To the Graduate Council:

I am submitting herewith a thesis written by David A. Bakewell entitled "Sustainable Technology and Land Use Controls: A Study of the Effects of Subdivision Regulations and Zoning on the Adoption of Sustainable Technology and Practices." I have examined the final paper copy of this thesis for form and content and recommend that it be accepted in partial fulfillment of the requirements for the degree of Master of Science in Planning, with a major in Planning.

Dr. Bruce Tonn,
Major Professor

We have read this thesis
and recommend its acceptance:

Accepted for the Council:

Vice Provost and Dean of
Graduate Studies

Sustainable Technology and Land Use Controls:

A Study of the Effects of Subdivision Regulations and Zoning on the Adoption of Sustainable Technology and Practices

A Thesis Presented
for the
Master of Science in Planning Degree
The University of Tennessee, Knoxville

David A. Bakewell
December 2003

DEDICATION

This degree is dedicated to Dean Marleen Kay Davis for being a great role model and my guardian angel. Without her support, encouragement and willingness to think outside the box, this "Project" (degree) would not have been possible. I am indebted to her for believing in me when few were willing to.

This thesis is dedicated to my parents, Robert and Marilyn Bakewell, for allowing me to find my way and for never telling me that I "can't" do something. I took the path less traveled and we made it!

ACKNOWLEDGEMENTS

I wish to thank all those who helped me complete my Masters of Science degree in Planning. I would like to thank Dr. Bruce Tonn for his guidance, patience and his vision in the development of this thesis. I would also like to thank Dr. Tim Ezzel and Dr. Mary English for serving on my thesis committee.

Lastly, I would like to thank my family and friends, whose suggestions and encouragement made this possible.

ABSTRACT

The purpose of this thesis is to examine the impacts of subdivision regulations and local government policies on the adoption of sustainable technologies and design practices in Knoxville, Tennessee. Case studies were conducted on three subdivisions, each marketed towards a different income level. Land-use zoning, city subdivision regulations, subdivision covenants and subdivision by-laws were reviewed in this study.

It was observed that all case studies had similar levels of restrictions placed on residential designs. The low-income case study had the newest zoning and incorporated the most sustainable practices into its regulations, in comparison with the other two case studies.

Overall, the evaluation concluded that in most cases sustainable technology and practices were not restricted. When a technology or practice was restricted, the placement of additional procedural hurdles was the most common form of restriction. Some regulations and polices did ban the use of some technologies or practices but only in very rare incidences.

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Introduction

Purpose:

The purpose of this thesis is to examine the impacts of subdivision regulations and local government policies on the adoption of sustainable technologies and design practices in Knoxville, Tennessee.

Background:

"Since the Industrial Revolution, the effects of human processes such as fossil fuel burning, urban expansion, deforestation and the use of chemicals, have put greater and greater strains on the environment, leading to problems such as pollution, resource depletion and the loss of biodiversity. Prior to the 1960s and 1970s these problems attracted relatively little attention from the public, media and governments." [1] The health of our environment was not considered an issue.

By the 1970s, "Americans were slurping leaded gas through massive V8 sedans. Industry belched out smoke and sludge with little fear of legal consequences or bad press. Air pollution was commonly accepted as the smell of

[1] ARIC. (2003). Electronic Reference. Retrieved June 18, 2003, from http://www.doc.mmu.ac.uk/aric/esd/Earth/Environmental_Movement.html

prosperity."[2] It was under these environmental conditions on April 22, 1970 that the United States had the world's first Earth Day. Many people consider Earth Day 1970 to be the birthplace of the modern environmental movement. The political momentum from this movement helped the federal government to create the Environmental Protection Agency and sequentially the Endangered Species Act, Clean Air Act and Clean Water Acts. It appears that Americans were beginning to become aware of the unsustainable demands they were placing on the physical environment.

In 1973 the Arab Oil Embargo helped to further awaken American to its dependence on fossil fuels, and to the stresses it was placing on the physical environment. The Embargo caused fuel shortages to occur across the nation. Sometimes automobile lines formed several blocks long as they waited for the limited supply of gasoline. The nation and its vehicles slowed as the economic engine began to sputter.

Decades of inefficient growth patterns, the popularity of the personal automobile, cheap fossil fuels and a belief that the earth's natural resources were infinite made

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[2] EarthDay Network. (2003). Electronic reference. Retrieved June 18, 2003, from http://www.earthday.net/about/history.stm

America's economic engine increasingly inefficient and dependant to foreign natural resources. As the nation's dependence on foreign fuel sources increased, the embargo made people begin to question the use of fossil fuels, as it's impact on the environment became known.

As a result of the embargo, funding for oil exploration and nuclear energy within the United States increased as the country looked for new sources of fuel. Energy efficiency became a consumer issue, as Americans began to demand more efficient cars and buildings. The increase in sales of smaller, more fuel-efficient foreign vehicles made American businesses re-evaluate the way they design and build their products.

Builders began to explore new methods of making buildings more environmentally friendly. In the 1970's solar homes grew in popularity and were publicized as the homes of the future. Office buildings were becoming better insulated and more airtight. The growing awareness from these events introduced many Americans to the concepts of sustainability.

It has been over 30 years since these events occurred; many new modern day technologies and practices were born as

responses to these events.

Today, the environment, urban sprawl, automobile congestion, energy usage, global warming, water consumption and declining urban centers are all still problems facing our nation, but there has been a growth in awareness of these issues over time. Grassroots efforts continue to push for stricter regulations, while the government attempts to find a balance between the current interests of industry and the long-term interest of the environment. Change cannot happen overnight, but advances in technology and changes in habits may help to bring our country slightly closer to a sustainable future.

This thesis attempts to examine how the local government regulations address this future. It examines how one community (Knoxville, TN) addresses one part (residential development) of a bigger picture (sustainability) to see how their regulations address the issue of sustainability. This may seem like a very small part of the described problems, but the decisions made on a local level, when combined with decisions from other communities, can have a profound impact on national efforts to promote sustainability.

Research Questions:

In this thesis the following questions will be addressed:

Primary Question:

- **How do subdivision regulations and local government policies affect the adoption of sustainable technology and design practices in residential communities of Knoxville, Tennessee?**

Secondary Questions:

- What are the primary regulatory barriers inhibiting the implementation of sustainable practices?
- What regulatory differences, if any, do residential developments of different price levels have when addressing issues of sustainability?
- What changes, if any, should be made to the overall system of subdivision regulations and land-use policies to promote the use of sustainable technologies and design practices?

Methodology

This thesis is a diagnostic case study on how the adoption of sustainable technologies are affected by

covenants, subdivision and zoning regulations. This study will examine three new subdivisions, each chosen to represent a different housing price level (low, medium, high) in Knoxville, Tennessee. A literature review was conducted to obtain a better understanding of the history behind the sustainability movement, intended purposes of housing regulations, available technologies, the physical requirements of these technologies, and commonly used sustainable design principles. This study will also look at how Knoxville regulations affect the ability to use these technologies and principles in residential design. To see if the quality of regulations is equal across economic levels, case studies were chosen from different price levels.

A matrix will be developed to evaluate how each case study's regulations affect certain areas of sustainability. The categories used for this evaluation are based from a study conducted by Oak Ridge National Laboratory (ORNL) titled: *Sustainable Design Construction and Land Development, Guidelines for the Southeast.*[3] They will include Land Use Planning, Site Development, Sustainable Buildings Materials and Sustainable Building Energy

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[3] Oak Ridge National Laboratory, *Sustainable Design, Construction and Land Development* (ORNL/TM-2000/192) iii

Efficiency. By coordinating these categories and sub-categories, it is hoped that any reader examining regulations identified by this thesis to be restricting would refer to the similar category in the ORLN report for technical reference on the purpose and physical needs of the technology in question. The results of the matrix will show areas where regulations address issues of sustainability. It will also attempt to show if they support or suppress sustainability principles.

It should be noted that a new classification system for evaluating housing environmental standards is scheduled to be completed in the next few years. This system is being developed by the US Green Building Council as an addition to its LEED (Leadership in Energy and Environmental Design) classification system.

LEED's has gained national support with its classification system for new building construction. The General Services Administration (GSA) and the Department of Energy (DOE) are supporting the LEED standards by requiring all new agency construction to be LEED certified. The Department of Housing and Urban Development (HUD) is helping and is anticipated to support the new LEED's

housing standards. If HUD were to support the new LEED standards and require all of its new construction to be LEED certified it would help the standard to gain support and acceptance as a national standard.[4]

Significance:

A suburban subdivision is one of the most common types of new land developments in the United States. Often these developments occur in the outskirts of urban areas and on previously undeveloped land. Their design promotes low density living, which underutilizes land and infrastructure, increases vehicle usage and decreases the biodiversity of the land. When viewed as a whole, these types of developments can have a tremendous impact on how communities allocate governmental and natural resources. When viewed from a national or global perspective, these impacts are not sustainable. Regardless, subdivisions remain the housing type of choice for many American families.

Assuming that economic forces will continue to promote this type of development in the foreseeable future, the question that could be asked is: How do we minimize the

[4] US Green Building Counsel. (2002). Electronic Reference. Retrieved June 14, 2003, from http://www.usgbc.org/leeds.htm

negative effects from these types of developments on our community and environment? Advances in technologies, governmental legislation and efforts toward conservation all attempt to address this question.

Governmental tools that communities can use to help answer this question include land-use zoning and subdivision regulations. These tools are part of the police power, which allows communities to regulate the use of private property when it is done for the public good. They help to regulate land uses and establish minimum standards that developments must meet. This evaluation of regulations should act as a significant attempt to aid in the recommendations of how a local government can use these tools of regulation to minimize the negative impacts of subdivision development and restrict sustainability.

Chapter II

Literature Review

Concept of Sustainable Development:

In 1983 the United Nations appointed an international commission to propose strategies for sustainable development. The resulting report published in 1987 was titled "Our Common Future," also widely known as "The Brundtland Report." The report defined sustainable development as "Development, which meets the needs of the present without compromising the ability of future generations to meet their own needs."[5]

William D. Ruckelshaus wrote in the magazine *Scientific American* that "sustainability is the emerging doctrine that economic growth and development must take place, and be maintained over time, within the limits set by ecology in the broadest sense-by the interrelations of human beings and their works, and the biosphere... It follows that environmental protection and economic development are complementary rather than antagonistic processes."[6]

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[5] United Nations, Our Common Future Report, New York: United Nations, 1987.
[6] Ruckelshaus, William. "Towards a sustainable world." Scientific American, Sept 1989: p114.

At the International Union for the Conservation of Nature (IUCN) conference held in Ottawa, Canada, over 50 nations agreed to the following statement that "Sustainable development seeks... to respond to five broad requirements:[7]

1. Integration of conservation and development
2. Satisfaction of basic human needs
3. Achievement of equality and social justice
4. Provision of social self-determination and cultural diversity and
5. Maintenance of ecological integrity"

Each definition is slightly different but all attempt to define the same theme. For the purpose of this thesis the IUCN's (International Union for the Conservation of Nature) definition of "Sustainable Development" is the basis for this discussion of sustainable development. This definition was chosen because it attempts to organize it's sustainable development into several themes. This thesis will only be addressing themes 1,2 and 5 in its research. While themes 3 and 4 are essential to having a sustainable development, they deal less with the physical

[7] International Union for the Conservation of Nature, Conference on Conservation and Development, Ottawa, Canada 1986

environment and more with the social and cultural issues of sustainability, which is not part of this research.

It is important to have sustainable development; without it we are writing checks that future generations will have to pay.

Sustainable Technologies and Practices:

This section explains the most common sustainable technologies and practices used in subdivision design and residential cladding techniques. The regulations reviewed in this study address only these external areas of residential design. There are many sustainable technologies related to design of residences including: construction methods, materials, and energy usage that focus more on the interior of a residence. The use of these technologies are commonly regulated by building codes and are not going to be discussed because they are outside the scope of the defined regulations.

Sustainable Technology:

There are many external and internal sustainable technologies available to residential design that lessens energy consumption. When regulations do conflict with

sustainable technologies, it is commonly the systems that are used, or applied, to the exterior of structures. This section will discuss the most common external sustainable technologies and the physical requirements in order to work.

Solar Energy Requirements

There are two types of solar energy system' s passive and active. Active systems harness the sun's energy through solar collectors that convert the energy to electricity, or as a heating source by warming air and fluids. Passive systems are designed to harness the sun's energy by non-mechanical means through the heating of thermal mass or air inside structures.

"In both systems the optimum collector orientation is true south. True south is the highest apparent point in the sky that the sun reaches during the day (True south should not be confused with magnetic south as indicated on a compass.) Collector orientation may deviate up to 20° from true south without significantly reducing the performance of the system. Trees, buildings, hills, or other obstructions that shade collectors reduce their ability to

collect solar radiation. Even partial shading will reduce heat output."[8]

Active Solar

According to the US Department of Energy, active systems require that solar collectors be tilted at an angle equal to your latitude minus 15° for optimum performance[9] in summer and plus 15° your latitude for optimum performance in winter conditions. Knoxville's optimum performance in winter would be latitude 36° + 15° = 51° or a 15/12 roof pitch. The optimum performance in summer would be 36° - 15° = 21° or a 4/12 roof pitch. A collector receives the most solar radiation between 9:00 a.m. and 3:00 p.m. It is usually most economical to design an active system to provide 40% to 80% of the home's heating needs.[10]
It should be noted that active solar collectors used to produce electricity should be oriented (South on June 22) to receive the maximum solar benefits for the summer months

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[8] US Department Of Energy, Offices of Energy Efficiency and Renewable Energy.(2003). Electronic Reference. Retrieved June 18, 2003, from http://www.eere.energy.gov/consumerinfo/refbriefs/ad4.html
[9] US Department Of Energy, Offices of Energy Efficiency and Renewable Energy.(2003). Electronic Reference. Retrieved June 18, 2003, from http://www.eere.energy.gov/consumerinfo/refbriefs/ad4.html
[10] US Department Of Energy, Offices of Energy Efficiency and Renewable Energy.(2003). Electronic Reference. Retrieved June 18, 2003, from http://www.eere.energy.gov/consumerinfo/refbriefs/ad4.html

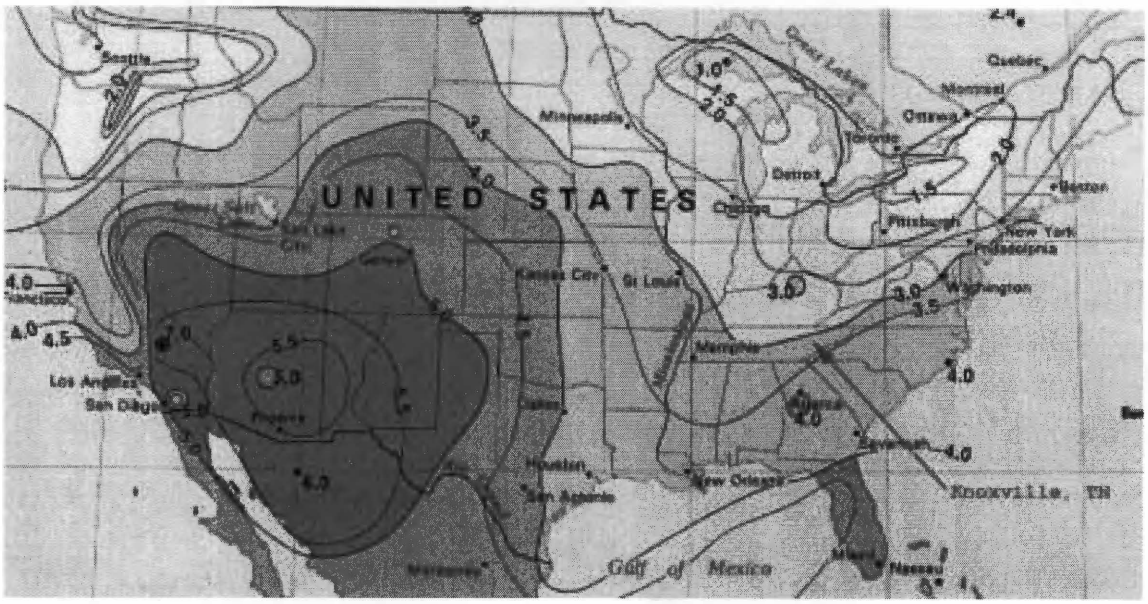

Figure 2-1. Average Annual Daily Solar Radiation

(From: US Department Of Energy)

when the energy is most abundant (Figure 2-1). It is assumed by the writer that most subdivisions would be developed with access to traditional utility services. For this reason, energy collection would be used in conjunction with a traditional utility service. Any excess energy collected during the summer months would be sold to the utility company and used to offset future needs in the winter months.

