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SOUTHERN VILLAGE
(CHAPEL HILL, NORTH CAROLINA)

INTRODUCTION

Southern Village is a 312-acre New Urban development in the Town of Chapel Hill, North Carolina. Strong population growth in Chapel Hill and the larger Raleigh-Durham-Chapel Hill Metropolitan Area prompted the town to reorganize future growth in the rural area on the south side of town into a more compact, sustainable urban form surrounded by farmland and very low density development. The town justified its response, in part, due to the negative impacts of uncontrolled sprawl on Jordan Lake – a highly-valued resource for drinking water less than eight miles from Chapel Hill.

Three issues defined how Southern Village impacted the Jordan Lake watershed. These issues derived from five land use policies the town used to guide development, and the implementation of those policies through site design.

In 1992 the town adopted a Small Area Plan for the Southern Village site and surrounding properties. The plan’s land suitability analysis indicated that many of these neighboring properties were hydrologically sensitive to development impacts. Thus, town planners increased future residential density on the Southern Village site and decreased future residential density on surrounding parcels through rezoning. However, under the new zoning, the Southern Village site would not absorb all of the future growth from surrounding parcels. Thus, the town’s rezoning policy may have the unintended consequence of creating sprawl.

Southern Village could have absorbed more growth if the developers had implemented more “watershed-protective” imperviousness. Although the town’s Resource Conservation District protected 73 acres, its Watershed Protection Ordinance only required stormwater management for impervious levels greater than 24% (maximum imperviousness was 50%). Since most of Southern Village was less than 24% impervious (due to low-density development), less than half the site had stormwater management. Though additional imperviousness would generate more stormwater runoff, higher imperviousness would also require stormwater management while absorbing growth from other more sensitive areas. Furthermore, the town’s Design Guidelines and Development Ordinance did not prevent steep streets, excess parking, and paved pathways in the Resource Conservation District. These forms of imperviousness threaten Jordan Lake water quality but do not absorb regional growth.

Where stormwater management was required, the developer only implemented detention ponds to control runoff, not treat runoff. The developer also sited a detention pond in the 100-year floodplain. A flood could flush the pond’s pollutants directly to Fan Branch Creek.
SETTING

Southern Village is 312 acres of rolling woodland and farmland in the North Carolina Piedmont on the south side of Chapel Hill. Two streams cross the site: Fan Branch Creek and Wilson Creek. The site is located in the Jordan Lake watershed (see Figure 1). Jordan Lake is a source of drinking water for the Town of Chapel Hill and other nearby communities. The soils, slopes, and streams of the site were significant development challenges. When rain falls on exposed areas of Chapel Hill gravel, the predominant soil type, it does not soak quickly into the ground. Rather, it runs off and erodes the soil. Soil erosion on the site is compounded by steep slopes up to 20% (see Figure 2). Steep slopes cause water to run off at higher velocities. The combination of erodible soils and high runoff velocities threatens Fan Branch Creek and Wilson Creek with large amounts of sediment after heavy rainfall.

Figure 1. Location of Southern Village in Jordan Lake Watershed
Southern Village is in the Town of Chapel Hill in Orange County, part of the Raleigh-Durham-Cary-Chapel Hill Metropolitan Statistical Area in North Carolina. Population data for these jurisdictions reflect strong growth during the last 20 years, particularly since 1990 (see Table 1 below).

**Table 1: Population and Population Trends of Political Jurisdictions that Contain Southern Village**

<table>
<thead>
<tr>
<th>SPATIAL UNIT</th>
<th>POPULATION</th>
<th>POP CHANGE (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>TOWN</td>
<td>32,038</td>
<td>38,711</td>
</tr>
<tr>
<td>COUNTY</td>
<td>77,055</td>
<td>93,662</td>
</tr>
<tr>
<td>METRO AREA</td>
<td>664,788</td>
<td>858,485</td>
</tr>
<tr>
<td>STATE</td>
<td>5,880,095</td>
<td>6,632,448</td>
</tr>
</tbody>
</table>

