

Background Reports: A Framework Plan for Preservation and Growth in Creswell

Harford County, Maryland

June 2019



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A study prepared for the Harford County Department of Planning and Zoning by students and faculty in a Scenario Planning Workshop, a graduate course in the Urban Studies and Planning Program at the University of Maryland, College Park.

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Introduction

By Uri Avin

This volume of background reports accompanies and supports the primary product of the Spring 2019 semester by graduate planning students at the University of Maryland for the Harford County Department of Planning and Zoning- *Creswell: A Framework Plan for Preservation and Growth*.

The project was part of a yearlong program within the National Center for Smart Growth (NCSG) called PALS (Program for Action Learning in Sustainability) which selects a jurisdiction each year and matches their needs for studies and research with relevant courses at the University of Maryland. Of more than two dozen projects for Harford County during 2018/2019, five addressed various aspects of Creswell, a 13,000 acre rural area adjacent to the County's urban area. The Creswell area had been targeted for further study in the County's 2016 master plan called *HarfordNext*. This study was the County's top priority for PALS and the basis for the 16-week course yielding the Framework Plan.

The chapters of the Background Report represent the research, data gathering and analysis conducted by the students as they familiarized themselves with Harford County and Creswell specifically. The chapters cover a wide range of topics. While the understanding gained from this work informs the Framework Plan, the Background Reports all have independent value as current perspectives on topics relevant to planning for Creswell and Harford County.

Nine of the 13 Appendices follow a similar format. Each is introduced by a matrix which summarizes the Chapter, which then follows the sequence of the matrix topics. The matrix is organized by those factors that are seen as the key drivers or issues for the topic. The constraints or opportunities that each factor represents are identified and their implications for Creswell noted. The treatment of the topics is not meant to be comprehensive but rather is targeted to highlighting information and factors relevant to understanding current and future forces that will affect Creswell. Three Appendices (Appendix G through Appendix I) follow a somewhat different format. These both provide background information as well as conduct impact analyses. They were produced in a parallel planning course on Infrastructure prior to the development of the final Framework Plan alternatives and thus use slightly different numerical totals for the scenarios studied.

While individual students wrote particular chapters, all worked on the overall project and Framework Plan. This elective course in the URSP program was developed and taught during Spring 2019 by Uri Avin FAICP, Research Professor at the NCSG and Matt Noonkester AICP, Adjunct Faculty, President of The City Explained and owner of CommunityViz software. Numerous expert adjuncts advised students and made presentations to the class.

Appendix A: Housing and Economic Development

By Nick MacKereth

Executive Summary

Harford County is the sixth largest County in the state of Maryland based on both its population size and population density.¹ Harford County also ranks 23rd out of 24 Maryland jurisdictions for lowest crime rates.² *HarfordNEXT* states, “Those who choose Harford County, do so because it affords them a great quality of life with low crime rates, varied housing options, suburban rural comforts, and a thriving economy.”³ This section of the appendix will cover the research on the demographics for both Harford County and the Creswell Study Area, as well as research on growth projections, housing (regionally and locally), and the current economic and business landscape of Harford County. Figure 1 provides a brief overview of the housing and economic development planning and regulatory factors which have been researched and analyzed for this part of the appendix.

Figure 1. Executive Summary Matrix

Planning/Regulatory Factors	Opportunities and Constraints	Implications
<p>Projected Growth Projected Future Growth: Key Takeaways and Future Needs</p>	<ul style="list-style-type: none"> Expect Household Growth but with Limited Space in Development Envelope 65+ Population may Double by 2040 	<ul style="list-style-type: none"> Need for more housing, specifically housing for population 65+ years Need to find solutions and space to handle future growth
<p>Housing Housing Trends, Local Needs, Regional Shortage, and Key Takeaways</p>	<ul style="list-style-type: none"> Harford County has a Strong Housing Market Currently, a majority of housing in Creswell are Large Homes on Large Lots Creswell has some of the highest home values in all of Harford County Future Housing Shortage due to low supply of land and housing within Harford Counties Development Envelope 	<ul style="list-style-type: none"> Lack of Affordable Housing Lack of 65+ Affordable Housing Options Need to find solutions for building more units on less land; preservation of current landscape
<p>Economic Development Employment Trends, Existing Retail and Commercial Nodes, Future Needs, and Key Takeaways</p>	<ul style="list-style-type: none"> I-95 Interchanges- Current and Future Potential Current Underutilized Commercial Properties Retail Growth with Household Growth 	<ul style="list-style-type: none"> Capacity for Future Needs: Driven by land use, infrastructure, and growth management future decisions If Creswell increases its housing supply expect retail to follow new homes

¹ Maryland Department of Legislative Services

² Maryland Department of Legislative Services

³ HarfordNEXT

All of the census data in the housing and economic development section of the appendix (unless otherwise stated) was compiled from the American Community Survey (ACS) 2012-2017 5 year estimates. The data for Creswell was compiled from the ACS 2012-2017 5 year estimates from two census tracts: 3011.02 and 3037. In this section of the report, all census data and information for the Creswell Study Area is represented by these two census tracts and are labeled on charts under the title Creswell. These two census tracts do not identically align with the consistently drawn boundaries of the Creswell Study Area for this report. However, these two census tracts cover the majority of the study area, and the data is representative of the areas demographics and residential information.

Existing Conditions

Creswell Study Area is adjacent to Harford County’s development envelope and borders the development envelope to the South along I-95 and to the west along the Bynum Run River Watershed. Creswell is home to many small locally owned farms. On the north end of the Creswell Study Area is Harford Community College, a crucial higher education resource, and also a cultural center of the County hosting many community gatherings, concerts, and cultural events. There are several large community parks and the study area is home to many of the County’s youth sports leagues. The Creswell Study Area is also home to Broom’s Bloom Dairy, a small farm cafe and ice cream shop, which is not only a favorite of local residents, but attracts many others from around the region.

The following charts display selected data points for both Harford County and the Creswell Study Area (represented by using data from census tracts 3011.02 and 3037) which have influenced many of the decisions and choices made throughout this report. Of all the census data compiled for Harford County and the Creswell Study Area there are several key statistics which are worth highlighting, including:

Table 1 shows the percentage of family household for Harford County is 72.30% and non-family households are 27.70% while the percentage of family households in the Creswell Study Area is 84.04% and non-family households is 15.96%.

Table 1. Harford v. Creswell Basic Household Info

Households	Harford	Creswell
Total Households	92,895	2,607
Family	72.30%	84.04%
Non-Family	27.70%	15.96%
Household Size	2.56	3.00
Median Age	40.6	46.2

Table 2 shows the percentage of the population 55 years and older are 28.82% and 35.84% for Harford County and the Creswell Study Area, respectively.

Table 2. Harford v. Creswell Demographics

Population	Harford County	Creswell
Population Total	250,132	7,522
Population 55+	28.82%	35.84%
Non-Hispanic White	79.40%	83.71%
Non-Hispanic Black	13.47%	6.33%
Total Non-Hispanic	5.82%	3.46%
Total Hispanic	4.24%	6.50%

Table 3 outlines the median household income for Harford County is \$83,455 and for the Creswell Study Area the median household income is \$112,622. The Creswell Study Area has one of the highest median household income levels, when it is compared to the rest of Harford County, which can be seen in Figure 2.

Table 3. Harford v. Creswell Household Income

Median Income	Harford	Creswell
Median HH Income	\$83,445	\$112,622
Mean HH Income	\$100,608	\$145,816

Figure 2. Harford Median Household Income

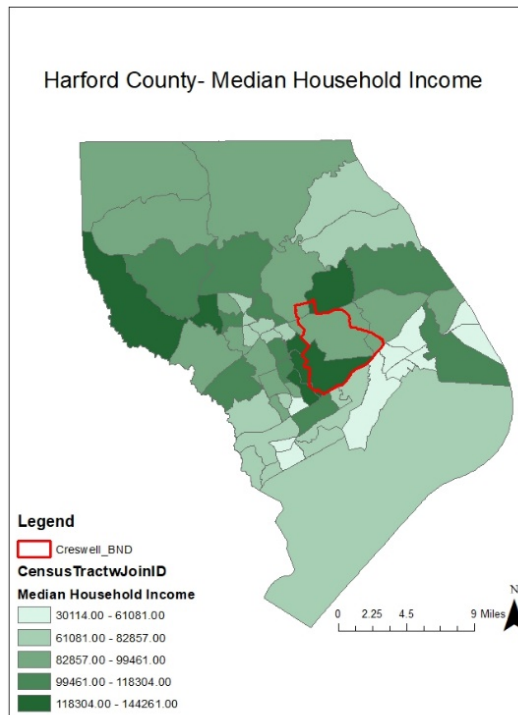


Table 4 shows over 1/3 of the population for both Harford County and the Creswell Study Area have at least a bachelor’s degree and over 90% of the same populations have a high school diploma or equivalent certification.

Table 4. Harford v. Creswell Educational

Educational Attainment	Harford	Creswell
Less than high school graduate	7.10%	9.37%
High school graduate, GED, or	27.10%	25.61%
Some college or associate	30.60%	27.99%
Bachelor’s degree or higher	35.20%	37.03%

Families with children have significant influence on local school and local school capacity. The elderly tend to use emergency services, particularly EMS, more often than those in their twenties and thirties. Local demographics allow planners to guide decisions which will best meet the needs of their residents. These highlighted local demographics helped to steer decisions made throughout this report. Demographics can also play a critical role in decisions for attracting or leveraging specific types of development, such as a focus on building senior housing, or in coordination with the local school system they can plan to build or expand new or existing facilities. Knowing that over one third of the current population of the Creswell Study Area is 55 and older, targeting development for senior housing maybe a good fit for the current community context.

Growth Projections

To understand the forecasted potential growth for Harford County, two different sets of future projections were chosen to evaluate. The first set of projections was forecast by the Maryland Department of Planning and the second was developed by Woods and Poole Economics, Inc. The Maryland Department of Planning projections are official projections the state complies and releases to be used by local jurisdictions to make policy decisions.⁴ The state projections are generally based on recent growth trends, local capacity, the aging population, in and out migration patterns and local policies.⁵ The Maryland Department of Planning projections expect growth for Harford County to continue to grow at its current rate, which the County has been experiencing since 2010. Woods and Poole are a privately owned economic business consulting firm who releases long-range population and employment projections based on local economic potential.⁶ Woods and Poole projections do not take into account any local factors including public policies. With an understanding of supply and demand, the local context, and sound research, this report has created a third set of projections which will be referenced in this report as PALS projections. These projections expect there to be a growth rate just slightly higher than the official Maryland Department of Planning projections and

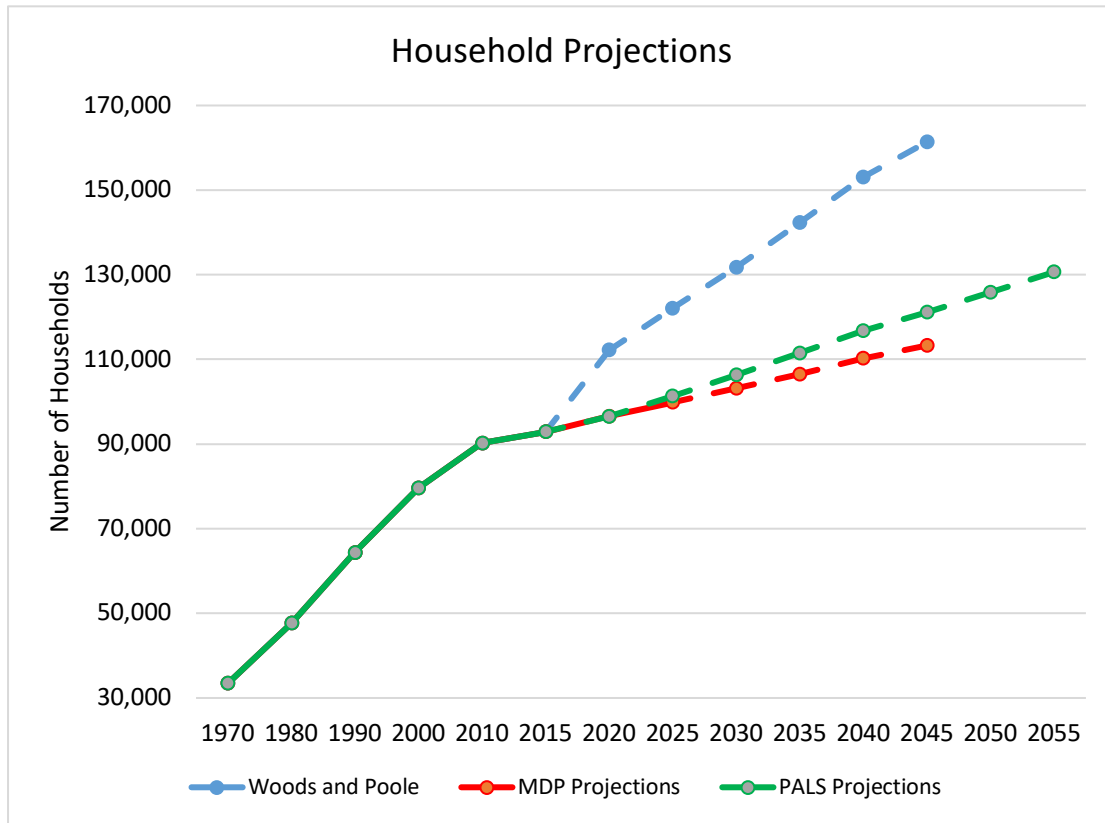
⁴ Maryland Department of Planning

⁵ Maryland Department of Planning

⁶ Woods and Poole Economics, Inc.

substantially less than the Woods and Poole projections. Figure 3 below outlines these three projections.

Figure 3. Household Growth Projections



Opportunities and Constraints

The Maryland Department of Planning, Woods and Poole, and the PALS projections all expect Harford County to experience population growth over the next several decades. Harford County must decide if they plan to accommodate this expected growth. Harford County, if they do decide to accommodate growth, must then decide where the growth will go and make decisions which will best meet the needs of both the current and future residents of Harford County.

One key set of demographic projections which have had influence on decisions and ideas made in this report are the Maryland Department of Planning projections for Harford Counties 65 years and older population. As seen in Table 5 the population of residents 65 years and older is expected to almost double from its current population thru 2045. Individuals 65 years and older, like children 18 and under, typically have a specific set of needs, services, and accommodations that may be unique to their circumstances. With the expected growth of the population 65 years

and older, the County has the opportunity to plan and provide the necessary services and accommodations which will meet the needs of their aging population.

Table 5. Age 65+ Population Growth Projections

Harford County (MDP)	2017	2020	2025	2030	2035	2040	2045
65+ Population Projections	37,366	45,205	53,980	62,015	66,103	67,972	66,577
65+ Population Projections	14.94%	17.54%	20.38%	22.81%	23.56%	23.50%	22.63%

Implications

If Harford County decides to accommodate the projected future growth expected from projections released by MDP, Woods and Poole, and PALS, the County they must decide how they want to grow, where they want to grow, and the best way to accommodate the needs of all current and future residents. With accommodating growth, the County will have to consider all needs and services which are tied to growth. This report provides research on all components which need to be considered when accommodating and planning for growth, including: housing, economic development, green infrastructure, water and sewer, local community character, local stakeholders, transportation, utilities, neighborhood amenities (schools, parks, fire, police and EMS), fiscal considerations and needs, and smart growth principles.