On the other hand, active solar collectors used to heat a structure should be oriented to receive the most

solar benefit for the winter months (South on December 21), since this is when the heating demand is greatest. Possible regulation conflicts with active solar systems might be height restrictions, use of external structures, aesthetics, and non-compliance to building codes.

Passive Solar

There are two methods that of passive solar systems use the sun's energy. The first relies on the sun's radiation to warm a large thermal mass inside a building. The most common thermal masses are water, stone, brick and concrete.

The second method a passive system uses the sun's solar radiation to warm the air. An example of this method would be a greenhouse. The only physical external requirement for a passive solar system to be effective is that it be oriented towards true south (December 21) and free of obstructions, which can cause shadows.

Wind Energy Requirements

All wind systems consist of a wind turbine, a tower, wiring and the balance of system components: controllers,

inverters and/or batteries. A wind turbine harnesses the kinetic energy of the wind and converts it into mechanical or electrical energy that can be used for practical purposes.[11] According to the US Department of Energy, wind turbines are economical in wind power classes 4-7.[12] The winds in Knoxville, and around most of the Southeastern US, have a wind power rating of 1-2, making wind generation not an economically feasible power source (Figure 2-2). Mountain areas surrounding East Tennessee including the Great Smoky Mountains National Park have wind class ratings of 4-7 making wind generation a feasible alternative for these locations. Since wind generation is not a feasible option in the proposed research area, it will not be addressed further in this document. Nevertheless, regulatory conflicts would be height restrictions, siting restrictions and sound nuisances.

Geothermal Heat Pumps

Geothermal energy is a power source not often considered in East Tennessee. Often, geothermal energy is associated with the harnessing of energy from hot springs

[11] American Wind Energy Association. (2001). Electronic Reference. Retrieved June 18, 2003, from http://www.awea.org/tur/wind.html
[12] DOE Offices of Energy Efficiency and Renewable Energy.(2003). Electronic Reference. Retrieved June 18, 2003, from http://www.eere.energy.gov/wind/we_map.html

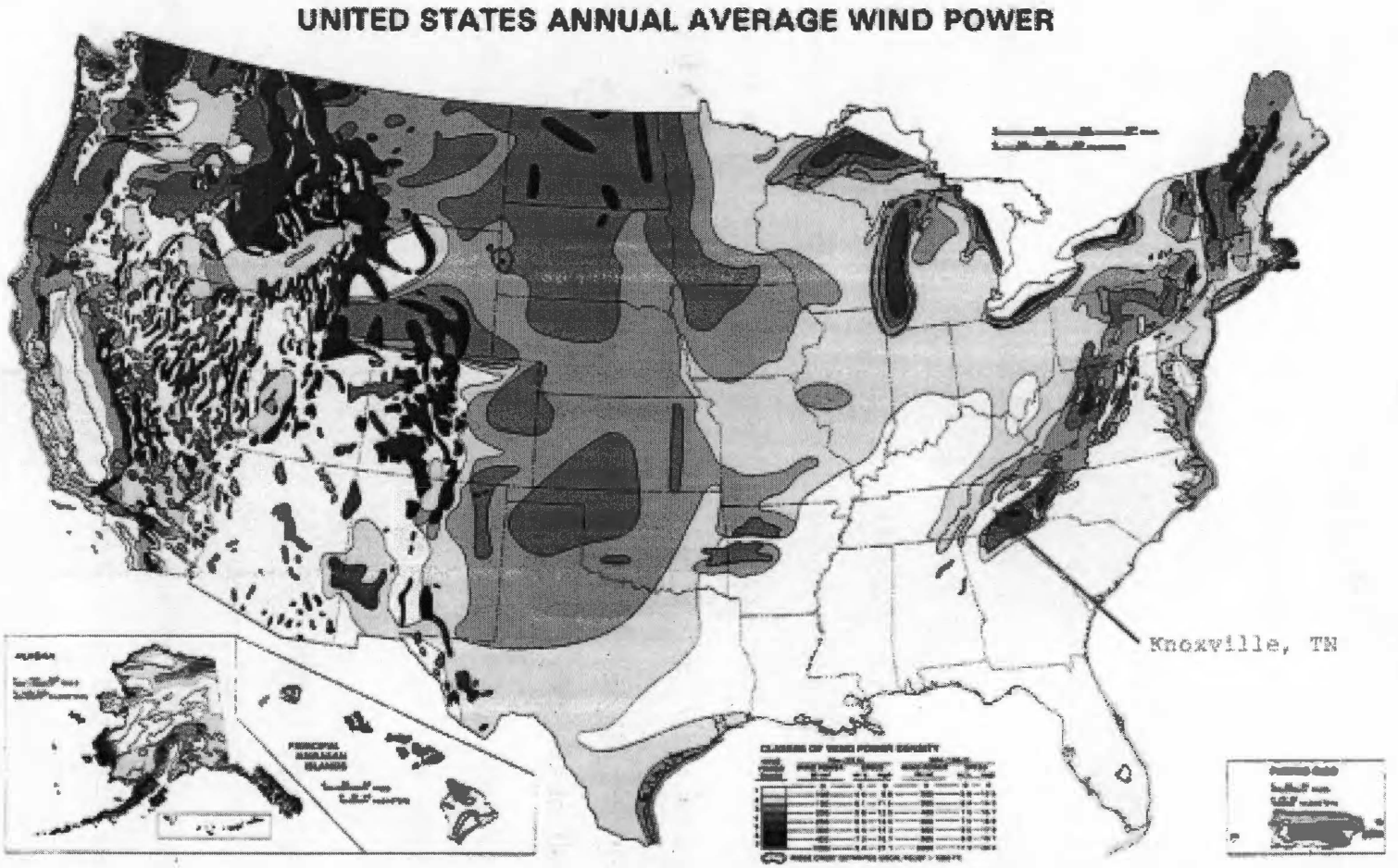

Figure 2-2. Wind Categories
(From: US Department of Energy)

and geysers mostly found in the western states. These natural features are not commonly found in East Tennessee, the geothermal energy of the earth is still available for use in buildings. The earth stays a constant temperature just ten feet underground. A geothermal heat pump (GHP) uses this constant temperature as a heat source in the winter, and as a heat sink in the summer to heat and cool homes. Through a system of underground pipes, a GHP transfers heat from the warmer earth, or water source, to a building in the winter. It then takes the heat from the building in the summer and discharges it into the cooler ground.[13] The US Environmental Protection Agency (EPA) calls GHPs the most energy efficient, environmentally clean, and cost effective space conditioning system available.[14] The biggest benefit of a GHP is that it uses 25%-50% less energy than a conventional heating and cooling system. The only requirement for the use of a GHP is available land or water for installation. Possible regulation problems associated with the use of a geothermal heat pump would be drilling and lot sizes.

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[13] US Department of Energy, Offices of Energy Efficiency and Renewable Energy. Geothermal Heat Pumps DOE/GO-10098-652 Washington: GPO 1998

[14] Environmental Protection Agency (1994). 430-R-93-004, April 1994

Sustainable Practices:

There are several common design practices associated with sustainability that are not technology intensive, but can offer significant benefits to issues related to sustainability. These design principles can be applied under the scope of the reviewed regulations.

Solar Building Orientation

The most beneficial energy saving practice that can be used to promote sustainability is to orient structures south (northern hemisphere) towards the sun. This was a very common design practice before the use of modern HVAC systems. With the invention of HVAC and cheap energy, designers feel less obligated to orient structures. The benefits were described in a previous section.

Solar Landscaping

Solar Landscaping is the use of natural vegetation to shade structures from sun in the summer and provide solar access to structures in the winter. A study by the Lawrence Berkeley National Laboratory and the EPA estimated a 25%-50% reduction in annual cooling energy consumption

through well-designed landscape design[15]. In addition, solar landscaping can improve aesthetics, environmental quality, privacy, noise buffering, privacy, and spatial definition. Landscaping and mounding of earth can also help to protect structures from wind. It should be noted that solar landscaping and solar energy collection are not compatible uses on the same structure. Solar landscaping produces shadows, which reduces the efficiency of solar collection. A shade tree in the summer can block up to 100% of sunlight reaching a structure, and can block a minimum of %30 in the winter. A possible regulation problem that might occur with solar landscaping would be setbacks for tree plantings.

Landscaping to Promote Biodiversity

Suburban subdivisions often reduce the biodiversity of the land when created. Subdivisions commonly have homogeneous plantings, which reduce the biodiversity of the ecosystem. An example of these plantings would be the use of non-native lawn grasses in front yards of residences. These types of plantings are not able to support the needs of

[15] Environmental Protection Agency. (2003). Electronic Reference. Retrieved June 18, 2003, from http://yosemite.epa.gov/oar/globalwarming.nsf/webprintview/ActionsLocalHeatIslandEffect.html

existing plant and animal life, thus causing them to perish or leave the area.

In Sara Stein's book Noah's Garden: Restoring the Ecology of Our Own Back Yards, she describes how the use of responsible landscaping and design can maintain biodiversity in a subdivision (figure 2-3).[16] She proposes the use of native plants arranged in a manner on a lot that, when combined with other lots, would produce an interconnected "mosaic ecosystem." This ecosystem creates bio-diverse plant and wildlife corridors within a development to support native plants and wildlife (figure 2-4).

[16] Stein, Sara. (1993) *Noah's Garden: Restoring The Ecology Of Our Own Back Yards*. Houghton Mifflin Company, New York. 48-50pp.

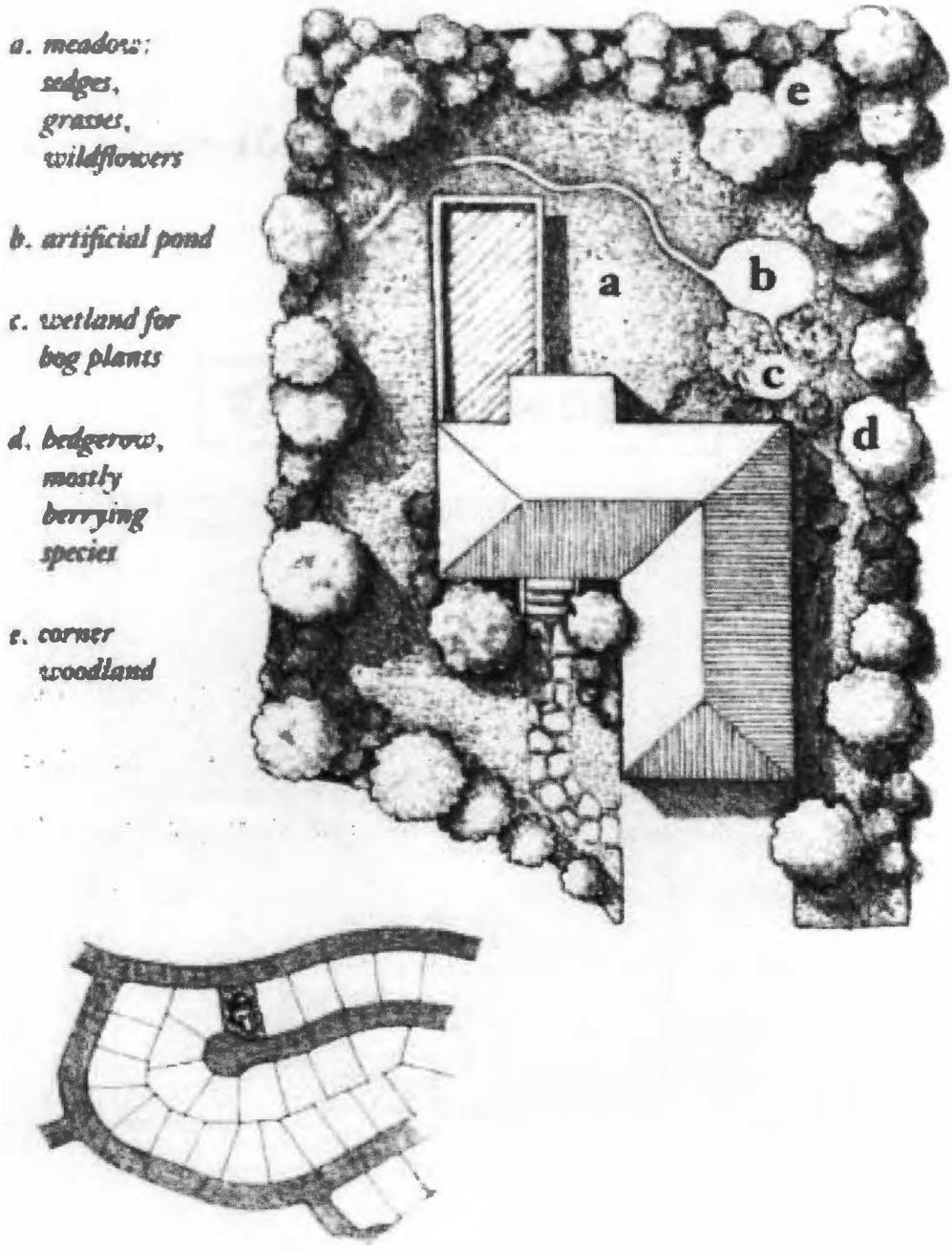

Figure 2-3. Landscaping to Promote Biodiversity

(From: Noah's Garden)

