The retail centers have grown to such a scale that it is not unheard of to drive through a shared parking lot to get to another business. A separation of uses consumes excess amounts of land causing the human stamp to become widened, interfering with the natural systems necessary for effective processing of nutrients and biodiversity. Changes in air quality due to longer transits result in higher fossil fuel use and increased carbon emissions. The more development extends, the more land with vegetation that could have mitigated emission impact will be cleared for single-family residential

developments. As previously discussed, automobile infrastructure necessary to traverse increased travel reduces the quantity of pervious surface required for water supply recharge (Frumkin et al. 2004; Wheeler 2004; Gaston et al. 2010). Additionally, as development spreads to the periphery of a developed area, habitat fragmentation is likely and developments strain the food supply as agricultural land required for growing crops and raising livestock is converted into masses of tract houses (Mandelker et al. 2008; Frumkin 2010; Tachieva 2010). If uses were closer together or combined in a single location, getting to daily needs would require less time and distance (Wheeler 2004).

The “cookie-cutter” tract homes that populate suburban developments rarely respond to the actual physical or cultural context in which they are built. Purciel and Marrone (2006) use complexity as a variable in their evaluation instrument for urban design qualities that encourage a walkable community. Described as a “visual richness” of architectural types and styles, communities that have safe, interesting pedestrian routes will encourage more people to leave their cars (Purciel and Marrone 2006, 4). Wheeler (2004, 39) reasons that suburban sprawl’s homogeneity contributes to environmental damage “since exploiters tend to feel little connection with the people and landscapes being exploited.” Because suburban developments primarily include only single-family residences on individual lots, a lack of housing options exists within these developments. With regard to Wheeler’s definition, suburbs impact the human system aspect of sustainability by not providing housing options. Those without the means to buy a single-family home are excluded from living in a suburban development. Additionally, limited housing types prevent those who may not wish to spend large

amounts of their time commuting to work or retail or maintaining property from having housing options (Downs 2005). A community containing single-family homes, duplexes, and multi-family residential housing integrated with retail and employment centers would allow all to access the same amenities and opportunities. There has been increasing demand for different residential configuration, and a sustainable community redesign would benefit from acknowledging this need (Wheeler 2004; Nelson and Young 2008; Nelson 2010; U.S. EPA 2010).

Low-Density Development

Low-density development is a commonly accepted indicator of sprawl (Ewing, Pendall, and Chen, 2002; Wheeler 2004; Knaap et al. 2007; Dunham-Jones and Williamson 2009; Filion 2010). Places of employment, retail businesses, homes, and institutions have become more separate, leading to an overall lower density of development. Downs (2005, 367) describes low-density as “large scale conversion of open space and environmentally sensitive lands to urban uses.” Additionally, lower density development impedes sustainable development by encouraging vehicular transport and increasing travel time due to the separation of buildings. Public transport remains elusive to municipalities due to low-density development (Frumkin et al. 2004). Train and bus systems require stops that are accessible for many people and businesses.

Characteristic low-density development shares many of the same detrimental environmental impacts as separation of uses. Destinations are too far apart for walking and bicycling rendering non-emitting transportation impractical and/or uncomfortable. Thus, the automobile is necessary even for daily trips, like going to work and school, and routine necessities, like purchasing groceries. Increased travel distances resulting

from lower density development, contribute to air quality degradation due to vehicular emissions and threaten water quality with stormwater runoff. Increased automobile infrastructure utilizes land that is necessary for proper groundwater recharge. Lower density development consumes unnecessarily large quantities of land that could be used for maintaining food supplies. Low-density development also encourages habitat fragmentation. The typical “leapfrog” pattern of suburban development reduces connectivity of one species - by creating enclaves for Homo sapiens of like socioeconomic status - while truncating the movement of other species. Increasing density may rectify this specific aspect of suburban development, but Ewing, Pendall, and Chen (2002, 22) point out fears that all will need to adjust to a “big city” life with “high rises in every neighborhood exist.” They contradict this notion with research “[indicating] that even modest increases in average density, from one or two houses per acre to as few as six or seven can offset the negatives [of sprawl development]” (22). A suburban retrofit would allow for these “modest increases in average density” by the addition of retail and renovation where the single-family could accommodate more families (Dunham-Jones and Williamson 2009).

Lack of Nodes

An overall lower density has decentralized our cities by pushing retail uses to the residential areas on a city periphery, creating disconnected pockets of population. This decentralized morphology is indicated by “a lack of well-defined, thriving activity centers, such as downtowns and town centers” (Ewing, Pendall, and Chen 2002, 3). This characteristic is not included as often as some of the other characteristics, but the importance of nodal structure is implied by Wheeler’s (2004, 3-4) definition of “inwardly

oriented” as “projects that don’t relate to one another.” Nelessen (1994, xii) indicates a lack of nodes by describing sprawl as “a pattern of physical development created by the decentralization of land uses,” and Warren, Harlan, Boon, et al. (2010, 176) describe suburban sprawl as “polycentric.” Tachieva (2010, 57) refers to the absence of nodes by stating that sprawl exhibits “lack of connectivity and block organization. Also related to the prominence of the automobile, a lack of nodal structures impacts travel behavior in that it spreads destinations far enough to make multi-stop trips difficult and rendering public transit less feasible, increasing distances traveled by vehicles. While public transit infrastructure may not be in place, a nodal structure in suburban retrofitting will allow for future mass transit systems to be implemented when the financial and/or public support surfaces.

Lack of Acknowledgement of the Public Realm

Dunham-Jones and Williamson (2009) emphasize the prominence of private buildings as an indicator of suburban form. They note “[p]ublic roadways, schools, and parks exist but are rarely treated as dominant spatial figures or outdoor public rooms, as is the case in urban form (x). This is a significant development indicative of the privatization of American society (Frumkin et al. 2004). A lack of acknowledgment of the public realm affects walkability and place-making, leading to automobile dependency. Dunham-Jones and Williamson (2009, x) describe suburban form as containing “[b]uildings designed ‘in the round’ to be viewed as objects set back in a landscape they dominate.” A more sustainable organization would include building frontage “[lining] up to meet the sidewalk and shape the public space of the street” (Dunham-Jones and Williamson 2009, X). The lack of a street wall created by building façades can impact the walkability of a community by failing to create a comfortable “outdoor room,”

essentially creating a hostile environment for any transport method other than the personal motor vehicle (Carmona 2003). Urry (2007) discusses the impact automobile proliferation has on the way contemporary citizens experience the built environment. Because “car-drivers, while moving at speed, lose the ability to perceive local detailing beyond the car, let alone to talk to strangers, to learn local ways of life, to sense each place,” our places have lost the richness of detail they formerly had when the car was not so common (Urry 2007, 129). He describes what the passenger perceives as “an affective other, kept at bay through the privatizing technologies incorporated within cars” (129). This disconnect - this privatization - the American population is experiencing is significant because it destroys social capital by “[privatizing] the public realm” (Frumkin et al. 2004, 173). Kenneth Newton defines social capital as the force “that binds society together by transforming individuals from self-seeking and egocentric calculators, with little social conscience or sense of mutual obligation, into members of a community with shared interests, shared assumptions about social relations, and a sense of common good” (quoted in Frumkin et al. 2004, 163). Social capital is the force that locates one in the world, and it has the potential to make individuals confront their place as part of a larger ecosystem. Those that exist in suburbia have the private amenities of a back yard and their own means of transport, and therefore, “may have little feeling for parks and other public assets” (Frumkin et al. 2004, 173). By reducing the demand for public amenities, sprawl undermines the environmental benefits of reduced and/or shared resources like mass transit and public parks. Features that encourage interaction with the physical environment are important to include in a sustainable redesign. In addition

to benefits related to water and air cycles, amenities like parks and other public spaces require the public to confront the natural systems of which they are part.

Concluding Assessment

The suburban morphology's great evil is that it encourages the excessive use of resources, especially land and petroleum products. Automobile dependency, lack of connectivity, separation of uses with limited housing typologies, low-density development, lack of nodes, and the disintegration of the public realm have all contributed to the damage to the Earth's ecosystem. It is the goal of this research to investigate what specific design elements can be used to address the weaknesses of suburban morphology within the existing systems of neighborhoods and developments with solutions for more sustainable future revision.

Policy and Other Factors That Have Promoted Suburban Development

The damaging characteristics of the sprawl morphology are a result of conditions instigated by political and cultural forces throughout the United States' history. Changes in transportation technology, well-meaning, poorly executed policies, and a culture of consumption with a resultant widening income divide have been the primary factors that created the context in which suburban development occurs. This section discusses these influential factors.

Changes in Transportation Technology

The great irony of the history of suburban development is that it began with the promise of nature and country living; however, characteristics of suburban morphology have played a large part in destroying this nature and rural life (Freilich et al. 2010). During the industrial revolution, factories drew many rural residents into urban areas with the promise of employment, dramatically expanding urban populations.

Overcrowding combined with inadequate sanitation led to unhealthy living conditions for impoverished city residents. As conditions of tenements in cities like New York and Chicago became known, urban dwelling was viewed as unhealthy - “a cancer or tumor on the body social and the body politic” (Hall 2002, 36). A resulting anti-urban movement of intellectuals urged the public to “reject the grosser trappings of industrialization and to return to a simpler life based on craft and community” (Hall 2002, 93). As early as 1923, the Regional Planning Association of America, a think-tank of influential intellectuals, advocated transportation technologies as “liberating agents” allowing citizens the means to escape the ills of urban living to populate undeveloped land beyond the city (Hall 2002, 158).

Changes in transportation technology made it possible for those with means to reside outside the central city and commute back into the city for employment (Hall 2002; Frumkin et al. 2004). The first suburbs were “streetcar suburbs,” communities developed around a transit stop, which “made increasingly distant residences possible because householders could more quickly reach jobs, services, and cultural sites within the metropolitan area” (Nelessen 1994, 26-7). Because of the need to be able to walk to the transit stop, these first suburbs “could not experience rampant and unchecked growth” of modern suburbs (Nelessen 1994, 27). This particular form of suburb became obsolete as streetcar transit was “dismantled by a coalition of automobile and oil companies” (Nelessen 1994, 31). The National Highway Users Conference (NHUC), headed by General Motors, aggressively lobbied for policy in support of the automobile industry and pooled their resources to buy streetcar companies to convert into bus systems (Judd and Swanstrom 2002). Their efforts led to a conviction in 1949 of

“conspiring to eliminate electric transportation and monopolize the sale of busses and parts” (Judd and Swanstrom 2002, 204). While only a few companies within the coalition had used \$9 million dollars in their strategy to disrupt streetcar transit, the judgment of the case penalized a single company \$5000 and fined a single executive \$1 (Judd and Swanstrom 2002). The resulting ubiquity of automobiles allowed development to no longer be locked into locations around a transit stop, and spread as far as one was willing to fund gas for their daily commute (Nelessen 1994; Hall 2002).

As more automobile infrastructure was built and more accommodation made for cars, not just residences moved to the urban periphery. In addition to ample parking lots and drive-through restaurants, employment and businesses began to move to suburban developments to supply services and goods to the suburban residents (Hall 2002, 316). This has manifested in the form of office/business parks “requiring office workers to drive to other places for lunch and errands” (Tachieva 2010, 163). The car became not just a “convenience device,” but also a necessity (Urry 2007, 119). Ample parking is provided in the businesses associated with suburbia - strip shopping centers, Big Box chain stores, industrial and office parks, and regional shopping malls - catering to the arrival and departure of personal motor vehicles (Dunham-Jones and Williamson 2009; Tachieva 2010). Because “[t]he seamlessness of the car journey makes other modes of travel inflexible and fragmented,” the public has been slow to accept public transit (Urry 2007, 119). With amenities like ample free parking and drive-through services for food, medicine, and banking available to the driver without cost, there is little incentive for one not concerned about the social and environmental impact to seek alternative modes of transit in suburbia.

Well-Meaning, Poorly Executed Development Policies

While zoning existed in the United States previously, single-use zoning spread rapidly following a 1926 Supreme Court decision. *The Village of Euclid v. Ambler Realty Co.* (272 U.S. 365 (1926); 297 F. 307,313-16 (N.D. Ohio 1924)), a landmark case, held single-use zoning constitutional as a valid police power (Nelessen 1994, 29). The Standard State Zoning Enabling Act (SSZEA) was “a draft ‘general law’ offered for use by state legislatures to delegate to municipalities the power to zone” that was created in 1924 by the U.S. Department of Commerce, and became standard practice following the Supreme Court ruling (Mandelker et al. 2008, 220). This influential case has instigated much criticism. Alfred Bettman, a leading national land use attorney, raised objections shortly following the verdict saying that the “city made no scientific survey” to justify their motivations (Mandelker et al. 2008, 98). Mandelker et al. (2008) criticize single-use zoning for its oversimplification. While easy to implement, more complex land use controls would have been more effective than single-use zoning. Frumkin et al. (2004, 37) points out that “[o]ver the last eighty years zoning has become a standard tool in town and city planning.” Controls such as historic preservation, site plan review, and impact fees acknowledge a development’s context (Mandelker et al. 2008, 223). Single-use zoning has had massive impact on the development of sprawl by encouraging separating land uses, further supporting automobile transport.

Nelessen (1994, 29) blames sprawl’s development on these “policies that were developed during the New Deal era in order to create consumer investment activity through infrastructure and policy incentives provided by the federal government.” The National Housing Act in 1934 established the Federal Housing Authority (FHA), which introduced the long-term mortgage with minimal down payment and low interest, still

continues today (Hayden 2004). In addition to offering risk protection for lenders, the policies created included “federal income tax deductions for home mortgage interest, points, and property taxes” and “insurance for mortgages to home purchasers” (Hayden 2004, 10; Nelessen 1994). Because those properties that complied with federal standards qualified for federal loans, neighborhoods became standardized (Ben-Joseph 2005). The FHA developed subdivision manuals and property standards advocating curvilinear streets, cul-de-sacs, and courts; private developments became standardized with features we now identify as environmentally detrimental (Ben-Joseph 2005). These policies set up the framework for the most significant expansion of suburbia following World War II. Construction for anything other than defense-related objectives during the war combined with the return of soldiers created demand for mass amounts of housing (Frumkin et al. 2004). The Veterans Administration Serviceman’s Readjustment Act of 1944 (a.k.a. G.I. Bill of Rights or simply, “G.I. Bill”) and the 1949 Housing Act increasing the FHA’s lending powers enabled a large portion of the country’s population to own homes and offered risk protection for lenders.

While the Federal Housing Authority’s policies were intended to respond to the national housing shortage, prejudices against women and minorities were built into the policies. In addition to “unfair lending practices” by the FHA, “the major National Housing Acts of 1935, 1937, and 1949 actually promoted racial discrimination by creating multi-family public housing subsidies in urban ghettos, leading to higher concentrations of poverty, and by failing to promote public housing in the suburbs” (Freilich et al. 2010, 27, 26). These practices continued unheeded until the establishment of the Housing Act of 1968 (Judd and Swanstrom 2002). The initial

policies were meant to provide housing for the population increase following World War II, but their application resulted in housing only for whites and only those with the money to relocate.

Another policy intended to stimulate the economy following World War II was federal funding for highways initiated by the Federal Highway Administration (Nelessen 1994; Hayden 2004). The 1944 Federal Highway Act provided 60% federal funding for local roads, but the automobile industry wanted more. Lobbies formed from vehicle manufacturers, petroleum companies, highway engineers, and others who stood to gain from a national highway system (Hayden 2003). Initially, a national highway system was proposed as necessary for national defense, and the Interstate Highway Act of 1956 was intended to “[provide] 42,500 miles of a ‘National System of Interstate and Defense Highways’” (Hayden 2003, 166). While 90% of the funding was federally supplied, the builders of the system never consulted the defense department (Hayden 2003). Talen (2009, 150) identifies this time as the end of “consideration of the relationship between street width and urban form” due to traffic engineers’ domain over street regulations. Because the traffic engineers only considered the safe and efficient movement of automobiles, highway planning was divorced from issues of “urban renewal, social regeneration, and broader transportation objectives in the programming” (Judd and Swanstrom 2002, 205). With this extensive infrastructure for automobiles in place, the Federal Highway Administration effectively “opened previously inaccessible land to speculators” (Nelessen 1994, 29).

There is complex web of factors and institutions that caused the current economic crisis (Downs 2009; Sowell 2009), but those relating to real estate financing are major

contributors. Changes in financial markets showed massive shifts of capital into real estate. Partly in response to the stock market crash of 2000, real estate was seen as a more stable and profitable investment (Downs 2009). As demand for real estate investment grew, there was a scarcity of investment property. Additionally, pressure to change lending standards from congress and the executive branch (Downs 2009; Sowell 2009). The government - due to a perceived affordable housing shortage - encouraged subprime mortgages (Sowell 2009). One of the risky methods for financing real estate assets was the subprime mortgage. The subprime mortgage eased the lending requirements in exchange for higher interest to offset the risk of lending to those who were previously ineligible for loans (Sowell 2009). This specific financing tool appealed to many with poor credit, as well as speculators interested in reselling homes for profit termed “flipping” (Sowell 2009, 6). Other factors, such as low interest rates and existing tax advantages for homeownership, added to the appeal of homeownership over renting to the public. Single-family housing was one of the building types that met the demand of investors seeking real estate investment and many low-income citizens aspiring to purchase their first house (Downs 2009). By producing neighborhoods built on cheap land – usually farther from the city core – with rubber-stamped houses in the ubiquitous automobile-dependent form, the resulting housing boom encouraged sprawling suburban developments.

The current economic recession has been compared to the scale of the Great Depression of the 1930s, and federal and national governments are scrambling to do whatever it takes to stimulate the economy. Future development policies need to consider the dangers of repeating policy that replicates what the New Deal policies

instigated in planning despite their good intentions. Planning efforts may endanger natural systems in exchange for any level of economic gain. Filion (2010, 15) warns “that any major urban structure transformation will have to wait until the recovery.”

In response to overbuilding in the 1980s, a massive surplus of real estate in need of buyers existed, and the solution resulted in the commodification of real estate into 19 standard types (Leinberger 2005). These types - which are the unsustainable building/development that have perpetuated sprawl - allowed for real estate debt and equity to be traded in the financial market (Leinberger 2005). Some product types included are: Big Box Anchored Power Center, Grocery Anchored Neighborhood Center, Lifestyle Center, Self-Storage, Budget Motel, Entry Level Housing, Move-Up Housing, Luxury Housing, Resort/Second home, Garden Apartments, Urban Apartments, Medical Office, Multi-Tenant Office, etc. (Leinberger 2005, 27). With the recent exception of the Mixed Use Urban Office/Retail/Restaurant type, the other types are “generally single product type, stand-alone developments with self-contained parking” (Leinberger 2005, 27). These properties were judged for worthiness of investment by “a massive underwriting system, managed by investment bankers and credit-rating agencies” (Leinberger 2005, 25). Standardization allowed for trading of “products” of similar value. Leinberger states (2005, 25) that “commodification has also required the elimination of external influences,” which holds implications for the destruction of place-making and contextually sensitive development. Therefore, developments proven to profit were preferred for funding and constructed. These products - as distasteful as it is to refer to the built environment as products - define

what is built because the basis of private development is market-driven. This evidence suggests that the core of the funding structure for building development is flawed.

Governmental structure may be a source for encouraging unsustainable development. Since 1926, land use planning is implemented at the local level with state government acting as a delegator with planning and zoning land use enabling legislation (Freilich et al. 2010). Because of financial constraints, local government can sometimes act for their best financial interests to continue operation as opposed to executing policy or encouraging development in the environment's best interest. Filion (2010, 6) credits "[i]nter-municipal competition, where suburban administrations use their low-density configuration and automobile orientation to lure development" as a contributor to sprawl development. Additionally, he cites the importance of property tax to local government for "the readiness with which they accommodate market preference for dispersed types of development" (6). Local government becomes an agent for sprawl and unsustainable development. This issue is compounded by reduced financial support from federal and state government for infrastructure, while requirements for provided services are maintained or increased (Nelson and Lang 2009). Considering the interconnectedness of natural systems, a regional approach - especially in regards to land use planning - may be a more effective approach for encouraging sustainability. Freilich et al. (2010, 12) blames "fractionalized governments and local parochialism" for "a lack of local governments' ability to coordinate necessary planning strategies throughout metropolitan regions."