Regional Housing Shortage

The Baltimore Metropolitan Council (BMC) area, which includes, Baltimore City and the surrounding suburban counties of Anna Arundel, Howard, Carrol, Baltimore and Harford, is increasingly experiencing a regional housing shortage in the suburban jurisdictions. The BMC region is expected to continue to grow, in both population and number of jobs, over the next several decades, due to its centralized East Coast location and its affordability, compared to other large East Coast metropolitan centers such as the District of Columbia, New York City, and Boston.⁷ The regional demand for land and housing is quickly catching up to the existing supply within the allocated County’s development envelopes. Table 6 provides an

Table 6. Remaining Years of Housing Supply

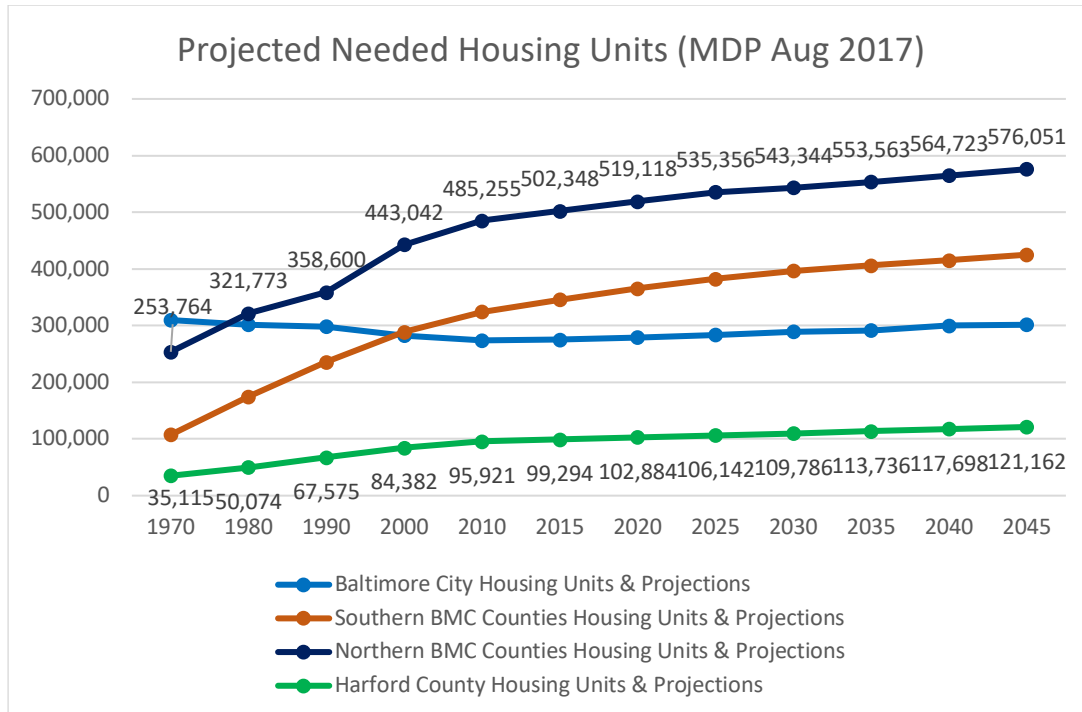
estimate for when each of the suburban BMC jurisdictions are expected to “run out” of supply. This table highlights that the southern suburban counties have less than ten years left in

County	Supply= Years left at av. Growth rates of 1998-2016	Year that Supply "Runs Out"
Baltimore	16	2032
Carroll	32	2048
Harford	17	2033
Anne	8	2024
Howard	9	2025

⁷ Comprehensive Housing Market Analysis Baltimore-Columbia-Towson, Maryland

their supply, which means as growth continues, the northern suburban jurisdictions should expect to increase their share of the regional growth. The BMC region will

Figure 4. Projected Needed Housing Units



continue to see growth over the next several decades and each jurisdiction must accommodate and plan for its fair share of the growth.⁸ As seen in Figure 4, Harford County has grown at a rate slower than the rest of the BMC region. Over the next several decades, the BMC has mentioned that they expect Harford County to increase its share of growth. If Harford County continues to grow, at even its current rate, which it has experienced since 2000, the County is expected to “run out” of its current supply of land and housing by 2033.⁹

⁸ The Crunch for Housing in Central Maryland Draft Report

⁹ The Crunch for Housing in Central Maryland Draft Report

Charts 1 and 2 using both the Maryland Department of Planning and Woods and Poole projections show the surplus or deficiency which each of the suburban jurisdictions will have by 2045.

Chart 1. Housing Supply Capacity Surplus v. Deficiency

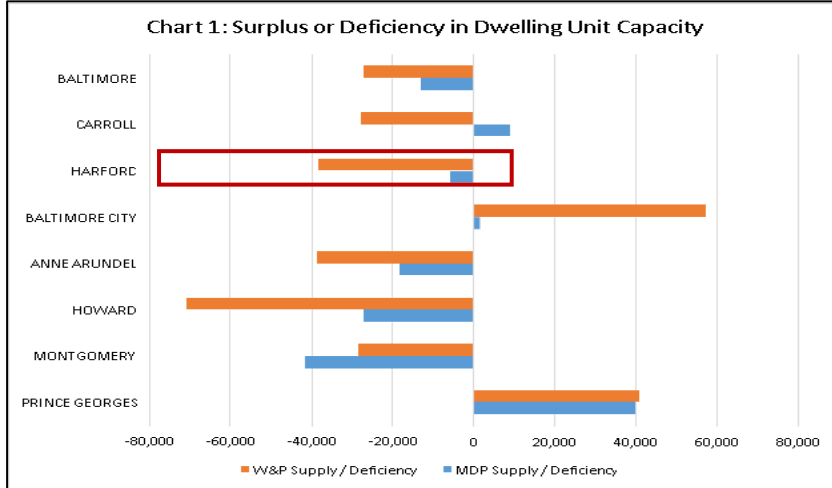


Chart 2. Housing Supply v. Deficiency

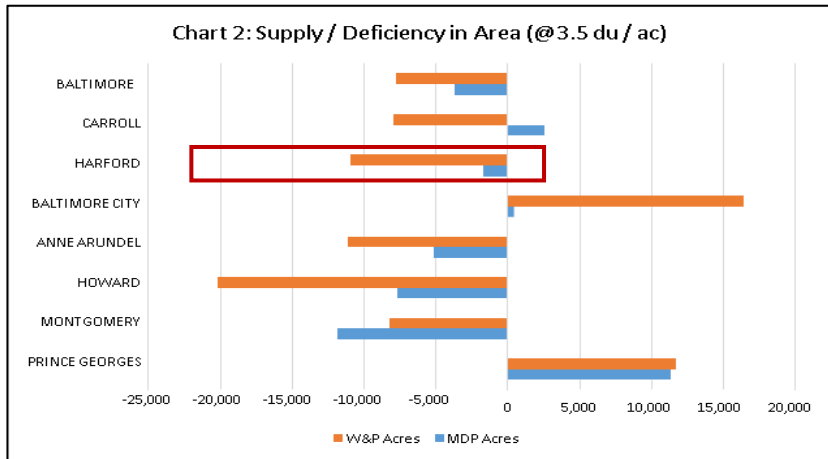


Figure 5 shows remaining development rights currently available inside Harford County's development envelope. If zoning laws are unchanged; there are only 8,029 development rights left.

As the region approaches residential build-out higher land and housing prices are expected. Currently, Harford County is relatively affordable compared to the other suburban jurisdictions in the BMC region. The average selling price for homes in Harford County in 2018 was \$255,000 compared to Howard County whose average home sales were \$415,000, Anne Arundel County was \$336,000, Carroll County was \$319,900, and only Baltimore County average home sale price was lower than Harford County's at \$239,000.¹⁰ Table 7 below highlights the average home sales for all of the BMC suburban jurisdictions, as well as shows the average for entire BMC metro region, for both 2017 and 2018. Figure 6 shows that since 2009, only Harford County has experienced an increase in their County's home values at 1.04% while all other jurisdictions have seen a decrease in their home values.¹¹ Looking ahead, home sales should be expected to continue to rise, and possibly at a faster rate than is currently being experienced, because as there becomes less supply, prices will likely rise.¹²

Figure 5. Remaining Development Rights

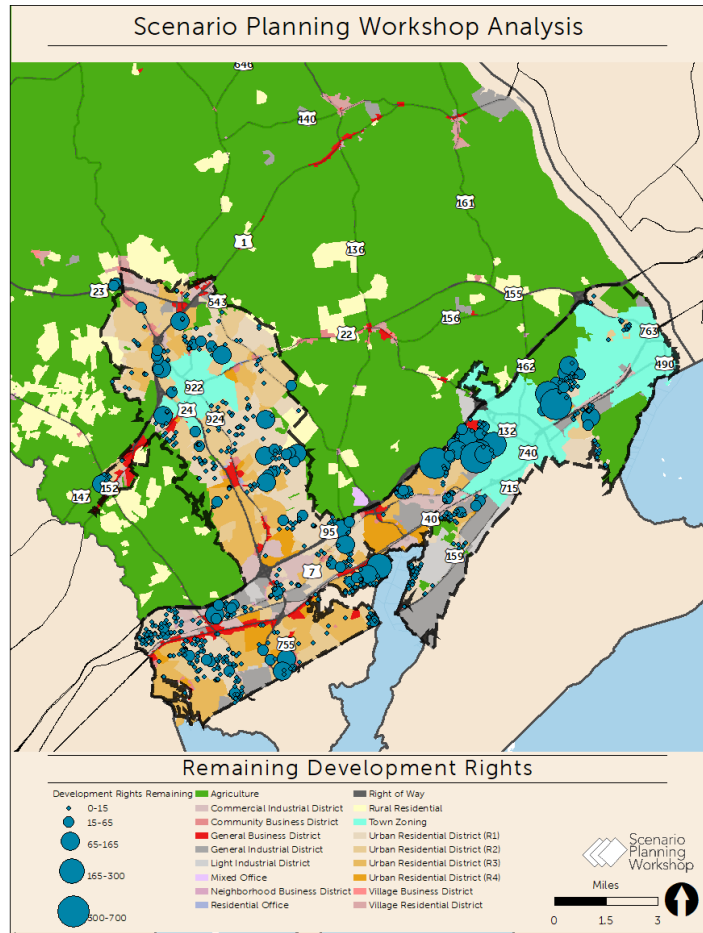


Table 7. Regional Average Home Sales

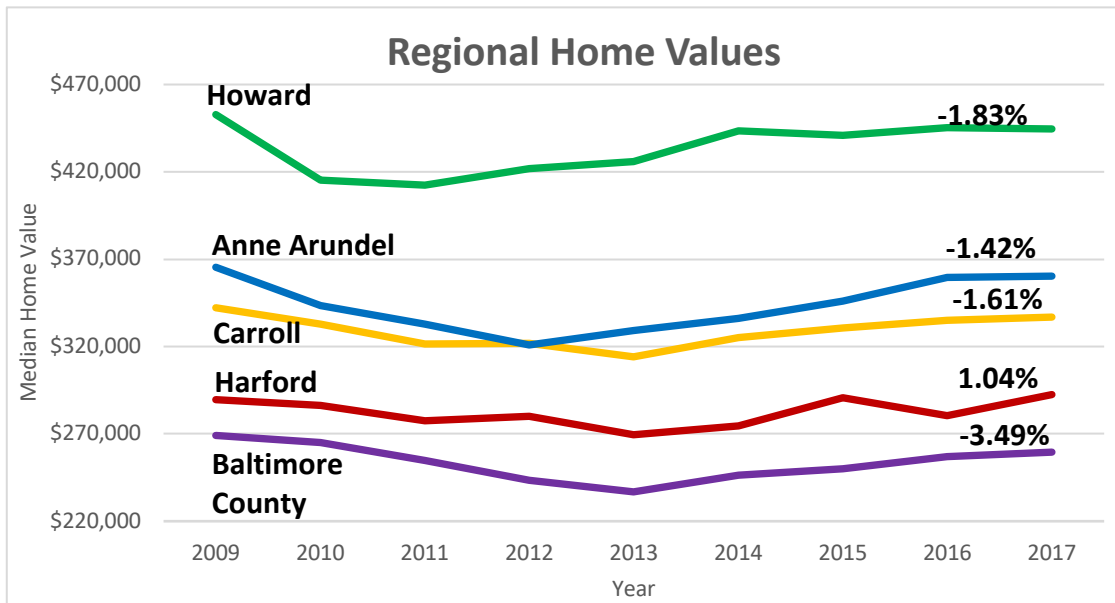
Locale	2018- YTD	2017-YTD
Howard	\$415,000	\$409,950
Anne Arundel	\$336,000	\$325,000
Carroll	\$319,900	\$300,000
Baltimore Metro	\$265,000	\$255,210
Harford	\$255,000	\$240,000
Baltimore County	\$239,000	\$228,000

¹⁰ Bright MLS Housing Market Update

¹¹ ACS 1-year estimates for median home values for collected for each jurisdiction

¹²Bright MLS Housing Market Update

Figure 6. Regional Home Values



Opportunities and Constraints

Due to Harford County, in the regional context, being relatively affordable, the County has the opportunity to attract many new residents. As home and land prices continue to rise in the BMC region, especially in the southern suburban jurisdictions, and as the area continues to grow, Harford County’s location and accessibility may make it a very attractive place to live.

As seen in Figure 7, part of the Creswell Study Area is home to some of the highest median home values in the County. Table 8 outlines that the median home value for Harford County, according to the ACS 2012-2017 5-year estimates is \$281,400 while the median home value in the Creswell Study Area is \$375,451 with over 50% of all homes in the Creswell Study Area costing more than \$300,000.

Table 8. Harford v. Creswell Home Values

Home Values	Harford	Creswell
Total Owner-Occupied	73,027	2,393
Median Value	\$281,400	\$375,451
Less than \$99,999	6.04%	5.22%
\$100,000-\$199,999	18.78%	11.83%
\$200,000-\$299,999	30.66%	26.54%
\$300,000-\$499,999	35.56%	31.76%
\$500,000-\$999,999	8.24%	21.86%
\$1,000,000 or more	0.72%	2.80%

Implications

One of the guiding principles for this report has been to preserve as much of the current rural landscape as possible. The recommendation to require all new development to be build using open space sub-division principles. Marketing this project in the lens of using open space sub-division a way to accommodate the future growth of the area with preserving as much of its current character will be key. The regional housing shortage will become more prevalent in the coming years and regionally decisions will have to be made which will best meet the needs of current and future residents.