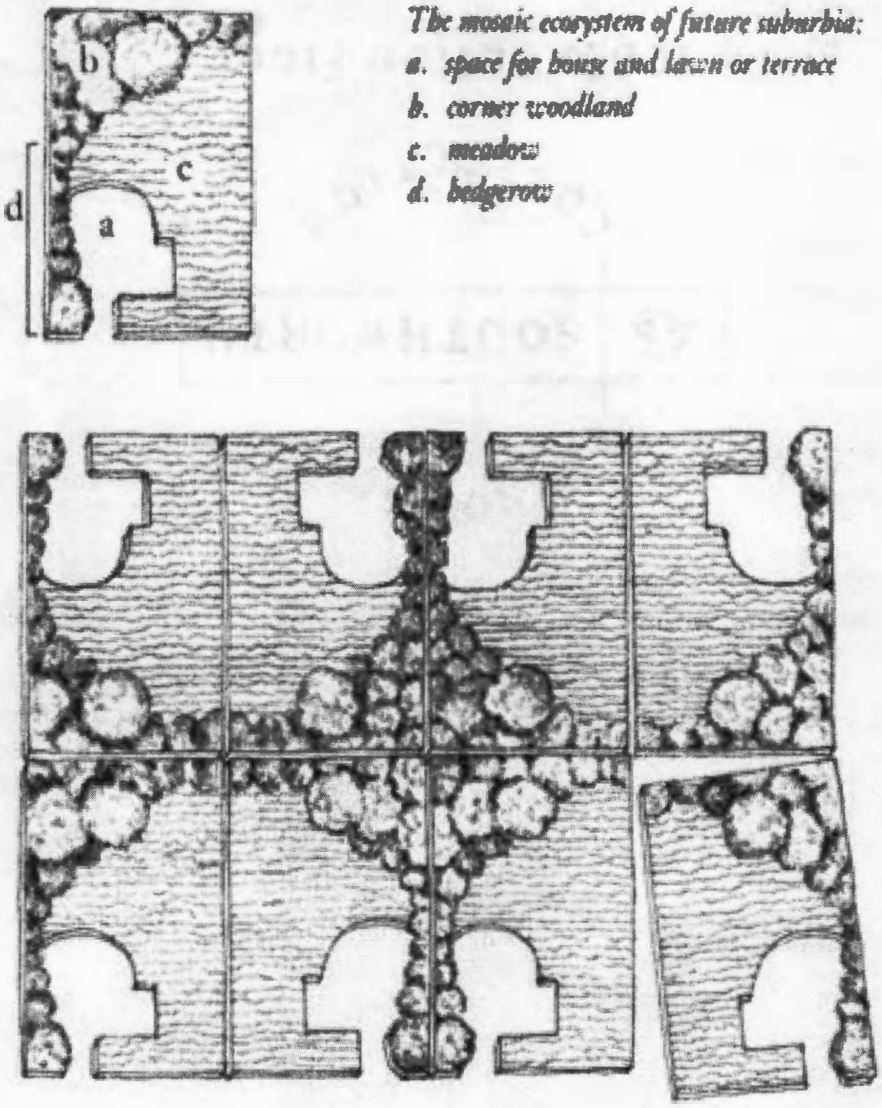

Figure 2-4. Mosaic Ecosystems

(From: Noah's Garden)

Chapter III

Case Study #1 Mechanicsville Commons

Figure 3-1. Rendering of Mechanicsville Commons

(From: Urban Design Associates)

Community Background:

Dating back to 1870's, Historic Mechanicsville is one of the oldest neighborhoods in Knoxville. Located close to the city center, it contains architectural diversity, historic significance, and a socio-economic mix unparalleled in the city (figure 3-1). In 1997 Knoxville's Community Development Corporation (KCDC), a quasi-governmental housing agency, received a $42 million Hope VI grant from the Department of Housing and Urban

Development (HUD), for the revitalization of the Mechanicsville neighborhood. College Homes, a deteriorating low-income public housing development constructed in the 1940's, was demolished as part of the Hope VI Plan.[17]

Constructed in phases, Mechanicsville Commons was developed to replace College Homes as a mixed-income Traditional Neighborhood Development (TND) also referred to as a New Urbanist Development. Located on the former College Home site, it contains lots for 255 new single and duplex homes in Victorian, Second Empire and Bungalow styles (figure 3-2). These home match the rest of the historic neighborhood and are available for rent or purchase from KCDC. In addition, the development contains new commercial buildings, a church, and two city owned parks. Former residents of College Homes displaced by the new construction were given first priority to return and move into the new development.[18]

As of June 2003, Mechanicsville Commons had completed two of four phases and construction was beginning on the new commercial areas. A neighborhood organization was just

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[17] Knoxville Community Development Corporation. (2003). Electronic Reference. Retrieved June 15, 2003, from http://www.kcdc.org

[18] Wade, Becky. (2003, April 10). Interview with author. Urban Planner, Knoxville Community Development Corporation, Knoxville, Tennessee

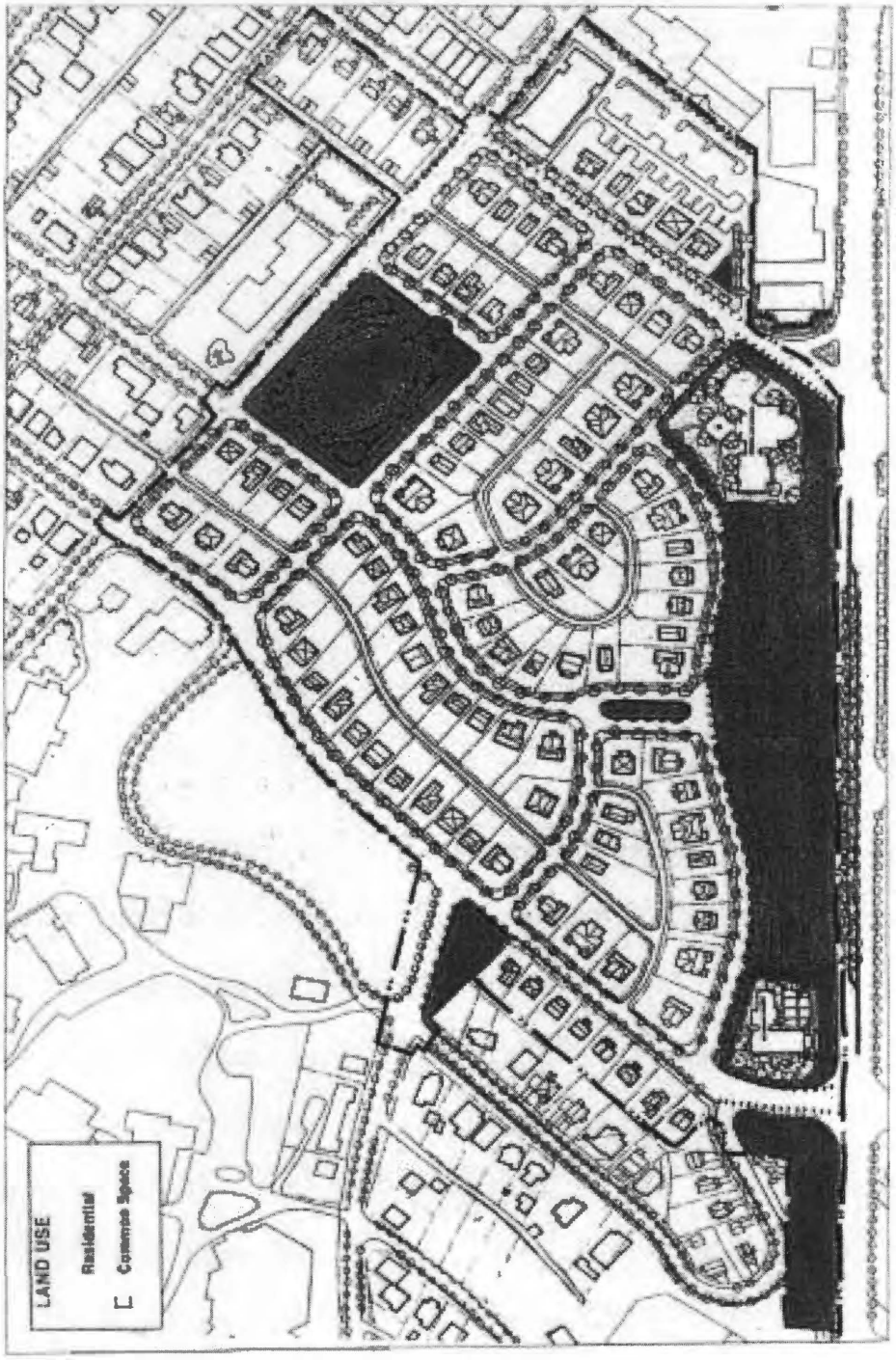


Figure 3-2. Mechanicsville Commons Site Plan

(From: Knoxville Community Development Corporation 2003)

being organized and they were beginning to draft community bylaws. Market rate 1,300 sq. ft. homes were listing at $119,000.[19]

Beginning with Seaside, Florida in the early 1980's, TND developments have been gaining popularity across the United States. They were created as responses to the negative impacts previously described that are associated with suburban subdivisions. TND's address the social and physical issues related to sustainability. The basic model for TND's are from pre-WWII noteworthy town developments.

Knoxville TND-1 Land-Use Zoning:

Mechanicsville Commons was developed under Knoxville's new TND-1 Zoning. This type of zoning classification was developed by Knoxville's Metropolitan Planning Commission (MPC) and approved by the city at the request of KCDC for the development of Mechanicsville Commons. Both KCDC and MPC realized that Knoxville's current zoning regulations were not flexible enough for a TND to be created without requiring variances, so they worked together to develop a new TND-1 zoning classification. This new zoning earned

[19] Wade, Becky. (2003, April 10). Interview with author. Urban Planner, Knoxville Community Development Corporation, Knoxville, Tennessee.

MPC an award from the Tennessee chapter of the American Planning Association (APA). As of June 2003, Mechanicsville Commons is the only development using this type of zoning.

A traditional neighborhood development is described in the TND-1 zoning ordinance as:

> A district established to foster the development of comprehensively planned, pedestrian-oriented neighborhoods. This is accomplished by promoting a variety of land-uses, housing types, and density, and requiring skillful architectural and landscape design in creating buildings and open spaces. This district is also created to avoid the negative impacts of suburban sprawl by minimizing infrastructure costs, traffic congestion, and environmental degradation.[20]

The TND-1 zoning also list 10 principles of pre 1940's town development that TNDs should reflect:

1. Architectural harmony
2. Varity of housing types, density, and cost
3. Parks, squares and open spaces
4. Neighborhood centers

[20] Knoxville/ Knox County Metropolitan Planning Commission. Zoning Article 4, Section 23a (2003)

5. Interconnected street systems
6. Sidewalks, street trees, on-site parking
7. Streets and sidewalks that are spatially defined with buildings
8. Traffic Calming
9. Lighting for the pedestrian
10. Developments designed that can be linked to others

The TND's description and 10 principles listed emphasize several land-use methods that help to accomplish the IUNC principles of "Sustainable Development." The principles, "Integration of Conservation" and "Development, and Maintenance of Ecological Integrity," are addressed in the TND description when it mentions the varying of land-uses, the encouragement of density, promoting the pedestrians and the promotion of open space. The IUNC principle, "Satisfaction of Basic Human Needs," is addressed in the definition by promotion of a variety of housing types and cost.

The Knoxville TND-1 zoning regulation is relatively short in text and, as a whole, does not appear to restrict any of the applications of sustainable technology and

practices. In fact, its principles help to promote growth in a manner that is more sustainable than a suburban subdivision.

The zoning promotes green space by minimizing allowable non-permeable surfaces (parking and driveways) and by requiring permeable pavement when extra user demand creates a need over the allowable limit. This practice is good because it reduces the heat island effect common in urban centers, and allows for a return of water to the ground to be recharged.

The zoning regulations also list pedestrian oriented developments as a TND design principle. This is accomplished by requiring lighting at the scale of the pedestrian, sidewalks on both sides of the streets, traffic calming, narrow streets and creating walk-able commercial destinations. By emphasizing walk-ability, people are encouraged to be more physically active and less dependant on the automobile, thus promoting a more sustainable lifestyle.

Native shade trees are a zoning requirement along all roadways. The impact of requiring native trees means they are less likely to be harmful to the environment and better

adapted to survive.

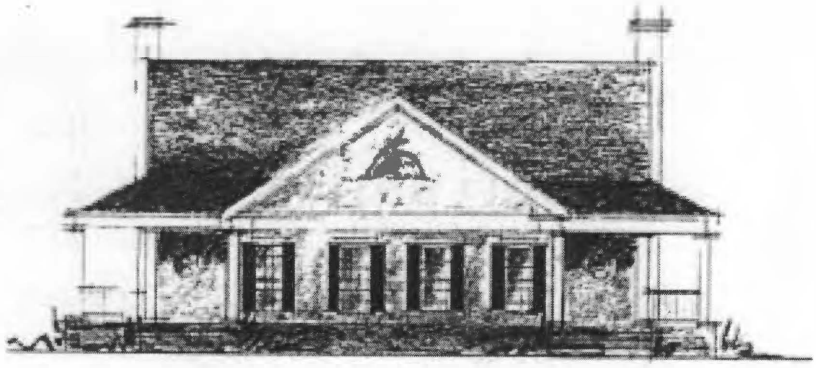
All of these requirements combine to help promote the concept of sustainability.