Another issue that undermines the strength/effectiveness of local government is the growing prominence of homeowners associations (HOA). These associations are

assuming the role local governments used to play due to greater demands on the local system. Lack of funding and increased state mandates have resulted in local governments ceding power to HOAs and other private governments (Nelson and Lang 2009). This, however, may not be such a terrible thing. If HOAs were regulated for compliance with certain policy relating to alternative modes of transit, connectivity to the community, and other elements that lessen a community's ecological impact, these associations could still be allowed to operate as they have, but with oversight by a regional body. The existing structure of private government can be used for implementing sustainable development. This, then, may provide a window of opportunity for local governments to regroup into a more regional structure, which would be a structure that may be more responsive to environmental concerns of development.

These factors - establishment of widespread zoning with *Euclid* and the SSZEA, FHA policies favoring suburban developments, and automobile infrastructure implemented by the Federal Highway Act, the housing boom fueled by subprime mortgages, the commodification of real estate, and governmental structure - have given priority to the single-family residential building type. Within the court's judgment in *Euclid*, Justice Sutherland vilified multi-family residential" by characterizing apartment houses as parasites robbing single-family neighborhoods of value" (Mandelker et al. 2008, 101). Hall (2002) claims the motivation was self-interest and preserving property values, and the FHA did the same, by "[working] through exclusion, to divert investment massively into new suburban housing at the expense of the central city" (319). Once again, this national program gave priority to single-family residential development, encouraging segregation and a lack of diversity (Hayden 1984; Hall 2002; Frumkin et

al.2004). Road systems heavily subsidized with federal money have encouraged the spread of development by making long-distance travel to work or home easy with the use of a private motor vehicle. The result of these policies has been discrimination, automobile dominance, and pollution. Lending practices targeted to the financially vulnerable ran rampant in the 2000s and encouraged a housing boom that resulted in even more sprawl (Downs 2009). A changing governmental structure is creating deficiencies that lead to unsustainable practices. While originally intended to uphold the health, safety, and welfare of the public by addressing the issues of an actual and a perceived housing shortage, discrimination, and stimulating the economy, the nation's history is fraught with policy that widens development's impact on the environment.

Cultural Context: Culture of Consumption; Widening Wealth Divide

Nelessen alludes to "the media-programmed American dream" as a reinforcing factor to suburbanization (1994, 29). Wallack (2009) expands on this idea by focusing on the marketing tool used by suburb developers that encouraged the demand for single-family residences. She argues that the model home was propaganda, encouraging a redefinition of lifestyle in post-war America. Wallack outlines the context within which the model home proliferated as a socially confusing time for gender roles. World War II created a situation where the traditionally domestic roles of women were reversed as women entered the workforce to fill employment demands that increased as American men were sent to fight. Emphasis of the marketing strategy was placed on the appliances and remote control features. Wallack refers to the focus on technology as a way to make domestic chores more efficient as "a superficial solution to a complex, deeply felt dilemma" (2009, 342). This helps to explain the initial proliferation of suburban development throughout America. As Wallack states, "[t]he prevalence of

model homes cannot be explained by economic conditions alone” (2009, 333). Her analysis of the model home helps to frame the cultural context that gave birth to the suburban tract home, and her argument that the model home was its powerful marketing tool attempts to explain its features within the nation’s collective sociological motivations.

Hardinghaus (2008, 425) investigates the evolution of the American dream in three stages: the Garden of Eden, frontier, and the Jeffersonian view that “country life produced a virtuous and egalitarian effect.” He discusses the perspective of the New World’s geographical context in terms of the Garden of Eden imagery in that it “reinforced a deep mistrust of dense urban settlement as a place of moral danger and loss of self” (425). With regards to the frontier imagery, Protestant values are also exhibited in the concept of the Self-Made Man. Hardinghaus (2008) argues that “a behavioral ethic grew out of the slow secularization process of the Protestant faith and the Calvinist faith in particular, which allowed the pursuit of material and social success to become a moral obligation” (426). He discusses political decentralization in terms of the Jeffersonian ideal that landownership/self-sufficiency allowed “equality of opportunity in overseeing the work of the local government” (Hardinghaus 2008, 427). Using the three stages to understand a context clarifies the development of the general American attitude of land consumption and the preference for owning a single-family house on its own lot.

Hardinghaus claims that suburban development is a compromise between the idealized agrarian lifestyle with necessity of urban center for economic functions. He links the attitude towards economic centralization with the Protestant belief in “gaining

God's favor and salvation could only be achieved by the individual" and "as being of fundamental importance for the American way of life" (2008, 429, 431). Hardinghaus discusses the parasitic/adversarial relationship Americans have with the inner city as being potentially replicated with suburban developments due to their primarily economic function. This is an interesting viewpoint in that it implies that Americans will begin to look outside the suburbs for a more individualistic existence as they once looked outside the inner city. As the desire for even more space prompts those to move even further beyond suburban development, evidence for expansion exists with the swiftly developing exurbia, "the middle area between the urban/suburban and the rural landscapes" (Davis and Nelson, et al. 1994, n.p.). Ultimately, it is not realistic to expect to change the way the American public thinks. Such a deeply ingrained collective mentality must be dealt with and responded to for a redesign of the suburban form to be successful.

Just as the Jeffersonian view influenced early American culture's movement to rural parts of the country, Filion (2010, 6) identifies "[t]he pursuit of flexibility, which derives from individualism" as contemporary manifestation of this value system, further encouraging automobile dependence in contemporary populations. He points at "[p]roduction and consumption tendencies [which have] translated into rising reliance on the truck and the automobile along with growing space consumption" as major factors in the endurance of the suburban form (6). Similarly, Urry (2007) has explored the relationship of American individualism with automobile infrastructure in that it has "provided a way of transcending a public timetable by enabling car-drivers to develop their own timetabling of social life" (112).

Filion (2010, 6) cites a preference for social segregation and “[f]ear of the unknown and of its possible impact on home values represent an impetus for NIMBY¹-type reactions against departures from the dispersed pattern.” In a recent interview, Marc Dunkleman, author and fellow at the Clinton Foundation and the Johns Hopkins Center for Advanced Governmental Studies, blames the current gridlock in Washington, D.C., on lack of diversity in communities in that people are “much more likely to find [themselves] in a part of America where everyone is in the same socioeconomic pocket...[e]ven if there’s a diversity of race, even if there’s a diversity of ethnicities, you’re living among people who, for the most part, have the same socioeconomic interest” (Halloran 2011). This may be a form of the echo chamber, selectivity of media that expresses one’s personal viewpoint (Anthes 2011; implied with Dunkleman via Halloran 2011; Yong 2011). This phenomenon may relate to the general disconnectedness that is fostered by the automobile-centric world and enforced by gated communities. American’s prized individualism has encouraged greater customization of goods and services, but may have also translated into self-centeredness as seen with the development of gated communities and privatization of the public realm resulting in more exclusion and less opportunity for exposure to diversity.

¹NIMBY: “Not in My Backyard”; “parochial and obstructionist” groups of organized community members (Judd and Swanstrom 2002, 418); objections runs the gamut from public housing to skate parks to Wal-marts

Table 2-1.Characteristics of sprawl.

Source	Automobile Dependency	Separation of Land Uses with Limited Housing Types	Low-Density Development	Lack of Nodes	Lack of Acknowledgement of the Public Realm
Tachieva 2010	Car dependence; dendritic and overscaled thoroughfares	Lack of neighborhood structure and mixed use		Lack of connectivity and block organization	Scarcity of defined public realm
Wheeler 2004	Poorly connected (street networks are characterized by cul-de-sacs, loop roads, or other poorly connected patterns)		Discontiguous (developments leapfrog out into the countryside)	Inwardly oriented projects that don't relate to one another or are separated by oversized roads)	Inwardly oriented projects that don't relate to one another or are separated by oversized roads)
Ewing, Pendall and Chen; Ewing quoted in Gillham (q. Gill)	A network of roads marked by huge blocks and poor access; poor accessibility – q. Gill	Separated homes, shops, and workplaces; Large expanses of single use development	A population that is widely dispersed in low-density development; Leapfrog or scattered development – q. Gill; Low density – q. Gill	A lack of well-defined activity centers, such as downtowns and town centers	A lack of well-defined activity centers, such as downtowns and town centers; Lack of functional (that is, public) open space – q. Gill

Table 2-1.Continued.

Source	Automobile Dependency	Separation of Land Uses with Limited Housing Types	Low-density Development	Lack of Nodes	Lack of Acknowledgement of the Public Realm
Gillham 2002	Automobile dominance	Separated land uses	Leapfrog patterns of development; Low density		Minimum of public space
Dunham-Jones and Williamson 2009 (“suburban form – a particular type of sprawl)	Almost entirely auto dependent, typically involving surface parking lots surrounding building; roads are often organized in a dendritic pattern with dead ends and cul-de-sac	Buildings tend to be dedicated to a single use – residential, retail, office, or industrial	Lower-density and evenly spread out		Dominant spatial figures are private buildings; characterized by buildings designed “in the round” to be viewed as objects set back in a landscape they dominate
Warren, Harlan, Boone, et al. 2010 (suburban sprawl)			Low density	Polycentric	

Table 2-1.Continued.

Source	Automobile Dependency	Separation of Land Uses with Limited Housing Types	Low-Density Development	Lack of Nodes	Lack of Acknowledgement of the Public Realm
Squires 2002 (focused on impacts of sprawl; political equity)	Automobile dependent		Low density		Exclusionary new development
Hayden 2004 (characteristics produced by sprawl)	Scale more suitable for automobiles and trucks than humans; landscapes characterized by wide highways	Large pods of isolated single-use development (such as malls or residential subdivisions)			Little public open space
Nelessen 1994		Decentralization of land uses		Decentralization of land uses	
Knaap et al. 2007 ("urban sprawl"; also included "unsightliness")	Automobile orientation	Separated land uses	Low density land uses		

CHAPTER 3 METHODOLOGY

The goal of this research is to investigate what specific urban design elements can be used to retrofit suburban communities and how they can be applied to achieve more sustainable development patterns. Following data collection, a pre-design assessment based on the neighborhood-level analysis method as detailed in *Measuring Patterns of Urban Development: New Intelligence for the War on Sprawl* by Knaap et al. (2007) was conducted. This measurement technique is unique in that it is a “neighborhood-level analysis” (Knaap et al. 2007, 240). The term “community” is used in the *Sprawl Repair Manual* to describe a roughly equivalent scale at which one level of intervention will take place. The term “community” will be used throughout to describe the critical scale for analysis. Because the community-scale measurement tool implemented GIS analysis to measure features, data sets were gathered from the Orange County, DOT, FGDL, and Labins websites. Following data collection, the method used to address the damaging features of sprawl will be that of Tachieva’s *Sprawl Repair Manual* (2010). This redesign will utilize methods for repair at the regional, community, and block scales. The study concludes with an analysis of whether this re-design was successful in reducing the unsustainable characteristics of sprawl according to the community-level analysis method.

Study Area Selection

The study area chosen to exemplify a viable transition from suburbia to sustainable communities is located at the eastern edge of the Orlando metropolitan area. As most sprawling, “edge city”-type places, the University of Central Florida

(UCF) / Waterford Lakes Town Center area is a nameless, placeless center of activity within an automobile-oriented metro-area.

The university is mainly a commuter university, classified as a “large four-year, primarily nonresidential campus” providing convenient housing for only 13%¹ of its students, but still has the potential to coagulate the disconnected uses within the study area. Waterford Lakes Town Center is a multi-million dollar retail center initiated in 1998 by Simon Property Group, Inc. and located approximately 3.5 miles from the university (Comas 2000). This town center provides services for the population that is already present due to the university and the Central Florida Research Park, a business park containing 116 companies in 56 buildings on 1,027 acres of land (Central Florida Research Park 2011). Additionally, an ample mix of housing types is available due to the diverse population residing in the area - university students, professors, and high-income professionals. This study area exhibits “concentrations of activity that help businesses thrive, and support alternative transportation modes and multipurpose trip making” (Ewing et al. 2002, 11). Unfortunately, these features lack integration that would make this area a more environmentally sustainable community.

The most comprehensive measure of sprawl found, Sprawl Index by Ewing, Pendall, and Chen, ranked the city of Orlando 40th out of the 83 cities measured (2002). Four sprawl factors, determined by a combination of 22 other factors, evaluated are: residential density factor, mix of homes, jobs and services, strength of town centers/downtowns, and accessibility of street network. The average score for all the

¹ Total housing available at UCF (including main campus, Greek, and “affiliated” housing; excluding Hospitality Department not located at main campus) totaled accommodation for 7,358. Considering Fall 2010 enrollment of 56,337, this provides on-campus housing for 13.06% of the university’s total enrollment.

cities measured is 100 with a score below 100 indicating a greater degree of sprawl and a score over 100 indicating a lesser degree of sprawl. A score over 100 is preferred for a community exhibiting fewer and/or weaker characteristics of sprawl, and therefore, reducing the harmful effects of sprawling development. While neither the best nor the worst city evaluated, Orlando is “less compact than average” with an index score of 96.39 (2002). Ranked 42nd for its residential density factor and 46th for its strength of town centers/downtowns, Orlando fell roughly in the middle of the cities evaluated with scores of 93.77 and 103.48 respectively. The city’s accessibility of street network was a little above average, ranked 66th of 83 with an index score of 120.6. Most notably, Orlando was the 6th worst for its mix of homes, jobs, and services with an index score of 60.81.

Because a full analysis of the city of Orlando would be unwieldy and beyond the scope of this study, a partial regional analysis is conducted on a portion of Eastern Orlando. The area selected is significant because of the location of the University of Central Florida (UCF). Following the move of the Martin Company, Kennedy Space Center, and other science-based firms in Central Florida, the university was established in 1963 as Florida Technical University to respond to the needs of these companies for “a local educational institution so that their scientific and technical employees could pursue advanced studies” (Sheinkopf 1976, 4). In addition to the 12,173 faculty and employees of UCF, Central Florida Research Park – directly adjacent to the university – employs approximately 9,500 workers. A relatively new regional shopping hub initiated in 1998 by Simon Property Group, Inc. was constructed less than four miles south containing a combination grocery/discount retail store for daily needs like groceries as

well as restaurants and smaller businesses. The residents of this area include a healthy mix of students, university workers, and professionals. The combination of these three uses – university, office park, and shopping center - combined with the proximity to Florida Highway 408 has enabled a thriving economic base. This area – while an edge city and environmentally unsustainable in its development pattern – will persevere because of the location of a sizable academic institution. It would behoove the city of Orlando to pay close attention to the development future of the UCF/Waterford Lakes area to create a node more supportive of the city core and to prevent further sprawl. This site exhibits land uses that form a skeleton for what could become a vibrant, walkable innovation district for the city of Orlando.

Sprawl Repair Method

Using simulation, a method “characterized by the generation of data, in propositional form, that can be returned to the real-world context for its benefit” (Groat and Wang 2002, 275), the goal of this research is to retrofit neighborhoods exhibiting suburban morphology to transform them into a more sustainable development pattern. Simulation is a good fit for the objectives of this research because it is a method that is “useful when dealing with questions of scale and complexity” (Groat and Wang 2002, 276). A study area of approximately fifteen square miles is used to apply three different scales of sprawl repair, with the added complexity of impacting many different landowners over a large area. Simulation allows controlling for those complex factors by proceeding with a method that acknowledges the difficulties of the logistics of coordinating these factors without focusing on dealing with these complications. While the simulation method exhibits weaknesses like the “loss of accuracy” and the “lack of real-world spontaneity,” a hypothetical redesign answers the question “What would a

suburban retrofit look like?” and provides a tangible example that can inform the retrofiting process if undertaken (Groat and Wang 2002, 276).

The method used for the simulation of a suburban retrofit is based on Galina Tachieva’s sprawl repair method from her publication *Sprawl Repair Manual* (2010). Her method includes retrofiting at multiple scales including region, community, block, and building. The simulation of a suburban redesign begins with a regional analysis through the tool of a sector map. This step highlights the most suitable areas for design retrofiting through identifying preservation and reservation areas, commercial and employment nodes, and potential transit and infrastructure networks. A portion of the city of Orlando is used for the development of a sector map that will assess sprawl and focus the sprawl repair to critical areas. One of these critical areas is selected as the study area for sprawl repair at the community scale. Tachieva (2010) presents repair methods for ten different sprawl elements (1) rural subdivision, (2) single-family subdivision, (3) multifamily subdivision, (4) shopping center, (5) shopping mall, (6) commercial strip, (7) business park, (8) edge city, (9) suburban campus, (10) sprawl-type open space.

Prior to a formal regional analysis, it is evident that of the sprawl elements identified in the sprawl repair method the typologies of the edge city, suburban campus, single-family subdivision, shopping center, commercial strip, business park as defined by Tachieva already exist within the study area. A community study area exhibiting characteristics of the above listed sprawl elements is selected, and the repair strategies detailed for that element are applied to the community-scale study area. The redesign concludes with sprawl repair at the block scale. A focus design of one specific problem

area is then determined for the block scale repair based on the outcome of the region and community analyses.

Because retrofitting suburbia will have to occur in a patchwork pattern focusing on nodes with the most potential, the redesign of this research will be one of the pieces – as they are purchased and developed by individual owners – that fit with other community redesigns achieving the goal of a more sustainable growth pattern. While Tachieva's method also includes building scale, the focus of this research is urban design and the building scale is something that will be contributed gradually through the development process by individual property owners and project architects.

While Ewing, Pendall, and Chen's sprawl analysis method detailed in *Measuring Sprawl and Its Impact* (2007) is one of the more commonly used sprawl indices, this index is based on 22 factors that relate to the city as a whole. Because the scope of this study will focus on a portion of the city, this would not be an effective measurement tool to use. Therefore, the community-level measurements detailed in *Measuring Patterns of Urban Development* (Knaap et al. 2007) are used to evaluate the final redesign of the study area. Geographic Information Systems (GIS) is used to measure factors represented with the following three categories: street network design, land use intensity, and land use pattern (Knaap et al. 2007).

Street Network Design

The sprawl morphology encourages automobile dependency due to its characteristic winding streets and cul-de-sacs in addition to the distance between sprawling enclaves and city cores, and the fact sprawl morphology lends public transit unfeasible. Connectivity is a necessity for sustainable development in that it enables alternative modes of transit like bicycles and walking. The importance of connectivity in

communities is represented by factors relating to street network design. This category measures internal connectivity and external connectivity. Internal connectivity “measures transportation route options within a neighborhood” by dividing the number of intersections by the sum of cul-de-sacs and/or dead ends plus intersections (Knaap et al. 2007, 244). The higher the resulting ratio, greater internal connectivity is indicated. External Connectivity “measures route options between neighborhoods” by calculating the median distance between ingress/egress/access points in feet (Knaap et al. 2007, 244). The greater the value of median distance, poorer external connectivity is indicated (Knaap et al. 2007).

Land Use Intensity

A low-density community containing only single-family residences is a hallmark of sprawl. Land Use intensity is measured with metrics for single-family lot size and single-family floor space. The median lot size of single-family dwelling units in the community indicates single-family lot size factor (Knaap et al. 2007). The smaller the lot size, the higher the intensity of residential density (Knaap et al. 2007). Median floor space of single-family dwelling units in the community is then calculated from the data on each property within the study area (Knaap et al. 2007). The larger the floor space for this factor, a higher residential intensity exists for the neighborhood (Knaap et al. 2007).

Land Use Pattern

The separation of land uses with limited housing types, one of the identifying characteristics of sprawl development, impacts land use pattern. Land use pattern is measured with three factors: “one measure of land use and two measures of

accessibility” (Knaap et al. 2007, 245). The first is a diversity index that measures the mix of land uses within a community.