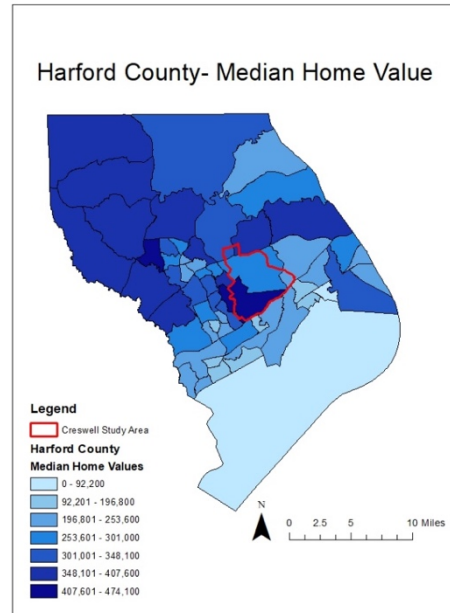
Housing Affordability

One goal identified in *HarfordNEXT* is to ensure a range of housing opportunities for all citizen. Furthermore, to accommodate growth, *HarfordNEXT* proposes the County will need to offer a range of housing choices and opportunities to ensure the demand for housing can be met and the need for the County to diversify its housing stock and to provide more housing options.¹³ Harford County's Consolidated Plan FY 2018-2020 FFY 2017-2019 in their three year strategic plan, done in coordination with the Baltimore Regional Housing Coalition, identifies goals and strategies for four funding priorities the County has identified through an extensive needs assessment and market analysis. The first priority identified is the need for the County to expand affordable housing opportunities. The plan further identifies five goals and strategies to expand affordable housing.¹⁴

1. Preserve and rehabilitate existing housing stock, particularly for elderly, frail elderly, and households with special needs.
2. Financial counseling and assistance for low-moderate income renters and first time homebuyers.
3. Rental assistance to low-moderate income households.
4. Housing construction for the creation of new or rehabilitated housing for low-moderate income homebuyers and renters.
5. Affirmatively furthering fair housing on the local and regional level.

Harford County's median household income has increased significantly over the past seventeen years, from \$57,234 in 2000 to \$83,445 in 2017 (an increase of 45.8%), housing costs have continued to increase at an even greater rate making it difficult for low and low-moderate income households to achieve housing stability.¹⁵

Figure 7. Harford Median Home Values



¹³ HarfordNEXT

¹⁴ Harford County's Consolidated Plan FY 2018-2020 FFY 2017-2019

¹⁵ Harford County's Consolidated Plan FY 2018-2020 FFY 2017-2019

Figure 6, once again outlines that regionally, Harford County’s median home values have increased 1.04% since 2009, while all other suburban jurisdictions’ home values have decreased in value. When residents pay more than 35% of their monthly income on housing costs they are considered to have a housing cost burden; while residents paying over 50% of their monthly income for housing are considered severely housing cost burdened.¹⁶ Table 9 shows the total number of households for both Harford County and the Creswell Study Area, and then further breaks these households into those who own and those who rent. Furthermore, Table 10 breaks down owner occupied units into those with and those without a mortgage. Table 10 then continues by showing the percent of monthly income, homeowners pay for housing costs, for both Harford County and the Creswell Study Area. You can quickly see that over 30% of Harford County residents pay more than 35% of their monthly income on housing costs and over 31% of the Creswell Study Area homeowners are housing cost burden. Tables 11 and 12 show the same results for renters in Harford County. There is no data for the Creswell Study Area due to the limited number of rental properties currently within the study area. You can see in Table 12 that over 40% of all Harford County renters are cost burden.

Table 9. Owner v. Renter Occupied

	Harford	Creswell
Households Totals	92,895	2,607
Family Households	72.30%	84.04%
Non-Family Households	27.70%	15.96%
Owners-Occupied Units	73.86%	84.59%
Renters-Occupied Units	20.11%	7.56%

¹⁶ Harford County's Consolidated Plan FY 2018-2020 FFY 2017-2019

Table 10. Mortgage Status & Monthly Costs

Mortgage Status	Harford	Creswell
Owner-Occupied units with a mortgage	73.56%	66.69%
Owner-Occupied units without a mortgage	26.44%	33.31%
<i>Housing Units with a mortgage</i>		
Less than 20.0%	43.64%	46.99%
20.0% to 24.9%	18.19%	10.53%
25.0% to 29.9%	11.90%	13.41%
30.0% to 34.9%	7.11%	2.63%
35.0% or more	18.79%	24.56%
Not able to Compute	0.38%	1.88%
<i>Housing Units without a mortgage</i>		
Less than 15.0%	64.17%	71.27%
15.0%-19.9%	10.85%	12.30%
20.0%-24.9%	5.49%	4.39%
25.0%-29.9%	5.10%	1.38%
30.0%-34.9%	3.10%	5.02%
35.0% or More	10.74%	5.65%
Not able to Compute	0.55%	0.00%

Table 11. Renter Status

Gross Rent-Renter-Occupied	Harford
Total Renter Occupied Units	18,817
Median Gross rent	\$1,197

Table 12. Rent as a % of Household Income

Gross Rent as a % of Household Income	Harford
Less than 15.0%	14.28%
15.0% to 19.9%	11.07%
20.0% to 24.9%	13.37%
25.0% to 29.9%	10.44%
30.0% to 34.9%	7.94%
35.0% or More	40.87%

Furthermore, Table 13 shows the number of Harford County households, broken down by renters and owners, who are cost burdened and severely cost burdened, using the Comprehensive Housing Affordable Strategy (CHAS) data provided by HUD for 2010, 2012, and 2015. This provides a further breakdown and emphasizes the issue, that there is a large percentage of residents within Harford County with are extremely cost burdened, meaning they pay more than 50% of their monthly income on housing costs.

Table 12. Housing Cost Burden

Harford County Cost Burden Residents								
	Cost Burden >30%				Cost Burden >30%			
	Renters				Owners			
	0-30% AMI	>30-50%A	>50-80%A	Total	0-30% AMI	>30-50%A	>50-80%A	Total
	Number of Households				Number of Households			
2006-2010 CHAS	3,035	1,670	1,470	6,175	3,315	2,655	4,680	10,650
2008-2012 CHAS	3,541	2,202	1,429	7,172	3,739	3,193	4,117	11,049
2011-2015 CHAS	3,720	2,900	1,540	8,160	3,885	3,470	3,245	10,600
	Cost Burden >50%				Cost Burden >50%			
	Renters				Owners			
	0-30% AMI	>30-50%A	>50-80%A	Total	0-30% AMI	>30-50%A	>50-80%A	Total
	Number of Households				Number of Households			
2006-2010 CHAS	2,495	640	170	3,305	2,400	1,565	1,735	5,700
2008-2012 CHAS	2,856	914	203	3,973	27,432	2,041	1,551	6,335
2011-2015 CHAS	3,060	1,180	85	4,325	3,050	2,020	1,020	6,090

HarfordNEXT further identifies the County’s need to address the affordable housing options for the elderly, minorities, and residents with special needs. The report concludes that a greater percentage of minorities are either cost burdened or extremely cost burdened compared to their white neighbors. The plan further states that 1,491 elderly renters and 961 elderly homeowners currently are paying more than 30% of their income on housing. Even more troubling is that 728 elderly renters and 2,379 elderly homeowners are extremely cost burdened, currently paying more than 50% of their monthly income on housing costs.¹⁷

¹⁷ Harford County's Consolidated Plan FY 2018-2020 FFY 2017-2019

Opportunities and Constraints

Harford County has a unique opportunity, if the County decides to move forward with ideas presented in this report, to prioritize housing affordability as a goal and strategy during the development of the Creswell Study Area. Using some of the goals and strategies presented in *HarfordNEXT*, the Creswell Study Area could become a catalyst for solutions to achieve the County's goal to expand affordable housing opportunities. The County has the opportunity to drive development of a range of housing types which can accommodate residents at all income levels.¹⁸

With housing costs in Harford County being significantly more affordable than other BMC suburban jurisdictions, the County is a desirable option for households seeking a home which provides them with easy accessibility, great schools, and a high quality suburban lifestyle.¹⁹ However, due to the strong housing market, low to moderate income households may struggle to achieve housing stability.²⁰ Currently, low income residents of Harford County struggle to find housing assistance. Harford County Housing Agency provides 1,000 housing vouchers for residents, however, they currently have a wait list of over 3,000 residents seeking a housing voucher with an average wait time of up to 5 years.²¹ The only public housing within Harford County is provided by Havre de Grace Housing Authority. They manage 50 single family townhomes and 10 elderly/disabled townhomes. They also have a waiting list of residents, many who have been on their list for over 3 years.²²

Harford Community College has identified the need and desire to build on campus housing for students. If the decision is made to develop Creswell, and to provide water and sewer to Harford Community College, there is a prime opportunity for housing to be built on campus. The opportunity for growth and the addition of dorms on campus would continue to allow Harford Community College offer more services, higher educational classes, and cultural events to all residents of Harford County.

Implications

While the County has outlined several strategies to achieve this goal as mentioned earlier, there are many other options, which have been adopted, around the United States and the World, which Harford County could potentially research and adopt to meet their goal to expand affordable housing opportunities. The following policies or programs have provided more affordable housing opportunities for residents:

- Adoption of inclusionary zoning incentives
- Redefining and promotion of accessory dwelling units
- Expand rental assistance programs (such as low income housing tax credits and housing vouchers)

¹⁸ Harford County's Consolidated Plan FY 2018-2020 FFY 2017-2019

¹⁹ HarfordNEXT

²⁰ Here We Grow

²¹ Harford County's Consolidated Plan FY 2018-2020 FFY 2017-2019

²² Harford County's Consolidated Plan FY 2018-2020 FFY 2017-2019

- Promote homeowner assistance programs
- Alter the local land use regulations and building codes, and follow smart growth initiatives.²³
- Provide dorms on Harford Community College’s campus

Economic Development Potential

Harford County is strategically located on the I-95 corridor and is accessible to one-third of the United States population within just an overnight drive.²⁴ Harford County is home to Aberdeen Proving Ground (APG) (the fourth largest employer in the BMC region) which is the United States Army’s premier research and development installation employing over 28,000 military and civilian workers. The County is also home to three major medical centers and has a growing agriculture and agribusiness community.²⁵ Harford County has a highly skilled workforce, due in part to the highly skilled and specialized positions required by APG but also in part to the County’s excellent public education system. This includes specialized STEM focused magnet school programs including a model Science and Math Academy at Aberdeen High School, a Homeland Security program at Joppatowne High, and Biomedical at Bel Air High.²⁶ Furthermore, the County, in partnership with Harford Community College, provides targeted higher education programs, which are designed to meet the needs of the local business community.²⁷ Harford Community College is also immersed in the education continuum with articulation and “2+2” programs that support seamless university opportunities.²⁸

Opportunities and Constraints

Harford County has great economic development potential, and the Creswell Study Area could benefit. Currently, in the Creswell Study Area, there is a mixed office designation adjacent to I-95 and MD 543 which was designed to accommodate corporate offices, research and development facilities, and high-tech services, that is currently underutilized.²⁹ This report will only show slow and minor office and industrial land use development and growth in the Creswell Study Area.

The Creswell Study Area is also home to many farms and several agribusiness. The Creswell Study Area has unique potential retail opportunities. There is also opportunity to expand or enhance agriculture and agribusinesses businesses within the Creswell Study Area. While conventional retail is not expected to grow vendors which emphasize local production are in high demand. So depending on how much residential development occurs, retail services will be necessary. The more closely

²³ Affordable Housing Policies: An Overview

²⁴ Here We Grow

²⁵ Here We Grow

²⁶ Harford County Economic Development Advisory Board Visioning and Work Plan

²⁷ Here We Grow

²⁸ Harford County Economic Development Advisory Board Visioning and Work Plan

²⁹ HarfordNEXT

retail aligns with local production the higher the comparative value of the neighborhood.

While Harford County has a lot of opportunity for future economic development, the Creswell Study Area is limited in some respects. Land suitability issues, which can be read about in the environmental section of the appendix, goals for maintaining and preserving the current rural landscape, and the need to meet future needed housing demand are all potential constraints for the Creswell Study Area. Refer to the appendix on fiscal impact for more information on the local tax structure.

Implications

Expansion of retail and retail jobs will be expected as development of the Creswell Study Area occurs. If Harford Community College is able to build housing on campus and expand their offerings and host larger events, due to connection of water and sewer; there is potential for expansion of retail options developed near campus. The agriculture and agribusiness in the Creswell Study Area also could benefit from the development of the area. For more information on the agriculture and agribusinesses within the Creswell Study Area please refer to the appendix on agriculture. The County must also target an appropriate employment use to anchor the mixed office space currently underutilized complex off of I-95 and MD 543 which will help transform that section of the community area into a regional commercial center.³⁰ The economic vitality of the Creswell Study Area has potential to flourish if decisions are made to develop the Creswell Study Area.

Conclusion

Harford County has to make some tough decisions in the next several years. The primary decision is for the County to decide if they are going to accommodate and plan for the expected future growth of their County. If Harford County decides not to accommodate future growth, than it should expect to “run out” of developable land within their development envelope by 2033. If the County does decide to grow, they then have the hard decision on where to accommodate the future growth. The Creswell Study Area offers a unique opportunity as a potential location for the County to accommodate this growth. One reason this area is unique is for the fact that the County would be able to provide Harford Community College with water and sewer, which is the only why the college will be able to expand its services offered to the local community. This section of the appendix covered the research on the demographics for both Harford County and the Creswell Study Area, as well as research on growth projections, housing (regionally and locally), and the current economic and business landscape of Harford County. All the information in this appendix could and should be used as sound guiding principles which should be used and leveraged before and during development of the Creswell Study Area.

³⁰ Harford County Economic Development Advisory Board Visioning and Work Plan

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Appendix B: Water Quality, Green Infrastructure, and Soil Health

By Sarah Latimer

Executive Summary

In order to preserve the ecological, agricultural, and environmental services provided by the rich natural landscape in Creswell while meeting housing and economic development needs, alternatives must prioritize agricultural and forested lands of high productivity and quality that preserve and support water quality, environmental health agricultural efficiency, and soil stability throughout Creswell. This appendix provides an inventory of the natural resources in Creswell across streams, forests, and soils, and establishes strategies to accommodate growth while preserving high quality environmental resources and mitigating environmental impacts.

The use of open space subdivision design provides a method by which to prioritize the conservation of contiguous green infrastructure with high runoff filtration potential, as well as the preservation of agricultural uses on high quality prime soils throughout Creswell. By implementing formal conservation standards in tandem

Table 1. Executive Summary Matrix

Planning/Regulatory Factors	Opportunities and Constraints	Implications
<u>Sensitive Water Quality</u>	<p>Opportunity: Nontidal water quality at generally safe levels in Bush River Watershed</p> <p>Constraint: Nonsupporting watersheds exist on the edges of Creswell to the northeast and southwest</p> <p>Constraint: the subwatershed Little East Bynum within western Creswell is rurally impacted</p> <p>Constraint: Grays Run forest has been identified as a priority for preservation and sensitive to changes</p>	Alternatives must minimize impervious surface and maximize green infrastructure and constructed bioretention areas in order to maintain water quality with new development.
<u>Pressured Green Infrastructure</u>	<p>Opportunity: Large existing GI of high ecological value</p> <p>Opportunity: Green Infrastructure provides a North-South connection of GI to Chesapeake Bay Critical Area</p> <p>Opportunity: Green Infrastructure in Creswell has High Biodiversity Value</p> <p>Constraint: Potential threats/loss of benefits from development</p>	Alternatives must consider prioritizing the protection and conservation of green infrastructure according to its ecological value by size, species, and health, as well as its opportunity to be a resource of open space and recreation for the community.
<u>Diverse Soil Types</u>	<p>Opportunity: Large Amount of acreage of prime agricultural soils</p> <p>Opportunity: Creswell contains a diversity of soil types that allow for multiple uses</p> <p>Constraint: The center of the study area contains steep slopes and highly eroded soils</p>	Alternatives must work to align land use with soil types while maximizing the preservation of prime soils for agriculture and minimizing development on steep slopes and highly eroded soils.

with clustered development, these resources can not only be protected from fragmentation, but can also be improved upon to allow for increased water and air quality, biodiversity, reduction of flood risks, and improved health of native plant species.