Mechanicsville Commons Regulations:

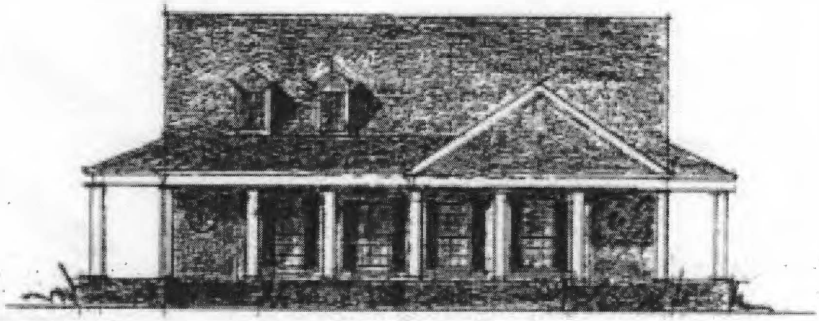
Mechanicsville Commons subdivision regulations are different than most current subdivision regulations. Its regulations are adapted into the form of a Pattern Book. The use of a pattern book is a requirement of the TND-1 zoning.

Pattern Books were developed at the turn of the 20th century to illustrate residential designs before the use of cameras. These books were very popular during this time, and helped to bring design ideas from distant places to the masses. This form of representation has had a resurgence in popularity with its use in the design of New Urbanist communities.

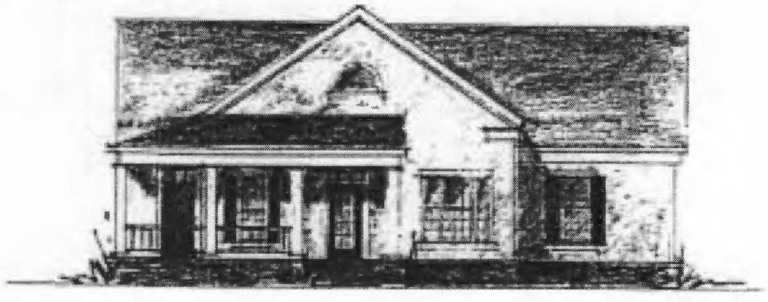
The pattern book used in Mechanicsville Commons establishes illustrated design guidelines for the development of streetscapes, residences, parks, a church and commercial district (Figure 3-3, 3-4). These guidelines establish acceptable colors, materials and



Colonial Revival Front Elevation A



Colonial Revival Front Elevation B



Colonial Revival Side Elevation

Figure 3-3. Typical Illustrated Page

(From: Mechanicsville Commons Design Guidelines)

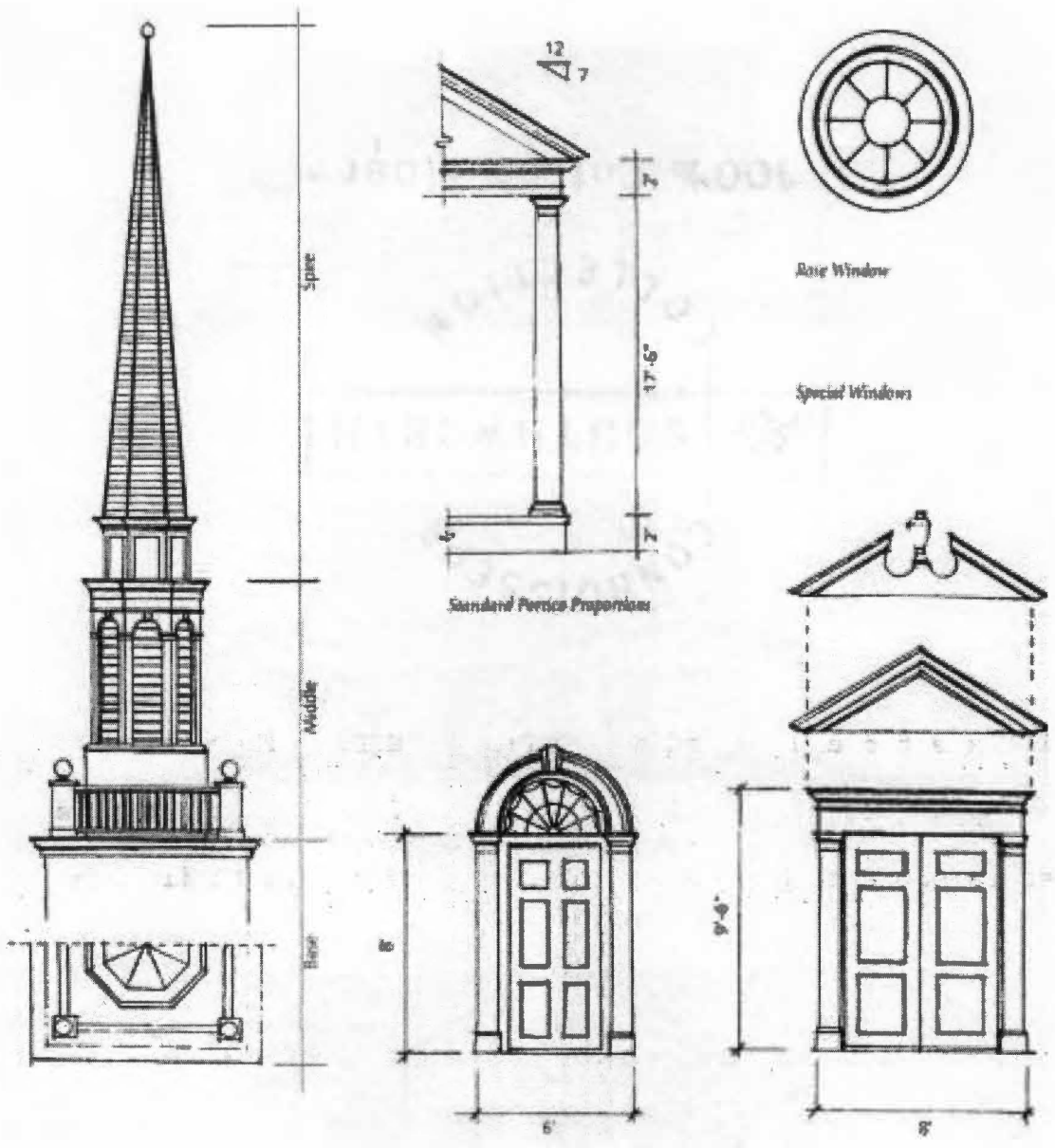


Figure 3-4. Typical Illustrated Detail

(From: Mechanicsville Common Design Guidelines)

architectural styles for the development.[21]

Mechanicville Common's pattern book offers only guidelines, not requirements, on how site layouts and structures should be designed and developed. The ultimate authority according to the TND-1 zoning to approve or disapprove a design or feature is given to MPC staff. Given the fact that KCDC is the developer, seller, renter, builder, and present voice of Mechanicsville Commons, it is the opinion of this writer that MPC and KCDC are sharing the authority to approve or disapprove design decisions.

The guidelines in the Pattern Book represent only what is expected and deemed acceptable by MCP. There are no written rules preventing a homeowner from incorporating a sustainable technology like solar panels into their home design.

To obtain approval the prospective homeowner would request to MPC staff, who would then evaluate the request on its compatibility with the character of the community and Pattern Book. This request is treated no differently than a request to use a different exterior paint color or fence detail. This system of decision making shows the resident what is acceptable and likely to be approved, but

[21] Urban Design Associates. Mechanicsville Commons Design Guidelines. Pittsburg: Random, 2000.

does not explicitly ban any material, technology, design or feature, so long as it can be adapted to conform to the character of the community.

A review of covenants, conditions and restrictions was conducted for Mechanicsville Commons. Within this 5-page declaration the only binding restriction placed on property owners was that all development of their property must conform to the architectural design guidelines established in the pattern book.

For all of these reasons, it seems that the subdivision regulations for Mechanicsville Commons do not restrict the use of sustainable technology, so long as these technologies are adapted into a form that is compatible to the character of the community.

Community Bylaws:

Conversations with Becky Wade, the KCDC Coordinator of Mechanicsville Commons, indicate that as of June 2003, a home owners / business association for Mechanicsville Commons has been created and is in the process of developing community bylaws. It is unknown at this time if these bylaws will restrict the use of any sustainable

technologies or practices.

Conclusion:

Overall is appears that the Zoning, Covenants and Bylaws do not encumber the use of sustainable technology and practices as long as they are used in a manner that is compatible to the character established by the developer's pattern book. The zoning classification, in fact, appears to promote many sustainable practices.

Chapter IV

Case Study #2 Fox Run Subdivision

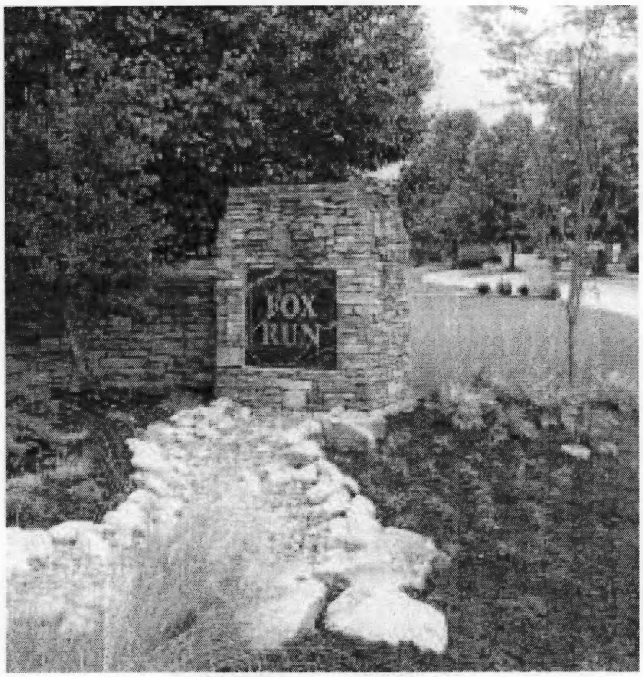


Figure 4-1. Entry to Fox Run Subdivision

(From: D. Bakewell)

Community Background:

Fox Run Subdivision is located in the Farragut area of West Knox Country on what was once farmland. The development, when completed, will be composed of 236 single-family residential lots (figure 4-1, 4-2). Local land developer John Fiser purchased the farmland for purpose of creating a subdivision. In January 1990, an

Figure 4-2. Fox Run Subdivision Site Map

(From: Knoxville Geographic Information System)

umbrella corporation named Fox Run Inc. was formed to act as the legal entity for the property development. In October 1993, after several months of construction, phase one of the development was completed and lots were listed for sale.

The subdivision is comprised of predominately white, middle/upper class families, which is consistent with other developments within its census tract. The community has an active homeowners association and a well-established set of covenants and by-laws.

While initial phases of this subdivision began ten years ago under older regulations, this subdivision was chosen as a case study because it is still experiencing new construction. Based on current building rates and economic influences, it is estimated that 15-20 residences will be constructed in 2003

As of October 2003, the final phase of the subdivision had just reached completion, but the subdivision is not completely built out. Market rate 3,764 sq. ft. homes were listing at $399,900 (figure 4-3).[22]

[22] Dyer, Vick. (2003, June 18). Telephone interview. Realtor, Wallace & Wallace Reality. MLS ID 321187, Knoxville, Tennessee

Figure 4-3. Typical Fox Run Single-Family Residence

(From: D. Bakewell)

Farragut R-1 and R-2 Land-Use Zoning:

Fox Run Subdivision is located in Knox County within the town limits of Farragut. It was developed under zoning and subdivision regulations developed by the Town of Farragut (not Knox County or the Metropolitan Planning Commission). Fox Run Subdivision utilizes Farragut's Residential-1 (R-1), Residential-2 (R-2) zoning and Farragut's Subdivision Regulations. Phases 1-2 were constructed under R-1 zoning. Phases 3-6 were constructed using R-2 zoning.

R-1 zoning is described in the Farragut zoning ordinance as:

> "A zone to provide for low density single-family residential use in designated areas of the town, and especially in areas where natural factors such as steep slope ... and public service considerations such as narrow and inadequate collector street impose high public, dollar, and environmental cost on intense urban development."[23]

R-2 zoning is described in the Farragut ordinance as:

> "A zone to provide for the development of moderate density single-family uses in areas suited for such development … and provide access to a street which meets minimum design standards established in the Farragut Subdivision Regulations."[24]

When comparing the two zoning classifications in description and overall text, the primary difference between these two zoning classifications is their lot size. The R-1 zoning requires larger lot sizes than R-2 zoning. Farragut town planner Ruth Hawk was unsure as to the official reason why a zoning change occurred in the subdivision's development.[25] Thus, it is concluded that the initial phases were constructed with a lower density to give the development a more spacious and prestigious

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[23] Town of Farragut. Farragut Municipal Planning Commission. R-1 Zoning Regulations of the Town of Farragut, Farragut Tennessee. Farragut: FMPC, 1987.

[24] Town of Farragut. Farragut Municipal Planning Commission. R-2 Zoning Regulations of the Town of Farragut, Farragut Tennessee. Farragut: FMPC, 1987.

[25] Hawk, Ruth (2003, June 19). Telephone interview with author. Town Planner, Town of Farragut, Farragut Tennessee

feeling when entering. Lots developed in the back of the subdivision were developed with a higher density to maximize the developer's return on investment. The visual difference in lot sizes when driving through the subdivision is not noticeable.

The zoning regulations address issues related to uses, lots sizes, building setbacks, building coverage and building height. The regulations do not appear to be specific enough to address issues of sustainability other than overall development density.

Fox Run Covenants:

The original design proposal submitted to the Town of Farragut was for the subdivision to be completed in 6 phases. The development was actually completed in 11 submitted phases. A set of regulations and covenants was submitted for each of the six originally proposed phases. The regulations for all six of these phases are based on a common 17-page document, with all new modifications listed at the beginning.[26]

The *Regulation and Covenants* document establishes a "Fox Run Advisory Committee" for the purpose of approving

[26] Fox Run Homeowners Association: Covenants and Restrictions. (1994). Electronic Reference. Retrieved May 30,2003, from http://www.korrnet.org/foxrun/covs_ph1.htm

or disapproving a building's plan for its conformance to the subdivision design guidelines. The committee consists of three or more members (or member representatives) appointed solely at the discretion of the developer. The committee's decisions are considered final, unless %80 of the property owners, within 1,000 feet of the property in question, disapproves of the committee's decision. The way this committee is established, it allows for the developer to maintain a large amount of control on how the development is completed.

In addition to establishing an Advisory Committee, the *Regulation and Covenants* place restrictions on the design of structures. These restrictions are listed under Article XIII - Dwelling Restrictions, which is listed below.[27]

Article XIII:

DWELLING RESTRICTIONS

Section 1. DESIGN REQUIREMENTS.

No dwelling shall be erected, placed, altered or permitted to remain on any Lot without the prior approval of the Advisory Committee and unless it conforms to the following requirements:

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[27] Fox Run Homeowners Association: Covenants and Restrictions. (1994). Electronic Reference. Retrieved May 30,2003, from http://www.korrnet.org/foxrun/covs_ph1.htm

1. The design of the dwelling and related improvements shall be of Traditional Architecture as approved by the Advisory Committee.