Diversity Index

$$H_1 = \frac{-\sum_{i=1}^s (p_i) \ln(p_i)}{\ln(s)}$$

where H1 = diversity, pi = proportions of each of the five land use types such as Single Family Residential (SFR), Multifamily Residential (MFR), Industrial, Public and Commercial uses, and s = the number of land uses (in this case s = 5) (Knaap et al. 2007, 245).

The higher the value, the more even the distribution of land uses. The second factor, commercial distance, measures the distance single-family residences to commercial uses represented with the median distance to the nearest commercial use. The greater the distance to the nearest commercial use, the lower the accessibility of the neighborhood (Knaap et al. 2007). The third factor is the pedestrian-commercial that indicates the pedestrian accessibility of residences to commercial uses. This is indicated by the percentage of single-family residential (SFR) units within a quarter-mile of commercial uses. A higher percentage means better pedestrian accessibility (Knaap et al. 2007).

While Orange County did not score best for any of the seven variables, the county was second best for measures for lot size and floor space. This indicates that there is a higher intensity in single-family residential communities throughout the county study area. Additionally, measures for internal connectivity within a community were second for Orange County in comparison to the other study areas. Pedestrian accessibility analysis resulted in a better than average score. However, the study (Knaap et al. 2007) indicated that there was significant variance of this throughout the county, which shows

that there are areas that exhibit good pedestrian accessibility and areas that do not. The county scored average results for external connectivity. While Orange County was in the middle of the variables for external connectivity, this study showed that conditions are worsening. Lower performance indicators were scored for “land use mix” and “distance to commercial.” A mixture of land uses in communities throughout Orange County is low in comparison to the other areas studied. Ranking fourth out of the five studied, the central Florida county exhibits an uneven distribution of uses. Worst of all areas studied, proximity to commercial uses from single-family residential communities is lowest in Orange County and appears to be worsening. These results may lead one to prioritize areas of intervention in order from most to least critical: proximity to commercial uses, mixture of land uses, and external connectivity. Internal connectivity, lot size, and floor space would rank lowest in priority.

The study by Knaap, Song, and Nedovic-Budic was intended to show differences in changes to urban form throughout the study areas over time. Therefore, this study does not define what a good target value is for each of these factors for sustainable development. Because of this, a comparison of this study’s numbers with the new values following redesign may not be too revealing; it would simply show how the area deviated from the median value within a county. Therefore, it is important to do a measure of the study area with this method prior to the redesign and following redesign to quantify improvement.

In order to address the negative impact of the sprawl morphology, the objectives of this research are to address those spatial features assessed in the literature review. In order to respond to vehicular dominance within a community, connectivity will be

increased. A mix of uses with a variety of housing types is the opposite of sprawl development. Because the community study area exhibits single-family and multi-family residential types, emphasis is placed on providing equal accessibility to the major employment and commercial nodes to equalize the available amenities to all of the residential options. Density is increased to aid in internal connectivity. The design seeks to create a nodal structure to facilitate current bus transit and future transit projects. Finally, it is important to acknowledge the public realm for the ecological benefit of shared amenities and for the potential these spaces have to foster awareness of ecological systems.

Summary

A redesign of a suburban community is undertaken in order to investigate the changes necessary for the community to become a sustainable place to live. Galina Tachieva's sprawl repair method is used to perform a retrofit of a suburban community type identified to be appropriate for sprawl repair. An analysis of the community is conducted prior to and following the redesign according to the community-level analysis by Knaap et al. By analyzing street network design, land use intensity, and land use pattern, improvement of sprawling characteristics are measured and compared with the median measures for Orange County, Florida, that were determined by the previous study by Knaap, Song, and Nedovic-Budic.

Sprawl and suburban morphology have been amply criticized for its adverse impact on the environment. By performing a simulation of a redesign, this research investigates a design solution with one proposed method for rectifying this problematic morphology. Although the research about suburban retrofitting is expanding, the application of proposed methods is still modest. Chapter 4 will present an application of

a recently developed sprawl repair method to a real context in order to investigate the redesign of suburban sprawl. While this is a simulation and hypothetical in its nature, the results of this research will produce a tangible, visual outcome that can inform future suburban redesign efforts. By adding imagery to concepts of Tachieva's method, the potential for changes to sprawl development become more accessible to policy-makers and citizens.

CHAPTER 4 FINDINGS AND RESULTS

This section will describe the results of applying the methodology detailed in Chapter 3. It will begin with a discussion of the results of the pre-design assessment. The steps of the Sprawl Repair Method presented in Tachieva's *Sprawl Repair Manual* (2010) will then be discussed. This method uses a sector mapping process for the repair at the regional scale. The steps of this process will be presented with resulting conclusions for each step. Implications for the community scale intervention will also be discussed in terms of the sector mapping process. Repair at the community scale will include the deficiencies of a multifamily subdivision and remedial techniques to be implemented according to Tachieva's sprawl repair method (2010). Intervention at the block scale will present focus areas selected from the community study area. The development of these areas, chosen for their significance within the community scale intervention, will be discussed. A comparison of the values found in the post-design assessment with the pre-design values will then be covered. This section will conclude with a discussion of site-specific obstacles.

Pre-Design Assessment

Assessment of existing community features used the method designed by Knapp, Song, and Nedovic-Budic from their article *Measuring Patterns of Urban Development: New Intelligence for the War on Sprawl* (2007). This analysis measures for street network design, land use intensity, and land use pattern with seven variables (Table 4-1). The results of the pre-design assessment will be used as a measure of improvement for the intervention when compared to values achieved following re-design.

Analysis of street network design included measures for internal and external connectivity of circulation routes. Internal connectivity was based on the number of intersections and cul-de-sacs calculated together resulting in a ratio. The higher the ratio, the greater internal connectivity is indicated. The initial data showed Orange County as having second best internal connectivity and average external connectivity ranking third of the five study areas. The community study area exhibited better internal connectivity than the county overall. The external connectivity variable was calculated by measuring access points to different neighborhoods by using the OD (origin-distance) cost matrix tool in GIS. The median distance of the measurements of access is used to judge for external connectivity. The larger this distance, poorer external connectivity is exhibited. Pre-design analysis of the community study area indicated poor external connectivity in relation to the value for the county.

Land use intensity was measured for single-family lot size and floor space in single-family floor space. For the lot size variable, the median size for single-family residential was determined. A smaller area shows a higher intensity. The median lot size in the community study area was significantly smaller than the county's variable, showing a higher intensity than the county. Similarly, the floor space variable was determined with the median floor space area for single-family residential units. Larger floor space for this variable indicated a higher intensity of land use. The initial analysis showed that the community study area scored lower than the county with a lower median floor space. According to this measurement, the community study exhibits a lower intensity than the county.

Land use pattern is an important indicator of a sustainable community because the mix and accessibility of resources is integral to reducing automobile transport. Other modes of transit - public mass transit, bicycle, and pedestrian – become more feasible when different uses are in close proximity. This characteristic of urban form was measured with three variables: land use mix, commercial distance, and pedestrian-commercial distance. The land use mix value for the community study area was slightly better than the land use mix value for the county. This indicates a marginally better distribution of land uses. Since the study area contains single-family and multifamily residences, a convenience store, six restaurants, and a neighborhood park, this specific area shows great potential for redesign. However, accessing these multiple uses is difficult. The median distance from single-family residential parcels measures commercial distance. Lower accessibility is evident with a greater distance. The median distance to the nearest commercial use within the community study area was much higher than the value for Orange County. According to this measure, the study area has lower accessibility than the county. The pedestrian-commercial distance shows that while commercial uses may or may not be accessible through the existing road network, a high percentage of single-family residential properties that are within a specified proximity of commercial uses determine favorable pedestrian accessibility. This community study area scored much higher than the county with a score over twice determined for the county. This means that the community exhibits dramatically better pedestrian accessibility than the whole of Orange County.

Repair at the Regional Scale

Repair at the regional scale is conducted through the process of sector mapping as defined by the *Sprawl Repair Manual* (2010). This includes seven steps, which “may

be used out of sequence or omitted entirely,” to create a protocol for sprawl repair. The regional scale analysis was conducted on an approximately 15 square mile portion of the region in order to simulate the regional repair process (Figure 4-1). For the purposes of this study, the sector mapping process was used to help situate the community scale study area detailed in the subsequent section within its context.

Step One: Determine Sprawl Repair Domains

The first step in the sector analysis was to determine sprawl repair domains. This step was initially conducted in the development of the methodology in order to select an area that was of a manageable scope for this simulation. The area selected as the sprawl repair domain includes three major features: the University of Central Florida, Central Florida Research Park, and the Waterford Lakes Town Center (Tachieva 2010, 36; Figure 4-2). The University of Central Florida (UCF) is designed to be pedestrian-friendly, but fails with a belt of parking circulating the main campus. Regardless, getting to UCF is the problem and this wall of parking can be retrofitted to be permeable. Tree-lined streets weave throughout the structures of the Central Florida Research Park. Retention ponds are maintained and attractive. Unfortunately, this segment of the study area lacks connected sidewalks. This could provide pleasant places to exercise and facilitate pedestrian transit from the community scale study area to the university. Currently, traffic makes it difficult for pedestrians and bicyclists. Buildings are set back from the streets, buffered with large parking lots. Waterford Lakes Town Center has great amenities and retail, but is only accessible by personal vehicle. Described by the developer as a “park-like, open-air environment,” the design of the town center appears to have been intended to make allowances for walking, but bicycles are forbidden (Simon Malls 2011). Crossing Waterford Lakes Parkway with anything other than an

automobile is difficult and dangerous. With minimal attention paid to crossings, drivers are likely to not notice the crossings. Additionally, the size and expanse of parking makes pedestrian movement unfeasible and dangerous. Sprawl repair sectors should be “individual agglomerations of single-use, disconnected commercial and residential enclaves, strip commercial corridors, and commuter-oriented districts” for their potential to be successful repair districts, and this site exhibits many missed opportunities for a more sustainable community.

Step Two: Delineate Preservation and Reservation Areas

The second step of the sector mapping process is to delineate preservation and reservation areas. It is unclear what specifically denotes a preservation or reservation through the text or the accompanying illustrations in the *Sprawl Repair Manual* (2010). For this step, preservation areas were determined to be more pristine natural enclaves “already protected by law” (Tachieva 2010, 37), and reservation areas were identified as areas that would ideally be preserved (Figure 4-3). A data layer for “conservation areas” obtained from the Orange County FTP site was used to identify the preservation areas. Since no specifics were provided for the type of features to be included as reservation areas, buffers were created around hydrological features for the reservation areas. The distance for this buffer was approximated based on information provided by a talk given by Sally Adkins of the Alachua County Environmental Protection Department. While the Alachua County Natural Resources Program currently protects an upland buffer of 150’ (75’ from the top of bank on each side), she considers an “ideal buffer” for water bodies to be 500’ to 1000’ (Adkins 2010; Alachua County EPD 2011). Without guidance from the *Sprawl Repair Manual* (2010), 300’ – double what Alachua County has protected, but less than an ideal distance - was chosen to buffer the existing hydrological features

indicated by Orange County's hydrology data layers. Additionally, parks and trail systems were identified in this step. It is apparent that there is an opportunity for a connection to the Little Econ (Econlockhatchee) Greenway to the north of the community study area. This step revealed the park at the center of the community study area and a linear preservation area (Figure 4-4), resulting in the conclusion that the design intervention should transform natural areas into public amenities and increase access through the development of a trail system.

Step Three: Prioritizing Commercial and Employment Nodes

Prioritizing commercial and employment nodes in the third step of sector mapping identified the ample surrounding commercial and employment nodes. These nodes were categorized according to square footage as designated in the *Sprawl Repair Manual* (2010), and buffers for their specified service areas were generated (Figure 4-5). This classified UCF as an Employment Center, Central Florida Research Park as a Power Center, and the Waterford Lakes Town Center as a Regional Center (Tachieva 2010, 38). These major features maintained a service area of a 15-mile radius each, encompassing the entire regional study area and beyond. This step showed that commercial uses were present within the community study area, but were concentrated just outside of the community study area boundary to the north and south (Figure 4-6). Also, East Colonial Drive creates a wall blocking movement north or south with any mode of transit other than personal vehicle. Strategies for the community scale intervention resulting from this analysis are to increase access to the ample surrounding commercial and employment nodes by enhancing existing paths in the East Orange Neighborhood Park into a trail system to facilitate pedestrian and bicycle movement through the site.

Step Four: Prioritize Potential Transit and Infrastructure Networks

The fourth step within the sector mapping process identified bus stops, future transit centers, and future park-and-ride lots within the regional study area (Figure 4-7). Transit centers are planned for the UCF campus and Waterford Lakes Town Center according to the Orange County Transportation Development Plan (LYNX Central Florida Regional Transportation Authority 2011). Additionally, the Waterford Lakes Town Center will include a park-and-ride lot (LYNX Central Florida Regional Transportation Authority 2011). This step mapped bus stops in the study area, and a buffer for a 0.25 mile (Tachieva 2010) and a 2,000 foot (10-minute walk according to Calthorpe 1993) pedestrian shed were generated. This exercise showed continuous coverage along the route, but it also revealed that bus lines or planned transit features do not serve approximately half of the community study area (Figure 4-8). In addition to showing that some connections within the existing road system needed to be made, the findings resulting from this step further supported the ideas of enhancing the park and developing the trail system to aid access to surrounding uses. Because a transit center and a park-and-ride lot were already planned for the study area, additional centers or lots may reduce the functionality of the planned facilities. Bus routes should be expanded to serve the east side of the community study area, and focus should be placed on providing access to planned transit centers and park-and-ride lots.

Step Five and Step Six: Redundant and Recommendations

The fifth step in the *Sprawl Repair Manual* (2010), identifying the sprawl repair targets, was omitted due to its redundancy of step one and initial decisions related to scope limitations to select the study areas for each scale. The sixth step of the Sprawl Repair Method is to implement transfer of development rights (TDR). The sector

mapping revealed potential to link the existing preservation areas in order to facilitate a continuation of the Little Econ Greenway identified in Step Two (Refer to Fig. 4-3). Implementing TDRs for land within the Central Florida Research Park would allow for better pedestrian and bicycle transit throughout the entire regional study area, and benefit the owners of the research park by allowing them to increase the density of future development within the other parts of their property. Generally, TDRs should be implemented on lands that fall within the hydrological features' buffers generated in the first step of sector mapping.

Step Seven: Assemble the Sector Map

The seventh and last step of sector mapping is to assemble the sector map. This map synthesizes the previous steps and allows all of the features to be viewed together (Figure 4-9). The intent of this step is to show a municipality where to focus development effort and resources. The takeaway from this part of the process was that enhancing the existing park and facilitating internal connectivity with minimal road connections and a trail system should become the main features of the community scale intervention (Figure 4-10).

Repair at the Community Scale

Repair at the community scale is conducted on an area bounded by East Colonial Drive / Highway 50 to the north; Waterford Lakes Parkway to the south; North Alafaya Trail to the west; and Woodbury Park Road to the east (Figure 4-11). According to Tachieva (2010), deficiencies of a multifamily residential neighborhood are the presence of a single building use and type, a lack of walkable block structure, dispersed and exposed parking, and residual open space. Exhibiting the first deficiency, the community study area contains primarily multifamily residential and single-family

residential uses (Figure 4-8). The multifamily structures are typically three stories and almost identical to the other structures within the complex. The single-family structures include individual structures on their own parcel of land or townhomes in connected structures of six units. A lack of walkable block structure is evident throughout the study area. No routes extend the full length or width of the study area, making access to the shopping center to the south or employment or school to the north difficult for anything other than vehicular travel. The multifamily residential complexes are gated with parking placed along circulation routes within the complex. These loops of circulation are closed with multiple cul-de-sacs and dead ends (Figure 4-13). In addition to a lack of connected internal roads, the community exhibits a hostile walking environment (Figure 4-14). While sidewalks exist along most of the perimeter roads bounding the study area, these are not shaded and disconnected. Some even maintain a substantial grass buffer from traffic; plantings that could mitigate discomfort for pedestrians are absent. Additional priority for vehicles is present with dispersed and exposed parking throughout the study area (Figure 4-15). Parking is placed perpendicular to circulation routes within the apartment complexes. A small parking lot is generally present for the residents of individual buildings or sometimes shared with residents of an adjacent building. Parking for the single-family residences is directly in front of the structure. Some homes do not have a front door, but have a façade dominated by a garage door (Figure 4-16). The commercial and public structures within the community study area have large paved parking lots fronting the building (Figure 4-17). Residual open space can be seen through the creation of a negative of the study area's figure ground (Figure 4-18). The ample parking pushes structures away from roads, and a neighborhood park is hidden

at the terminus of a parking lot (Figure 4-19) While small, the East Orange Neighborhood Park has well-maintained facilities including a playground, a walking trail, picnic shelters, basketball courts, and a baseball diamond (Figure 4-20).

Methods from Tachieva's *Sprawl Repair Manual* (2010) were combined to address the deficiencies of a multifamily subdivision. New building types and mixed uses were introduced into the residual open space within the community study area (Figure 4-21). Mixed-use structures containing office and retail were located along East Colonial Drive to strengthen the street wall (Figure 4-22). Buildings that meet the street define urban space making it more comfortable for pedestrian traffic and providing opportunities for social interaction (Carmona et al. 2003). "Liner" buildings were added to the front of strip malls per the manual's recommendation (2010, 98). The southeast corner of the study area is densified with the addition of commercial and residential mixed-use structures and continuation of the adjacent townhome development (Figure 4-33). While the mixed-use structures are multiple floors and may dwarf the adjacent structures, creating a transition in height with the additional townhomes minimizes impact to the single-family residences. This part of the intervention responds to the objectives of increasing connectivity by encouraging pedestrian activity through convenient commercial uses and creating a street wall for pedestrian comfort. The existing community study area has a density of 10 dwelling units per acre. This was increased with approximately 700 new residential units to 12 dwellings per acre. While it is a modest increase, this is enough of an increase to support an Urban Transit-Oriented Developments (TOD) (Calthorpe 1993). Population in Orange County is projected to increase almost 13% by

2020 (Florida Housing Data Clearinghouse 2011). The additional housing units will accommodate a 23%¹ increase of population living within the study area.

Connecting and repairing thoroughfares was the next method used to address the lack of walkable block structure within this community. Existing sidewalks are connected, and new sidewalks are provided along all streets. Road connections were made at the least invasive locations, and a trail system was developed throughout the entire site to foster bicycle and pedestrian movement (Figures 4-23 and 4-27).

Street parking and parking structures are introduced to address the deficiency of dispersed and exposed parking. Perpendicular parking within the multifamily residential complexes is converted into parallel street parking. This allows for residents to have personal vehicles, but the change in parking configuration can provide an additional buffer for pedestrians on sidewalks (Figure 4-24). Parking structures are located within the residual open space within each multifamily residential complex. Currently, access from Sussex Place to the East Orange Neighborhood Park is blocked with fencing the surrounds the development. Parking along the rear of each building is relocated to street parking along, Sophie Boulevard, the road that fronts the development. This allows the rear of the structures to become green space and opens access to the park. Changes to the parking structure within the apartment complexes increases connectivity by transforming the parking access roads to actual roads that link the residents to the adjacent commercial uses.

The manual recommends addressing residual open spaces by defining open and civic spaces. In the community study area, this is done with the introduction of new

¹ Existing units within study area = 2888; Change in units within study area = approximately 673; $(673 * 100) / 2888 = 23.3\%$

development along the main thoroughfares along the perimeter (Figures 4-33 and 4-34). The existing park only utilized part of the undeveloped land at the center of the study area and is extended to the south. The trail system throughout the study area is connected to a new trail system implemented within the extended area (Figure 4-25). This creates access to the park and facilitates connectivity throughout the entire community study area.

Integrating local food production is another intervention recommended by the *Sprawl Repair Manual* (Tachieva 2010). Space for urban agriculture is allocated throughout the study area and on roofs of the larger buildings within the study area (Figures 4-26 and 4-33). Effort was made to locate community gardens for equal access for all residential developments. There is also the opportunity to locate strips for food production along the eastern and western borders of the neighborhood park. Even though grocery stores with available fresh produce are located directly adjacent to the community study area, local food production is vital to a sustainable retrofit.