Sensitive Water Quality

Overview

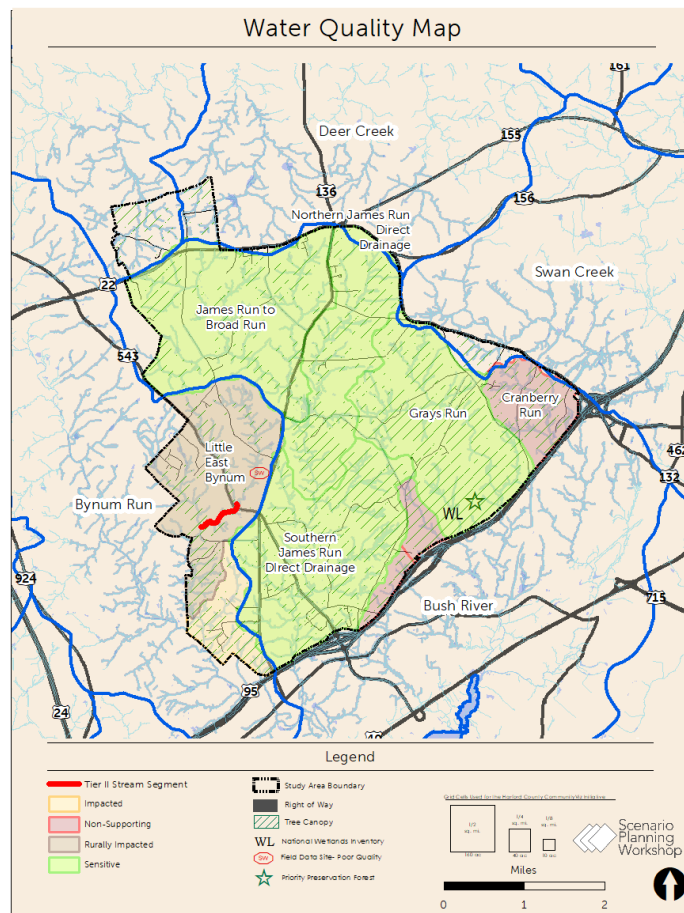
Creswell is located largely in the nontidal estuary portion of the Bush River watershed and larger Bush River Basin, which reach to the tidal coast of the Chesapeake Bay in the south and up to the north at Bel Air and further northwest towards Jarrettsville. In order to understand water quality of runoff to the coastal Bush River and out to the Chesapeake Bay, this analysis will largely focus on six subwatersheds within the Bush River watershed that make up the core of the Creswell study area, as seen in Figure 1.

Overall, water quality in Creswell is relatively stable and of high quality, but is extremely sensitive to changes to the infrastructure and ecological landscape in Creswell³¹. Alternatives to accommodate growth in Creswell will need to minimize impervious surface expansions while maximizing contiguous forested land, stabilize soils to minimize sediment erosion into waterways, and mitigate impacts of development with open space and environmental site design practices.

Opportunities

The water quality in Creswell is relatively high, particularly in comparison with its neighboring subwatersheds to the west and east, where higher levels of impervious surface allow for increased flows and minimal filtration before runoff reaches key

Figure 1. Water Quality



³¹ Draft Green Infrastructure Plan, Harford County. 2003

waterways³². While the tidal portions of the Bush River watershed have recently been identified as impaired by the state of Maryland's Department of Natural Resources for Polychlorinated biphenyl (PCB) contaminants and mercury levels³³, the same is not true in the northern, nontidal portions of the watershed, such as those in Creswell³⁴.

The most recent study of the subwatersheds in Creswell in 2003 found minimal impairments over the maximum levels of nitrogen, phosphorous, and suspended sediment in the six core subwatersheds in Creswell³⁵. Further, challenges to water quality in Creswell are minimal³⁶. With only 6.59% of the study area in impervious surface, risk of high flows of contaminated runoff are minimal. In undeveloped land, 40% of the core subwatersheds are forested, not only slowing the flow of stormwater and minimizing risks of flooding, but also improving stormwater quality before it reaches waterways. Existing older growth, deciduous, and contiguous forest provide opportunities for filtration and wetlands protection. In Grays Run in the eastern edge of Creswell along Rt. 95, large contiguous forest tracts with over 250 acres of interior forest provide a stream buffer and support filtration in a Nationally Inventoried Wetland in the southeastern edge of Creswell, identified in Map 1 with "WL" ³⁷.

Constraints

While water quality is both safe and environmentally productive within Creswell, neighboring subwatersheds in the Bush River and Bynum Run watersheds have been identified as past maximum contaminant levels due to impervious surface levels, loss of green infrastructure, and heavy industrial uses. In combination with development pressure in Creswell from the western Bel Air and eastern Aberdeen, large changes in the forested area, impervious surface levels, or lack of environmental design and stream buffering could not only worsen water quality within Creswell, but could also create a significant effect on the Bush River watershed and coastal Chesapeake Bay area as a whole³⁸.

Outside and on the edge of the study area, several subwatersheds to the east and west of Creswell near Aberdeen and Bel Air, respectively, are marked as non-supporting, or are made up of over 25% impervious surface and do not support biologically productive ecological systems and services in their waterways³⁹. Cranberry Run, within Creswell, was identified as non-supporting due to impervious

³² Bush River Watershed Implementation Plan, Harford County. 2003.

³³ While PCBs were outlawed in the 1970s, water quality scientists believe new contamination has occurred from sediment erosion from the north reaching coastal streams many years later.

³⁴ "Watershed Report for Biological Impairment of the Bush River in Harford County, Maryland Biological Stressor Identification Analysis Results and Interpretation." Maryland Department of Natural Resources.2013.

³⁵ Bush River Watershed Implementation Plan, Harford County. 2003.

³⁶ Water quality is considered to be diminished at 10% impervious surface and poor at 25%

³⁷ Bush River Watershed Implementation Plan, Harford County. 2003.

³⁸ Ibid.

³⁹ Ibid.

surface levels to the south across I-95 within the subwatershed⁴⁰. Identified waterway impairments include limited flows from soil erosion and sediment in waterways, acidity, insufficient support of biological communities, and inorganic contaminants such as chloride and sulfate⁴¹. Many of these impairments are directly linked to industrial uses of land, including the spread of chemical waste and high levels of impervious surface that allow for both increased flow of runoff as well as the destabilization of soils that creates erosion into waterways⁴².

However, some impairments have also been noted inside the study area due to rural land uses. Little East Bynum on the western edge of Creswell was measured as high in nutrient loads of nitrogen and floating sediment in waterways, primarily due to livestock access to stream buffers. Importantly, Little East Bynum contains a state identified .65 mile long Tier II stream segment in the central area of Little East Bynum (seen in red on Map 1) However, despite the need to maintain high water quality in Tier II stream segments, streams near this segment were measured as impaired in both nitrogen levels and limited support of biological communities in the most recent watershed implementation plan⁴³. With 53% of the Little East Bynum subwatershed in agricultural use, the highest proportion of agricultural land across all core subwatersheds, nutrient loads from fertilizers and sediment erosion from tilled cropland continues to challenge water quality in the western edge of Creswell⁴⁴.

Although water quality in the core of Creswell remains high, changes in the contiguous forests that provide significant interior forest space, riparian buffers, and wetland filtration of runoff could cause significant impacts on water quality throughout the Bush River watershed. With several subwatersheds in direct drainage to the Bush River and Bynum Run, loss of forested land could significantly increase flows of unfiltered runoff to non-supporting watersheds, creating a compounded negative effect on the water quality entering the Bush River and Chesapeake Bay Critical Area on the coast⁴⁵. The Grays Run forest on the eastern edge of Creswell was noted as a priority contiguous forest with over 300 acres of moderately biodiverse, deciduous forest that provides buffering for 200 meters for three streams, including a nationally inventoried wetland in the southern portion of the forest⁴⁶. However, with site plan and development review based conservation of

⁴⁰ Ibid.

⁴¹ "Watershed Report for Biological Impairment of the Bush River in Harford County, Maryland Biological Stressor Identification Analysis Results and Interpretation." Maryland Department of Natural Resources.2013.

⁴² Ibid.

⁴³ Bush River Watershed Implementation Plan, Harford County. 2003.

⁴⁴ Tier II streams identified by the state are required to maintain high water quality as part of county MS4 municipal stormwater permits.; For a greater detail on agricultural uses within Creswell, refer to the Agricultural appendix.

⁴⁵ "Watershed Report for Biological Impairment of the Bush River in Harford County, Maryland Biological Stressor Identification Analysis Results and Interpretation." Maryland Department of Natural Resources.2013.

⁴⁶ Bush River Watershed Implementation Plan, Harford County. 2003.

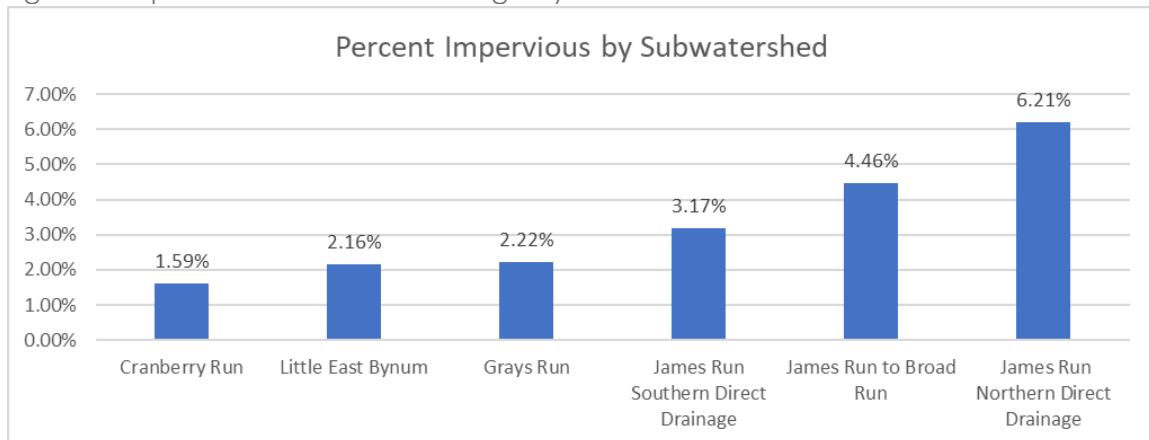
contiguous forest, the potential for forest fragmentation of forested land and loss of stormwater filtration potential remains a threat to water quality in Creswell.

Implications

While Creswell currently has high water quality with minimal impervious surface and maximum forest coverage, development pressures on unprotected forested land and the intensification and urbanization of land uses in Creswell could threaten water quality in Creswell and in the Bush River watershed. However, with minimization of impervious surface coverage, implementation of environmental site design principles, and prioritization of key green infrastructure, Creswell can accommodate development while maintaining its relatively high water quality levels.

At present, impervious surface percentages remain under the 10% threshold for water quality across the core of Creswell and within the six key subwatersheds, as seen in Figure 2. Impervious surface percentages are highest in the James Run Northern Direct Drainage subwatershed with 6% of the subwatershed in impervious surfaces, which contains the rural village of Churchville along Rt. 22. All other subwatersheds have impervious surface percentages beneath 5%. New development in Creswell will need to implement measures to minimize impervious surface, particularly in the James Run subwatersheds in the core of the study area that make up the three highest percentages of impervious surface in Creswell. Strategies like clustered development and open space and conservation focused design can provide densification that minimizes impervious surface, thus mitigating significant impacts on water quality from increased flows and decreased runoff filtration potential⁴⁷.

Figure 2. Impervious Surface Percentage by Subwatershed



Lastly, the prioritization of key green infrastructure that provides ecological services like stormwater filtration for water quality will be essential in mitigating impacts of development on water quality in Creswell. Clustered open space design

⁴⁷ For a detailed discussion and case study on open space design, see the Agricultural Appendix.

strategies can be combined with the prioritization and preservation of forested, stream buffered, and other ecological areas important to maintaining high water quality in Creswell through site planned forest conservation as well as open space easements. Contiguous forest land in Grays Run, identified as a priority forest in the 2003 Bush River Watershed Implementation Plan, provides significant ecological benefit and will be key in mitigating impacts of development on water quality in Creswell. On the western edge of Creswell, restoring stream buffers to the tier II stream segment in Little East Bynum through open space design easements and prioritized reforestation can assist in rehabilitating water quality in the western subwatershed.

Throughout Creswell, the prioritization of forests and green infrastructure with significant interior forest and stream buffering for preservation, as well as reforestation and afforestation, can both improve current water quality in Creswell's subwatersheds and mitigate loss of runoff contaminants with new development. The following section will examine the existing green infrastructure in Creswell and work to prioritize forested and habitat land for water quality, biodiversity, and other ecological services.

Pressured Green Infrastructure

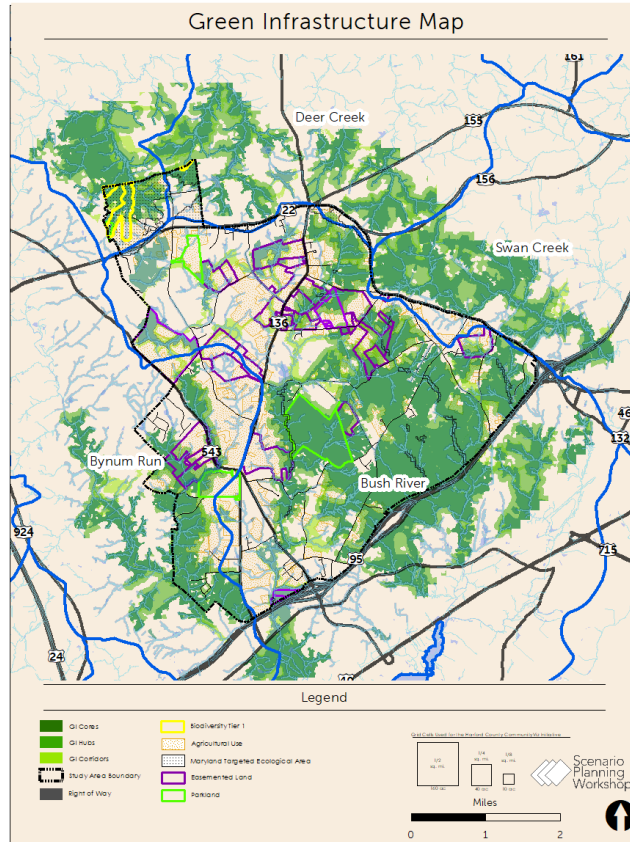
Overview

Creswell's forested land, habitat, and green infrastructure ecosystem provides a wealth of environmental resources providing key ecological services such as water and air quality improvements, biodiverse habitat, and open space and recreation. At the edge of two sides of the development envelope, the large, contiguous green infrastructure stands in stark contrast to the developed edges along Route 24 and I-95, marking a distinct environmental character within Creswell. However, with increasing development pressures in Creswell, existing green infrastructure remains potentially affected from development that could impact connections between key interior forest habitats and the network of green infrastructure throughout Creswell and Harford County. Further, with the implementation of monitoring and forest management beyond state mandated forest conservation, forest quality in Creswell can be preserved and built upon to improve biodiversity, opportunities for recreation and community stewardship, and environmental benefits like water and air quality.