2. The minimum living area square footage requirements shall be determined by the Advisory Committee on a case by case basis and shall be within the sole discretion of the Committee, however, except for special circumstances justifying an exception, a one-story dwelling having less than 1800 square feet of heated living area, or a two-story dwelling having less than 2400 square feet of heated living area, will not be approved.

3. All windows and related trim shall be of wood or wood clad construction.

4. All dwellings shall have a minimum roof pitch of 8/12.

5. All dwellings shall be of brick, or stone, or stucco, or a combination of brick or stone or stucco, or a combination of brick or stone or stucco and siding.

6. All above ground exterior foundation walls shall be veneered with brick, or stone, or stucco or such other material approved by the Advisory Committee.

7. All fireplaces and chimneys shall be specifically approved on an individual basis by the Advisory Committee.

8. The outside wiring of all dwellings, buildings and any other structure shall be placed underground. No overhead wiring of any type shall be permitted. Outside light poles, etc. shall be approved by the Advisory Committee.

*9. **All dwellings shall have not less than a two-car attached garage capable of accommodating two automobiles. The driveway shall provide a minimum of two additional off-street parking spaces. All driveways shall be paved with asphalt or concrete or other materials approved by the Advisory Committee.***

10. Heating and air conditioning systems shall be concealed from view by appropriate screening, subject to approval of the Advisory Committee.

11. Every dwelling shall be connected to the sanitary sewer and public water systems serving the Lots.

12. Each dwelling may have one or more utility areas subject to approval of the Advisory Committee. Each utility area shall be walled or fenced to hide from view all materials inside and the entrance thereto shall be screened, using materials and styling which is compatible with the materials and style and general landscape of the Lot and the Properties.

13. There shall be no occupancy permitted of any dwelling until such time as the dwelling, yard and landscaping are complete except by approval of the Advisory Committee.

14. Once the retention basins as set forth on the recorded plat have been dedicated by the recordation of said plat, neither the Developer nor the Owners shall be responsible or liable for the maintenance of the same.

15. The finished grading for all Lots shall be completed in conformity with the recorded plat for The Properties and in such manner as to retain all surface water drainage on said Lot or Lots in "property line swales" designed to direct the flow of all surface waters into the drainage easements as created by the overall drainage plan for the development, as approved by the municipal authority having jurisdiction over the Properties.

Section 2. MISCELLANEOUS RESTRICTIONS.

1. Mail boxes, outside lighting, and other post structures shall be of a traditional type and design consistent with the overall character and appearance of the neighborhood and as selected by the Developer or an approved by the Advisory Committee.

2. No outside radio transmission towers, receiving antennas, television antennas, satellite antennas or dishes or solar panels may be installed or used, except as approved by the Advisory Committee.

3. No one shall be permitted to store or park house trailers, campers, pleasure or fishing boats, trailers, trucks over one ton, or other similar type vehicles on or

about the dwelling unless the same are stored or parked inside a garage so as not to be readily visible from the street or adjoining Lots. No automobiles or other vehicles which are inoperable or being stored shall be repeatedly parked, kept, repaired or maintained on the street, driveway or lawn of any Lot.

4. Builders will be responsible for providing silt control devices on each Lot during construction activities.

5. Clotheslines and other devices or structures designed and customarily used for the drying or airing of clothes, blankets, bed linen, towels, rugs or any other type of household ware shall not be permitted and it shall be strictly prohibited for articles or items of any description or kind to be displayed or placed on the yard or exterior of any dwelling for the purpose of drying, airing or curing of said items.

6. No wall, hedge or shrub planting which obstructs sight lines at two and six feet above the roadways shall be placed or permitted to remain on any corner lot with the triangular area formed by the street property line connecting them at twenty-five (25) feet from the intersection of the street lines or in the case of a rounded property corner from the intersection of the street property lines extended. The same sight line limitations shall apply on any lot within ten (10) feet of the intersection of street property line with the edge of a driveway. No trees shall be permitted to remain within such sight distances of the intersection unless the foliage line is maintained at a sufficient height to prevent obstruction of such sight lines.

Section 3. MODIFICATION.

In keeping with the purpose of this Declaration, Developer recognizes that the restrictions set forth in this Article XIII are not inclusive nor totally comprehensive for a quality and aesthetically pleasing neighborhood development. Accordingly, notwithstanding anything to the contrary in this Article XIII as to the design of dwellings, ***the Advisory Committee may, in its sole discretion, in special circumstances, make exceptions to the design criteria set forth herein and approve other***

types of architecture and designment requirement, provided that such exceptions in each instance shall be consistent with the intent and purpose of this Declaration and be approved by the Developer.

The design regulation and covenants for Fox Run subdivision contain several regulations that would be considered counter productive to the promotion of sustainability.

While not addressed in earlier sections as a sustainable practice, the act of air-drying clothes outside is considered a sustainable practice for its use of the sun's energy to dry clothes. Section 2.5, banning the act of air-drying clothes increases family energy demands.

The use of solar panels (section 2.2) and permeable driveway surfaces (section 1.9) are prohibited, "except as approved by the Advisory Committee." By requiring committee approval for the use of these devices and materials, it discourages their use. Homebuilders are generally unwilling, for economic reasons, to invest the time it takes to prepare and submit a request to use an alternate building material. If a resident was to request an exception, they could be declined purely on the grounds of aesthetic or for no reason at all.

By placing square-footage minimums on structures (section 1.2) and requiring each residence to have a two-car garage (section 1.9), is promoting the creation of residences that may be larger than what the user needs. This practice helps to protect investment and promote a uniform neighborhood character, but it also leads to higher energy usage, large buildings, inefficient use of building materials, and a loss of building diversity.

Fox Run Subdivision Bylaws:

Fox Run's bylaws are incorporated into an 8-page document before the Regulation and Covenants section. The bylaws are written to define the officer roles and responsibilities within the established subdivision association. The bylaws also establish procedural rule for voting, electing and quorums. The bylaws for Fox Run subdivision do not address issues related to the physical environment.

Conclusion:

Only the regulations and covenants of Fox Run begin to address issues related to the design and construction of

residences. Within this document, only three covenants conflict with sustainable design and practices of residences. Within these covenants, sustainable design or practices are not absolutely prohibited, but allowed only on appeal.

Chapter V

Case Study #3 Gettysvue Development

Figure 5-1. Entry to Gettysvue Subdivision

(From: D. Bakewell)

Community Background:

In November 1994, several large tracts of farmland were purchased by Gettysvue Partners LP to create the residential development called Gettysvue Polo, Golf, and Country Club. Located in West Knoxville, it is an exclusive high-end residential golf and country club subdivision (Figure 5-1, 5-2). Named after two of the former landowners, George and Mary Gettys, Gettysvue is a

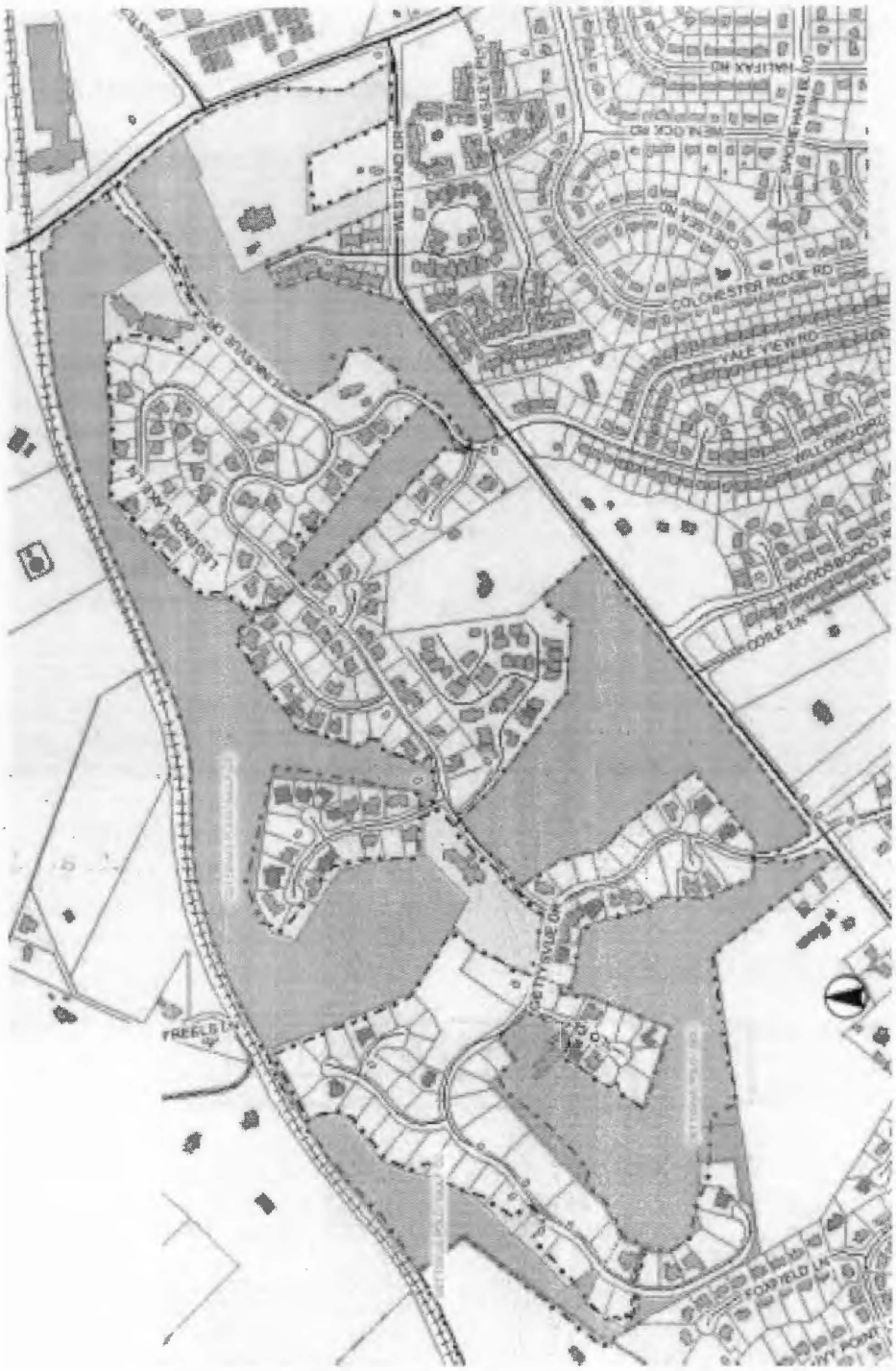

Figure 5-2. Gettysvue Subdivision Site Map

(From: Knoxville Geographic Information System)

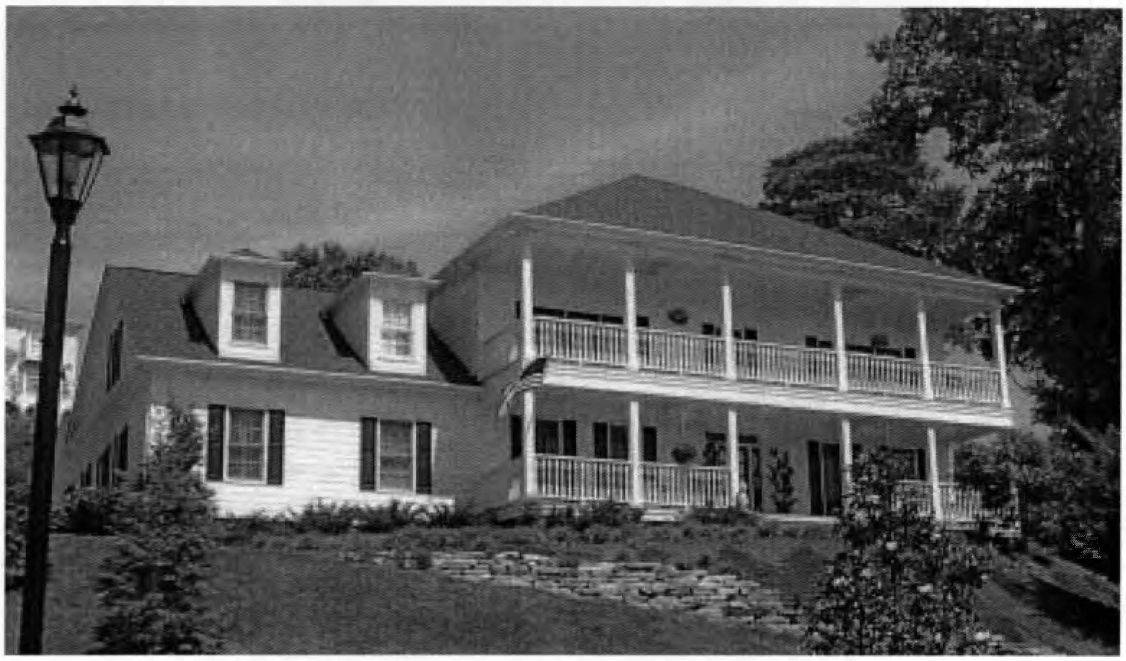

Figure 5-3. Typical Gettysvue Single-Family Residence (From: D. Bakewell)

multi-phase development consisting of 208 residential lots and 20 or more condominium units.

Gettysvue is predominantly devoted to single-family residential homes and a private 18-hole golf course (figure 5-3). In addition, it does include a legally independent, private Country Club, a condominium development called "The Racket Club," and a small commercial area.

The Country Club and amenities are located in the center of the development on top of a ridge providing views of the overall development and long views to the distant

Smokey Mountains. The amenities include an outdoor pool, tennis courts, polo field, golf course, banquet rooms, and a restaurant. It should be noted that the polo field has no horse stables or support facilities required for playing of the game Polo. Given the fact that Polo is traditionally viewed as a sport only played by the wealthy, it is the opinion of the writer that the open space referred to as the "Polo Field" is not used for the game Polo, but called such to elevate the social status of the Country Club. All property owners in Gettysvue are required by covenant to have a membership at the club.

Located adjacent to the country club is the condominium development referred to as "The Racket Club." It is composed of 20 or more high-end condominiums. A small commercial area is located on the perimeter of the development, adjacent to Ebenezer Road. It provides a gas station, laundry cleaner, real estate agency, and other small businesses providing basic services to Gettysvue residences and surrounding neighborhoods.

As of June 2003, the Gettysvue development had completed all of its four phases, but is not completely built out. Market rate houses were listing between

$318,500 and $824,500 (unknown sq. ft.).[28]

Knoxville PR and OS Land-Use Zoning:

Gettysvue Development is composed of several zoning classifications. The golf course portion of the development is regulated under Open Space (OS) Zoning. All residential areas, the Country Club, and the commercial area are regulated under Planned Residential (PR) Zoning.