*Source: U.S. Census Bureau*

Between 1980 and 1990, strong population growth in Chapel Hill (21%) and even stronger growth in the surrounding metropolitan area (30%) motivated town planners and elected officials to create more sustainable growth. They were particularly concerned that the existing countryside south of town would be overrun by sprawl if action was not taken. Thus, in 1989, the idea for a new approach to development in the southern area of Chapel Hill was conceived as the Southern Small Area Plan. Approved in 1992, the Southern Small Area Plan preserved most of the existing rural landscape through extensive downzoning (lowering the maximum number of residential units per acre) and a concentrated area of upzoning (increasing the maximum number of residential units per acre). The upzoned area became Southern Village. Unfortunately, the plan did not
relocate all the “eliminated” density from the other parcels to Southern Village. If the trend toward stronger population growth in Chapel Hill and the rest of the metropolitan area continues (26% and 40% respectively during the 1990s), the town’s policy may cause more sprawl, not less.

SITE DESIGN FEATURES

Southern Village consists of lower-density residential districts clustered around a core of high-density residential, retail, office, and civic uses (See Figures 3 and 4). There are a total of 1150 residential units: 525 single-family houses, 150 townhouses, 225 condominiums, and 250 apartments. There are also 65,000 square feet of retail space and 140,000 square feet of office space. Businesses include Weaver Street Market, Lumina Movie Theater, Hangers Dry Cleaners, Bloom Home and Garden Center, Market Street Books and Maps, and Annie’s Pizzeria. Civic institutions include Christ United Methodist Church and Mary Scroggs Elementary School. Recreation facilities include 70 acres set aside for the future Southern Community Park, small neighborhood “pocket parks,” and the Southern Village Racquet and Swim Club. A Resource Conservation District contains 73 acres that serve as stream buffers and also provide paths for walking and biking along the creeks and their tributaries.

Figure 3. Southern Village Master Plan
Southern Village has experienced considerable market success. Since the project’s inception, the developer has sold 400 of 525 single-family homes, priced between $250,000 and $800,000; 110 of 150 townhouses, priced between $170,000 and $290,000; 150 of 225 condominiums, priced between $120,000 and $190,000; and has rented all 250 apartments.

**LAND USE POLICY FRAMEWORK**


The first land use policy implemented by the town that affected Southern Village’s impact on Jordan Lake was the Southern Small Area Plan. In 1989, town planners and the Chapel Hill Town Council expressed concern about the spread of low-density sprawl. Of particular concern was the loss of the bucolic landscape (See Figure 5) that surrounded the town, particularly the southern region. Rather than wait for what they perceived would be the inevitable transformation of rural beauty to suburban sprawl, the town leaders developed a plan to concentrate future growth in the area best able to sustain it and reduce potential for future growth in areas more susceptible to environmental degradation.
After three years of planning, the Town Council adopted the Southern Small Area Plan in 1992 (see Figure 6). Essentially, the Southern Small Area Plan established a comprehensive policy framework for southern Chapel Hill. Maps of slopes and elevations, soils, natural features, stream networks, and watershed features were used to conduct a land suitability analysis. Through this process, town planners chose a site best able to sustain a compact, mixed-use, urban development. Densities were raised at the chosen site and lowered elsewhere. The intended result was less growth in more hydrologically sensitive areas and more growth in less hydrologically sensitive areas (please see Figure 7).
The second land use policy implemented by the town that affected Southern Village’s impact on Jordan Lake was the town’s Watershed Protection Ordinance. The Watershed Protection Ordinance limited imperviousness in Southern Village. The ordinance was consistent with state stormwater regulations (North Carolina General Assembly 2000). The ordinance provided three stormwater management scenarios for developers based on imperviousness (Town of Chapel Hill 2000):

Scenario 1: 0 - 24% maximum imperviousness (stormwater management not required)

Scenario 2: 24 – 50% maximum imperviousness (control first inch of rainfall)

Scenario 3: more than 50% maximum imperviousness not permitted

There are two key provisions in the Watershed Protection Ordinance. First, developers did not have to implement stormwater management if they kept an area less than 24% impervious. Second, Chapel Hill’s ordinance specified a standard for stormwater runoff control (control runoff from the first inch of rainfall) but did not specify a standard for stormwater runoff quality. The developers were not required to implement stormwater best management practices (BMPs) for runoff treatment.