Wackernagle and Rees (1996) have calculated the ecological footprint of land needed for an average North American's diet to be 1.3 hectares per person, which is equivalent to 2.5 acres per person. This total includes land for fruit and vegetable production, crop land, pasture for dairy and meat production, forest land, and land area necessary to sequester the corresponding carbon dioxide resulting from fossil energy consumed in the production process. The community study area is 287 acres, and this would mean that the study area – without development – could supply food for 89 people. Assuming only one person lived in each residential unit present in the current study area, 2888 people would be contained. At the current rate of land consumption, Wackernagel and

Rees have determined that each North American requires 4.27 hectares per person when the amount of ecologically productive land available per person on this planet is 1.5 hectares (1996). Considering this, local food production would contribute to reducing the land used for growing food and the energy used in processing and transporting food, and as a result, have impact on the current ecological deficit.

Rezoning concludes the intervention steps for a multifamily subdivision in the *Sprawl Repair Manual* (2010). Building intervention within the study area was focused at the perimeter of the site. Residential and commercial uses were added through mixed-use parcels carved out of residual open space in the existing multifamily residential complex at the southwestern corner of the community study area (Figures 4-22 and 4-33). Mixed-use consisting of retail and office was incorporated by rezoning the parcels at the northwest corner of the study area. Additionally, some of the parcels in this area were consolidated to create a natural area surrounding a water retention pond. As well as creating a small park, this change allows for the new trail system to skirt the apartment complex to the east for accessibility for the residents and natural surveillance that would occur due to the proximity of the residential development.

Repair at the Block Scale

The most significant features of the community study area intervention were enhancing the existing neighborhood park and developing a pedestrian/bicycle trail system to encourage connectivity throughout the site. Repair at the block scale focused on access to the East Orange Neighborhood Park. Intervention at the block scale was conducted at two focus areas – the library entry on East Colonial Drive and a space between Sussex Place and Victoria Place Apartments (Figure 4-28). These areas were selected to improve overall access to the park by designing a civic space that is shared

with the library. Current access to the library is car-dominated; the library maintains a drive-through window (Figure 4-29). The parking lot is reconfigured to have fewer frontages to East Colonial Drive. This makes space for a small square that has planters, benches, and creates an entry for the park (Figures 4-30 and 4-31). The park is extended north by incorporating the parking lots of the community center and the Orange County Health Clinic. As it is an old structure, relocating the health clinic can be accommodated by the additional space created by the liner building applied to the adjacent strip center. The community center will remain, as its use is very compatible with a community park. The existing vehicular access to the park is extended through the park's current parking lot to the neighborhood directly to the park's west. This neighborhood, Sussex Place, is a group of 42 buildings consisting of owner-occupied and rental structures borders the entire western edge of the park and is currently blocked from direct access to the park by fencing surrounding the development. Additional parking can be accommodated along one side of this new street if necessary. The trail system is meant to improve access to the park and throughout the park. It is intended to make the park into a shared amenity. While the existing multifamily subdivisions are not connected with roads, the park spatially links them providing an opportunity to remedy the isolation that was designed into the initial developments.

While vehicular circulation was connected in various places in the community scale intervention, space between Sussex Place and the Victoria Place apartment complex presents a potential outlet for pedestrian and bicycle access to the retail and services of Waterford Lakes Town Center. The crossings of Waterford Lakes Parkway are inadequate in that they are basic painted lines on the road depositing those crossing

to the backs of big box retail stores. Intervention at this focus area is a pedestrian promenade linking the park to the commercial center to the south of the community study area (Figure 4-32). This is simply a pocket park that creates a southern entry to East Orange Neighborhood Park. Having this element will provide cues for future renovation of the commercial to the south. A renovation creating an atrium in the Town Center's building directly south has the potential to further link the commercial node with the adjacent residences.

Site-Specific Obstacles

The great potential that exists within the selected study area due to the strength of the university can be seen when comparing the University of Central Florida (UCF) to an older university town/university like the University of Florida (UF). The Orlando / University of Central Florida area is dramatically different than the Gainesville / University of Florida area. While both schools maintain relatively the same enrollment with 2010 fall enrollment of 50,116 and 56,337 respectively, the characters of the two towns are vastly different. Despite the similarity in enrollment, UF maintains a 2,000 acre campus when the main campus at UCF is 1,415 acres (University of Florida 2011; Office of Institutional Research (UCF) 2011). While parking maintains a significant presence on both campuses, the University of Florida campus is easier to navigate and access with the Gainesville bus system subsidized with student's tuition and ample bicycle-friendly features (City of Gainesville Regional Transit System Transit Development Plan FY2007 – FY2011). UF can accommodate approximately 20% of its students with on-campus housing, while UCF can only provide 10% of its enrollment

with on-campus housing.² However, “affiliated housing,” or housing “located off campus, but [maintains] a relationship with UCF Housing and Residence Life,” is offered as a student housing option, but this can only house approximately 2% of the school’s enrollment (Division of Student Development and Enrollment Services 2011, 2).

Considering these facts, University of Florida is a silver-haired professor with the grace and sophistication enabled by years of experience, while UCF is a college freshman full of energy and potential yet still unsure of which major to select for undergraduate study. However, the strength of Orlando metropolitan area as a regional center for employment is a great advantage that UCF holds over UF, and this feature should be enhanced by creating a substantial transit node linking the university with the city core.

If actually applied to the block scale study area, the proposed design intervention will have several difficulties in implementation to consider. Although there are significant problems with the design, the Waterford Lakes Town Center is still relatively new and planning for renovations may be unrealistic. The adjacent single-family residential developments may incur objections as well. East Colonial Drive / Florida Highway 50 acts as a wall between retail and employment nodes. Obtaining land to create a trail system to increase connectivity within the site and access to the East Orange Neighborhood Park will require utilizing the power of eminent domain. This may also cause opposition for connecting apartment complexes by the apartment developments for issues relating to security of and access to shared amenities.

² Total of students accommodated on-campus at UF = 10,143 and Total enrollment for Fall 2010 at UF = 56,116 (Office of Institutional and Planning Research 2011) resulting in 20.24% students accommodated; Total housing available at UCF (including main campus and Greek housing; excluding “affiliated” housing and Hospitality Department not located at main campus) totaled accommodation for 6,144. Considering Fall 2010 enrollment of 56,337, this provides on-campus housing for 10.9 % of the university’s total enrollment.

Post-Design Assessment

Following the designed intervention, a post-design assessment was conducted. The results of this assessment are compared to the pre-design assessment values (Table 4-1). Variables for street network design improved for internal connectivity, but external connectivity decreased. Care was taken to avoid removing existing property and other invasive methods. Therefore, connections within the formal road network were modest, but resulted in a 10% improvement for internal connectivity. Alternately, measures for external connectivity worsened slightly. While external connectivity for the entire county was a middle value in the study by Knaap et al., the community study area scored dramatically worse with a value over six times the size of the county's. However, the change from before to after design intervention was only a 5% change in accessibility and this may be attributed the conversion of one complex's parking to part of the street network. Data layers used in the pre-design assessment did not count the complex's circulation as a road, but the design process revealed the parking configuration has potential for increasing connectivity. Measures for lot size showed a 66% improvement over the pre-design assessment. Since this value was based on lot sizes for single-family residential, the addition of 79 townhomes improved this variable. Surprisingly, measurement of floor space decreased less than 1% from the pre-design value, showing a decrease in density. Diversity in land use mix worsened slightly from the pre-design assessment by 2%. Like the land use intensity measures, this was most impacted by the addition of single-family residential in the form of townhomes that exist on their own parcel. The change in this measure is most likely because this value is based on parcel quantity and not square footage. Measurement of commercial distance showed worse accessibility in the pre-design assessment than the accessibility for the

complete county. Commercial distance for the post-design assessment was based on partial results obtained through the network analysis in GIS. The median distance for 60% of the location following design indicated worsening accessibility to commercial uses. Pedestrian commercial distance improved by 8% that is due to the increase of single-family residential added within 0.25 miles of commercial uses and the addition of commercial uses.

Summary

The focus of design intervention emphasizes enhancing the existing park space, increasing access throughout and beyond the site with the addition of a paved trail system, and filling in residual open space to raise the overall density of the study area (Figure 4-27). Internal connectivity, land use intensity in the form of smaller lot sizes, and pedestrian accessibility to commercial uses is improved in the study area following design intervention. Analysis of distances to commercial uses following the design intervention was inconclusive. Decreases in external connectivity, land use intensity with reduced floor space in single-family residences, and land use diversity are the result of the design intervention. However, these decreases were very small and ranged from a 1% to 5% worsening of conditions. While it is expected that measures of urban design for the community study area would show improvement in all areas following the sprawl repair method, mediocre performance is evident with improvement occurring in three of the variables, worsening in three of the variables, and one with indeterminate results. This may be due to a faulty measurement system or a weak intervention strategy. The next section will analyze the method for measuring urban form and the method for sprawl repair, concluding with a discussion of implementation issues.

Table 4-1. Quantitative measures of urban form.

Variable	Before	After	Orange County*
Internal Connectivity	0.83	0.93	0.78
External Connectivity	4098 FT	4294 FT	631 FT
Lot Size	2763 SF	1813 SF	7695 SF
Floor Space	1475 SF	1473 SF	2107 SF
Land Use Mix	0.44	0.42	0.39
Commercial Distance	6060 FT	6072 FT**	3653 FT
Pedestrian Commercial Distance	77%	85%	28%

* Orange County Data Source: Knapp, G., Y. Song, and Z. Nedovic-Budic. 2007. Measuring patterns of urban development: New intelligence for the war on sprawl. *Local Environment* 12(3): 246.

**Calculation indicates median value for 62% of the origin locations.

Context: Orange County

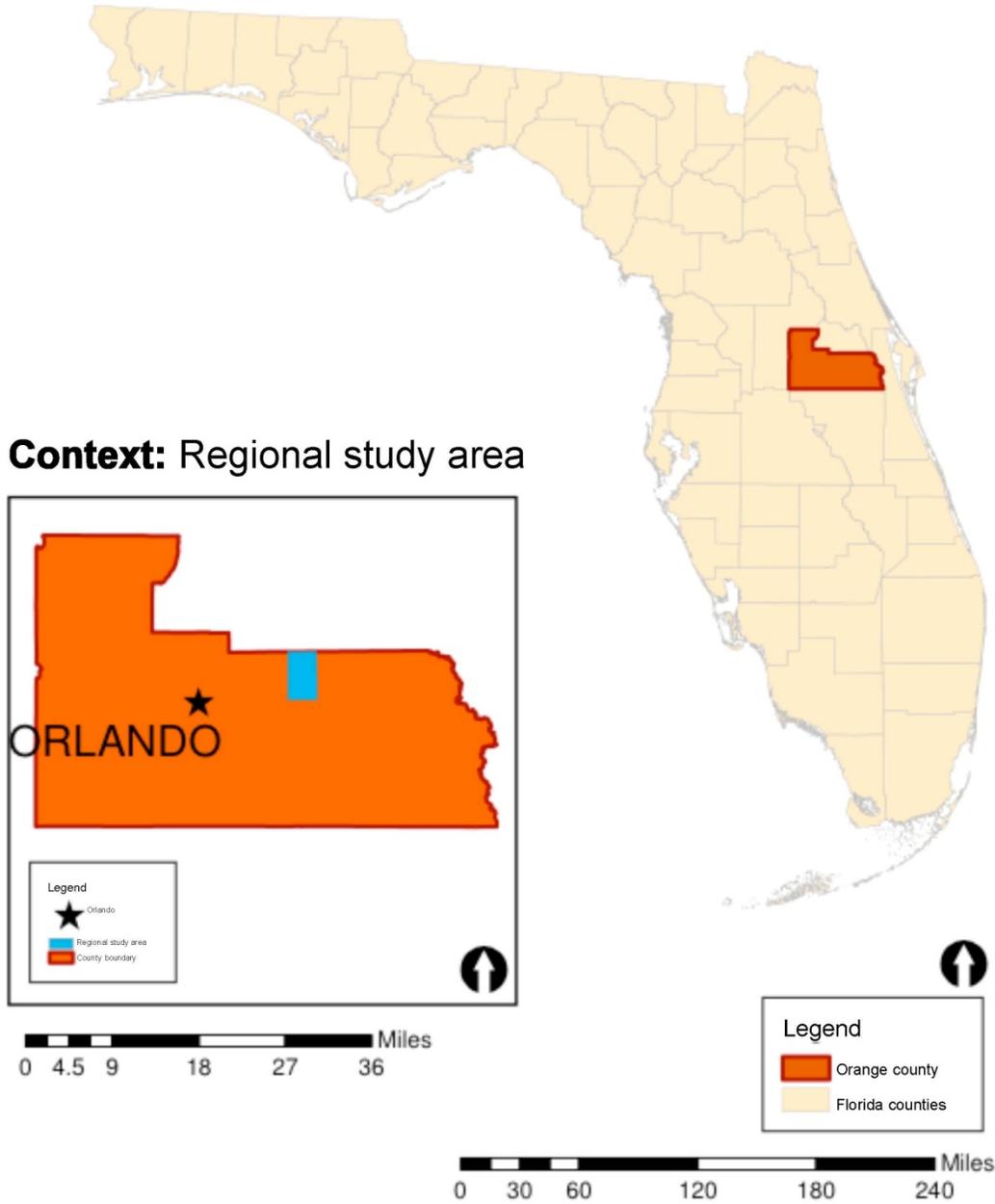


Figure 4-1. Regional study area. A) Context within County B) County within State.

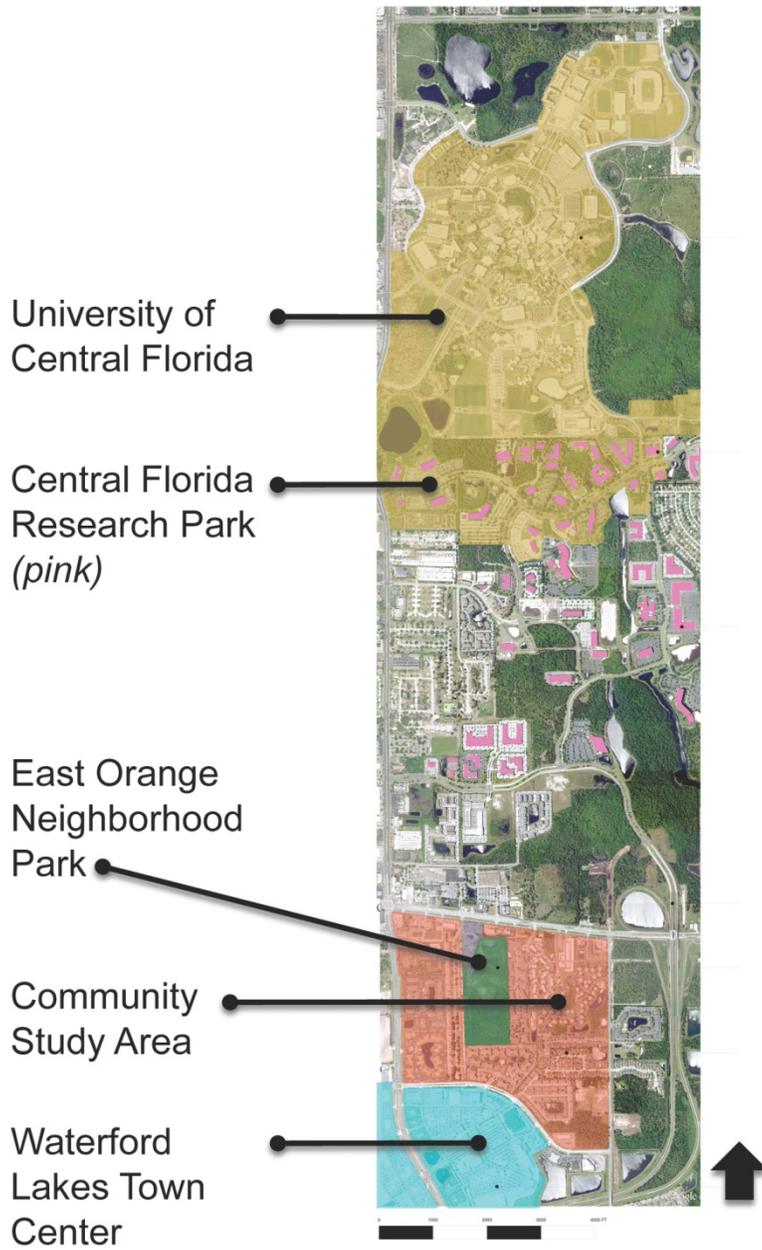


Figure 4-2. Sprawl repair domain.

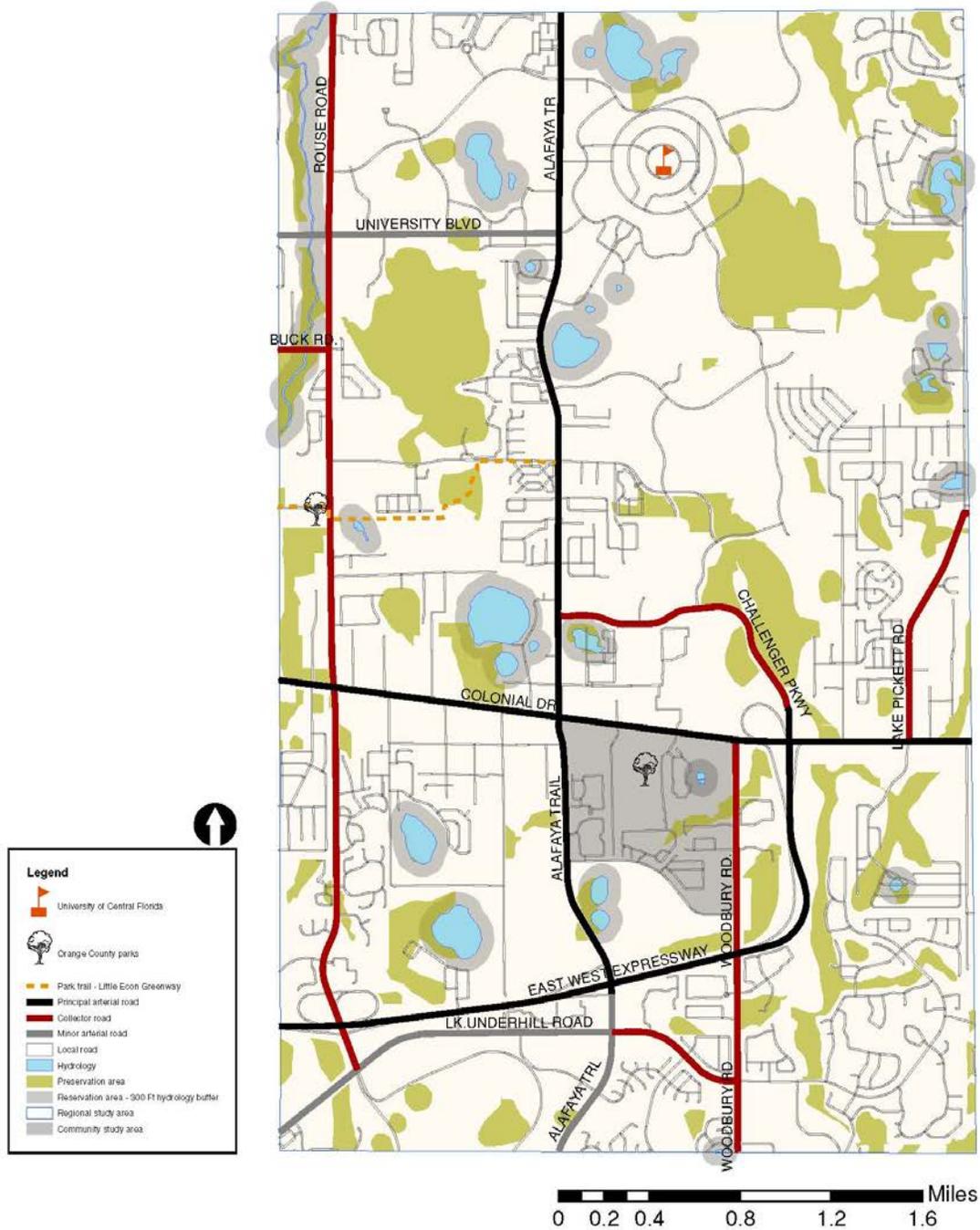


Figure 4-3. Preservation and reservation areas at the regional scale. The Little Econ Greenway and the disconnected preservation areas provide an opportunity for increased access throughout the regional study area.