Open Space zoning density is established by MPC and is between 1-4 dwelling units per acre. This zoning classification is designed to be low density with a emphasis on recreation activities such as golf.

Knoxville Subdivision Regulations:

MPC has developed a set of regulations that establish the minimum standards of improvement required for all subdivision of land in Knox County, excluding the town limits of Farragut.

These regulations establish subdivision design standards for roadways, sidewalks, sewerage, utilities, easements, drainage, block and lot layout, and open space requirements. They also establish the procedures for

[28] Dyer, Vick. (2003, June 18). Telephone interview. Realtor, Wallace & Wallace Reality. MLS ID 324456, Knoxville, Tennessee

submittals, plat reviews, public hearings, land surveying, variances and appeals.

The general purpose for the subdivision regulations as stated in the regulations is to:

"Provide for the harmonious development of the City of Knoxville and their environs; for the coordination of roads within the subdivided land with other existing or planned roads or with the state or regional plans … for the avoidance of population congestion; for the avoidance of such scattered or premature development of land…"[29]

The regulations coordinate the development of land within the community to minimize the development's impact on the community and on the area infrastructure. For this reason, the regulations focus more on how the development will be connected to and impact the community than what will happen within the development boundaries. There are regulations that do address issues within the development related to the allocation of open space and basic infrastructure requirements, but a majority of the regulations focus on minimizing the development's impact on the community.

Issues related to what happens on individual residential lots are not addressed, other than how a lot makes a connection to the road.

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[29] Gettysvue Community Association: Bylaws. (1994). Electronic Reference. Retrieved May 30, 2003, from http://www.gettysvuenews.com/covenants.htm

Gettysvue Covenants and Bylaws:

In June 1995, Gettysvue development adopted a 50-page Covenant and Bylaw document. The document is divided into eight sections addressing issues related to use, design, membership, and general provisions.

Section Two of the document describes prohibited uses and activities within residential lots. Most of the regulations in this section address issues of vehicle storage and external structures on property.

Two of the regulations within this section address uses and activities that affect sustainable practices. One example is Regulation 2.5, which restricts property owners from erecting a clothesline on any lot. The sustainable benefits of clotheslines were discussed in Chapter 4. The other example is Regulation 2.8, which restricts property owners from operating a home business and working at home. While not addressed in previous chapters as a sustainable practice, working at home is a growing trend promoted by the increases in connectivity to the Internet. Referred to as telecommuting, its primary benefits include reductions of average daily trips,

reductions in employer office space and energy needs. Both of these sustainable practices have positive effects on energy conservation.

Section Three of the Covenants discuses the architectural controls that regulate the design of residences. Issues related to material usage, building size, architectural style, prohibited features, and maintenance are all addressed. For this reason the section has been included below:[30]

Section III:

ARCHITECTURAL CONTROLS

Section 3.1 Advisory Committee; Approval of Construction and Landscape Plans. *Declarant shall appoint an Advisory Committee (the "Advisory Committee") to oversee the approval of all architectural and landscape plans. The Advisory Committee may be composed of such number of individuals or firms as Developer shall determine. Developer may appoint an architectural firm to serve as the Advisory Committee. A representative of the Declarant may serve on the Advisory Committee.*

(a) Grading and Construction Plans. (i) No clearing or grading of any Lot shall be permitted, and no structure may be erected, placed or altered on any Lot, until (A) the Lot owner has delivered to Declarant a $500.00 deposit (the "Deposit") for each Lot, and (B) the Lot owner has submitted, and Advisory Committee has approved, in writing, in its sole discretion, a Lot grading plan showing proposed structures, including, without limitation, (1) the location of all improvements and proposed improvements on the Lot and

[30] Gettysvue Community Association: Bylaws. (1994). Electronic Reference. Retrieved May 30, 2003, from http://www.gettysvuenews.com/bylaws.htm

the minimum elevation of any proposed improvements, (2) the final grade elevation (including rear, front and side elevation) and first floor elevation, which must be in compliance with Declarant's drainage and grade plans for the Subdivision, (3) the type of exterior material (including delivery of samples thereof requested by Declarant), and (4) the time frame within which all construction shall be completed. Declarant may further specify the requirements of such plans and specifications in the Design Guidelines (as defined below) or otherwise as shall be acceptable to Declarant. The Deposit shall be used by the Declarant in accordance with Section 3.10 below. During the clearing of any Lot and the construction of, or addition to, a residence thereon, each Lot owner shall cause to be placed, and maintained in good repair and condition, a fabric silt fence with a minimum height of eighteen inches (18") above-ground, and a minimum burial of six inches (6") underground, along that portion of the perimeter of the Lot bordering, backing up to or otherwise in the near vicinity of any developed Lot or the Gettysvue Polo Golf & Country Club golf course in order to prevent silt/or fill from migrating to and contaminating such Lot or the golf course. The silt fence may be removed only upon sodding of the Lot or establishment of grass thereon.

(ii) All driveways on any Lot shall be of concrete, or other similar materials approved by the Advisory Committee, which shall be constructed in final finished form not later than thirty (30) days subsequent to the substantial completion of any residence on a Lot, as determined by the Advisory Committee in its sole discretion.

(iii) Declarant reserves the right to compile and modify from time to time architectural and design review and /or construction standards manuals and guidelines, or other written standards (collectively, "Design Guidelines"), for use by Lot owners for guidance in the construction of any structures and other improvements on the Lots, and for such other purposes as described in this Declaration, and all improvements addressed therein shall be constructed by Lot owners in accordance therewith and pursuant to the plan(s) therefor approved pursuant to this Article III.

All such manuals and guidelines constituting Design Guidelines shall, from time to time when issued by

Declarant, be deemed to constitute a part of and be incorporated within this Declaration.

(iv) All approved construction activities, and landscape activities contemplated by Section 3.1 (b) below, shall be completed by the Lot owner within the time frame specified in the approved plans contemplated by this Section 3.1, such period not to exceed eight (8) months after beginning (except for waivers granted by Declarant in its sole and absolute discretion). Upon completion of all such construction, the Lot owners shall, at the Lot owners's cost, furnish to Declarant upon request a written statement and certification of the Lot owner's Builder and/or an engineer acceptable to Declarant, to the effect that (1) the improvements constructed upon the Lot substantially conform to the plans and specifications approved pursuant to this Section 3.1, and (2) drainage of the Lot after improvement is in positive drainage compliance with the drainage plans for the Phase and Subdivision.

(v) In the event any such structures or other improvements constructed on any Lot, and/or the final grade of any Lot, do not conform to the approved construction plans or drainage plans for the Phase and Subdivision, the Lot owner shall, within thirty (30) days after written notice from Declarant (or such greater period as Declarant shall specify in such notice), cause such non-compliance to be fully remedied to the satisfaction of Declarant. Further, in the event that the Lot owner shall fail to diligently proceed with and/or complete the construction of any improvements on a Lot within the time frame established pursuant to the construction plans and specifications therefor approved by Advisory Committee, the lot owner shall, within thirty (30) days after written notice from Declarant, complete such improvements in a good, workmanlike and professional manner, or, if the existing status of the improvements on the Lot are such that the same cannot be reasonably completed within such thirty (30) day period, the Lot owner shall immediately commence and proceed with all due diligence and best effort toward the completion of all such improvements, which such in any case shall be completed within one hundred eighty (180) days of such notice from Declarant or within such other greater or lesser period as shall be reasonably specified by Declarant (which specification shall be deemed reasonable if confirmed in

writing by at least two (2) Builders). Should such Lot owner fail to cure such non-compliance if confirmed or to complete such construction within the applicable period provided above, Declarant may, in its sole discretion, elect to cause such non-compliance to be so cured, and may, in its sole discretion, elect to complete such construction on such Lot in accordance with the approved plans therefor and Declarant and/or the Board and their respective agents, employees and contractors, may enter upon the Lot and all improvements thereon at any time and from time to time in connection therewith, without liability or obligation of any kind to such Lot owner or any resident or lessee of such Lot, and the Lot owner shall reimburse Declarant upon demand for all costs and expenses incurred in connection therewith, including, without limitation, reasonable attorneys' fees and court costs, and all such costs and expenses shall constitute a charge on the Lot, and Declarant shall have lien in such Lot to secure the payment thereof of equal priority to the lien for assessments provided for in Article IV below.

(vi) Any modifications to the existing grade of any Lot shall comply with any approved drainage plans for the Property.

(b) Landscape Plans. (i) In addition to, and contemporaneously with, the plans and specifications referred to in Section 3.1 (a) a landscape plan shall be submitted by such Lot owner to the Advisory Committee for its approval in writing, which plan shall show the trees, shrubs, and the other plantings then existing and/or to be planted on the Lot, and specify the time frame within which such landscaping shall be completed. Each landscape plan for a Lot submitted to the Advisory Committee shall show that the Lot has or will have prior to occupancy a minimum of two trees (at least 2-1/2 inches in diameter) in the front yard of the Lot and an additional two trees (at least 1-1/2 inches in diameter) elsewhere on the Lot, and shall further obligate, and this Declaration does so obligate, each Lot owner to install such approved landscaping in good health at all times thereafter, and to replace such approved landscaping as necessary, in the front and side yards of each Lot, readily visible from the street(s) adjacent to the Lot, if any. Further, any portion of the yard not to be landscaped pursuant to an approved landscape plan shall be

sodded by the Lot owner. All lot owners shall install an irrigation system at the time the landscaping and sod are installed.

(ii) The Lot owner shall install all required landscaping and the irrigation system for inspection by Declarant at its request at any time following commencement of occupancy of the residence on the Lot; provided, that when seasonal limitations prohibit, the approved landscaping on, and/or sodding of, the Lot must be installed with fifteen (15) days from the time planting operations can be feasibly undertaken as determined by Declarant. Moreover, when seasonal limitations do not permit planting, erosion control measures must be immediately implemented in accordance with generally accepted practices in the real estate development industry, as approved by Declarant in its sole discretion, and as otherwise may be required by applicable laws, rules, regulations, and ordinances, and as otherwise provided in this Declaration. In no event shall any irrigation or other water system on any Lot be permitted to draw or otherwise use water from any lakes or waterways within the Subdivision, without the prior written consent of Declarant in its sole discretion. Declarant reserves the right to waive in its discretion all or any of the requirements of this Section 3.1(b) with respect to any Lot.

(iii) In the event that the Lot owner shall fail to diligently proceed with and/or complete the landscaping of the Lot within the time frame established pursuant to the landscape plans therefor approved by the Advisory Committee, the Lot owner shall, within fifteen (15) days after written notice from Declarant (or within such greater period as specified by Declarant considering seasonal limitations in Declarant's sole discretion), cause such landscaping to be completed in a good, workmanlike and professional manner. Should such Lot owner fail to complete such landscaping within the applicable period provided above, Declarant may, in its sole discretion, elect to complete such landscaping on such Lot in accordance with the approved plan therefor, and Declarant, its agents, employees and contractors, may enter upon the Lot at any time and from time to time in connection therewith, without liability or obligation of any kind to such Lot owner or any resident or lessee of such Lot, and the Lot owner shall reimburse Declarant upon demand for all costs and expenses incurred in connection therewith,

including, without limitation, reasonable attorneys' fees and court costs, and all such costs and expenses shall constitute a charge on the Lot, and Declarant shall have a lien on such Lot to secure the payment thereof equal priority to the lien for assessments provided for in Article IV of this Declaration.

(c) Definitions.

(i) References to "Declarant" in this Declaration shall include any entity, person or association to whom Declarant may from time to time assign all or any of its rights or obligations under this Declaration, including rights of approval, whether on a permanent or temporary basis. Declarant, its successors and assigns shall have the right to so assign all or any such rights or obligations to the Community Association, which assignment the Community Association hereby irrevocably agrees to accept when executed by Declarant.

(ii) References to "Structure" in this Declaration shall include, without limitation, any building, residence, garage, fence, wall, antennae, microwave and other receivers and/or transmitters (including those currently called "satellite dishes"), dock, deck, swimming pools, tennis courts and basketball courts.

(d) No Occupancy Before Completion. No occupancy of any residence shall be permitted prior to the completion thereof to the satisfaction of Declarant, and the compliance with the provisions of this Declaration, including, without limitation, this Article III, in connection with the construction thereof and other improvements on the Lot.

Section 3.2 Building Materials; Roof; Builder; Architectural Standards and Design Guidelines.

(a) Building Materials.

(i) The exterior building material of all residences and structures on any Lot shall extend to ground level, and the exterior building materials of all residences shall be brick, stone, brick veneer, stone veneer, stucco or a combination of same, or such other materials as shall hereafter be specified for any Phase in the Supplemental

Declaration for such Phase, if any, or on the Plat for such Phase. Declarant recognizes that the appearance of other exterior building materials (such as wood siding) may be attractive and innovative and reserves to the Advisory Committee the right to approve in writing the use of other exterior building materials. Exposed smooth or brick mold-poured concrete walls shall not be permitted. All exterior paint and stain finishes and combinations and prefinished exterior materials must receive the prior written approval of the Advisory Committee.

(ii) Each Lot owner and resident of the Subdivision is hereby advised that rights of approval reserved by Declarant to the Advisory Committee in this Declaration include, without limitation, the right of prior approval and specification, in its sole discretion, of the color, texture and appearance of all brick, stone and mortar to be used on the exterior of residences or other structures built on Lots which abut or are adjacent to, or are in the vicinity of (as determined by Declarant in its sole discretion), portions of the Common Area or Gettysvue Common Area on which entry walls, signature gates and/or entryways, or other walls and/or structures have been constructed.

(b) Roof Pitch and Height. The roof pitch of any residential structure shall not be less than a plane of 6 inches vertical for every plane of 12 inches horizontal for structures with more than one story, provided, however, the dormers on one and one-half story houses may have a roof pitch of less than 6 inches vertical for every 12 inches horizontal with the prior written consent of the Advisory Committee in its sole discretion, which consent may be arbitrarily and unreasonably withheld; and a plane of 8 inches vertical for every plane of 12 inches horizontal for one story structures; or such other plane(s) as shall otherwise be specified in any Supplemental Declaration or on the Plat for any Phase. The Advisory Committee may waive the requirements of this Section 3.2(b) in its sole discretion in special cases where architectural design warrants or requires for proper perspective. No residence shall exceed two and one-half stories in height.