The third land use policy implemented by the town that affected Southern Village’s impact on Jordan Lake was the town’s Resource Conservation District. The Resource Conservation District created a conservation buffer whose extent was defined as the
The fourth land use policy implemented by the town that affected Southern Village’s impact on Jordan Lake was the town’s Design Guidelines, established in the Chapel Hill Comprehensive Plan. These guidelines defined minimum width standards for streets. The guidelines also suggested, but did not require, street orientation on steep slopes. According to the guidelines, if the site’s landform was hilly and/or steep, a curving route paralleling one contour (line of equal elevation) was recommended because less steep roads provided more comfortable access for pedestrians and bicycle riders. Such roads
also required less power output from automobile engines and therefore decreased both noise and air pollution (Town of Chapel Hill 1986). Streets that follow contours also help slow runoff, reducing peak flow during heavy rainfall.

The fifth land use policy implemented by the town that affected Southern Village’s impact on Jordan Lake was its Development Ordinance. The ordinance provided developers with the town’s concept of “buildability” on steep slopes (Town of Chapel Hill 2000, Article 14.4.2 (Site Design)):

The buildability or potential for development of a site shall be defined as follows:

a) Land with slopes of less than 10 percent had little or no building restrictions.

b) Land with slopes of 10 to 15 percent should utilize site preparation techniques to minimize grading and site disturbance.

c) Land with slopes of 15 to 25 percent should demonstrate specialized site design techniques and guidelines for building and site preparation to occur.

d) Land with slopes greater than 25 percent is generally unsuitable for development.

The language of the Development Ordinance, such as “site preparation techniques” and “specialized site design techniques and guidelines” is not very clear. The wording leaves ample room for developer interpretation. Furthermore, neither the Development Ordinance, nor the Design Guidelines, is mandatory. The developer has considerable discretion under both policies.

**SITE DESIGN**

Chapel Hill’s five land use policies translated to three site design issues that defined Southern Village’s impact on the Jordan Lake watershed. First, Southern Village was designed to protect hydrologically sensitive areas but it was not built at high enough density to absorb potential growth in surrounding areas. Second, Chapel Hill limited imperviousness at Southern Village through its Watershed Protection Ordinance and Resource Conservation District, but the site was not designed to maximize watershed protection for Jordan Lake. The developers avoided stormwater management for more than half the site through low-density single-family residential development characteristic of sprawl. Imperviousness generated by steep streets, greenway paths, and extra parking contributed to excess stormwater runoff. Third, Chapel Hill did not mandate stormwater runoff treatment through its Watershed Protection Ordinance. Thus, Southern Village developers built detention ponds to control runoff, but ponds do not remove most runoff pollutants. Developers also placed the largest pond in the Fan Branch Creek floodplain, where it remains a pollution threat when the creek floods.
Southern Village was designed to protect hydrologically sensitive areas but it was not built at high enough density to absorb future growth in the area. The Southern Small Area Plan was approved in 1992 to distribute 3,748 units of future residential development among 2,216 acres of land. The intent of Chapel Hill planners and political leaders was to decrease development density in more hydrologically sensitive areas and increase development density in less hydrologically sensitive areas (see Figure 9). However, while the plan did produce the “downzoning” of many sensitive areas and the “upzoning” of less sensitive areas, it did not incorporate 3,748 residential units. The Southern Small Area Plan called for 2,760 units on 2,216 acres. The result was a net loss of 988 units. Increasing development pressure due to increasing population growth rates in Chapel Hill and the rest of the metropolitan area may cause these units to materialize as sprawl elsewhere in the region, possibly in another part of the Jordan Lake watershed.

![Figure 9. Overlay of Up Zoned and Down Zoned Areas on Hydrologically Sensitive Areas (Building Restricted and Steep Slopes)](image)

Higher densities at Southern Village would have absorbed the residential units not included in the Southern Small Area Plan. Closer inspection of the Southern Village site reveals that, despite its New Urban classification, the development was not built at the gross density recommended for New Urban sites: seven units per acre (Calthorpe 1993). Southern Village was approved for 1150 units on 312 acres - a gross density of only 3.7 units per acre. Adding 988 units to the site would produce a density of 2,238 units per...
312 acres, or 6.9 units per acre. Thus, if Southern Village was built to the density appropriate for New Urban neighborhoods, it could have included all the area’s units prior to the Southern Small Area Plan. Some critics of this approach, however, may suggest that higher densities at Southern Village would have led to higher levels of imperviousness and greater negative development impact on the Jordan Lake watershed.