Opportunities

As part of the Environmental Stewardship goals of the 2016 *HarfordNEXT* Plan, Harford County published a Draft Green Infrastructure Plan in 2018⁴⁸. The Green Infrastructure Plan identifies green infrastructure and ecological resources in forested areas within the county; establishes priorities for preservation and protection within the existing green infrastructure; and outlines several best management practices and next steps to protect and improve upon the quality of green infrastructure throughout the county. The Green Infrastructure Plan (see Figure 3) and associated data and analysis provides a firm foundation to examine, prioritize, and protect green infrastructure throughout the county for water and air quality, biodiversity, resilience, and open space and recreation⁴⁹.

Figure 3. Green Infrastructure



The Green Infrastructure Plan's use of the Green Infrastructure Assessment, first outlined in 2003, provides a useful, easy to understand, and impactful measurement of green infrastructure in Harford County using state and county level inventories, satellite analysis, and previous land cover studies⁵⁰. By categorizing green infrastructure into habitat cores of highest value, hubs with potential for improvement, and corridors that link larger habitats, the plan provides an easy to use method that can be expanded upon as new green infrastructure is studied, or as the health of existing green infrastructure improves. Further, the studies' scoring of green infrastructure for remediation and protection based on measurements of biodiversity, interior forest habitat, stream buffering and quality, soil types, and species inventories establishes a method by which to prioritize green infrastructure for conservation policies or remediation programs that may be able to arise from the Green Infrastructure Plan. New regulatory and formal policies providing conservation and forest management based on prioritized features of the

⁴⁸ *HarfordNext*. Harford County Department of Planning and Zoning. 2016

⁴⁹ Draft Green Infrastructure Plan, Harford County. 2003

⁵⁰ Weber, Ted. "Green Infrastructure Assessment Tool". Maryland Department of Natural Resources Watershed Services Unit. 2003.

green infrastructure of the county would allow for the development of consistent, balanced, and healthy forested ecosystems across urban and rural areas that provide ecological services, habitat, and open space throughout the county⁵¹.

Creswell’s green infrastructure is of relatively high quality, accounting for 13.85% of green infrastructure within Harford County. Within Creswell, 69% of Creswell’s 6,983 acres of forested lands are made up of core habitat. Hubs, or edge forests, make up another 16%, and corridors make up the remaining 15% of green infrastructure in Creswell (See Figure 4). Figure 5 depicts Creswell’s green infrastructure as a percentage of the Bush River Watershed. Given the large quantity of core forests, 52% of all forested areas in Creswell are interior forest, providing habitat for biodiverse and sensitive species such as the Hooded Warbler. Further, much of the green infrastructure within Creswell supports high water quality, with 68% of forests providing a stream buffer of 100 meters and 49% providing buffers of 200 meters. As a part of the Bush River Watershed, Creswell’s green infrastructure supports a significant portion of filtration and stormwater management. The USDA I-Tree Model estimates that overall, the green infrastructure within the Bush River watershed provides an estimated \$73,523.00 in runoff filtration annually, providing significant ecological services for the county in its Critical Bay Area⁵². With 61% of the forested land in the Bush River watershed made up of forested land in Creswell, the green infrastructure in Creswell is key to supporting high water quality in nontidal and tidal portions of the Bush River watershed⁵³.

Figure 4: Green Infrastructure in Creswell

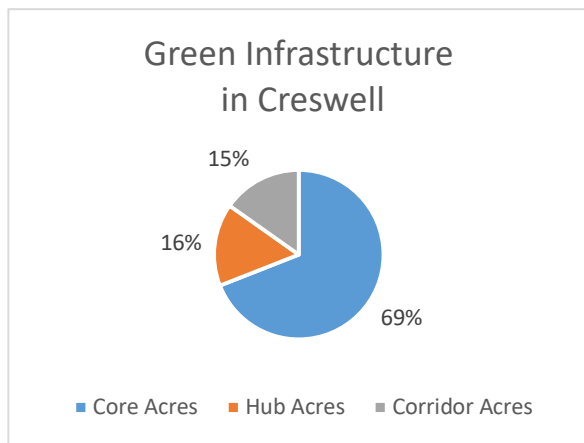
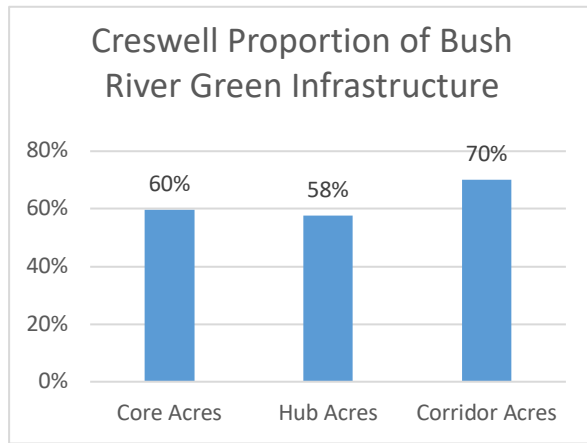


Figure 5: Green Infrastructure in Creswell as a % of Green Infrastructure in the Bush River Watershed



⁵¹ Ibid.

⁵² USDA I-Tree Landscape Model, United States Department of Agriculture. Accessed April 19, 2019.

⁵³ Ibid.

Green infrastructure in Creswell not only provides significant opportunity for water quality and open space, but also provides opportunities to support biodiverse habitats in Creswell and the throughout the county. 1,033 acres of forest in Creswell have been identified as extremely or moderately significant for biodiversity⁵⁴, and 668 acres have been identified as Targeted Ecological Areas by the Maryland Department of Natural Resources⁵⁵. In the Bynum Run Conservation Area in the southwestern area of Creswell, habitat was noted to support a wide diversity of animal species due to its relatively high water quality and interior forest acreage, including rare species such as the river otter⁵⁶. Further, field data collected for the Green Infrastructure Plan identified the Bynum Run Conservation Area and Creswell as key in supporting biodiversity as a connection of cores, hubs, and corridors between the Critical Area of the Chesapeake Bay to the south and the Priority Preservation forested areas to the north. By providing contiguous pathways between core forested areas for biodiversity, the forested lands in Creswell are able to absorb larger amounts of carbon, hold greater soil retention and minimize erosion into waterways, and provide higher levels of runoff filtration for water quality⁵⁷.

With the accommodation of growth, the existing regulations in Harford County provide site plan and development review based protection of contiguous forest, steep slopes, streams, and wetlands. The Forest Conservation Act of Maryland, set out at Article VI in the Harford County zoning code, requires preservation of forests with some prioritization of forests that are essential to these ecological and community services. Under Article VI of the Harford County zoning code, 40% of forested land on large medium-density residential developments must be preserved on the lot or parcel outside of the development envelope. Forests that are connected to large, contiguous forest on adjacent land, or that are part of a floodplain or stream buffer, are priorities for retention of existing forest under Article VI⁵⁸.

In addition, Harford County has a strong Natural Resource District element within its zoning code, which provides protection of steep slopes, nontidal wetlands and 75 foot forested buffers, and streams and 75 foot forested buffers, as well as key site-identified sensitive environmental areas. It does so by allowing a lesser development footprint because it permits more compact development types (townhouses and garden apartments) on the land, but with no density increase. Within the Natural Resource District, in addition to minimum waterway buffers, woodlands that are cleared for development must be 70% preserved to reduce erosion, sedimentation, and impacts on water quality. Further, a rear yard setback

⁵⁴ Tier 1 and Tier 2 on the BioNet Biodiversity Ranking

⁵⁵ "Watershed Report for Biological Impairment of the Bush River in Harford County, Maryland Biological Stressor Identification Analysis Results and Interpretation." Maryland Department of Natural Resources.2013.

⁵⁶ Draft Green Infrastructure Plan, Harford County. 2003

⁵⁷ Ibid.

⁵⁸ Harford County, Maryland. Municipal Code Art. VI § 267-39 Retention and Afforestation. 2008.

of 20 feet or greater provides buffering from the Natural Resource District⁵⁹. With the implementation of Article VI in combination with the Natural Resource District, site planning provides strong protections of streams and wetland buffers, steep slopes, and on-site forested land.

Constraints

While Article VI and the Natural Resource District provide opportunity for conservation and prioritization of forests on a site by site basis, the parcel and site review based nature of the preservation process can lead to eventual forest and habitat fragmentation. With 40% of forest preservation preserved on site, the development of several forested parcels can allow for the fragmentation of large contiguous forest cores, and potentially the degradation of green infrastructure cores into edge forest hubs or corridors across several developed parcels. While a natural resource based preservation of contiguous forest would work to preserve the entire contiguous forest on one of the existing parcels in forest cover, such as the easternmost parcel of the Grays Run forest, the development based nature of Article VI protections could allow for fragmentation of forest cover into several hubs and corridors across several parcels.

For example, with Natural Resource districts in place, forested parcels that could be developed in the Grays Run forest would first hold protected forest buffering the Nationally Inventoried wetland, its buffers, and 75 foot stream buffers in all parcels. Secondly, the need to preserve 40% of forests on each parcel, even with priorities for contiguous forest, could mean that remaining forest is left on the edges of developed parcels along parcel lines, which creates contiguous corridors of green infrastructure from the higher value green infrastructure cores which previously existed there⁶⁰. In contrast, the focus on preservation of green infrastructure cores and interior forest percentages through a holistic, green infrastructure network focused policy may create a preserved core of green infrastructure by conserving 100% of forests on one parcel within the Grays Run forest. This would allow Article VI preservation requirements, excluding necessary Natural Resource Districts on all parcels, to be sent from the developed parcels of the Grays Run forest in order to conserve a high value interior forest and green infrastructure core of the Grays Run forest. Thus, while the Natural Resource District and Article VI measures do provide significant and valuable conservation measures to developed parcels with high value natural resources, their site plan and parcel based nature can potentially inform the fragmentation of high value green infrastructure cores in Creswell, and thus can inform potential loss of soil retention, water filtration, and biodiversity.

⁵⁹ Harford County, Maryland. Municipal Code Art. VI § 267-62 NRD Natural Resource District. 2008.

⁶⁰ Interview with Licensed Forester, April 18, 2019.

Implications

In order to meet the needs of housing and economic development in Creswell while maintaining key green infrastructure for water and air quality, soil retention, biodiversity, and open space, alternatives for Creswell must consider strategies to both prioritize forested land for protection as well as implement forest conservation and management to maintain high quality forests. The 2018 Draft Green Infrastructure Plan provides several opportunities for the prioritization and formal protection of forested land in Creswell and across the county through regulatory forest preservation and forest management programs. As mentioned in the Green Infrastructure Plan and Creswell Sector Plan, the implementation of a Forest Conservation Ordinance, Tree Canopy Ordinance, and/or expansion of the Natural Resource District site plan regulations could significantly improve the capacity of the county to protect high quality green infrastructure⁶¹. In combination with open space subdivision design, policies for the conservation of forested land can prioritize forested land while clustering development to both accommodate housing needs while conserving the ecological services provided by high quality green infrastructure within Creswell.

Box 1: Utilizing Active Forest Land Uses for Conservation

In addition to preservation of forested land, the management of green infrastructure can not only maintain high quality forests, but can also improve the quality of forests in corridors and hubs that may contain nonnative species. Forest management planning, including selective and conservation focused forest harvesting, can improve forest health, and thus improve the forest's ability to filter runoff, provide habitat for biodiverse species, and sequester carbon. Further, with conservation-oriented forest management, landowners are able to provide ecologically beneficial services to the larger community while stimulating economic development through selective harvesting⁶².

Forests in the eastern edge of Creswell along I-95 with previous histories of selective harvests could provide enough contiguous acreage of forest for conservation harvesting while providing an improved biodiverse habitat with stream buffering and wetland filtration that also allows access to recreation and open space⁶³. Utilizing the Natural Resource District, high value forests can be combined with active uses like conservation oriented forestry and active trails to efficiently utilize high value forests, not only for their ecological values in protecting water quality, soil health, and biodiversity, but also in supporting economically productive uses and providing community resources for open space, recreation, and active transportation.

⁶¹ Draft Green Infrastructure Plan, Harford County. 2003.; For greater detail, refer to the Environmental Implementation section of this report.

⁶² Williams, Bob. "Battle for the Pinelands." Forest Landowner. January/February 2015.

⁶³ Interview with Licensed Forester, April 18, 2019.

Harford County’s Draft Green Infrastructure Plan provides an extremely useful dataset on existing green infrastructure in Creswell and the county, as well as applicable steps to prioritize, protect, and manage forested resources in the county. Expanded Natural Resource Districting and a Forest Conservation Ordinance, in combination with open space subdivision design, would allow for the conservation of key forested land and its ecological benefits while accommodating housing needs of the surrounding community. Further, utilizing conservation management of forests and selective harvesting can improve upon forest health and quality while creating access to open space throughout Creswell.

Diverse Soil Types

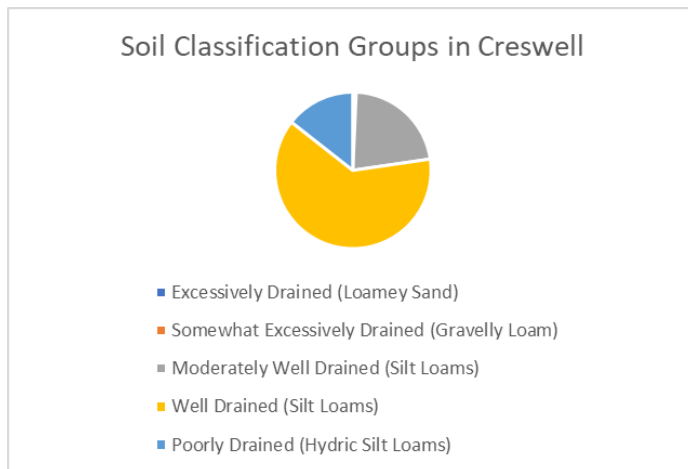
Overview

Creswell is made up of a wide diversity of upland soils across a variegated topography. However, with a significant proportion of Creswell made up of prime soils for agriculture, the preservation of prime soil land for agricultural use provides a key priority for the framework plan. Further, consideration of topography, soil erodibility, and compatibility of soil types with land use to maintain soil retention, water quality, and agricultural productivity will be essential in developing alternatives to accommodate growth and land use changes Creswell.

Opportunities

With 44 different soil series in Creswell and 132 different soil types, a large diversity of soils throughout Creswell provide opportunity for a variety of land uses supporting development while providing soils for a working landscape across agriculture, forested, and mineral lands⁶⁴. As seen in Figure 6, the majority of soils in Creswell are well drained to moderately well drained, largely including upland loams, silt loams and stony silt loams that provide opportunity for development while maintaining stable soil retention for forested open space or on-site agriculture.