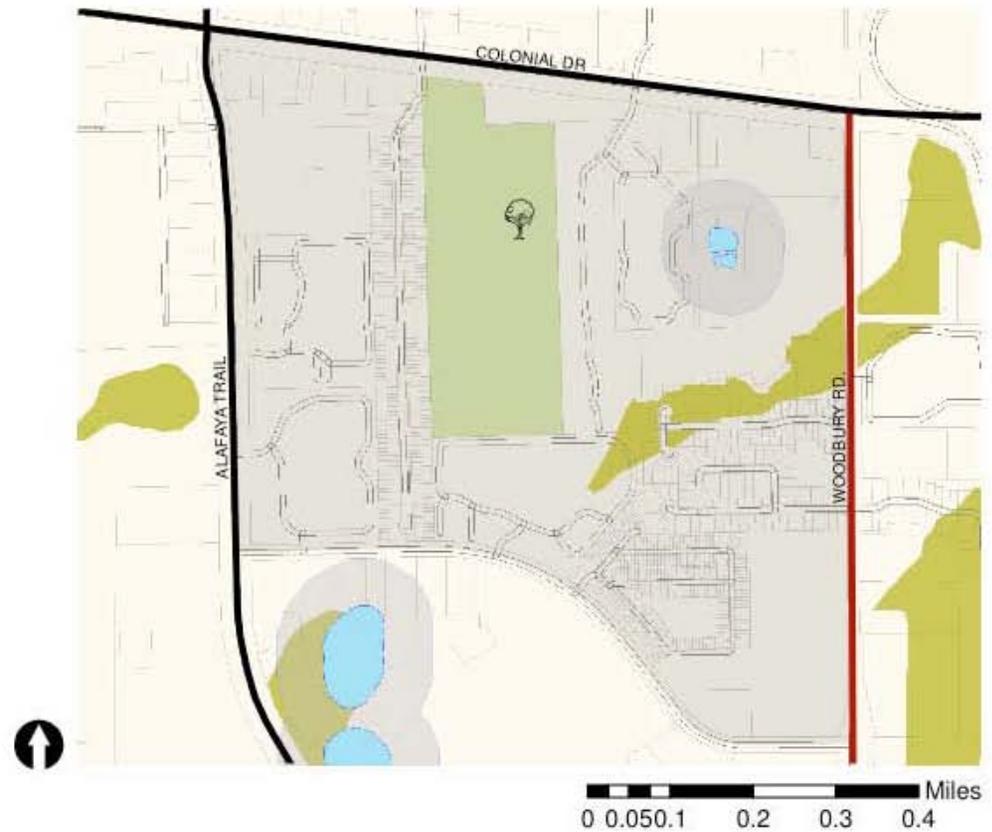


Figure 4-4. Preservation and reservation areas at the community scale. A neighborhood park at the center of the community study area and the linear preservation area can be used to transform natural areas into public amenities.

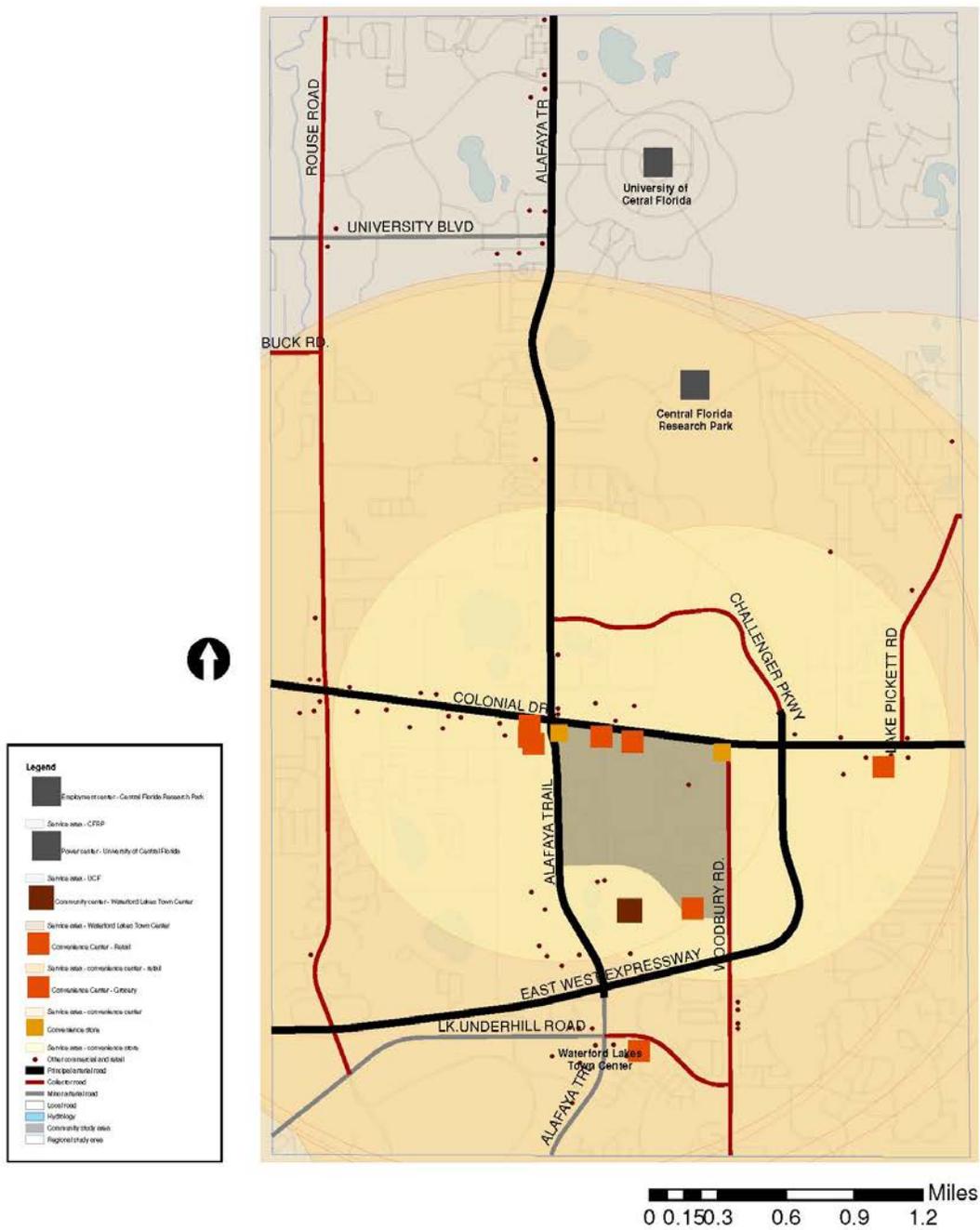


Figure 4-5. Commercial and employment nodes at the regional scale. Ample commercial and employment nodes exist within the study area, including UCF and the Central Florida Research Park.

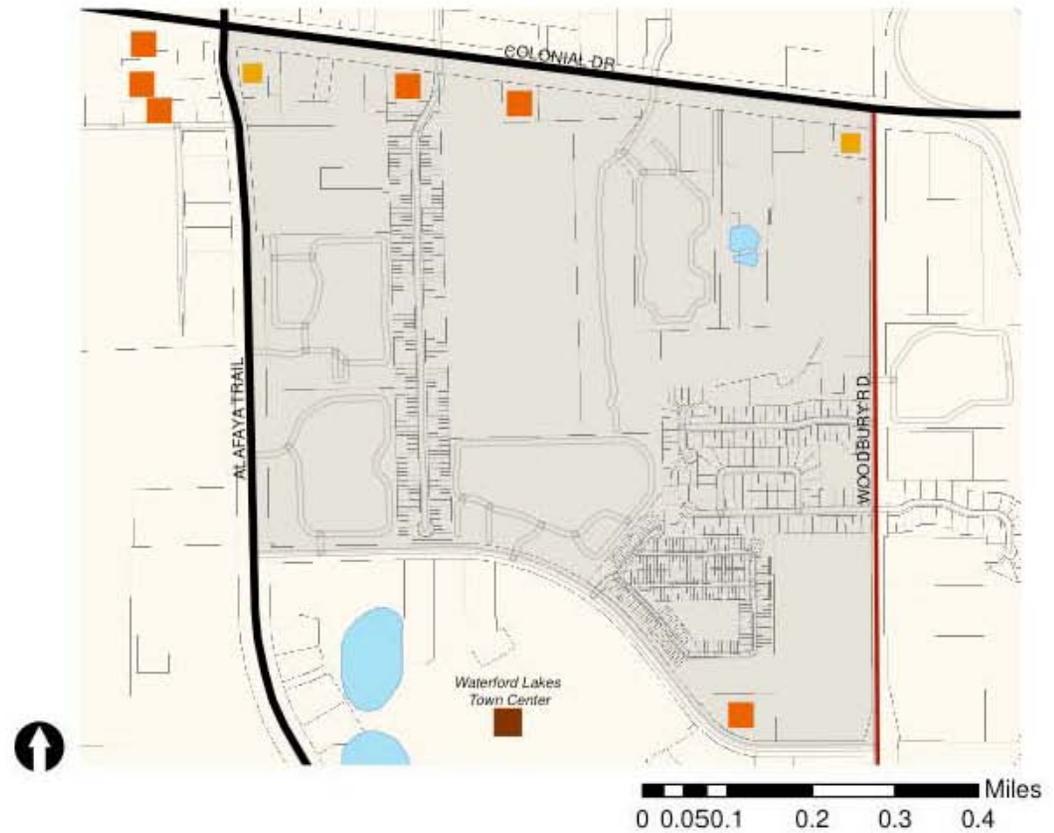


Figure 4-6. Commercial and employment nodes at the community scale. Ample commercial uses and employment centers surround the community study area, but accessing these nodes without an automobile is difficult and dangerous.

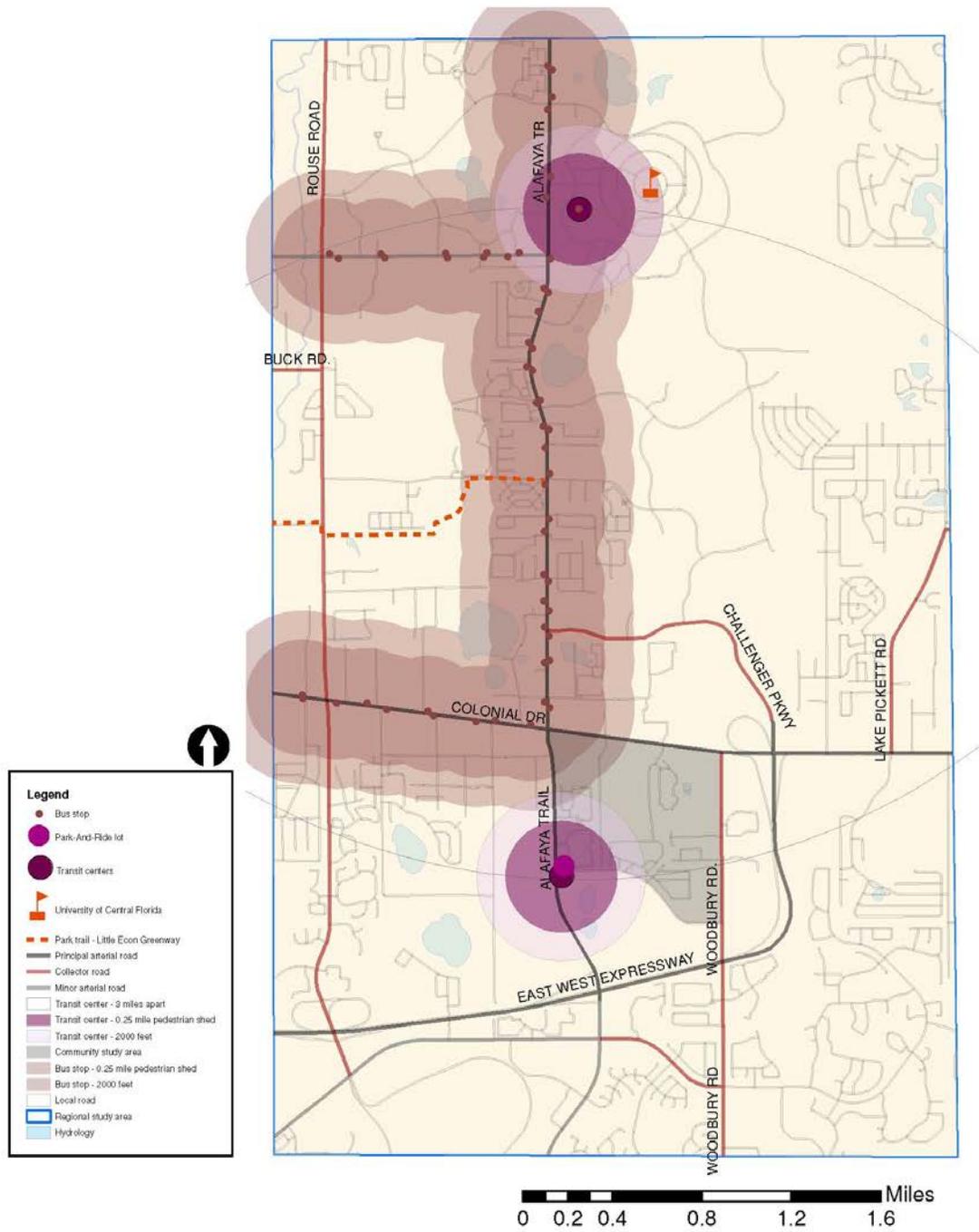


Figure 4-7. Transit and infrastructure networks at the regional scale. Transit centers are planned for the Waterford Lakes Town Center and UCF. A park-and-ride lot is planned for Waterford Lakes Town Center.

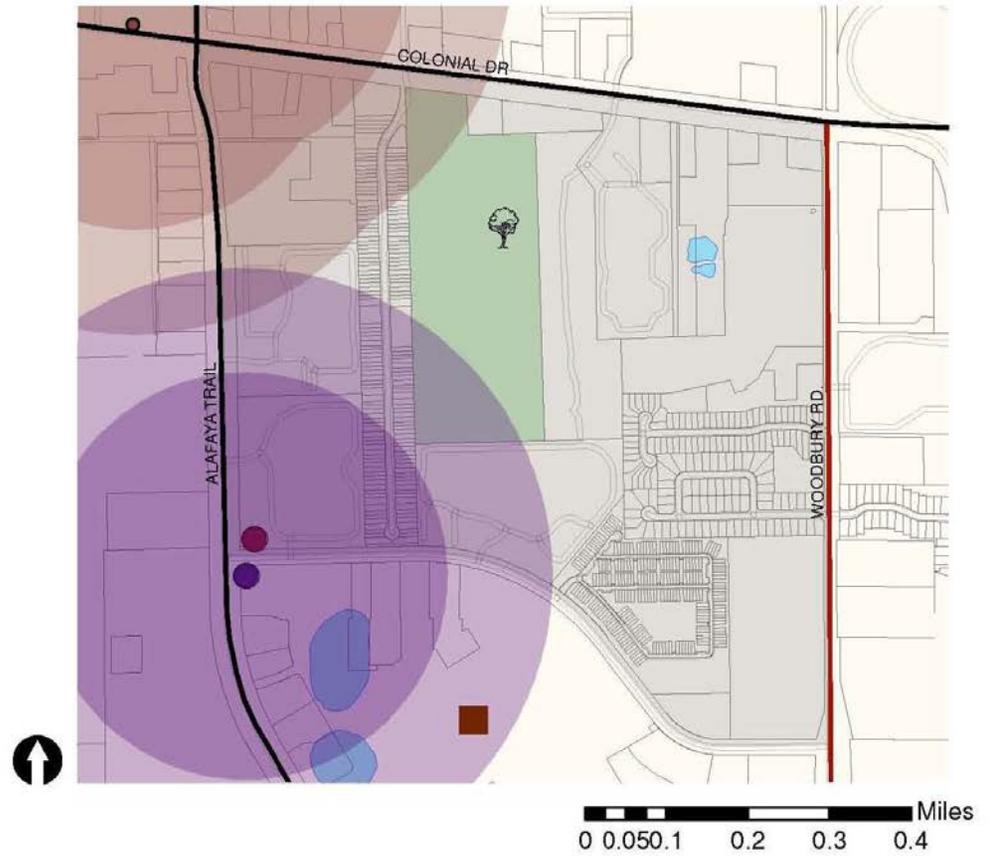


Figure 4-8. Transit and infrastructure networks at the community scale. At least half of the community study area is not served by a bus route and do not have convenient access to planned transit nodes.

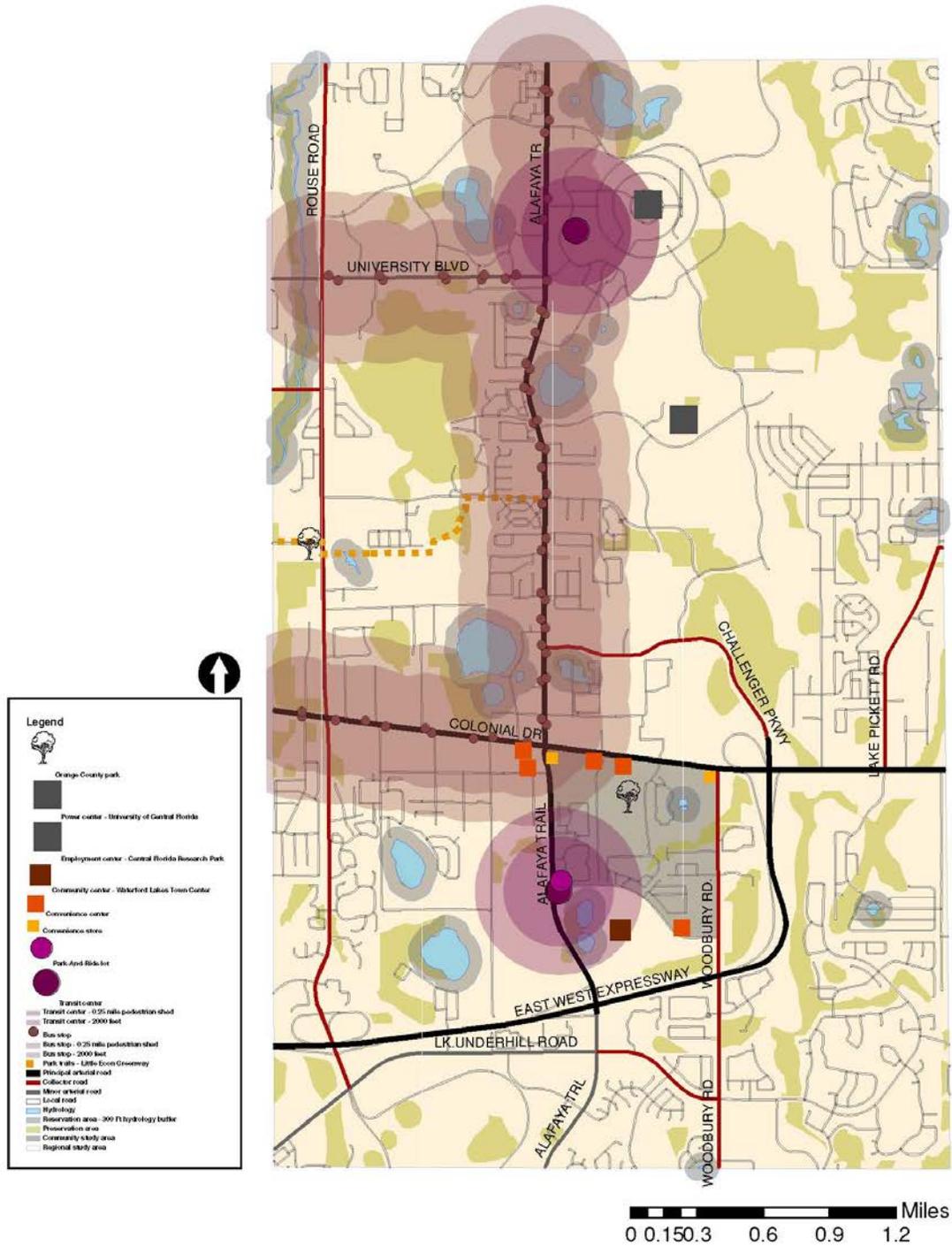


Figure 4-9. Sector map at regional scale. The intent of this step is to show where to focus development effort and resources.