An analysis of the current density and imperviousness of Southern Village reveals that the site could actually absorb the extra growth without creating an excessive burden on the Jordan Lake watershed. The town’s Watershed Protection Ordinance strictly limits site imperviousness to 50%. However, The Overall Pond Phasing Plan shows that Southern Village is only 35% impervious. The Pond Plan includes both a map of Southern Village’s drainage basins and a table of their areas, densities, and imperviousness (see Figure 10 and Table 2). Table 2 provides data that helps explain how Southern Village could have absorbed more growth. Table 2 shows the area, units, density, and imperviousness of each of Southern Village’s four drainage basins (A, B, G, and I) whose stormwater runoff is controlled by detention ponds and the remainder of the site (“none”) where there is no stormwater runoff control.
Table 2. Area, Density, and Imperviousness of the Southern Village Drainage Basins

<table>
<thead>
<tr>
<th>BASIN</th>
<th>AREA (acres)</th>
<th>UNITS</th>
<th>DENSITY (units/acre)</th>
<th>IMPERVIOUSNESS</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>ACRES</td>
</tr>
<tr>
<td>A</td>
<td>36.0</td>
<td>142</td>
<td>3.9</td>
<td>13.5</td>
</tr>
<tr>
<td>B</td>
<td>51.3</td>
<td>320</td>
<td>6.2</td>
<td>25.2</td>
</tr>
<tr>
<td>G</td>
<td>25.9</td>
<td>48</td>
<td>1.9</td>
<td>11.6</td>
</tr>
<tr>
<td>I</td>
<td>41.8</td>
<td>342</td>
<td>8.2</td>
<td>20.8</td>
</tr>
<tr>
<td>none</td>
<td>157.0</td>
<td>298</td>
<td>1.9</td>
<td>38.2</td>
</tr>
<tr>
<td>TOTAL</td>
<td>312.0</td>
<td>1150</td>
<td>3.7</td>
<td>109.3</td>
</tr>
</tbody>
</table>

Southern Village could have accommodated more development on the site without violating the town’s Watershed Protection Ordinance. According to the ordinance, the site cannot exceed 50% imperviousness, or 156 impervious acres. According to Table 2, the site was only built with 109.3 impervious acres. Therefore, 46.7 additional impervious acres are permissible under the Watershed Protection Ordinance. However, it is not obvious how to generate units based on impervious acres. Table 2 helps solve the problem. The number of impervious acres was divided by number of units to generate the number of impervious acres per unit.\(^1\) Table 2 shows that Basin I, where the highest density development is located (apartments, village core), averages 0.06 acres of imperviousness for every residential unit, the most “impervious-efficient” of the four basins. 46.7 additional impervious acres would generate 778 additional units if the additional development were built like that of Basin I. Since the downzoning of surrounding properties reduced maximum build-out of the plan area by 988 units, the remaining 210 units could be generated by adding more stories to buildings near the village core, as additional floors would not create more imperviousness.

It is noteworthy that a proposal to add 988 additional units to Southern Village to capture all the growth from the downzoned parcels could be constrained by a variety of factors that this analysis does not consider. The above analysis is somewhat simplified as it does not account for the full range of issues that must be considered in arriving at a total number of dwelling units for a site. For example, market conditions may not support the additional units. Specifically, consumer demand for large-lot housing rather than townhouses, condominiums, and apartments may render a higher-density Southern Village less marketable. Furthermore, site features such as steeper slopes and the close proximity of streams may make higher densities undesirable. Southern Village was essentially a “test” for New Urbanism in the area; neither the town, nor the developers, may have been willing to oversell high-density urban living in the environmentally sensitive, rural areas of a town with less than 50,000 residents.