Figure 6: Soil Classification Groups in Creswell



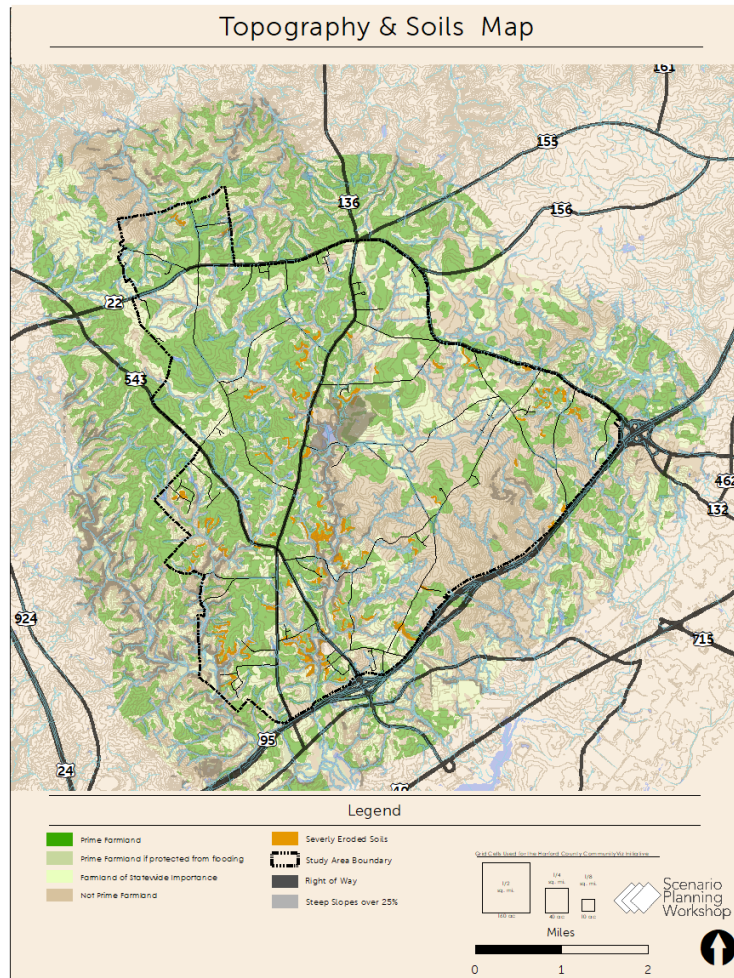
⁶⁴ SSURGO Database. Natural Resources Conservation Service: United States Department of Agriculture. Accessed March 01, 2019. 2018.

Creswell also supports a significant agricultural landscape through its high valued prime soils throughout the study area. 6,731 acres in Creswell, or 52% of the study area, is made up of prime soils for agricultural use. As seen in Map 3, these prime soils are largely focused in the western edge and northern core of the study area, with the eastern edge and stream buffers made up of nonprime and hydric soils⁶⁵. These prime soils are well utilized by agricultural industry. If preserved, these prime soils can continue to support a local agricultural character and economy to an expanded consumer base with new growth⁶⁶.

Constraints

Despite the wealth of prime agricultural soils throughout Creswell, steep slopes in the topography of Creswell, as well as a quarry and major ridgeline in the center of the study area, pose constraints on the ability to accommodate growth in the center of the study area⁶⁷. As seen in Map 7 in dark grey and orange, steep slopes and highly eroded soils in Creswell are focused along two points in the study area. Slopes within highly biodiverse forests west of Harford Community College allow few opportunities for development in the northwestern corner of Creswell. Further, along the center of the study area, a steep ridgeline and quarry hinder opportunities for

Figure 7: Topography and Soils



⁶⁵ Ibid.

⁶⁶ For a discussion on the productive agricultural economy in Creswell, refer to the Agricultural Appendix.

⁶⁷ Graduate Landscape Architecture Creswell Analysis. Studio II. University of Maryland. Fall 2018.

development, particularly in the north with steeper changes in elevation and more gravelly, erodible soils⁶⁸.

Implications

By maximizing conservation of prime soils for agriculture within and around the core of Creswell, new growth can maintain soil retention by avoiding steep and erodible soils while preserving the agricultural character and industry in Creswell. Transfers of development rights provides a useful way to send development rights from steep, erodible, and prime soil rich areas to other areas in Creswell in order to preserve prime soils for agricultural uses and maintain soil retention⁶⁹. In combination with clustered development and open space oriented design principles, Creswell can maintain both an agricultural core as well as smaller scale agricultural uses embedded within new growth to maintain rural character⁷⁰.

Conclusion

Through the implementation of a transfer of development rights program that prioritizes the preservation of ecologically valuable agricultural and forested land, in combination with open space subdivision design that preserves high priority natural resources and mitigates environmental impacts of development, the environmental landscape and ecological services in Creswell can be preserved and improved, providing improved water filtration potential, wildlife habitat, and open space to the community. Maximizing the preservation of high quality forests and green infrastructure around clustered development that minimizes impervious surface levels supports high water quality, air quality and pollution absorption, biodiversity, and maximum opportunities for open space. Development that works in tandem with existing soil types to maximize agricultural utilization of prime productive soils supports local agritourism and industry and provides opportunities for development while maintaining soil retention and water quality. By incorporating the natural resources throughout Creswell into the core of alternative futures for Creswell, development that addresses housing need and economic development can also support a healthy natural ecosystem.

⁶⁸ Ibid.

⁶⁹ For analysis on the potential for TDR in Creswell, refer to the agricultural appendix.

⁷⁰ For a detailed methodology and analysis on open space for rural character, refer to the rural character appendix.

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Appendix C: Farm Character, Agritourism and Land Preservation Programs

By Kari Nye

Executive Summary

Developable land is an increasingly scarce resource in Harford County. Land use plans have established a development envelope which has served to contain development and maximize public infrastructure investment within this area. The County's comprehensive plan, *HarfordNEXT* (2016), identified these challenges in a community assessment of the Churchville/Creswell Area with a suggestion for further planning studies.⁷¹ The question of whether and how to grow is especially sensitive in Creswell, because while the area is just outside the Development Envelope—the County's target growth zone—it's also far south of the Priority Preservation Area, where Harford County funds the majority of its land preservation efforts. Current zoning and subdivision regulations mandate one dwelling unit per ten acres with two-acre minimum lot sizes for the majority of Creswell's agricultural acreage. Often, the land that's easiest and most affordable to develop also serves as prime farmland, which centers decisions about future growth squarely in the backyard of local farmers. From the agricultural perspective, one of the most pressing questions becomes whether Harford County can design its future growth in Creswell to be spatially and financially compatible with farming. Engaging ideas such as conservation subdivision and keystone parcels, this appendix draws the following conclusions about alternatives for Creswell:

- The viability of farming is predicated on access to a stable farmland base. The County cannot guarantee that economic conditions are always ripe for farming, but government policy and planning can ensure options for current and future generations of farmers by making careful choices about development patterns.
- Innovative site design models — conservation subdivision or open-space subdivision design — offer a pathway to growth that is grounded in conservation. A conservation subdivision protects acreage that is critical to working farms, green infrastructure, and maintaining rural character. It requires coordinated government guidance and flexibility, and motivated developers.
- Creswell has a higher proportion of agritourism businesses than anywhere else in the County, indicating favorable conditions for this stream of on-farm income that can be crucial to financial success. Future growth should be mindful of keystone parcels that are critical to ongoing operations, and County

⁷¹ HarfordNEXT- A Master Plan for the Next Generation, p 126.

policy could explore options to support farmers in expanding their business models to include agritourism. Urbanization has been shown to be financially beneficial for farms on the fringe of metropolitan areas, especially if those farms can adapt from traditional crops to specialty, high-value crops with a local consumer base. It may be that the future of farming in Creswell should, in part, reorient toward increasing direct sales markets; County policy can help.

- Harford County’s preservation portfolio — consisting in Creswell primarily of the County-run easement program, the State-run program, and donation allowances — is critical to the future of farming. Yet, purchase of development rights (PDR) programs have been shown to be less effective than transfer of development rights (TDR) programs when it comes to preservation of contiguous acreage and limiting the overall erosion of the farmland base. There is an opportunity for the County to revise its existing land preservation programs in Creswell to protect strategic acreage, while directing growth to where it makes the most sense.

Considering the multifaceted challenge of analyzing future alternatives, this appendix encourages a strategy that centers on commitment to the long-term financial, spatial, and social predominance of farming in Creswell. This will come down to more than just defining new growth boundaries or entering new properties into conservation easement; securing the future of farming will require a comprehensive plan amendment with support from political, public, and private interests. This appendix intends to lay a foundation for understanding how tools for growth can also be wielded for preservation. Table 1 provides an overview of the factors and driving forces examined.

Table 1. Executive Summary Matrix

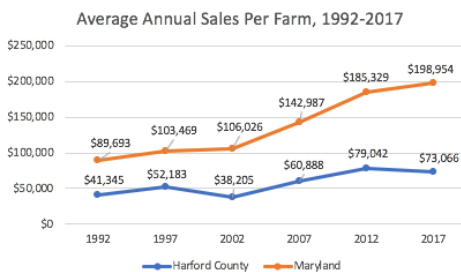
Key Factors	Opportunities and Constraints	Implications
<p>Farm Character Number and size of farms on the rise, but majority depend on off-farm income.</p>	<ul style="list-style-type: none"> • Constraint: Increasing size may reflect increased productivity of land, or it may indicate more land needed for financial viability. • Constraint: Farms and farmer network have clear place in center of County’s identity, marketing, and appeal. • Opportunity: Large landholdings mean that only a few properties may be needed to provide for development sought. 	<ul style="list-style-type: none"> • Conservation subdivision model — prioritizing land preservation — may offer appealing pathway for ag-land development that helps protect active farming by preserving 50-70% open space per property.
<p>Agritourism Creswell has high proportion of County’s ag-tourism businesses; depend on and feed into rural character.</p>	<ul style="list-style-type: none"> • Opportunity: Increased urbanization may benefit direct sales markets by bringing expanded, built-in audiences. • Constraint: Too much density could undercut rural appeal. • Constraint: New commercial from potential development could challenge appeal/success of agritourism. • Constraint: Some large parcels are key to agritourism operations. 	<ul style="list-style-type: none"> • Expanding commercial into study area (via mixed-use or other) may threaten locational advantage of farm businesses. • Could agritourists and future residents of study area be the same population? Potential selling point for growth if so.
<p>Easements Strong conservation easement portfolio; may not be most effective for landscape-scale preservation</p>	<ul style="list-style-type: none"> • Opportunity: County/State easement programs use public \$. • Opportunity: County policy prioritizes easement in PPA. • Constraint: Easement patchwork limits growth options in study area. • O/C: Landowners may “wait and see” if zoning changes, or rush to preserve, esp. if backed against development envelope. 	<ul style="list-style-type: none"> • Future growth may influence per-acre costs for PDR program, making preservation in PPA more cost-efficient. • Public support for PDR program suggests appetite for preservation: makes way for new tools/approaches.
<p>Transfer of Development Rights Program currently underused, but could prove crucial, complementary tool to PDR</p>	<ul style="list-style-type: none"> • Opportunity: Equitable, balanced system for landowners and developers, if expanded. • Opportunity: Market-driven tool relies on private money. • Opportunity: Has been shown to increase preservation, decrease fragmentation of farms and land uses. • Constraint: No guarantee unless implemented effectively. 	<ul style="list-style-type: none"> • Strong growth forecast + limited existing infrastructure mean conditions could be ripe for tightly managed TDR program, if market supports. • TDR should pre-date densification of study area; may be challenging to align TDR program with development timelines.

Farm Character

Overview

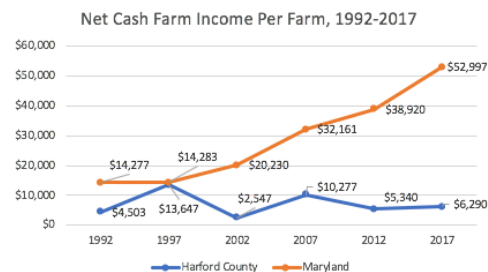
Harford County Planning and Zoning underscores the importance of the agricultural landscape when the agency writes in its comprehensive plan, *HarfordNEXT* (2016), that “Farms and farming are the cornerstone of the community.”⁷² While indeed the majority of the County’s land base⁷³ is allotted to agricultural use—presumably for working landscapes—“cornerstone” signifies the historical and visual importance of farming as much as it does the economic or fiscal impact. Over the past 15 years, farming in Harford County has not kept pace with state-level average sales and market value.⁷⁴ Average annual sales per operation fell by 7.5% between 2012 and 2017, while the average Maryland farm saw an increase of 7.3% during that same period (see Figure 1). As of 2017, 85% of all farms in Harford County generate fewer than \$50,000 in income per year, indicating that the vast majority of local farmers—whether full- or part-time—depend on off-farm income to subsist.⁷⁵ Finally, Harford County’s average net cash farm income—a measure of economic health that encompasses cash receipts from farming, including government payments, minus cash expenses—has been steadily declining since 1997 (see Figure 2). These data suggest that Harford County generally and the Creswell study area specifically will continue to negotiate challenges to the long-term survival of working

Figure 1. Annual Sales per Farm



Source: USDA Census of Agriculture, County-level statistics, 1992-2017.

Figure 2. Net Income per Farm



landscapes.^{76,77} And yet, from apple orchards to dairy farms to fruit and vegetable operations, farming is inextricable from what it means to live and work in Creswell. The County’s comprehensive plan (2016) and land preservation, parks, and recreation plan (2018), for example, make this clear, but it was also apparent in how planning staff and residents spoke about the singular importance of their heritage.

⁷² Harford County Government Planning and Zoning. *HarfordNEXT*. 2016.

⁷³ In Creswell, existing agricultural land use accounts for 11,108 acres, of 86.3% of the total land base.

⁷⁴ USDA Census of Agriculture. Maryland State and County Data. Years analyzed: 1992-2017.

⁷⁵ USDA Census of Agriculture.

⁷⁶ This revelation is unlikely to surprise anyone who follows agricultural trends in Maryland and nationwide, but it’s useful background for understanding needs and possibilities that future alternatives could bring to life.

⁷⁷ Refer to the Demographics Appendix for a thorough overview of Creswell’s demographic and housing projections.

As Harford County explores future alternatives for Creswell, securing the sustainability of farming will be central to all considerations.