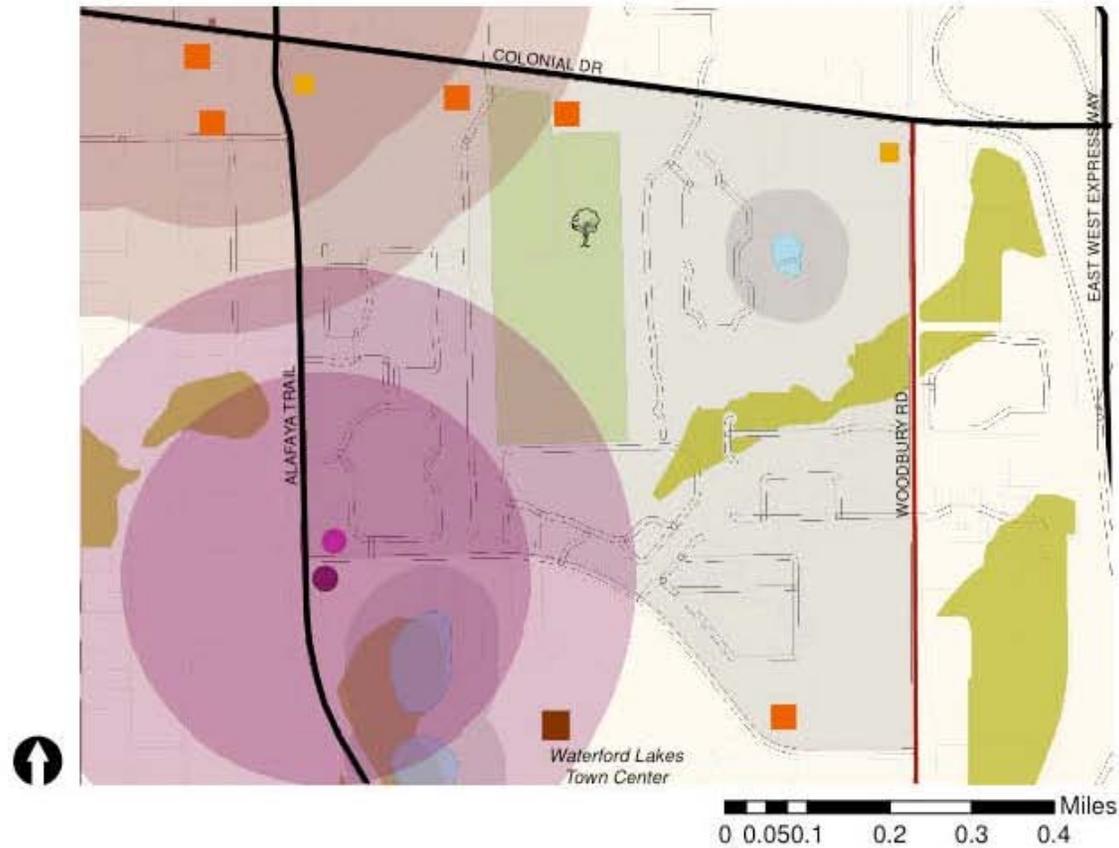


Figure 4-10. Sector map at the community scale. The park and existing natural features can be used to enhance connectivity throughout the site while becoming a shared amenity for the residents of the community.

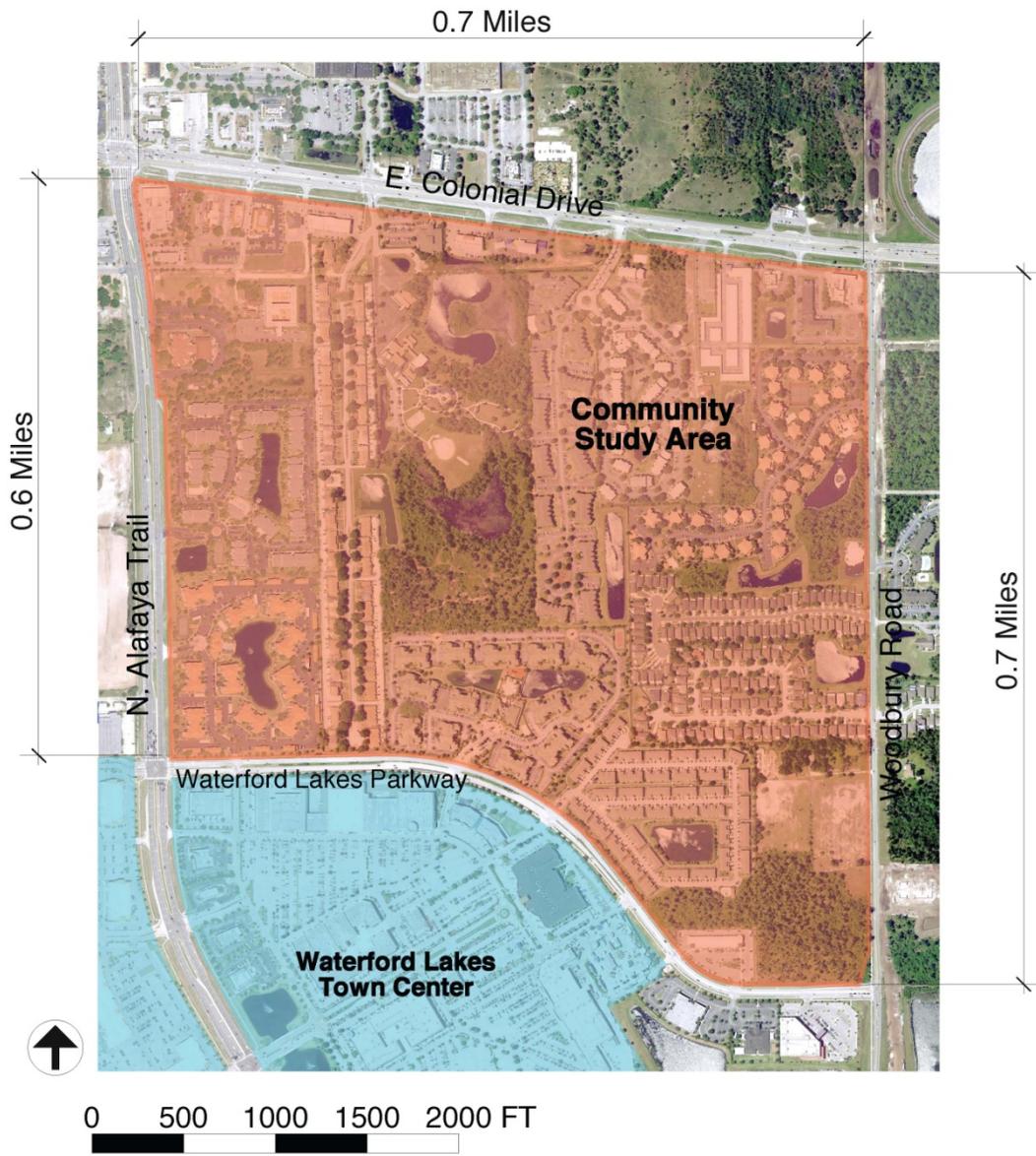


Figure 4-11. Community study area.



A



B

Figure 4-12. Deficiencies of a multifamily subdivision: Single building use and type. A) The similar buildings can be identified with their respective apartment complex. B) The majority of the building uses within the community study area are residential.



Figure 4-13. Deficiencies of a multifamily subdivision: Lack of walkable block structure. A) The contained pods of a sprawling multifamily development are evident in the existing figure ground. B) Missed opportunities for connectivity are indicated by orange circles.



A



B

Figure 4-14. Deficiencies of a multifamily subdivision: Lack of walkable block structure. A) There is available space for vegetation buffers for more comfortable pedestrian movement. B) The community exhibits a hostile walking environment.

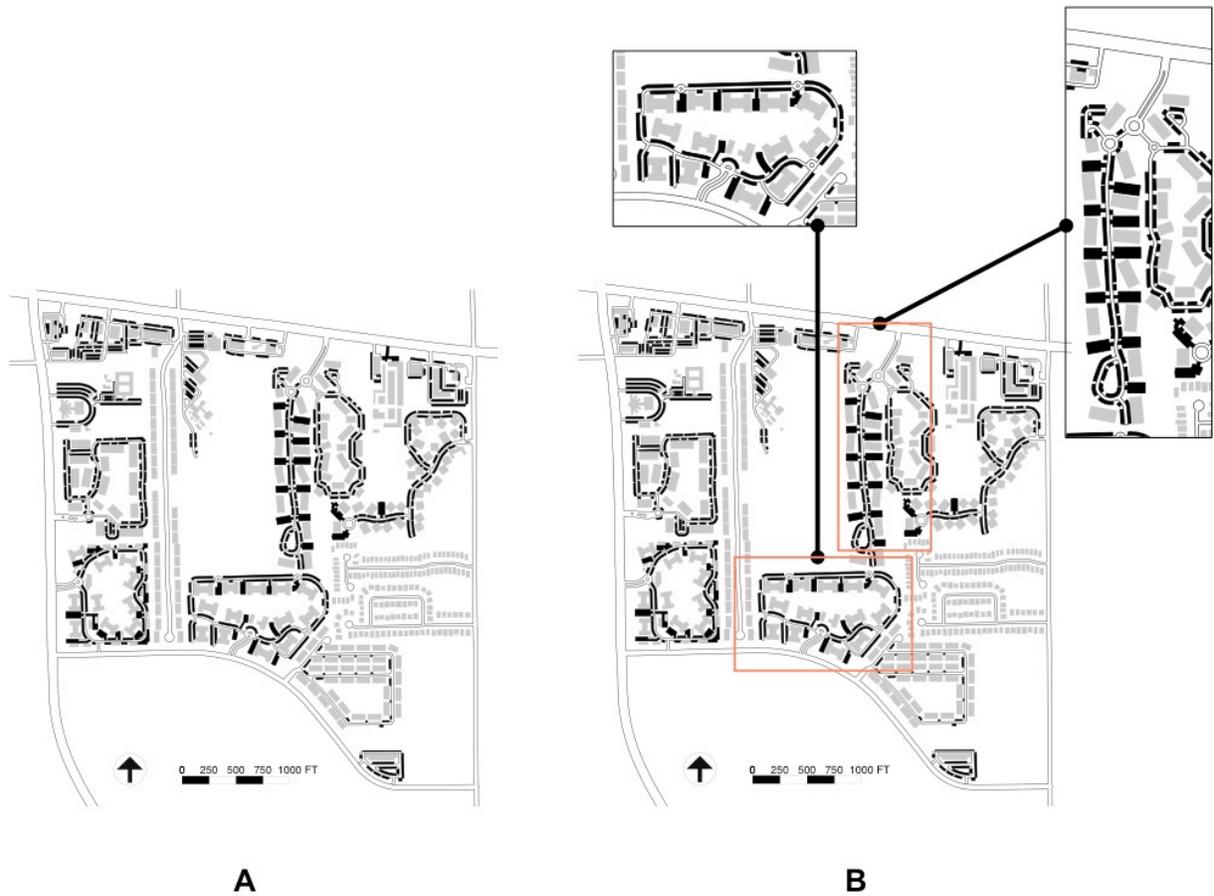


Figure 4-15. Deficiencies of a multifamily subdivision: Dispersed and exposed parking. A) Parking is indicated by black masses. B) A small parking lot is generally present for the residents of individual buildings or sometimes shared with residents of an adjacent building.



Figure 4-16. Dispersed and exposed parking. Some homes do not have a front door, but have a façade dominated by a garage door.



A

B

Figure 4-17. Dispersed and exposed parking. A) Image showing the Orange County Health Department Women and Infants Clinic. B) The Orange County Community Center, while directly adjacent to the health clinic, maintains its own parking lot.

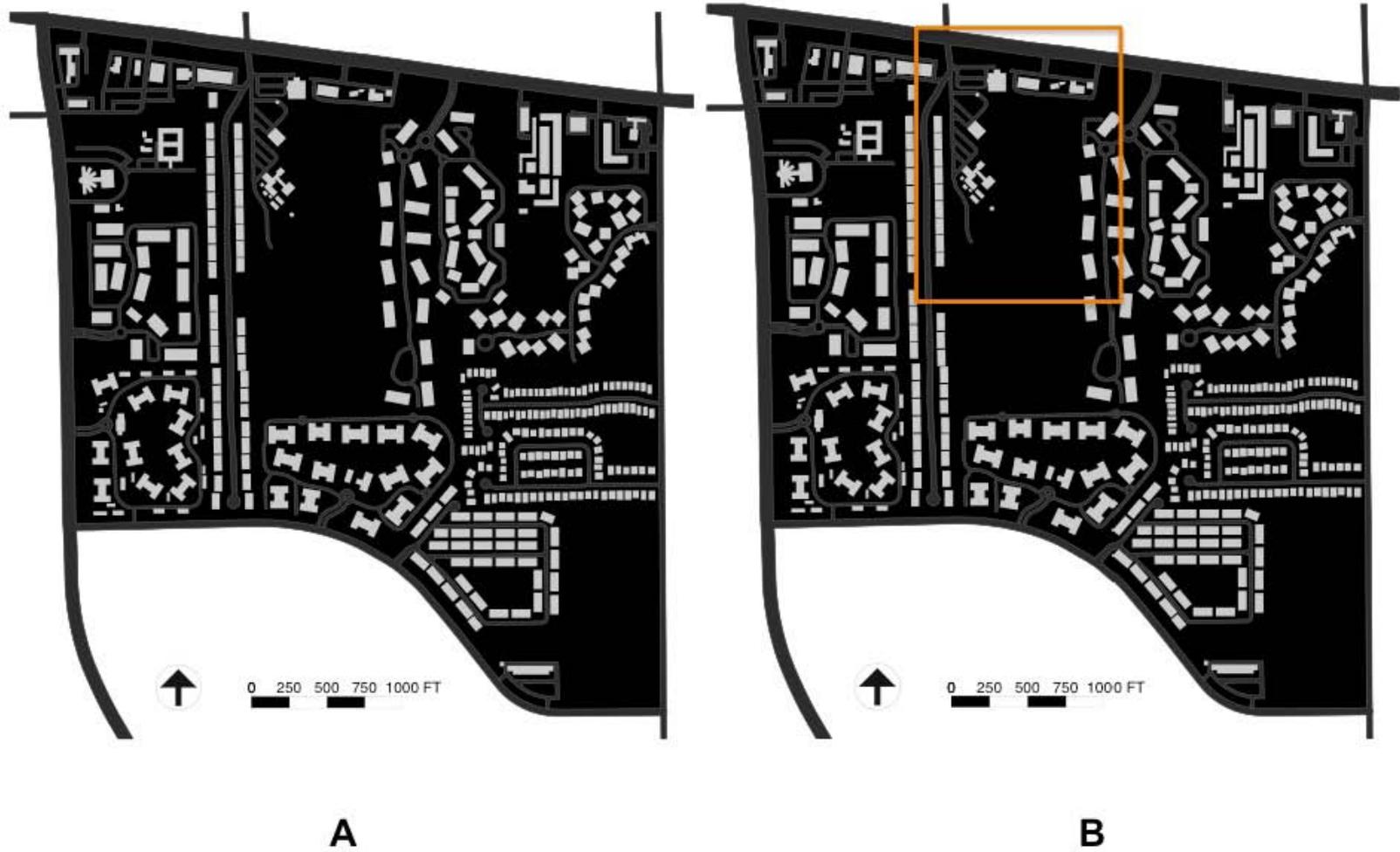


Figure 4-18. Deficiencies of a multifamily subdivision: Residual open space. A) Open space is indicated by the black mass. B) The orange rectangle indicates a hidden park – East Orange Neighborhood Park.



Figure 4-19. Residual open space: Underutilized Neighborhood Park. Image shows the entry to the East Orange Neighborhood Park.



A



B



C



D

Figure 4-20. East Orange Neighborhood Park. A) Playground. B) Basketball courts. C) Walking Trail. D) Picnic Shelters.



A



Indicates new structures

B

Figure 4-21. Intervention: Figure ground. A) Figure Ground before intervention. B) Figure Ground after intervention. New building types and mixed uses were introduced into the residual open space within the community study area.



A

B

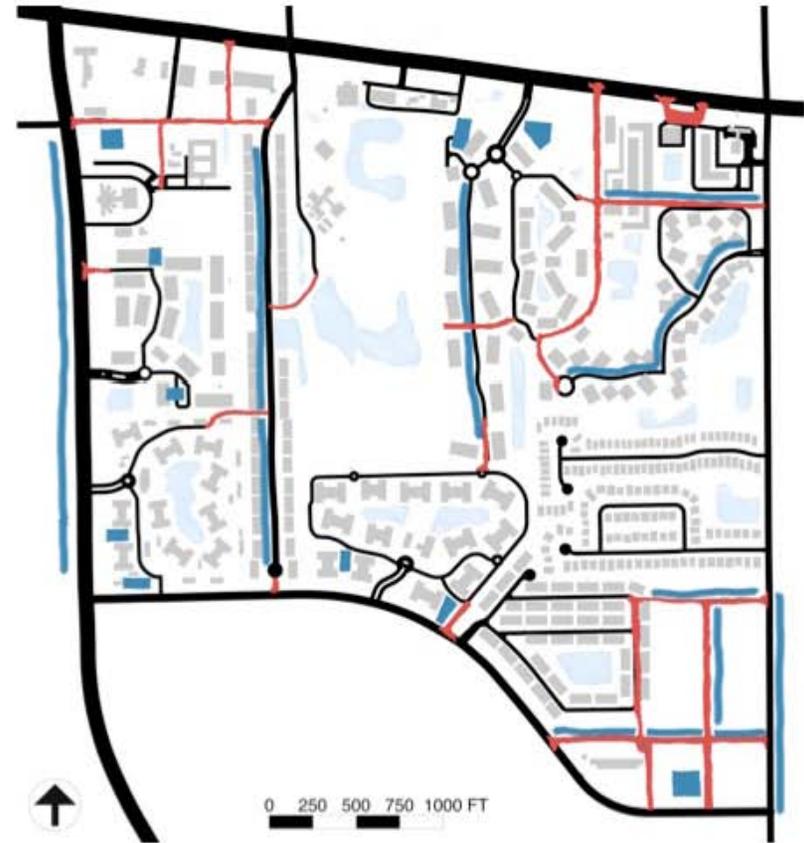
Figure 4-22. Intervention for a multifamily subdivision: Introduce new building types and mixed uses. A) Building uses before intervention. B) Building uses after intervention. Dashed lines indicate structures that remain unchanged.



Figure 4-23. Intervention for a multifamily subdivision: Connect and repair thoroughfares. A) Gaps in the community's street network exist. B) Road connections were made at the least invasive locations, and a trail system was developed throughout the entire site to foster bicycle and pedestrian movement



A



B

Figure 4-24. Intervention for a multifamily subdivision: Rationalize parking. A) A small parking lot is generally present for the residents of individual apartment buildings or sometimes shared with residents of an adjacent building. B) Street parking throughout the site and parking structures within multifamily residential developments are introduced.