Watershed Protection through Imperviousness

Chapel Hill limited total imperviousness on the Southern Village site through its Watershed Protection Ordinance and 73-acre Resource Conservation District, but the town was unable to ensure developers would make the best use of imperviousness on the
site to maximize protection of Jordan Lake. The previous section described how Southern Village could have accommodated 988 additional residential units, largely through increasing imperviousness. The developers managed to avoid even detention ponds on more than half the site by limiting imperviousness to less than 24% through low-density, single-family residential development. This type of sprawl was exactly the kind of development Southern Village was originally intended to counter. Furthermore, some of the imperviousness on the site is attributed to uses that do not accommodate more growth but only create more runoff. These include steep streets, paved pathways in conservation areas, and excess parking.

The slope of streets affects stormwater runoff. Through its Comprehensive Plan Design Guidelines, the town endorses streets with minimal slope to reduce runoff velocity. Town engineers maintained that a developer typically follows the grade around a hill when laying streets. However, New Urbanism promotes a grid street network resulted in some steep streets in Southern Village due to hilly terrain (see Figure 11). The developer also felt that steep streets provided a more attractive streetscape. The consequences of steep streets are that runoff flows faster and in higher volumes, without accommodating future growth from the downzoned properties surrounding Southern Village (see Figure 12).

Figure 11. Steep Street in Southern Village
There was little impervious surface reduction through design modifications of sidewalks and pathways on the site. Field observations revealed sidewalks on both sides of Southern Village streets and a 10-foot wide paved path through the Resource Conservation District along Fan Branch Creek (see Figure 13). In some of the lower-density sections, it may only be necessary to have a sidewalk along one side of the street. Furthermore, while hard pavement allows many different groups to use the path (including cyclists, rollerbladers, baby strollers, and the elderly), pervious surfaces such as brick pavers would create less runoff. This is an important consideration since the path in the Resource Conservation District is so close to Fan Branch Creek, and also because the path adds imperviousness without accommodating more density.
Parking was also a concern in core of Southern Village. Originally, the center of the village core was designated a public green (see Figure 14). However, the developers wanted to make certain they offered enough parking for the stores and offices planned for the village core. Though New Urbanists suggest that mixed-use developments do not need as much parking as conventional shopping centers since some of the patrons will walk or bike, the developers in Southern Village wanted to make sure they provided additional surface parking lots near their stores to attract retail and office tenants. Thus, half the original village green was converted to a parking lot. The parking lot increases stormwater runoff by creating more imperviousness, without absorbing future growth.

![Figure 14. Village Core with Original Public Green](image)

**Best Management Practices (BMPs) for Stormwater Runoff: Control vs. Treatment**

The local Watershed Protection Ordinance does not provide guidance the most appropriate BMPs to protect the Jordan Lake watershed. Although the developers built ponds to control runoff, ponds generally do not treat most of the pollutants found in stormwater runoff. Even more harmful to watershed protection is the location of the detention pond for Basin B in the 100-year floodplain of Fan Branch Creek. Basin B’s pond stores the most sediments and pollutants since it drains the largest area in Southern Village (55 acres). When Fan Branch Creek floods, the sediments and pollutants in Pond B may be washed into the creek and eventually Jordan Lake.

Stormwater detention ponds were originally standard practice for stormwater management. Ponds handled sediments and associated turbidity well. However, they did...
not significantly reduce nitrates and phosphates in the water (Booth and Jackson 1997; Booth and Leavitt 1999). Buffers, wetlands, level spreaders, and bio-retention serve these purposes. The stormwater engineer for Southern Village feels constructed wetlands are quite possibly the best protection, but they are the most expensive, the hardest to build, and possess limited aesthetic appeal. There are many more components that must work properly together, including weirs, plants, filters, and soil types, for a constructed wetland to do its job. Hence, the Southern Village pond system serves the role of detention (controls volume and peak runoff flow) and, to a very limited extent, sediment and turbidity control.

While a Chapel Hill town planner affirms ponds are useful tools to control stormwater runoff, he also admits that it was difficult for his department to verify imperviousness calculations and whether the ponds actually controlled the runoff from the first inch of rainfall since the Town of Chapel Hill had not assigned anyone to this task. Instead, the town planner and his colleagues relied on the developer to be both honest and accurate. The town planner cited the need for his staff to be more diligent to ensure that what is proposed on paper actually gets built on the site, controlling both runoff and sediment erosion as promised by the developer when the plan was approved.