(c) Builder Approval. Declarant reserves the right of prior approval, in its sole and absolute discretion, of each general contractor, contractor, builder or other person or

entity (collectively, as so approved, the "Builders" and individually, a "Builder"), which proposes or is contracted with, hired or otherwise retained by or on behalf of any Lot owner to construct a residence on any Lot, which approval must be obtained prior to the commencement of any such construction. No Lot owner, unless an approved Builder, may construct a residence on the Lot. Declarant reserves this right of prior approval because the Subdivision is a planned community of high aesthetic and construction quality with which the Declarant's name and reputation, and the name and reputation of Declarant and that of its affiliated and related entities, shall continue to be associated and identified and further, in an attempt to ensure ***(i)*** *the maintenance of a high quality of construction within the subdivision,* ***(ii)*** *that the economic value of other Lots and structures within the Subdivision will not be impaired by the construction of residential structures not of the same or comparable quality as now exist in the Subdivision,* ***(iii)*** *the maintenance of the existing high aesthetic quality of the Subdivision, and* ***(iv)*** *a uniform subdivision, development, improvement and marketing program for the Subdivision. Nothing contained in this Section 3.2 or otherwise within this Declaration shall constitute or be deemed to be a representation or warranty by Declarant or the Advisory Committee with regard to any matter whatsoever pertaining to any Builder, or of the value or quality of any Lot, or any residence or other structure or improvement constructed thereon or otherwise within the Subdivision.*

(d) Approval of Plans. A complete and final set of architectural plans and drawings for any residence to be constructed on any lot shall be submitted to the Advisory Committee with a request for approval. The Advisory Committee shall be the sole arbiter of same and may withhold approval for any reason including truly aesthetic considerations. In the event the Advisory Committee fails to approve or disapprove the plans for design, specifications, and location within twenty (20) days after they have been submitted, approval will be implied and this section will be deemed to have been fully complied with. A complete set of final plans and specifications of the house to be built shall be left with the Advisory Committee during the time of construction.

(e) Architectural Standards. Declarant reserves the

right to issue and modify from time to time architectural and other standards and design guidelines as a part of the Design Guidelines to assist Lot owners in their initial design efforts prior to submitting plans and specifications for approval pursuant to Section 3.1 hereof. All Lot owners and their Builders and other contractors shall comply with the construction regulations portions, if any, of the Design Guidelines. Such regulations may affect, without limitation, the following: trash and debris removal; sanitary facilities; work trailers; parking areas; outside storage; conduct and behavior of Builders, contractors, subcontractors and Lot owners; the conservation of landscape materials; and fire protection.

Section 3.3 Minimum Finished Floor Areas. The following shall be the minimum finished floor areas for homes to be constructed within each Phase (unless other minimum finished floor areas are otherwise specified with respect to any Lot in any Supplemental Declaration or on the Plat filed in the aforesaid Register's Office with respect to such Phase):

(a) One-Story. The ground floor area of a one-story residence shall be a minimum of 2,200 finished and habitable square feet, exclusive of the garage.

(b) One-and-One-Half-Story. The ground floor area of a one-and-one-half-story or Cape Cod residence shall be a minimum of 1,800 finished and habitable square feet, exclusive of the garage, and the residence shall contain a minimum of 2,800 finished and habitable square feet.

(c) Two-Story. The ground floor area of a two-story residence shall be a minimum of 1,600 finished and habitable square feet, exclusive of the garage, and the residence shall contain a minimum of 2,800 finished and habitable square feet.

(d) Others. All other housing designs shall contain a minimum of 2,800 finished and habitable square feet, exclusive of garage.

(e) Exclusions. Finished basement areas, garages and open porches are not included in computing minimum floor areas pursuant to this Section 3.3.

(f) Waiver. Advisory Committee shall have the right, but no obligation, to waive the square footage required of this section and to approve plans for a residence containing less than the minimum square footage specified herein.

Section 3.4 Setbacks. *No structure shall be located on any Lot nearer to the front lot line, the side street line or other side lot lines, or to rear lot lines, than the minimum building setback lines required by the applicable zoning regulations and (in addition to such regulations) shown or otherwise specified on the Plat of any Phase, or in any Supplemental Declaration recorded with respect to any Phase, except that reasonable (as determined by Declarant) bay windows, chimneys, roof overhangs and steps may project into said areas, and open porches may project into said areas not more than six feet, if permitted by applicable law and as shall be acceptable to the Advisory Committee. Declarant may from time to time vary the established building setback lines, and/or grant variances therefrom, in its sole discretion, where not in conflict with applicable zoning regulations or other applicable law.*

Section 3.5 Garages; Carports.

(a) Openings. The openings or doors for vehicular entrances to any garage located on a Lot shall include doors and shall not face the front lot line unless otherwise approved in writing by Declarant in its sole discretion. All Lots shall have at least a two car garage. Garages, as structures, are subject to prior plan approval under Section 3.1. The interior of all garages shall be dry wall finished and painted. Garage doors shall be kept closed except when in use.

(b) No Carports. No carport shall be constructed on any Lot.

Section 3.6 Landscaping; Sidewalks; Driveways; Trees.

(a) Sod. After the construction of a residence, the Lot owner shall grade and sod the yard, and shall otherwise landscape all remaining portions of the Lot in accordance with the provisions of this Declaration and the landscape plan for such Lot which has been approved pursuant to

Article III hereof, and each Lot owner shall thereafter maintain (and replace, as necessary) all of the same in good health and in a neat, attractive and well-kept condition satisfactory to Declarant. Only fescue sod shall be permitted.

(b) Driveway. Each Lot owner shall concrete or otherwise finish in a material or materials approved by the Advisory Committee, and thereafter maintain in good repair and condition, the driveway from the abutting street to the Lot within thirty (30) days after substantial completion of a residence on such Lot as determined by Declarant. All driveways shall be on the side of the Lot as may be designated by Declarant for each Lot.

(c) Trees. Each Lot owner shall cause to be planted on the Lot such trees as shall be required and otherwise approved pursuant to Section 3.1 hereof. No tree shall be removed from any Lot subsequent to the implementation of the approved initial lot grading plan for such Lot without the prior written approval of Declarant in its sole discretion. No Lot owner shall cause or allow any placement or storage of any chemicals, solvents, material construction machinery or temporary soil deposits within the drip line of any tree. The term "drip line" as used herein shall mean an imaginary perpendicular line that extends downward from the outermost tips of the tree branches to the ground. Except as permitted by Declarant in its sole discretion, no trenching shall be allowed within two-thirds of the drip line of any tree having a trunk diameter of six inches or greater. Declarant reserves the right to establish, from time to time, regulations or rules relating to the preservation and planting of trees. In addition to its other remedies hereunder, Declarant may require any Lot owner to immediately replace all damaged or improperly removed trees with a new tree of equal type and size.

(d) Default. Upon a Lot owner's failure to comply with the provisions of this Section 3.7, Declarant may take or cause to be taken such action as may be necessary in Declarant's opinion to cause compliance therewith, without liability of Declarant, the Community Association or any of their respective successors, assigns, officers, employees, stockholders, directors, partners, agents, servants or contractors, or affiliates or related entities

(collectively, the "Gettysvue Group"), to the Lot owner or others for trespass or otherwise, and the Lot owner shall immediately, upon demand, reimburse Declarant or other performing party for all expenses incurred in so doing, including, without limitation, attorney fees, together with interest at the same rate prescribed or permitted pursuant to Section 2.6(b) hereof, and Declarant shall have a lien on that Lot and the improvements thereon to secure the repayment of such amounts, which lien shall be of equal priority as the lien for assessments provided for in Article IV of this Declaration.

Section 3.7 Mail and Paper Boxes. *Each Lot owner is advised that Declarant shall require that a uniform mail box and paper holder (with uniform letters and numbers) be purchased directly from Declarant, a related entity, or a specified third party vendor, in order to ensure uniform use and appearance in each Phase. No other mail boxes or paper holders, whether temporary or otherwise, shall be permitted on any Lot.*

Section 3.8 Docks and Other Structures. *No dock, walkway, gazebo or other structure may be constructed in, projected into, or floated upon, any lake, pond or other body of water within the Property or otherwise within the Subdivision without the prior written approval of Declarant in its sole discretion.*

Section 3.9 Design Guidelines. *Notwithstanding anything to the contrary in this Declaration, Advisory Committee reserves the right to reject any plans that do not comply with such architectural and other standards set forth in the Design Guidelines, as the same may be issued from time to time by Declarant.*

Section 3.10 Maintenance of Roads and Curbs; Deposit. *Any builder performing construction services on the Property, and any Lot owner purchasing such services, shall be jointly and severally liable for any damage caused by either party, or any subcontractors, material suppliers or other parties claiming by, under, or through such parties, to any portion of the Property, including, without limitation, the Common Areas, curbs, roadways and signage. All builders and Lot owners shall take such measures as are necessary to avoid the deposit of any mud or dirt on roads*

within the Subdivision. The Deposit shall be applied by the Declarant to the cost of review of any submittals (not to exceed $50 per submittal) and any clean up or repair as set forth above, provided that, upon application from the Lot owner following completion of all construction and related activities on the lots, Declarant shall return such portion of the Deposit as has not been applied. This remedy is in addition to that set forth in Section 4.16 below.

3.11 Temporary Window Treatments. *Any temporary window treatments, including, without limitation, sheets, canvas, plywood or other opaque or security coverings, shall not be permitted to remain more than thirty (30) days except as may be permitted by Declarant, in its sole discretion.*

3.12 Street Lamps. *Each Lot owner shall install an outdoor lamp which shall be placed near the street at a location to be approved by Declarant. A uniform lamp fixture shall be purchased directly from Declarant, a related entity, or a specified third party vendor in order to insure uniform use and appearance of all street lamps in each phase. No other street lamp fixture shall be permitted on any lot.*

The architectural controls included in Gettysvue's Covenants address several issues, which have a negative impact on the concept of sustainability. In sections 3.1 ii and 3.6b, the regulations require that driveways be constructed of concrete. Concrete is a durable material well suited for driveways, but it has a negative impact on sustainability because it is a non-permeable surface. These concrete surfaces do not allow water to be absorbed back into the ground. Reducing the ability for water to be

absorbed increase surface water runoff and can cause flooding problems.

In section 3.1 vi, irrigation systems and sod grasses are required to be installed in the yards of all residences. Non-native grasses used in yards increase the water usage demands on the environment. This is evident with the requirement of an irrigation system to accommodate the grasses additional needs. The use of non-native grasses is not sustainable because it creates a homogeneous environment that decreases ecological diversity and places greater demands on the environment with it water demands.

In section 3.3, all residences are required to have a minimum floor area of: 2,200 sq. ft. for a single story and 2,800 sq. ft. for a two-story residence. These requirements are designed to ensure a uniform residential building scale in the development. Unfortunately, this practice does not address all homeowners space needs and can lead to people living in houses larger than their actual need. The effect of this practice would be increased use of construction materials and utility costs. These issues and regulation requirements found in Gettysvue covenants are common in many suburban subdivisions.

Conclusion:

Gettysvue development could be considered a typical suburban subdivision in terms of zoning and regulations. The zoning established minimum lot sizes, which encourages low-density development. The covenants address issues related to the design and construction of residences, but do not promote sustainability. Covenants were found to be more counter productive to sustainability were requirements: for the use of non-native grasses, non-permeable surfaces, no at home business and no use of clothes lines. Community Bylaws were found to not be relevant to this thesis topic. Overall, Gettysvue places an increased burden on the environment from the issues addressed above.

Chapter VI

Conclusion and Recommendations

Decision Matrix:

After careful analysis of the regulations addressed in the case studies evaluations, a decision matrix was created using ORNL's *Sustainable Design Construction and Land Development, Guidelines for the Southeast.* The purpose of this matrix was to review and evaluate, which sustainable issues from the guidelines, were addressed in the case study regulations.

The basic intent was to analysis the matrix information on a numerical scale but, after close review of the case study regulations, it was determined that not enough of the guideline issues were addressed to make a comprehensive matrix meaningful. Looking for an alternative critical response, a decision matrix was created to determine if guideline issues were addressed in the regulations. The guideline issues were then evaluated in a positive / negative format if they were addressed. The results of the decision matrix are reported in (figure 6-1).

Case Study Decision Matrix

	Mechanicsville Commons	Fox Run Subdivision	Gettysvue Subdivision
Land Use Planning			
-Preserve Open Space	P	U	P
-Encourage Walkable Communities	P	P	U
-Mixed-Use Development	P	N	U
-Encourage In-fill Development	P	N	N
-Encourage Brownfield Redevelopment	U	U	U
-Smart Growth Plan	P	N	N
Sustainable Site Development			
-Preserve Open Space	U	U	P
-Consider Environmental Features On Site	U	U	U
-Minimize Soil Disturbance	U	U	U
-Control Soil Erosion during Construction	P	P	P
-Protect Tree during Site Clearing	U	P	U
-Use Landscape for Energy and Water Efficiency	P	U	U
-Manage Stormwater Naturally	P	U	U
-Reduce Irrigation Needs by Using Water on Site	U	U	U
-Promote Environmental Stewardship	U	U	U
Sustainable Building			
-Efficient Floor Plans	P	U	U
-Orient Buildings for Daylight and Solar Heating	U	U	U
-Sustainable and Healthful Building Materials	U	U	U
-Design Interiors for Health Indoor Air Quality	U	U	U
-Reduce Job-Site Waste	U	U	U
U = Unaddressed Issue	11	14	15
P = Positive Impact	9	3	3
N = Negative Impact	0	3	2

Figure 6-1. Case Study Decision Matrix

Mechanicsville Commons addressed the most issues (9) related to sustainability in its regulations and development. Fox Run and Gettysvue subdivisions each had 3 positive responses to sustainable out of the 20 issues that were reviewed. Fox Run (2) and Gettysvue (3) subdivisions each had regulations that had a negative impact on the promotion of sustainable technology and principles. Mechanicsville Commons was the most sustainable development out of the reviewed case studies.

Local Government Land-Use Policies:

Subdivision regulations and local government policies in Knoxville, Tennessee appear to have a some effect in the promotion and adoption of sustainable technology and design practices. Traditionally Knoxville's land-use zoning and subdivision regulations established only the minimal requirements for development to occur, such as requiring only the provision of proper access to utilities, water, sewer and roads. This level of regulation ensures that basic access and sanitation needs are met, but places minimal importance on directing the type and quality of

development that is to be created. Having such minimal zoning regulations could be contributing to the reason why Knoxville has such a large problem with urban sprawl, in comparison to cities of similar size. Regulations establishing minimum lot sizes, which are large in size, contribute to this problem. Land-use zoning and subdivision regulations can be a useful tool for communities to direct the way in which future land development is to occur.