The working landscape in Creswell is characterized by a rich array of industries, sizes, and operator statuses. After a sharp decline in the number of farms and farm sizes between 2007 and 2012, the latest data from the USDA Census of Agriculture show a nearly 8% increase in Harford County's number of farms (currently 628), and a 5% increase in average farm size (118 acres). Given that Creswell contains approximately 6% of Harford County's land,⁷⁸ the area can be estimated to contain approximately 6% of its working farms, or between 30 and 35 total, ranging in size from less than one to 300 acres. Farm types are patterned across industries in a distribution similar to that which characterizes much of the rest of Maryland: grain operations make up part of the central core, a large apple orchard and cider-processing business resides in a northern easement, fruit and vegetable operations line the area just south of MD 22, a popular nursery and landscaping operation is nestled at the western edge of the Development Envelope, adjacent to a historic and conserved cow dairy and creamery that is one of Creswell's most successful operations. Another large cow dairy resides in the southernmost portion of Creswell, just north of the I-95 corridor. In addition to these primary operations are the dozens of homesteading ventures and small farms, which include sheep and wool production, horse pasturage, and apiaries, among others. Notably, the number of cow dairy farms in Harford County is perilously low. There are just 16 total remaining, reflecting a 43% decrease in the number of such operations since 2012—Creswell is home to 12.5% of them.⁷⁹

Without surveying farmers directly, it's challenging to generate data about specific operator characteristics.⁸⁰ However, anecdotal evidence offered by staff from Harford County Planning and Zoning indicates that some of Creswell's major operations and landholders are on the cusp of a generational changeover.⁸¹ At least two families, for example, are transitioning business operations to their older adult children. In addition, statements made by Planning and Zoning staff, along with land ownership records, indicate that the vast majority of Creswell's grain parcels are operated by tenants who do not live in the Creswell area. As grain is one of the most land-intensive and land-competitive farm pursuits, it's very likely that any grain parcels in Creswell are component properties of larger farming operations based in the Harford County Priority Preservation Area (PPA), where the majority of the County's land in farms and farming operations exist. These data, while limited, suggest that there may be openings for innovations as new family farmers seek to

⁷⁸ Calculated with input from Harford County Planning and Zoning estimating that Creswell accounts for 4,650 of Harford County's 74,273 acres in farms, or 6.2%. One could also make this estimate considering that Creswell contains 12,873 acres of Harford County's 279,680 total acres of land, or 4.6%.

⁷⁹ USDA Census of Agriculture, 2012-2017.

⁸⁰ Actively engaging with the public was beyond the scope of this project. The author did speak briefly to several Creswell residents and farmers to whom she was introduced by staff at Harford County Planning and Zoning.

⁸¹ Harford County Planning and Zoning staff, in conversation with the author on February 8, 2019.

strengthen operations or as land-intensive ventures seek relief from high operating costs.

Opportunities and Constraints for Farm Character

First and foremost, farming has a central place of historic importance in the heart of Harford County's identity and future. The County supports resilient local food systems, maintaining rural character and heritage, and ensuring that future generations of farmers are equipped to thrive.⁸² In any alternatives analysis for Creswell, the imperative remains to establish stronger conservation methods to secure a viable farmland base in perpetuity.

Moreover, large landholdings throughout Creswell may aid the County in ensuring a healthy growth strategy. It's plausible that Harford County's projected housing shortage⁸³ could be largely alleviated by developing just a handful of 100- to 300-acre parcels at a higher density than is supported by current Rural Residential zoning (one dwelling unit per two acres). Some of these parcels may be critical components of operations in the Priority Preservation Area, or they may be keystone farms in the Creswell area (see Map 1, in the section on Agritourism), but updated zoning and land use regulations could support maximum conservation of acreage with minimal disruption to the farming ecosystem.

Implications for Farm Character

Empirical evidence supports the economic benefits of adapting traditional field farming practices to high-yield, specialty crops and specialty land uses that are compatible with the desires of urban consumers.⁸⁴ Ensuring the future for farming in Creswell requires deeper analysis. The finding that the average amount of sales per farm has decreased even as the size of farms has grown may indicate that land-intensive operations are no longer value-efficient. Reliance on off-farm income may point to an evolving opportunity for operators to adapt to higher-value practices or to generate new streams of on-farm income. Such operations could include ornamental horticulture, cut flowers, or mushrooms, in addition to wedding venues, solar farming, bio-gas, and other options with high potential for strong streams of on-farm revenue that still maintain a farmer's ability to work the land.⁸⁵ Adaptive pursuits have been shown to be especially compatible with farming in the metropolitan fringe, which offers farmers a built-in audience for direct sales.⁸⁶

⁸² HarfordNEXT.

⁸³ See Housing and Demographics Appendix for details on when Harford County is projected to reach build-out, along with Maryland Department of Planning projections for population growth versus housing supply.

⁸⁴ Larson, Janelle, Jill Findesis, and Stephen Smith. "Agricultural Adaptation to Urbanization in Southeastern Pennsylvania." *Agricultural and Resource Economics Review* 30/1 (April 2001) 32-43; Brinkley, Catherine, under the supervision of Dr. Thomas Daniels. *Fringe Benefits*. PhD Dissertation. University of Pennsylvania, 2013; Heimlich, E. and Charles H. Barnard. "Agricultural Adaptation to Urbanization: Farm Types in Northeast Metropolitan Areas." *Northeastern Journal of Agricultural and Resource Economics*. April 1992.

⁸⁵ Larson, Findeis, and Smith, 2001.

⁸⁶ Larson, Findeis, and Smith, 2001; Brinkley, 2013

The conservation of prime soils as part of a contiguous, stable farmland base is fundamental to the continuity of farming at any scale. Conservation is key to any model for growth in Creswell. Some zoning and site design interventions facilitate conservation of land—and farming potential—at the landscape scale. Conservation subdivision design (CSD) offers a workable model for growth predicated on preservation. CSD is a form of super-clustering that works to preserve 50% to 70% of buildable open space on a given parcel by closely grouping homes together to protect beneficial environmental features (see Figure 3 and Figure 4).⁸⁷ The strategy can also be used at a larger scale to connect networks of open space and enhance green infrastructure.^{88, 89}

Figure 3. Conventional Versus Conservation Subdivision Design

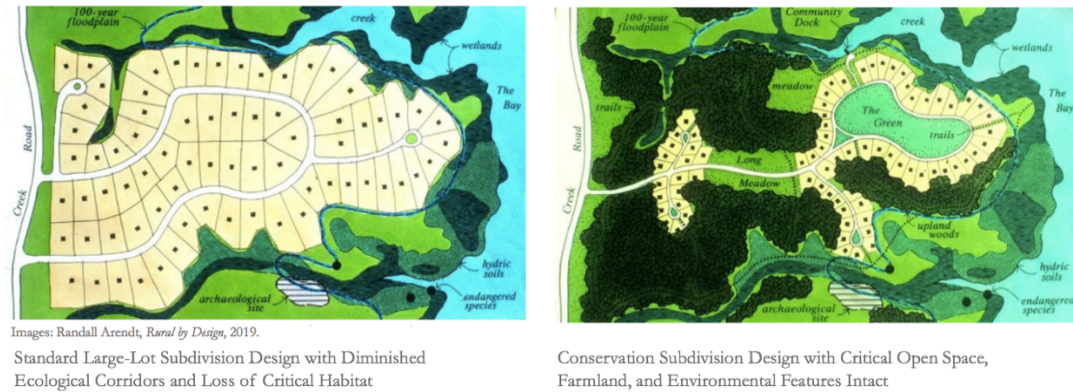


Figure 4. Conservation Subdivision Design Examples



In Creswell, implementing a CSD model would require coordinated improvements to existing zoning, subdivision regulations, and infrastructure plans, as well as an improved development process that both educates developers, landowners, and the

⁸⁷ Allen, Steven et al., *Conservation Subdivision Handbook*, North Carolina State University, n.d.

⁸⁸ Arendt, Randall. *Rural by Design*, 1994. Revised 2019.

⁸⁹ For a discussion of Creswell's green infrastructure corridors and hubs, refer to the Environment Appendix.

public about the benefits of CSD while incentivizing its use among developers. The County’s zoning code currently offers CSD as a design option of developers, though it is rarely if ever used.⁹⁰ Assuming these updates and revisions are politically feasible, Randall Arendt, a leading proponent of conservation subdivisions, offers a four-step CSD process (see Box 1) that can result in attractive neighborhoods in rural areas, conservation at the landscape scale, and growth with minimal disruption to an area’s rural character or working landscapes. Rather than start with lot yield, CSD first considers conservation areas — a tweak in conventional thinking that holds the key to preservation-oriented growth. Without CSD or its less-intensive cousin, Open-Space Subdivision (OSD) design,⁹¹ growth in Creswell will likely continue at the Rural Residential density — or something like it — that prioritizes two-acre minimum lot sizes without regard for natural features that might be critical to the agricultural ecosystem at the landscape scale. In the context of a rural region on a metropolitan fringe, the sustainability of farming is often an issue of having an accessible, adequate land base; this is an issue of government policy. Rethinking and improving the spatialization of future development is critical to growth alternatives that can nurture and protect rather than harm the farming ecosystem.

Box 1. Four-Step Conservation Subdivision Design Process

- 1) Identify conservation areas. In an agricultural context, conservation areas could include working farm acreage, as opposed to all acreage “in farms.” This step could also prioritize wetlands, rural viewsheds, mature woodlands, storm water management areas, or any sensitive natural features with an ecological benefit or economic development benefit at the landscape scale.
- 2) Select housing locations. Housing sites should complement the open space. Clustering homes around conservation features will allow residents to take advantage of the effort. This contrasts with traditional, cookie-cutter site design that divides parcel by total lot yield rather than holistic benefit.
- 3) Connect the dots. Draw in roads and streets to connect to existing networks. Often, CSD requires fewer new impervious surfaces due to the clustering of home. Add in regional trail networks and greenways where possible.

⁹⁰ Refer to the Appendix on Zoning and Land Use for a thorough discussion of CSD as it exists — and is rarely used — in Harford County today.

⁹¹ Arendt is specific that CSD should conserve 50-70% or more of buildable land. Site design that conserves between 30% and 50% should be referred to as Open-Space Subdivision (OSD). OSD can follow the same four-step process, just with less intensive conservation efforts and presumably more intensive building efforts.

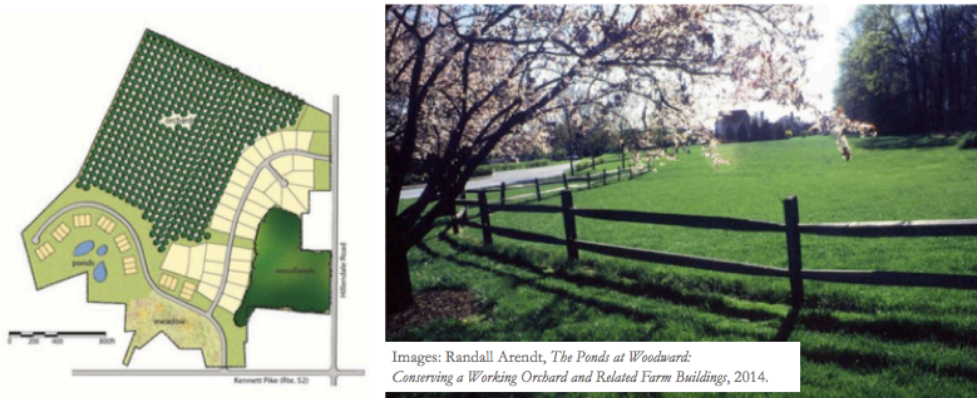
4) Draw in the lot lines. Greater flexibility in zoning and design regulations will allow planners and developers more options in minimum and maximum lot size, setback requirements, and, ultimately, the quantity and quality of conserved arable land.

Source: Randall Arendt. *Rural by Design*. 1994. Revised 2019.

Conservation Subdivision Design Case Study

To get a flavor for the potential of conservation subdivision in Creswell, it may be useful to consider an example from Kennett Township in Chester County, Pennsylvania. This case study was documented and provided by Randall Arendt, and it details an example of how flexible zoning can facilitate excellent design, how CSD can be more profitable for developers and landowners than standard yield subdivisions, and how CSD can be compatible with working farms—in this case an apple and peach orchard. Now known as the Ponds at Woodward, the original parcel was 120 acres and would normally have yielded 57 two-acre houselots under the township’s rural residential zoning allocation. The property was also eligible for a planned residential development option that could have allowed a four-fold increase in overall density of up to 230 units. The owners were reluctant to pursue maximum allowable density given the property’s extensive environmental features and community benefits, so they sought assistance from a local land trust and township officials who helped design a revised layout and conservation plan for the parcel (see Figure 5).

Figure 5. Flexible Site Design and Resulting Character



Flexible site design allowed this subdivision to reach its standard yield of 57 lots while preserving nearly two-thirds of the property’s acreage, including a working orchard, meadow, and woodlands.

The owners selected a developer who paid \$1.3 million for the parcel, which was more than 60% higher than initial offers for the 230-unit PRD, despite the new plan offering only one-quarter of maximum density. The developer surmised that infrastructure costs would be much lower for 57 clustered units, and that with the preservation of viewsheds, woodlands, historic farm buildings, blossoming fruit trees, and beautiful rural open space, the units would be able to command high sales

prices (see Figure 6). Notably, the developer’s conservation layout made use of the design flexibility afforded by the PRD allowance, which enabled fluctuations in lot size that could accommodate conservation goals. The final development contained 31 detached single-family homes on lots measuring one-third to one-half acres, along with 24 condominiums attached in groups of three, set on 9,000 square feet of land per unit. The working orchard continues to operate and is open for pick-your-own agritourism and community events. According to Arendt’s documentation, the condominiums sold for almost three times market rate of condominiums in the area bereft of beautiful views, and the detached homes earned similarly healthy sales prices. The owner and developer credit the flexible zoning with generating the success of this subdivision. The farmer was not interviewed as part of the case study, but needless to say, was likely pleased to continue to operate with an expanded built-in audience nearby.

Figure 6. The Ponds at Woodward Detached Single-Family Homes



Images: Randall Arendt, *The Ponds at Woodward: Conserving a Working Orchard and Related Farm Buildings*, 2014.

Agritourism

Overview

Agritourism is one of the fastest-growing segments of agricultural direct marketing, both in Maryland and nationwide.⁹² It was not until 2018, however, that the State of Maryland passed legislation (HB 282) designed to prompt counties to consider agritourism as an allowable land use under their agricultural zoning ordinances.⁹³ The legislation offers a formal definition — grounded in educational opportunities to learn from or work alongside working farms — however, it is neither a code nor a mandate.⁹⁴ Agritourism, then, is generally understood to include classic iterations such as pick-your-own flowers, fruits, and vegetables; hayrides and corn mazes; picnicking; recreation such as walking, equestrian, and bicycle tours; and farm stays,

⁹² University of Maryland Extension. “Agritourism.” extension.umd.edu/mredc/specialty-modules/agritourism (accessed April 2019).

⁹³ Maryland Department of Agriculture. “Governor Hogan Signs Agritourism Bill Into Law.” May 16, 2018. news.maryland.gov/mda/press-release/2018/05/16/governor-hogan-signs-agritourism-bill-into-law (accessed April 2019).