Finally, at the time Southern Village was approved, the Resource Conservation District ordinance permitted ponds. The developers of Southern Village were in compliance with the Resource Conservation District ordinance when they sited the pond for Basin B (see Figure 10) adjacent to Fan Branch Creek. However, town planners and engineers realized that a more intense development like Southern Village could fill the detention ponds with a significant amount of eroded soil and polluted runoff. If a pond was breached by a flooding creek, the pollutants and sediments in the pond would be washed into the creek and eventually transported to Jordan Lake. Thus, town planners pressed for relocation of Pond B after Southern Village was approved. Southern Village developers did not want to move the pond and lose buildable lots. The town acquiesced for Southern Village, but passed the current ordinance to prohibit future placement of ponds in the Resource Conservation District.

CONCLUSION

The Town of Chapel Hill Southern Small Area Plan was a major policy achievement for watershed protection. Through this plan, the town became proactive in the management of future growth and land use design in the southern portion of the town’s planning jurisdiction. The town specifically chose the current site for Southern Village to concentrate growth in an area the town felt was best able to handle intense development (i.e. least erodible soils, least imposing terrain, least impact on Jordan Lake). The town simultaneously lowered future residential density properties around Southern Village because those areas were more hydrologically sensitive. Unfortunately, Southern Village did not absorb all the potential growth shifted away from the more sensitive sites. The result was a New Urban site built at low densities, more typical of sprawl than New Urbanism. Furthermore, Southern Village developers did not use the site’s imperviousness to maximize watershed protectiveness. The developers did not
implement any stormwater management for most of the site and only the most basic stormwater management (detention ponds) for the remainder.

*What Worked?*

There is much to praise regarding the Town of Chapel Hill’s policies regarding watershed protection. The Southern Small Area Plan was a forward-looking approach to reorganize growth, protect the Jordan Lake watershed, and inaugurate New Urbanism into the community as a solution for sprawl. The Watershed Protection Ordinance limited imperviousness and mandated stormwater management. The Resource Conservation District protected 73 of the site’s most pristine acres from development. The Town’s Design Guidelines specified how street orientation should follow lines of equal elevation, a method to reduce runoff velocity. The Town’s Development Ordinance advised how to build on steep slopes and supported New Urban parking standards.

*What Did Not Work?*

Despite all the good intentions of the policies that helped guide the development of Southern Village, the project fell short of its potential. The Southern Small Area Plan effectively reduced overall development in the southern part of Chapel Hill by nearly 1,000 residential units. These units could sprawl in another local jurisdiction and still be in the Jordan Lake watershed. The Watershed Protection Ordinance capped imperviousness, but did not include guidance on how imperviousness should be allocated to absorb future growth and not exacerbate stormwater runoff. The Watershed Protection Ordinance mandated stormwater management, but did not prescribe the most appropriate BMPs for removing pollutants other than sediments. The Resource Conservation District included the largest detention pond and paved walkways within its greenspace, both harmful to watershed health. Since the Design and Development Guidelines of the town were not mandates, the developer was not required to comply.

*What Did Southern Village Teach Us?*

If carried out successfully, the concept of the Southern Small Area Plan is one of the most effective for using New Urbanism to protect watersheds. Communities should reorganize projected growth for a region based on a regional land suitability analysis. Hydrologically sensitive lands should be spared at least some of their potential growth in exchange for more intense development of less sensitive lands. The redistribution of growth should be such that there is zero net loss within the rezoned area. Then, a careful framework of open space and imperviousness should be crafted within the site itself to protect the site’s sensitive lands from development impact. Southern Village was developed in this type of policy framework, but the outcome suggests weak implementation may limit the development’s effectiveness in protecting Jordan Lake.
REFERENCES


1 Although not all imperviousness on the site is due to residential development (some attributable to retail, offices, school, church, and parking), this formula offers a reasonable translation of residential units to impervious acreage based on the actual development of Southern Village.