It seems that a large portion of the zoning reviewed in these case studies is almost unchanged from when it was originally adopted in the early 1970's. The fact that several counties surrounding Knoxville that routinely vote not to adopt a zoning code, Knoxville could have very easily taken a "something is better than nothing" approach when adopting its original zoning regulations. These regulations address only the very basic issues and could have been written to be weak in order to obtain approval and acceptance by the community, with hopes that stronger regulations could be adopted in the future. This theory is further supported by the fact that the MPC has listed for years the updating of its zoning as one of its

priorities. It is for these reasons that zoning and subdivision regulations for Gettysvue Subdivision, which uses older PR and OS zoning classifications and Knoxville Minimal Subdivision Regulations, address no real issues related to sustainable technology and practices.

While overall it appears that Knoxville's existing zoning and regulations need updating, it is producing new zoning that does address issues of sustainability. The newly adopted TND-1 zoning addresses sustainable issues like the use of native plants, permeable surfaces, sidewalks, on-street parking and mixed-use development. While this new zoning is addressing issues of sustainability there is no strong trend to have land rezoned to the new classification.

A correlation could be drawn between the quality or strength of the regulations and the time in, which these regulations were adopted or last updated. This can be supported by the fact that Farragut, Tennessee, which was incorporated in the last 20 years, has stronger zoning and subdivision regulations than Knoxville. Farragut's zoning and regulations address issues related to sidewalks, native plants and open space more than Knoxville's older

regulations. Since requiring more land improvements on new developments causes higher land costs it can be assumed the motive for these regulations strengths maybe for exclusionary reasons than sustainability reasons.

Only one development has used Knoxville's TND-1 zoning, to date. As most people live in Knox County, and do not live in Town of Farragut, a lot of development is being created using the older zoning codes and regulations that do not address issues of sustainability. This trend in development does not help Knoxville in promoting sustainable issues.

One hope is that Knoxville's TND-1 zoning is an indication of what to expect in future zoning and regulations updates. Knoxville's MPC did receive an APA award in recognition for the quality and sensitivity of the new TND-1 regulation. If it updates it older zoning with the same sensitivity to issues like sustainability, as indicated in the TND-1 zoning, Knoxville will be better positioned to address issues of sustainability in the future.

Primary Regulatory Barriers:

The primary regulatory barriers observed in the case studies, which inhibited the use of sustainable technology and practices, were private subdivision covenants. These covenants are written by the developers (seller) and form a legal agreement upon purchase of land with a buyer. Developers generally use covenants as tools to ensure that all property owners use and develop their property in a predictable and acceptable manner. This is done to protect other landowner's interests and the developers remaining financial interest in the development. Local regulatory bodies can require the developer to place additional regulations in covenants; common additions are utility and right-of-way easements.

One-way developers use covenants to protect their interests in a development is by using them to regulate a development's architectural character. This character is commonly established by regulating the design, size and materials used on structures and in their yards. Additionally, covenants can be used to regulate property nuisances, uses and activities. Since developer's primary use of covenants is to protect their remaining investment,

they are generally not financially motivated to ensure that the covenant requirements they produce are counter productive to issues of sustainability. Several states have attempted to address this issue of non-concern by passing legislation overruling covenant requirements that ban the use of certain sustainable technologies and practices. An example of this effort is California's state law, which overrules covenant restrictions that place bans on the use of solar panels in neighborhoods.[31] This approach is similar to how states outlawed the legality of covenants that restricted the sale of property to minorities in the mid 1900's.

Developers have realized that architectural styles, building designs and materials not listed in covenant regulations as acceptable, can be successfully used in certain situations while not affecting a neighborhood's character by diminishing anyone's financial return. For this reason many covenant regulations incorporate the clause "or upon review" at the end of a regulation. This review clause acts as a loophole for the developers when addressing potentially sensitive issues with homeowners.

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[31] Department of Energy, Office of Energy Efficiency and Renewable Energy. (2000). Electronic Reference. Retrieved June 21, 2003, from http://www.eere.energy.gov/solarbuildings/pdfs/ccrcalaw.pdf

By having a "use on review" clause, it gives developer discretionary power to review alternatives and approve or deny them on a case-by-case basis.

An example of this practice might be a homeowner's request to install a solar panel on their residence. If solar panels were allowed on a review basis only, then the homeowner would have to request and get approved by the neighborhood architectural committee before installation. The committee has the legal authority given to them by the covenant (contract) to deny a request for any reason. They have the authority to deny the homeowner the use of solar panel solely on the fact that the southern direction on that homeowner's lot is also the home's front elevation. They can claim it detracts from the character of the neighborhood, while accepting the use of a solar panel on the rear elevation (south) of another residence without any legal recourse.

Generally, restricted items, regardless of any potential benefits or any technological advances, have a perceived reputation of being one or all of the following: large, unsightly, cheap looking or non-contributing to the image and character of the neighborhood. By making

alternative items allowable on a review basis only, the developers are able to comply with any applicable laws but still discourage the use of alternatives through the creation of additional procedural hurdles. Satellite dishes, solar panels and basketball goals are the most commonly restricted items that are allowed only on a review basis.

The creation of additional procedural hurdles required to use an alternative technology, material or practice deters its use. These hurdles place additional time and money requirements on residential builders, in order to potentially obtain permission to use an alternative. There is no economic incentive placed on builders to seek such an alternative when there is a pre-approved list of architectural styles, materials and practices referenced in the covenants. Only an active homeowner seeking the potential benefits of an alternative for economic or philosophical reasons might be willing to invest the time and money necessary to overcome these procedural hurdles.

The most common sustainable technologies and practices restricted in the case study covenants were the use of clotheslines and working out of one's home. The most

common sustainability technologies and practices such as solar panels and permeable paving surfaces were allowed only by review.

Few sustainable practices and technologies in the case studies covenants were found to be completely restricted or only on a review basis; the ones that were restricted will continue to be underutilized from economic and regulatory barriers.

Regulatory Differences Between Case Studies:

Land-Use Zoning

Each case study was selected to represent a different residential price level in the Knoxville real estate market. By having each case study represent a different income level, there is an opportunity to offer a comparison between each regulation's ability to address issues of sustainability. The case study income levels for new construction in Knoxville were as follows: Mechanicsville Commons as the low-income level, Fox Run Subdivision as the medium income level and Gettysvue Subdivision as the highest.

When comparing the regulations, there is a similar

level of thoroughness and order between each of the case studies. No case study appeared to be more thorough than the other. All developments conformed to area zoning regulations and established a series of covenant restrictions. Gettysvue Subdivision and Fox Run Subdivision were also required to comply with area subdivision regulations. Mechanicsville Commons' TND-1 zoning does not require compliance with Knoxville's Minimum Subdivision Regulations.

When comparing each development's zoning, Knoxville's TND-1 zoning stands out among the others. It was used in the Mechanicsville Commons development and is the newest zoning classification in the case study group. Unlike the others, it requires developments to incorporate several sustainable principles as mentioned earlier. The other zoning classifications address only basic issues related to lot sizes, permissible uses, building coverage, setbacks, and height restrictions. None of these zoning classifications go into any written details, where issues of sustainability could be explored.

It should be noted that even though there is little mention of sustainable issues in the written zoning MPC

commission and the Town of Farragut do have the ability to address issues of sustainability. Both the MPC and the Town of Farragut have the ability to waive and place additional zoning requirements on new developments within their jurisdictions. By having the ability to remove and add requirements these authorities have a lot of flexibility when negotiating with developers. This practice is limited in the amount of additional requirements an authority can place before it becomes economically unfeasible. While this is an additional way for them to address issues of sustainability, this practice was not observed within the case studies.

There were zoning classifications that did appear to be better than others, but no direct correlation between housing values and the quality of the regulations could be drawn. It should be noted that some zoning regulations do place requirements that, from a cost of improvement perspective, could only be afforded in more high-end developments. An example of this are, the infrastructure and architectural requirements of TND-1 zoning. As Mechanicsville Commons, is the low-end case study in this document that uses the TND-1 zoning, its development and

financial risk was highly subsidized by the government. Under normal market conditions, it would be more likely that a higher-end development would be created under this zoning classification due to the increased risk and development costs.

Subdivision Regulations

In addition to zoning regulations, Gettysvue and Fox Run Subdivisions were both required to meet area subdivision regulations. The TND-1 zoning used in Mechanicsville Commons, does not require developments to meet Knoxville Subdivision Regulations.

The major difference between Knoxville (Gettysvue) and Farragut's (Fox Run) subdivision regulations are the comprehensive nature of each. The Knoxville regulations address only the basic issues of land-use. These regulations address issues such as the process of land sub-division, open space requirements, street naming, plat reviews, easement requirements, lot design, utilities and street design. These zoning requirements do not go into enough detail to review the technologies and practices mentioned in chapter two. Furthermore, there are no

requirements in these zoning requirements, which help to promote or exclude the use of these technologies and practices.

Farragut's subdivision regulations address all of the same issues as the Knoxville subdivision regulations. However they also include more sustainable oriented issues, such as sidewalk, pedestrian facilities, community assets (ie: historic buildings, large trees) and greenway connections. Like Knoxville, this regulation does not go into enough detail to review its impact on technologies and practices mentioned in chapter two. The document is more comprehensive in its descriptions and details in comparison to Knoxville's regulations. Farragut's regulations do make an effort to address more issues related to sustainability, but these efforts are still very minimal.

All developments with residential (ie: R-1, R-2) zoning classifications in Knox county, regardless of housing values are required to conform to one of these subdivision regulations. Because these regulations apply to all income levels, there is no difference in the quality of regulations related to housing costs.

Development Covenants

The greatest variation in regulations between the case studies occurred with covenants. Mechanicsville Commons' covenants were presented in the form of a pattern book containing drawing details and descriptions of the proposed community. Incorporated into each of the purchase contracts was an agreement to follow the intent of the pattern book, bylaws and its design committee (KCDC). Fox Run and Gettysvue covenants were presented in the form of 100+ page legal documents, containing written descriptions on all aspects of use, design, maintenance and procedures.

The pattern book, while offering detailed written and visual information on acceptable architectural styles, materials, design details and neighborhood character, does not address procedures, easements, uses and maintenance issues, as found in the other two case study covenants. A review of the pattern book and a typical homeowner sales contract gave no indication where easements were legally reported. Written examples of regulations addressing sustainability issues were only incorporated at a zoning level. The pattern book references the sustainable issues

introduced and required in the zoning, but does not incorporate any additional written requirements on the development.

When interviewing Becky Wade of KCDC, it became known that all residential units in the development were designed with an emphasis on low maintenance and high energy efficiency; this requirement was given by KCDC (the builder) to the architect.[32] The intent of this was to minimize the maintenance and utility expenses for the low-income residents. Because KCDC is the developer, building contractor and sole controlling agent of the development, issues, traditionally addressed in covenants to control a developments completion and to protect a developer's financial interest, were not incorporated into the regulations. Many of the sustainable issues incorporated into the development were made as design requirements at the client / architect level.

Residential units constructed or lands purchased at market value (not subsidies) from KCDC are required to use KCDC as their construction general contractor in a design/build fashion, but they are not required to

[32] Wade, Becky. (2003, April 10). Interview with author. Urban Planner, Knoxville Community Development Corporation, Knoxville, Tennessee.

construct a building with similar performance standards, such as the subsidized KCDC houses.

The pattern book as a whole was mainly used as a visionary document. It addressed all issues besides design on a very general level. Since KCDC was the only party involved in the development, the information commonly written in a traditional covenant, related to building construction, was most likely not written, but addressed internally within KCDC. All issues related to the development after construction, it is assumed, will be addressed and written in the yet to be completed neighborhood bylaws.

In contrast, Fox Run and Gettysvue development covenants were written in a manner most commonly found in suburban subdivisions. Both developments' covenants are similar in design and will be discussed together. Each set establishes a review and approval process, architecture design standards, neighborhood organizations, permissible uses, rights to use common areas, maintenance, setbacks, and legal fines. The impacts on sustainability were discussed in earlier chapters.

When comparing the covenants of the three case

studies, Mechanicsville Commons' pattern book appears to be the most non-prescriptive in its writing and did not address any issues of sustainability in a positive or negative manner. While Mechanicsville Commons appears to be the most sustainable of the three case studies in actual design, it is not reflected in the covenants. Many of the decisions, outside of zoning, that make Mechanicsville Commons such a sustainable development were made at what could be described, not a covenant level, but at a homeowner level. KCDC (the homeowner) desires to build a responsible sustainable house in a development that does not have requirements stating such.

Comparison Conclusion

When comparing regulations and market values, no difference in the quality of the regulations in regard to the housing values of the development was found. The fact that zoning and subdivision regulations affect all developments of a sufficient area, in the same manner regardless of housing values, there are no differences in the quality of the regulations. Some zoning classifications require a higher level of improvement than

other classifications, but there is no observed correlation between zoning and housing values in the case studies.

Because Mechanicsville Commons was created with help from government subsidies and not subjected to economic open market forces, comparisons between developments at a covenant and bylaw level could not be made.

Recommendations:

There are several changes that could be made to the overall system of subdivision regulations to promote the use of sustainable technologies and design practices.

1. Pass a state-law similar to California's that outlaws the exclusionary practices of proven sustainable technologies and practices in subdivision regulations and private covenants. This would allow sustainable technologies and practices to be considered a public good.

2. On a national scale, redefine how home values are calculated to reflect not just the construction costs, but also the life cycle costs of a residence, including maintenance and energy usage. This would show the true value of materials and make sustainable technologies more competitive in the open market.

3. Encourage public housing entities (HUD, KCDC) to support the soon to be released LEED standards for their residential construction projects (2005). A majority of federal agencies currently support and require the use of the new commercial LEED standards, which has helped rating systems to gain acceptance and popularity in the construction industry (Economy of scale).

4. Encourage lending institutions to connect mortgage interest rates to the LEED rating system. Banks determine interest rates by calculating their desired rate of return on investment and the level of investment risk. Because LEED certified buildings have lower operating expenses and greater resale values, they expose lenders to less risk. Interest rates are generally lowered when a lender's risk is lowered. This would help to create an economic incentive for people to buy LEED certified houses.

5. Encourage communities to require new residential construction to meet a performance standard (Public good).

6. Lobby local and state government to create incentives to promote sustainable technologies.

In conclusion, the case study regulations observed had

several positive or negative effects on the use of sustainable technologies and practices. Negative impacts include required use of non-permeable surfaces, required use of non native grasses, minimum lots sizes, minimum building square footages, banning of clotheslines and home businesses, use on review for solar panels and building materials. The positive impacts observed include, required use of natural vegetation, use of permeable surfaces, sidewalks, mixed-use development, connectivity to greenways and required community open spaces. As natural resources become more precious, it could be hoped that regulations targeted to address the positive and negative issues of sustainability will become more common in communities. Recommendations, mentioned above, will help to bring about this change.

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