A



B

Figure 4-25. Intervention for a multifamily subdivision: Define open and civic spaces. A) Residual open spaces are shown prior to intervention. B) Existing park is enhanced and access to the park is increased with the trail system.



Figure 4-26. Intervention for a multifamily subdivision: Integrate local food production. Space for community gardens are reserved throughout the community study area and concentrated at the currently undeveloped parcel at the southeastern corner of the site.



Figure 4-27. Synthesis. Connectivity is prioritized. Street parking and parking structures are proposed. Residual open space is used as opportunities for densification. The existing park is enhanced and access to the park is increased with the implementation of a trail system.



A

B

Figure 4-28. Repair at the block scale. A) Focus areas include a public space at the library that creates an entry to the park and a pedestrian promenade linking the park, and therefore the rest of the site, with the Waterford Lakes Town Center. B) Concept sketch for public space at the library entry.



Figure 4-29. Drive-through at the Orange County Public Library.



Figure 4-30. Public space at library.

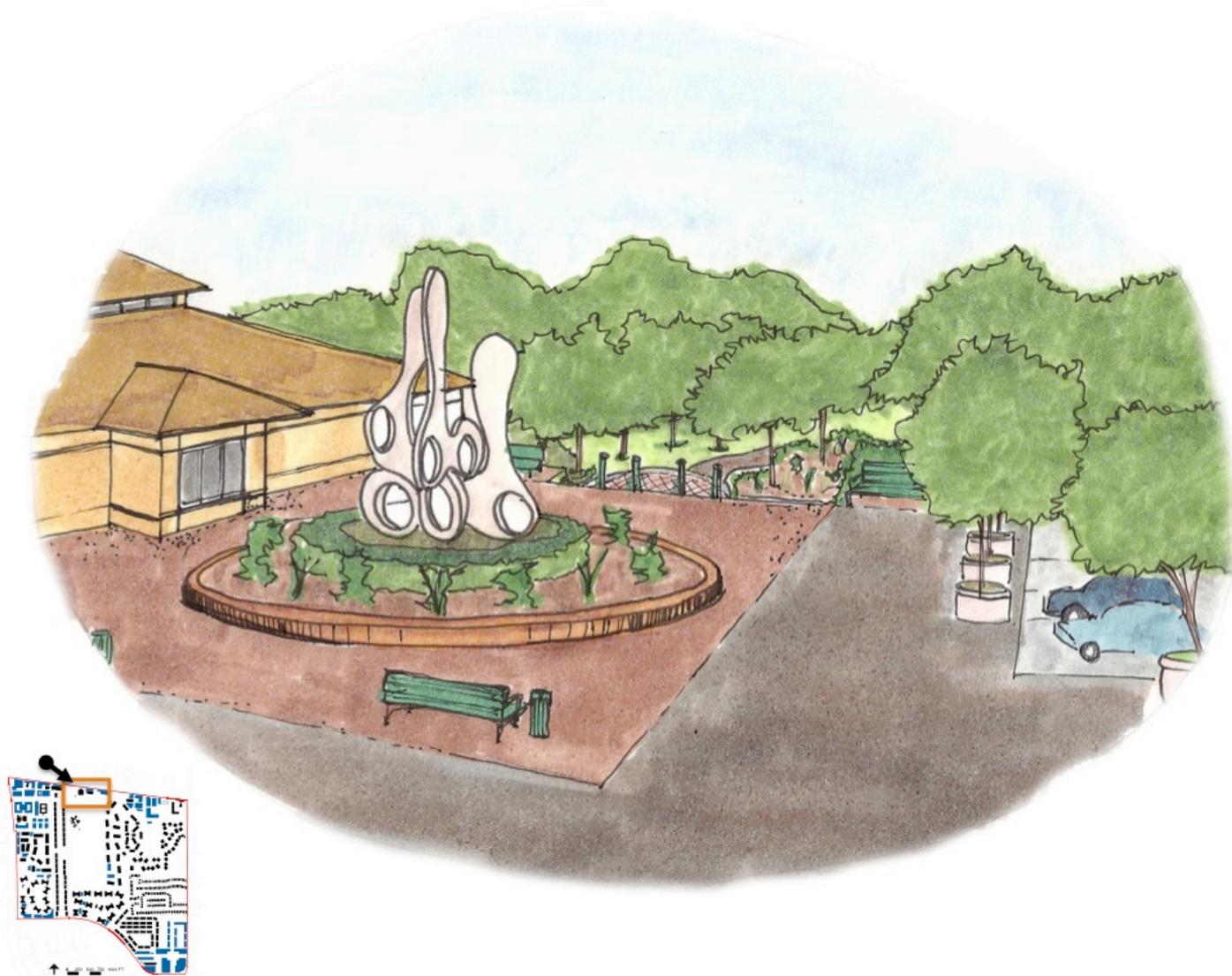


Figure 4-31. Public space at library: Detail view.



Figure 4-32. Pedestrian promenade. Pedestrian circulation linking park space with commercial center.



Figure 4-33. Southeast corner of study area.

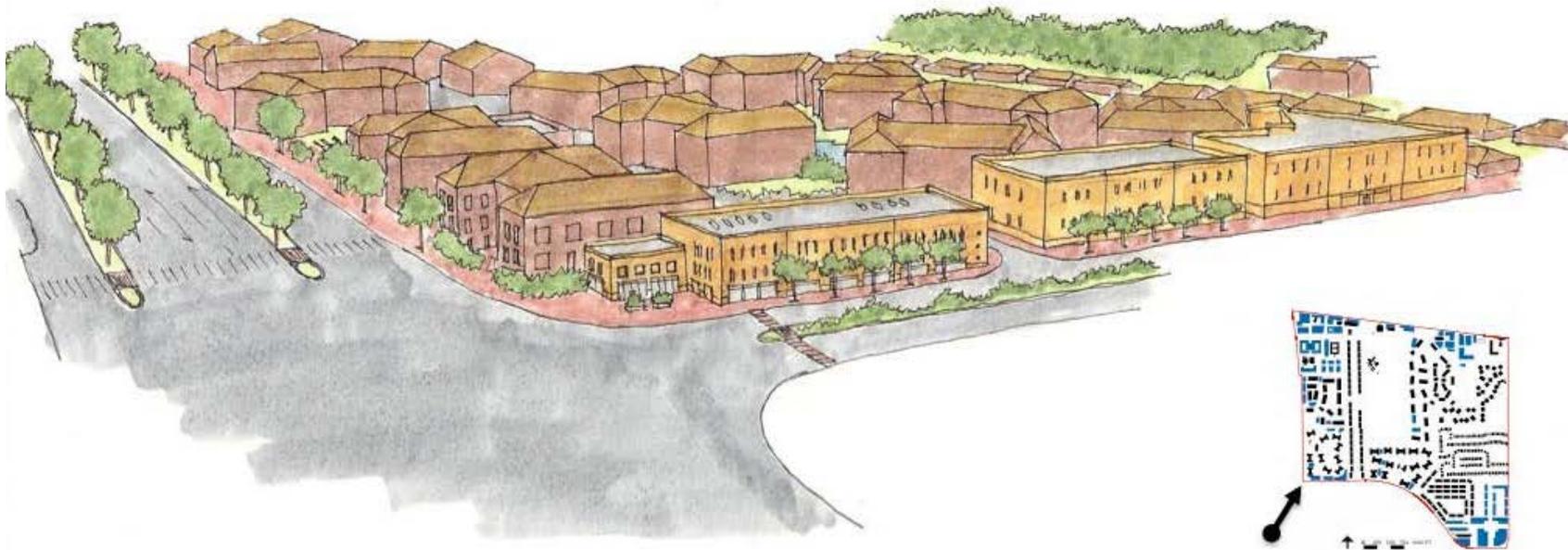


Figure 4-34. Southwest corner of study area.

CHAPTER 5 DISCUSSION

The *Sprawl Repair Manual* (2010) attempts the monumental task of creating a document to guide one of the most pervasive development morphologies in the United States. Beginning with an overall analysis of the method, this section will deal with issues relating to the actual application of Tachieva's method (2010). Obstacles to implementation will relate the method to windows of opportunity identified by the intersection of Down's (2005) research in the likelihood of Smart Growth initiatives and Nelson and Lang's (2009) investigation into emerging trends in national planning efforts. Finally, form-based codes and their potential as a tool for implementation will conclude the discussion.

Analysis of Quantitative Measures of Urban Form

The major strength of the community-level analysis used to measure urban form detailed in *Measuring Patterns of Urban Development: New Intelligence for the War on Sprawl* (2007) is that they are a combination of variables that evaluate sprawl at a scale which may be more reflective of a scale at which retrofitting would occur. Unfortunately, this method is focused on the single-family residential neighborhoods, while sprawl can exist in many different forms as indicated by the *Sprawl Repair Manual* (2010). Because only seven variables are included in the analysis method, it is within the capabilities of a municipality with a geographic information systems (GIS) technician to perform. The ease of performing the measurements give this method a great advantage in its applicability, but the individual variables would be improved if some complexity were added in order to take into account the variants of the sprawl morphology and potential solutions.

A higher ratio measured in the analysis shows greater internal connectivity within a community. While this variable showed improvement, this measure is based on the formal road system. Ideally, an accurate representation of the connectivity of a place could be drawn from the traditional street system, but internal connectivity can be provided in alternate ways. This is especially true for a retrofitting situation. A single-family residence might exist on a parcel that would be ideal to remove for a road connection, but depending on the ownership situation of the parcel, taking this approach is risky for a municipality. The intervention developed in this thesis chose a trail system to provide for alternate modes of transport while increasing connectivity. Another alternate method may include pedestrian streets, squares, or public plazas. This measure does not take into account the existence of these elements. The external connectivity variable measured access to different neighborhoods. Where a larger distance to different neighborhoods exists, a poorer external connectivity is evident. Similar to the internal connectivity measure, this variable does not consider alternate means of connection. For both values, the sprawl morphology poses an issue for measurement when dealing with a multifamily residential neighborhood. The circulation of some apartment complexes was counted as roadway. This was usually a paved surface with parking spaces perpendicular to the road along both of its sides. In most cases, these “roads” were behind the gates of the complex and provided circulation to only those with access to the complex. This situation results in ambiguous qualification of routes and will lead to an inaccurate calculation.

Variables measuring land use intensity were the most problematic. A smaller lot size indicated higher and better intensity, and a larger floor space indicated a higher

and better intensity. The individual measures are not descriptive. This part of the analysis assumes that a larger floor space with a smaller lot is better for intensity, but it is the combination of the two that is critical. In the sprawl repair intervention detailed in this thesis, townhomes were added to increase density. Even though these properties are single-family residential, they maintain a lower floor space than the typical single-family residential unit. However, adding a building type with a higher intensity caused the post-design value to decrease indicating a worsening effect, yet the overall density for the community study area increased. If a large number of very large houses on very large lots existed within the study area, the measure for floor space would be very favorable and indicate a higher intensity. Without factoring these two variables together, the results do not accurately convey density.

A higher index number calculated for land use mix indicates a more even distribution of land uses. A higher index indicates less of the separation of uses and minimal building types characteristic of the sprawl morphology. The variable for diversity measured land uses based on parcel quantity alone, and not area of uses. This does not take into account having large parcels with a very small structure. Factoring in the area would consider the intensity of the use and indicate a higher score for a community with a mix of uses that utilized the properties adequately. The variable to measure commercial distance from single-family residential to the nearest commercial use indicates lower accessibility for a greater median distance. These variables exhibit the same weaknesses. The pedestrian commercial variable measures the percentage of single-family residential properties within 0.25 miles of a commercial use. Once again not considering the variations of sprawling development, these variables do not take

into account multi-family residential development and can skew results. Just as the connectivity measures rely on traditional road systems, the commercial distance and pedestrian commercial are calculated using the traditional road system, discounting any improvement in accessibility that can be made with alternatives like the proposed trail system. Also, these measures are based on the distance to any commercial type without assigning any ranking for demand. That would mean that a community with many gas stations and comic book stores in close proximity to single-family residential communities would receive the same rating as a community with ample corner grocery stores and general retail in close proximity to single-family residential uses. While adding a ranking makes calculating more complicated, the result would paint a more descriptive picture of a community's access to commercial uses.

While not a weakness of the method for measurement itself, a lack of ideal values for compact urban form is needed in order for results of any method to be meaningful. Until agreement on exactly how connected, dense, and diverse a sustainable community should be is made, a community measuring for sprawl can only compare to other communities that have been measured or to show improvement. The method created by Knaap et al. would become significantly stronger if accompanied by a set of indicators for the impact street network design, land use intensity, and land use pattern has on the environment. If the method becomes widely used and a collection of measures for different communities is amassed, the best environmental results would justify a particular value for a variable, providing better guidance for rectifying the adverse impact of a sprawling community.

Analysis of Method

Galina Tachieva's *Sprawl Repair Manual* (2010) is one of the more complete documents detailing a design strategy to correct sprawling developments' faulty morphology. Although Tachieva states that the manual is intended for use by citizens as well as "design professionals, developers, regulators, and citizens" (2010, 1), the publication reads as a guide for a municipality and its planning department. Actually implementing this specific sprawl repair method requires analysis that is more rigorous than can be performed by a layperson. The format of the method is step-by-step, yet methods for each of the steps had to be formulated without guidance from the text. Terms and analysis methods require specialized knowledge in order to apply the sprawl repair techniques to a target repair area. For a citizen group, the most advantageous use of Tachieva's sprawl repair method would be as a guide provided to a municipality with an associated appeal to initiate sprawl repair. It would show the municipality exactly what is desired, and the method includes a step-by-step protocol to achieve the desired outcome.

The method responds to multiple scales of development, acknowledging the role of each for sustainable development. A complete regional analysis conducted according to the method is logistically very difficult. This would need to be a countywide effort developed in conjunction with a comprehensive plan. Because of the scale and difficulty of this particular step in the sprawl repair method, a portion of the city was used for simulation in an area that will almost certainly be enduring. Additionally, this step was only possible because GIS data sets for Orange County of most of the features necessary for the Sector Map were existing and easily accessible. This benefit is largely due to the fact that the state of Florida has GIS data for all of its counties. The

availability and use of this software is something to which mainly professionals have access. Geographic information systems or any other tool is not identified as a route for the analysis of a sprawl repair target. Even if one has the tool, a complete analysis is not something that can be accomplished without a specialized GIS technician. If a municipality needed to compile the information and create the necessary data sets, a regional analysis would be labor-intensive and expensive.

Sprawl repair at the community level is one of the strengths of Tachieva's Sprawl repair method, and may be the best use for this method. The community scale is smaller in scope, and therefore, more realistic for actual results. Citizen groups and homeowners' associations (HOA) usually operate at scale, so mobilizing support from these channels may be easier to accomplish. The Sprawl repair method can be used in conjunction with a community charrette process, which has to be conducted with smaller groups.

Redesign at the block level in this scheme requires obtaining easements on multiple properties with different property owners. The challenges of eminent domain are detailed in the next section as a trend is occurring for changes relating to the compensation of owners. A complicated issue, a municipality would need to take this into account for a sprawl repair project.

Overall, the method lacks values to justify the recommended interventions. Deficiencies are only judged through a visual assessment of positive and negative space using a figure-ground graphic. Percentages for the voids and masses are not provided for existing conditions or proposed intervention. A goal in the form of the common measure for density – dwelling units per acre – is not indicated for an

intervention. If the goal of the manual is for a sustainable community, no environmental indicators are presented to support that the solutions are indeed sustainable. The manual is more of an idea book, providing attractive solutions without showing that the results will actually achieve a goal.

Throughout the simulation of applying the design solutions, designing required striking a balance between some of the manual's heavy-handed recommendations and less invasive solutions that may be more realistic to implement. The methods presented in the *Sprawl Repair Manual* (2010) for retrofitting at each scale called for the complete removal of buildings to introduce new uses, to make road connections, and to create civic spaces. While the simulated intervention of this thesis did call for connecting roadways and removing or relocating some buildings, effort was made to respond to the existing conditions and alter them only to facilitate functionality. The *Sprawl Repair Manual* (2010) made repair of existing conditions into a complete redesign. If sprawl really is to be repaired, actual solutions must respond to actual conditions.

Implementation: Overcoming Obstacles

The focus of this research is an urban design response to the deficiencies of sprawl morphology. Revision of the spatial features that are responsible for the unsustainable development pattern is vital to sprawl repair, but efforts to reform sprawl and manage growth have faced much adversity. In order to solve a problem, then the obstacles to said problem must be assessed. Downs (2005) outlines why smart growth has not been successful, while Nelson and Lang (2009) present areas of common ground that are developing between state government, local government, and citizens. Combining their ideas and utilizing existing development methods (form-based codes,

land banking, etc.) may provide a path out of the unsustainable cul-de-sacs and winding streets of suburbia.

Downs (2005, 368) discusses pressure for Smart Growth policy originating with non-government environmentalists, urban planners and other local officials, and innovative private real estate developers but not “plain citizens.” One difficulty of retrofitting suburbia is that a potential redesign would require the buy-in of multiple “plain citizens” or homeowners. The persuasion of local citizens, according to Downs (2005, 369), “is a critical aspect of getting Smart Growth policies actually put into practice.” He investigates the likelihood of Smart Growth measures’ implementation by identifying eight obstacles to implementing Smart Growth policy and evaluating each obstacle on nine of the most common Smart Growth principles. His study concludes with an evaluation of the degree of difficulty of implementation based on the strength of opposition and support among various stakeholders, classifying each policy as *very unlikely*, *unlikely*, *somewhat likely*, *likely*, *very likely*, and *unclear*. The most favorable policies, classified as *very likely* to be implemented, are “loading public costs of new development onto residents of growth areas” and “adopting more diverse regulations on aesthetics, street layouts” (2005, 375). Additionally, providing for more mixed land uses and pedestrian-friendly environment is *likely*. Those deemed *somewhat likely* are emphasizing public transit to reduce the use of private vehicles and revitalizing older existing neighborhoods (2005, 375). These are the policies that should be given the most attention for future sustainable development (Downs 2005).

A publication by the Urban Land Institute, *The New Politics of Planning: How states and Local Governments Are Coming to Common Ground on Reshaping*

America's Built Environment, shows areas of opportunities for policy and implementation of land use controls (Nelson and Lang 2009). The areas Nelson and Lang have identified are transforming planning efforts and can be channels for suburban redesign. Topping a planner's wish list, willingness to raise taxes for smart growth initiatives is increasing among voters. Exemplifying what Nelson and Lang (2009, 9) term "a new dialogue," governments' have been acknowledging and responding to the American relationship with property rights through "increasing protections for private property rights" (19). The rise of private nonprofit land trusts and public land acquisition programs that restrict land development provides an opportunity for more effective sustainability planning. Finally, an increase of special districts and private governance may provide a back door to retrofitting suburban development. These trends that may be worth expanding upon for revising sprawling development will be discussed.

Voter Willingness to Raise Taxes for Smart Growth Policies

Evidence of "voter willingness to raise taxes," especially for transit and land preservation, shows that awareness of Smart Growth policy benefits – although maybe indirectly - is growing and receptivity to sustainable goals may be increasing (Nelson and Lang 2009, 18). Additionally, Downs (2005, 375) identifies the likelihood of implementation of "emphasizing public transit to reduce the use of private vehicles" as *somewhat likely*. Therefore, it is important to nurture this trend. The key may lie in public participation. Because of this gap in support for Smart Growth policy, advocates must appeal to the electorate that control policy-making through ballot initiatives or selecting representation. Form-based codes present a vehicle for public involvement, while addressing the spatial features that contribute to sprawl. Developing a FBC can become

a community project where residents are faced with development issues and are educated as to how development strategies may or may not be beneficial. While Smart Growth and land development regulations are not anti-growth, all development is not equal. This is where planners' expertise is required. A layperson may know that their community is lacking, but they may not know why. A planner leading the code-revision effort is an expert that can help guide citizens towards goals that improve their community socially and environmentally.

The visioning process of form-based code development is a process that creates a "vision" or "desired outcome" that will become the objective of a form-based code (Parolek et al. 2008, 144). This aspect of the form-based code formulation process will aid a community by initiating the creation of or rediscovering its collective identity through what Ben-Joseph (2005) describes as "place-based norms." Because these "norms may be dormant," communities can access place-based norms of the countries of prominent cultures within their community demographics to create a hybrid of the typical Americana with these "place-based norms" of other places (Talen 2009, 157). One of the strengths of Tachieva's sprawl repair method (2010) is its accessibility. The manual includes many simple, descriptive graphics. One can clearly understand the existing conditions and see the repair. There is an abundance of very interesting and even innovative strategies for addressing the variants of sprawl, and can be used to guide the redesign process. While it may lack the rigorous procedure needed by a professional to actually implement the repair, a layperson can see the ills and potential of their own corner of sprawl. The Smart Growth Policy of "revitalizing older existing neighborhoods" is considered by Downs to be *somewhat likely* to be implemented, and

FBCs can be used as an exercise in developing or re-establishing “place-based norms” in communities that are in the process of retrofitting (2005, 375).

Excuse me? Your Eminent Domain is Showing...

It is imperative that efforts to reform sprawling communities acknowledge and respond to the American relationship with property rights. Nelson and Lang’s research shows that there is “broad support” for “eminent domain restriction ballot measures” (2009, 23). They discuss the example of Oregon’s Measure 37 that “allows people whose land would have been eligible for development before land use restrictions were imposed to be compensated for the alleged lost value of the land or to have current regulations waived in favor of prior legislations” (2009, 19-20). As discussed in the literature review of factors that have enabled suburban development, the Jeffersonian view of the country life as virtuous is deeply ingrained in the collective American mentality and owning a single-family residence on an individual parcel is still a prized manifestation of the “American Dream” (Hardinghaus 2008). Where the *Sprawl Repair Manual* (2010) falls short is providing actual values for the impact of the interventions. The more invasive recommendations in the manual, like removing buildings to make road connections made, have little hope in being approved by the general public without some measure of their benefits. This could be in the form of environmental indicators or benchmarks for density, parking, or percentage of land devoted to urban agriculture. By acknowledging private property issues and generating a solid case for intervention, sustainable land development policies may encounter less opposition than in the past.

The Rise of Private Nonprofit Land Trusts and Public Land Acquisition Programs

The rise of private nonprofit land trusts and public land acquisition programs that restrict land development is described as a “revolution” in land use management by

Nelson and Lang. Wheeler (2004, 77) indicates, “environmental restoration efforts, under which urban areas might be dramatically greened and large areas of land or ecosystems outside cities might be restored to something approximating an undisturbed state, are still in their infancy.” Land banking may provide an opportunity for environmental restoration areas (Wheeler 2004, 77). If partnerships can exist between the private nonprofit land trusts and the municipalities that maintain a stock of land at the urban fringe, these the land trusts and land banks can be used in combination for watershed protection and wildlife corridors. They will help to preserve the natural systems necessary for a healthy ecosystem. According to Snep and Opdam, “[b]iodiversity and related ecosystem functioning is limited by the impact of fragmentation effects,” and an effective strategy would require linkages in a network (Snep & Opdam 2010: 272-3). They posit, “[a]n irregular shape with green wedges intruding into the urban zone ensures a better connectivity between rural and urban ecosystem sites” and legitimize ecology as part of the urban environment (272-3). Creating linkages to these land preserves from urban parks has the potential to provide a human amenity while supporting the health of natural cycles.

While Downs’ research indicates “limiting outward extension of new developments” as *very unlikely* to occur, the benefits of this “revolution” in land acquisition may be able to contain development the same way an urban growth boundary (UGB) can (Nelson and Lang 2009). If conservation areas are strategically selected to be on the fringe of development, these pieces of land can act as an urban growth boundary containing development to already urbanized areas. Even though broad support for urban containment policy may not exist currently, the emergence of

land trusts and land banks could be used to help limit expansion. However, this may only work temporarily, causing leapfrog development further from the urban core.

Another Smart Growth policy of “loading public costs of new development onto residents of growth areas,” which Downs (2005, 368) has determined as *very likely*, may be beneficial to limiting sprawl development if it is implemented in tandem with a green belt program.

The development of land banks can be facilitated with the method in the *Sprawl Repair Manual* (2010). Tachieva acknowledges the ecological function of natural space by dedicating an entire step of the regional analysis protocol to “Preservation and Reservation Areas.” The intent of this step is positive, but beyond identifying known sensitive areas, the method falls short. For example, a specific buffer width around hydrological features could be proposed. This buffer would need to be presented along with data that scientifically proves that this would improve watershed restoration, diminish habitat fragmentation, and the like. As the manual is currently written, it is a designer’s idea book. A more comprehensive, and therefore applicable, manual would compile the research on why proposed strategies are ecologically beneficial along with the design intervention.

Special Districts and Private Governance as a Means to Transition to a Regional Structure

Successful sustainable development requires regional oversight (Wheeler 2004; Downs 2005; Ben-Zadok 2006; Knaap et al. 2007; Tachieva 2010) Special districts and private governance have become more widely used and can be used to the advantage of Smart Growth. This strategy utilizes existing mechanisms – local government and burgeoning private government - to move towards a regional structure. Sustainable

development maintains natural systems while still meeting the needs for human development (Wheeler 2004). In order to respond to the needs of both human and ecological systems, urban planning problems require dealing with issues at a large scale. A policy's reach may extend only to a municipal boundary, and this boundary may exist in a place that truncates a natural system. Because natural systems exhibit connectedness to other natural systems within their cycles, intervention that extends beyond these boundaries – the regional scale - is required. This will enable progress in transit and ecosystem management that will respond to the automobile dependency and lack of nodes that characterizes suburban development.

The Model Pedestrian Overlay District (POD) ordinance outlined by the American Planning Association's *Smart Codes: Model Land-Development Regulations* includes policy that "prohibits setbacks of principal buildings, contains standards for the inset of entrances in order to protect pedestrian movement, requires that ground floors of buildings are chiefly transparent and do not present blank walls, and mandates that the ground floors of parking garages contain commercial or service uses" encouraging pedestrian transit (APA 2009, 127). There may be future success in such efforts like overlay districts according to the likelihood of implementing policy that "[provides] for more mixed land uses and pedestrian-friendly environments" (Downs 2005, 375). In addition to promoting non-automobile transportation, a denser urban structure would result within the district and contribute to the formation of nodes. The elements recommended in the model ordinance transform streets into a public room, addressing the lack of acknowledgement of the public realm typical of suburban morphology.

There is potential for a suburban retrofit overlay district. The Sprawl repair method allows for the piecemeal approach of sprawl repair. Following the identification of sprawl repair targets in the regional analysis, these districts can become sprawl repair overlay districts. Because of potential issues dealing with multiple property owners, transfer of development rights (TDR) strategies play a prominent role in Tachieva's method.

Private governance occurs in forms such as homeowners associations (HOA) and business improvement districts (BID). Evidence exists that private governance is on the rise (Nelson and Lang 2009). These "governments" are beginning to replace initial functions performed by local municipal government such as managing neighborhood change and paying for additional infrastructure (Nelson and Lang 2009). As "[m]unicipalities are ... freer to work on big issues, such as long-range planning and economic development," this change may neuter local government in certain areas, providing an opportunity to restructure favoring a regional organization (Nelson and Lang 2009, 33). The need for regional planning may develop with this increase of private governance.

Various authors have emphasized the necessity of regional oversight for sustainable development. In Ben-Zadok's analysis of compact development policies amended to Florida's Growth Management Act, his criticism is that regional planning councils are "the weak link in the intergovernmental process" and that "[r]egional agencies are crucial for physical-spatial planning and coordination of anti-sprawl policies among communities in the same region" (2006, 75). Wheeler (2004, 141) also emphasizes the importance of regional agencies through the functions of "bringing local governments together, facilitating consensus on better growth directions, providing

incentive funding for local governments to implement regional growth goals, and potentially withholding funding from local governments who refuse to take regional needs into account.” Regional planning is paramount for truly effective sustainable development through the regulation of natural systems and infrastructure.

Regional governing can provide oversight for the large land trusts that are emerging as discussed in the previous section (Wheeler 2004, 141). When considering natural systems like watersheds, the spatial dimensions of these areas “may or may not overlap with urban areas” (Wheeler 2004, 135). Additionally, bioregions, “distinctive plant and animal communities that form a typical natural mosaic of ecosystems,” are important for maintaining biodiversity (Wheeler 2004, 136). These systems extend beyond political boundaries. Development must be framed within a regional context in order to be sustainable (natural systems, nodal structure, transit, city/municipality hierarchy). Without a regional system that facilitates coordination of local governments planning initiatives, Smart Growth policies will not succeed in repairing the systems that human development now threatens. While the logistics of this sort of shift are beyond the scope of this research, it cannot be stressed enough that sustainable development depends on some level of regional oversight.

Form-Based Codes: A Tool for Implementation

Following the comodification of real estate in the late 1980s, typologies of buildings were defined for their investment potential. Some product types included are: Big Box Anchored Power Center, Grocery Anchored Neighborhood Center, Lifestyle Center, Self-Storage, Budget Motel, Entry Level Housing, Move-Up Housing, Luxury Housing, Resort/Second home, Garden Apartments, Urban Apartments, Medical Office, Multi-Tenant Office, etc. (Leinberger 2005, 27). These typologies were easier to obtain

financing for, and therefore, were constructed more often (Leinberger 2005). On top of the existing standards of disconnected roads developed in the 1940s, these typologies have exacerbated the unsustainable characteristics of development by being “modular” and “stand-alone developments with self-contained parking” (Leinberger 2005, 25, 27). Changing the norm for development has been so challenging because of these 19 Standard Real Estate Types. Because of the ease of financing a project with an approved type, these “products” have persisted in the United States and are being replicated in foreign countries (Leinberger 2005). These forms of building/development were not built because they were necessarily the best form the project should take, but because there was data on these types that these were proven investments.

The core of the funding structure for building development is flawed. Tweaking this element may help to remedy the situation while maintaining the framework of the existing system. The form-based code (FBC) may provide a tool for affecting change with these 19 – largely unsustainable – building types. If a trained planner leads the development of a form-based code, this professional has the ethical responsibility to advocate for sustainable development while still enabling the creation of a form-based code that responds to the social and cultural context of a municipality (American Institute of Certified Planners 2005). A form-based code requires public participation, and is an innovative method that has the potential to originate from a community workshop or charette. This synergy between the planner trained in sustainable development (which is the norm in current planning education) and local citizens advocating the interests of private property and the social interests of their community may provide momentum for more walkable, mixed-use development.

Judged as *very likely* by Downs (2005, 375), “adopting more diverse regulations on aesthetics, street layouts, and design” may lead to using form-based codes in special districts. Described by Dunham-Jones and Williams (2009, 193) as “an innovative regulatory method,” a form-based code created for the redevelopment of Downtown Kendall / Dadeland of Miami-Dade County, Florida, used one type of regulating plan that “locates new ‘streets’ of varied types” (196). The planners developed “the tool of street types to require larger parcels to be ‘broken up’ into smaller blocks by through-ways – some pedestrian, some for vehicle traffic as well – in locations that were roughly designated in the plan” (Dunham-Jones and Williamson 2009, 196). While a complete overhaul of the transportation system is not plausible, special districts focusing on transportation may transform pieces of a larger transportation plan incrementally as was seen with the rapid redevelopment of Downtown Kendall/Dadeland (Dunham-Jones and Williamson 2009). The Sprawl repair method (Tachieva 2010) clarifies the puzzle of sprawl with typologies of the various forms of the morphology. Because of this, the method lends itself to the form-based code format by providing a clear counterpoint to desirable development.

As with the typical process of policy, as more municipalities elect to devise their own form-based codes, they model theirs based on the precedents of other communities. There is evidence on the similarity among the states’ growth strategies according to Nelson and Lang (2009). Ultimately, a lot of the same goals are addressed and the codes will become increasingly similar (Nelson and Lang 2009). This self-reinforcing pattern is a back door to redefining the standard real estate type. As more of the standardization becomes apparent in the various FBCs, the market will have to

respond. While changing the entire way real estate is financed and developed is unrealistic, simply redefining these types can be a catalyst for incremental sustainable development.

Summary

Filion's (2010, 11) study investigating structural obstruction to new urban form showed that "the deteriorating fiscal climate compromised the possibility of creating new infrastructure systems compatible with alternative forms of development." This has implications for planning today, especially considering today's volatile global economy. It is important that policy-makers understand that growth management is not anti-growth. As demand for more sustainable characteristics increases, changes to existing policy and land use patterns may prove to be of economic benefit. Now may be an advantageous time to develop policies and tools that will encourage future sustainable development that is primed and ready to be implemented when (*not if*) recovery occurs.

Due to the lack of an objectively identifiable sustainable development model, planning is far from a true ecological solution to the ills of current development patterns. However, in an effort to succeed at remedying sprawl, the *Sprawl Repair Manual* (2010) initiates the journey with a detailed protocol that can be executed for the redesign of more sustainable communities. The Sprawl repair method in combination with implementing form-based codes may provide a back door to achieving sustainable development. In light of the windows of opportunities presented by Nelson, Lang, and Downs, there is hope with form-based codes as a tool for progress. While single-use zoning is problematic, a form-based code can operate within the existing framework given authority in the *Village of Euclid v. Ambler Realty Co.*. As form-based codes become more commonly used - a study in 2010 found 323 form-based codes either

adopted or in development in the United States and Canada (Berg 2010) - the typologies defined within them have the potential to reform the existing outdated 19 standard real estate product types (Berg 2010). While these tools are not quickly administered with black and white solutions, they are able to produce more socially- and environmentally-responsive development.

CHAPTER 6 CONCLUSION

Until a sustainable community is defined and a comprehensive, yet easily applicable, method for measuring urban form is formulated, a solution to correcting the damage sprawl has inflicted on the Earth's population and its habitat is far away. While a very difficult concept to operationalize, research on sprawl and how to repair it is growing and it is important that this research continues to expand.

Opportunities for Future Research

While this study only deals with the analysis of the detrimental spatial features, environmental analysis of suburban retrofits and sprawl repair is an opportunity for further exploration. Understanding the changes to actual ecological indicators that can take place because of sprawl repair would substantially strengthen the argument for retrofitting sprawl. As more suburban retrofits are executed, the same analysis method by Knaap et al. can be used on multiple communities. As the number of places with this measure increases, a comparison might be possible with the objective of identifying an ideal "sustainable" community.

Sowell (2009) has described one of the contributing factors to the housing bust of 2007 was a misconception about the availability of affordable housing. The solution at that time was government intervention focused on making ownership more feasible for lower income citizens. Because this issue actually existed in select communities with severe land use restrictions, widespread, national policies were not necessary to address the issue (Sowell 2009). It is evident that addressing any lack of affordable housing solely with the single-family residential type is not realistic or sustainable. The American Dream has perpetuated the belief that success is linked to homeownership.

Just as there is not only one type of family, there is not only one type of housing that is appropriate for every individual or family. Renting an apartment or townhome may be a more ideal solution, depending on need. Homeownership is not the single solution to affordable housing. Investigation into the relationship between growth management and affordable housing may lend strength to sustainable development efforts, while actually addressing the results that impact the cost and availability of affordable housing in a more comprehensive way.

The changes resulting from the retrofit within the community study area will increase the overall population of the area. Tachieva does not refer to this change or a change in demand of public services such as school enrollment due to a population increase. A complete population profile of the study area would be necessary to determine enrollment projections, and the projected values would need to be calculated with Orange County's student generator index for both single-family and multifamily residences. While beyond the scope of this research, it is important to acknowledge that a change in the design of this community will alter the demand for existing services.

A major difficulty of retrofitting suburbia is the complexities of involving homeowners. Downs (2005) points out that this is critical for Smart Growth and a potential redesign would require the buy-in of multiple "plain citizens" or homeowners. He has found that Smart Growth is the objective of non-government environmentalists, urban planners and other local officials, and innovative private real estate developers – not "plain citizens" (368). While there is objection to regulation of private property, many Americans willfully purchase homes in communities with HOAs and their associated guidelines (Nelson and Lang 2009). Exploring why this is preferable and where there

are opportunities for working with HOAs for more sustainable communities is a line of research that needs expanding.

The standardization of building types for the commodification of real estate is reminiscent of building typologies in form-based codes, which leads one to wonder if focusing on different, more sustainable building typologies within form-based codes will encourage more environmentally responsible development in the private sector. Research of how possible this might be and how it can actually be done could indicate another “back door” to sustainable development. Additionally, sprawl repair efforts would benefit from research into the development of a specifically “suburban retrofit” form-based code.

The Kumbaya Approach

While the research of this thesis is a design-oriented approach to sprawl repair, any realistic application of retrofitting requires policies, programs, etc. for successful implementation. Wheeler (2003) analyzed the evolution of urban form in Portland and Toronto and came to the conclusion that “if it ever comes about, [sustainable urban form] is most likely to appear through the synergy of urban social movements and public sector planning” (334). Any enduring repair effort is going to need the support of non-profits, governmental bodies, and citizen-interest groups for implementation. Repairing a pattern of development as persistent as suburban sprawl will have to be an active effort placing equal emphasis on redesigning a deficient morphology and the social mechanisms that will put the redesign into effect. It is a complicated task – to change our world – but it is a task that benefits our species’ continuation.

Concluding Thought: Growing Awareness

There are signs that awareness of the environmental ramifications of development is growing among the general public. Wheeler (2004) points out that although the modern environmental movement initiated only 50 years ago, movements that formed in the 90s like New Urbanism, Smart Growth, and livable communities show that awareness in sustainability is indeed growing. A study produced for the Urban Land Institute has investigated what is called “new dialogue” about land use between state and local government (Nelson and Lang 2009). This has found that voter willingness to raise taxes for a variety of transit, open-space, and related smart growth initiatives has increased (Nelson and Lang 2009). Even more encouraging, this same study showed increasing private nonprofit land trusts and public land acquisition programs for preservation or recreation purposes. Generally, market surveys are showing increasing demand for increased neighborhood accessibility, alternative transit, and other smart growth characteristics, and this is projected to increase significantly in the recent future (Litman 2011). Public transit has been implemented in “what once appeared to be the most transit-averse states, such as those in the Mountain West” (Nelson and Lang 2009, 18). Studies have indicated that Baby Boomers, as they age, are downsizing and are showing a preference for smaller homes and new urbanism communities (Nelson 2010). In spite of this, many of the efforts to curb sprawl and address the issues of suburban development have not been effective, but these conditions suggest that support for and actual redesign of suburban development are more possible now than ever before.

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BIOGRAPHICAL SKETCH

Laura Erdely was born in Metairie, Louisiana. A South Louisiana native, she grew up in a Luling suburb 20 miles outside of the city of New Orleans. Laura earned her Bachelor of Arts in Architecture in 2004 from Louisiana Tech University. Her fifth year project was master planning an under-utilized park in Ruston, Louisiana. This concluded with her team designing and building a picnic pavilion as the first step in revitalizing Roberts Park. Following graduation, Rojo Architecture, LLC in Tampa, Florida employed Laura as an intern architect through January 2007. Her projects included commercial, multifamily, and single-family structures. She had the opportunity to develop projects for the historic Ybor City. From 2007 to 2009, Laura worked at Cooper Johnson Smith Architects. Her experience included working on a project for the Ritz-Carlton Hotel Company, LLC in Abaco, Bahamas. The firm was responsible for master planning the 534-acre development and designing the approximately 300 buildings for the project.

Laura attended the University of Florida from 2009 to 2011 to earn her Master of Arts Degree in Urban and Regional Planning. She was honored with the Carl Feiss Urban and Environmental Planning Award in 2010. Laura served as a graduate assistant to Dr. Joseli Macedo and co-authored "From Suburbia to Sustainability: Envisioning the New American City," a paper presented at the Association of Colligate Schools of Planning (ACSP) 2011 Annual Conference. She currently resides in Orlando, Florida with her partner of six years.