⁹⁴ General Assembly of Maryland. “HB2052: Land Use: Agritourism.” mgaleg.maryland.gov/webmga/frmMain.aspx?pid=billpage&stab=01&id=HB0252&tab=subject3&ys=2018rs (accessed April 2019).

among other enterprises. Increasingly, agritourism also includes destination dining, drinking, and shopping opportunities at on-farm restaurants, farm breweries, and produce markets that allow operators to build unique experiences for clientele. In 2017, the average Harford County agritourism operation generated an additional \$34,266 in on-farm income per year, per operation — the fourth-highest average in the State.⁹⁵ This may be a testament to the appeal of Harford County’s culture and offerings given that the county is tenth in the number of agritourism operations and 11th in total average value of sales generated per farm.⁹⁶

Harford County was one of the first counties in Maryland to allow on-farm agriculture-commercial zoning, which has been in place since 2008.⁹⁷ Of the 23 Maryland county agricultural zoning codes consulted, Harford County was the first and one of the only to include value-added products in its definition of “agricultural products” that are allowed to be marketed off-site or sold in on-premise commercial operations. Harford County is also one of just two Maryland counties that allow on-farm restaurants; the other is Wicomico.⁹⁸ Finally, Harford County defines a “farm” as any operation with the “potential to produce \$1,000 in gross annual sales of agricultural products” as opposed to an operation that must meet a minimum size in acres, which is the measure employed by most other counties.⁹⁹ Altogether, the County’s inclusive definitions enable a wide swath of its farming community access to the opportunities inherent in agritourism pursuits. Creswell itself is home to five of Harford County’s 15 agritourism businesses — as defined and counted by the USDA — which is remarkable considering Creswell has only 6% of the county’s total farm operations. This suggests that Creswell may serve as a particularly fertile location for agritourism, especially because of its proximity to the Development Envelope, its extensive rural character, and its anchor farms and agri-businesses, such as Broom’s Bloom Dairy. Broom’s Bloom, for example, is renowned statewide as part of Maryland’s “Ice Cream Trail” and takes advantage of the on-premise 30-seat restaurant zoning allowance that Harford County offers. As a destination unto itself, the business likely generates increased patronage of surrounding agritourism operations and is essential to the existence of agricultural support businesses. Broom’s Bloom could also and likely does serve as a model for other farms that aspire to break into agritourism.

Opportunities and Constraints of Agritourism

One major opportunity connected to such a strong agritourism landscape is the potential benefit of increased urbanization on direct marketing. Population growth

⁹⁵ USDA Census of Agriculture.

⁹⁶ USDA Census of Agriculture.

⁹⁷ Maryland Department of Agriculture. “Summary of Planning and Zoning Issues Related to Agritourism/Agriculture at the County Level.” 2014. https://mda.maryland.gov/about_mda/Documents/Planning-Zoning-Issues.pdf (accessed April 2019).

⁹⁸ Ibid.

⁹⁹ Harford County Government Department of Planning and Zoning. *Zoning Code*. December 2008.

in Creswell could bring new audiences for direct sales, and empirical evidence supports the claim that northeastern farms at the metropolitan fringe benefit financially from their proximity to urbanization.¹⁰⁰ Yet, a farm stand is not a grocery store, and the locational advantage and touristic appeal of such businesses over traditional commercial will need to be protected in part by careful maintenance of the surrounding rural character.¹⁰¹ Additionally, new commercial development might have the potential to challenge the appeal or the success of agritourism businesses, but the alternatives explored in this report are cognizant of the need to locate shopping center spaces away from their on-farm counterparts.¹⁰²

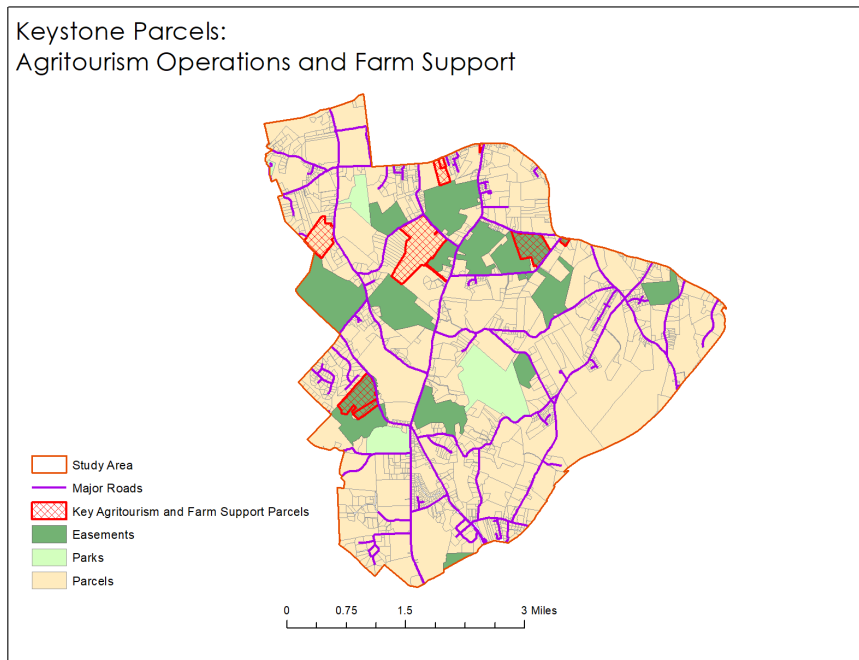
One the most important constraints to growth posed by the agritourism landscape are the few key parcels throughout Creswell that are intrinsic to the agritourism operations. Two of the five agritourism businesses operate wholly on protected conservation easements, while the remaining three operate entirely on developable parcels or on some combination of easement and developable parcel. Map 1 illustrates the parcels operated by Creswell's agritourism businesses — Boxwood Farms, Brad's Farm Stand, Broom's Bloom Dairy, Harman's Farm Market, and Lohr's Orchard. In addition, several small parcels in Churchville depict a tractor dealer — an agricultural support business that is both dependent on and necessary to farms in the immediate area. The interconnectedness of multiple parcels to individual operations, as well as to the community of farming in Creswell more broadly, demands that alternatives for growth are especially careful not to harm this web of strong businesses. Open-space or conservation subdivision may offer a solution that enables farmers to efficiently operate these key parcels in concert with super-clustering, but the point is that they will need to be considered carefully to protect the agritourism base. This reflects a constraint of the current zoning codes which, while they allow for robust agritourism opportunities, may not do enough to protect them.

¹⁰⁰ Larson, Findeis, and Smith, 2001.

¹⁰¹ Refer to the Rural Character Appendix.

¹⁰² Refer to the Housing and Economic Development Appendix.

Map 1. Keystone Parcels: Agritourism Operations and Farm Support



Implications of Agritourism

Preserving the viability of agritourism operations will yield a number of positive benefits for Creswell and for Harford County. First, maintaining or increasing the number of agritourism businesses is likely to strengthen both the perceived and experienced rural character in Creswell. Preserving rural character will become increasingly important as population growth impacts Creswell, and it appears that agritourism businesses are essential since they provide that experience for both local and visiting residents. Second, the financial benefits of agritourism are unequivocal. Protecting the conditions that have allowed Creswell to become such an agritourism-rich destination may preserve the possibility that other farmers may expand into the agritourism realm. Ultimately this will strengthen the active farming network and farming economy in Creswell. As demonstrated previously, farming is frequently a financially insecure pursuit; nurturing additional streams of on-farm income will be essential if the county hopes to see a future in which agriculture is still a defining aspect of life in Creswell.

Conservation Easement Programs

Overview

Over the past 60 years, Harford County has lost more than 100,000 acres of farmland to development.¹⁰³ Low-density rural sprawl largely characterizes the housing pattern beyond the Development Envelope, much of which is zoned at one dwelling unit per ten acres with a two-acre minimum lot size. The County has taken several steps toward redressing farmland development, by designating a Priority

¹⁰³ *HarfordNEXT*, p. 78.

Preservation Area (PPA) and facilitating opportunities for agricultural landowners to enter into permanent conservation easement agreements through either County-administered or State-level purchase of development rights (PDR) programs. Agricultural land is also preserved through Rural Legacy and Maryland Environmental Trust (MET) easement donations, but the Harford Agricultural Land Preservation Program (HALPP) and Maryland Agricultural Land Preservation Foundation (MALPF) easement program account for the bulk of land preserved in Harford County.¹⁰⁴ While County policy prioritizes the preservation of farmland in the PPA, ranking factors for HALPP also consider the amount of acreage, adjacency to easements or parkland, remaining development rights, operator status, and general contribution to the farming community, among other qualitative and quantitative measures. Overall, the combination of preservation programs has been critical to conserving farmland in Harford County: approximately 60,000 acres have been conserved since 1977, and the County is on its way to hitting its target of 75,000 acres of conservation easement in the PPA.¹⁰⁵ HALPP is the primary focus of this discussion because it is County-administered and represents a large proportion of acres preserved in Creswell (see Map 2).

HALPP is a PDR program, meaning that the development rights of approved landowners are purchased by the County using public revenue from one-half percent real estate transfer taxes, then retired in perpetuity. This results in the total and permanent preservation of specific parcels of agricultural land. In exchange, owners receive per-acre compensation that fluctuates with fair market value and annual program budget.^{106, 107} Land in conservation easement also yields a permanent annual tax-break of \$50 per acre. Perhaps most important to the active farming community, landowners who go into the easement program get to keep their land and continue farming as long as it is financially feasible. In addition, once development rights are sold and retired, the land loses some of its value, making it less tax-burdensome to future generations as inherited property.

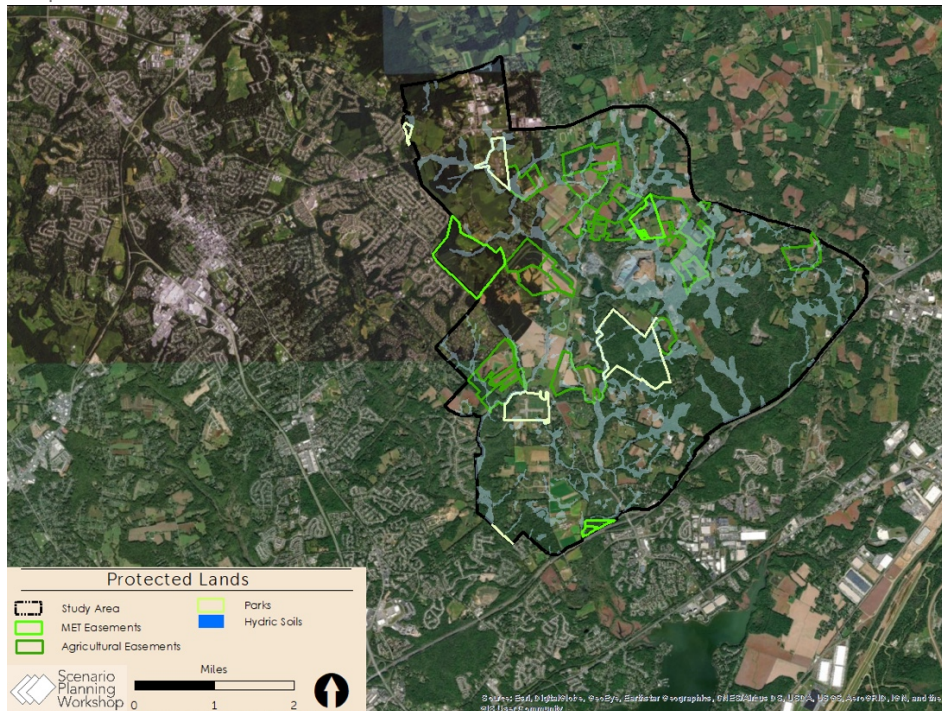
¹⁰⁴ Harford County Government Planning and Zoning. "Harford County Agricultural Easements." <http://harfordgis.maps.arcgis.com/apps/View/index.html?appid=81d8566fc5264db8b10173f3bc4185a2> (accessed April 2019).

¹⁰⁵ *HarfordNEXT*, p 78-79.

¹⁰⁶ Harford County Agricultural Preservation Advisory Board, Meeting Minutes, March 5, 2019. http://www.harfordcountymd.gov/AgendaCenter/ViewFile/Minutes/_03052019-1097 (accessed April 2019).

¹⁰⁷ *Ibid.*

Map 2. Protected Lands in Creswell



Opportunities and Constraints of Conservation Easement Programs

Granting an easement is an excellent opportunity for farmers, and in practice, it is essential to Harford County’s goal to maintain a viable land base. However, some studies have indicated that while PDR programs are highly effective at preservation at the parcel level, they are not the most effective strategy to prevent farmland fragmentation at the regional level.¹⁰⁸ First, the public monies used to purchase development rights are limited and fluctuate with market value. In 2019, the Harford County Agricultural Preservation Advisory Board capped the per-acre value for a sale at \$6,500 — up from \$6,000 in 2018¹⁰⁹— compared to the 2017 USDA estimation that Harford County agricultural land is worth \$10,900 per acre.¹¹⁰ For comparison’s sake, MALPF is also capped at a per-acre rate of 75% fair market value.^{111, 112}

¹⁰⁸ This statement is made with deep respect for Harford County’s easement program, which by all accounts is the leading preservation program in the state. As the ensuing discussion will make clear, the limits of PDR are intrinsic to the program generally, not to Harford County specifically.

¹⁰⁹ Harford County Agricultural Preservation Advisory Board, Meeting Minutes, March 5, 2019.

¹¹⁰ USDA Census of Agriculture.

¹¹¹ Harford County Agricultural Preservation Advisory Board, Meeting Minutes, March 5, 2019.

¹¹² Harford County also caps the price per development right at \$60,000 or at the going per-acre rate, whichever will cost the public less. In 2018, the capped price per development right was \$100,000. See the Harford County Agricultural Preservation Advisory Board Meeting Minutes from 2016 to 2019 for more information. www.harfordcountymd.gov/AgendaCenter/Agriculture-Land-Preservation-Advisory-B-37.

For many farmers, who are often land-rich and cash-poor, selling development rights through a PDR program is worth the access to new capital and lifetime ownership of their farmland, compared to the consequences of selling off land to development. It's important to underscore that PDR being publicly funded indicates a strong appetite for farmland preservation among Harford County's residents; in fact, the recent efforts of a Harford County Councilman to dissolve the program and funnel transfer-tax revenue elsewhere were roundly quashed.¹¹³ This suggests that County residents may be open to supporting additional preservation programs that can complement HALPP and MALPF.¹¹⁴

Next, in comparison to the transfer of development rights (TDR)—or, the sending of existing development rights from a (frequently rural) preservation area to an area designated for growth, using private money—PDR has been shown to be effective, but less effective at preserving large parcels of land, preserving contiguous parcels, and preventing the erosion of the farmland base overall.¹¹⁵ The constraints are clear: PDR is publicly funded, meaning that it may be more difficult to preserve large parcels, which would require bigger sums of available money.¹¹⁶ Conversely, the preservation of small or strategic parcels of land could supply critical connective tissue between larger parcels, but as PDR is voluntary and targeted to parcels at 50 acres and larger in Harford County, HALPP can only strongly influence rather than control preservation at the micro-scale. The current patchwork of easements in Creswell supports this conclusion, as preserved parcels are proximate but not always contiguous. Overall, tightly managed, mandatory TDR programs have been shown to be much more effective at conserving the farmland base at the regional scale.¹¹⁷ When measuring total acreage conserved, contiguity and adjacency to protected parcels, and preservation of an active farmland base, TDR alone — when employed correctly and efficiently¹¹⁸ — comes out on top. Furthermore, a well-managed TDR program demands that density be built up only in specified receiving areas identified by the County, and that maximum density is only achievable with the use of transferred rights. While PDR influences what is preserved, TDR takes the next step by influencing what gets built where. In a relatively small area like Creswell, where decisions at the parcel level will be key, TDR could be critical to orchestrating the sort of landscape-scale preservation that will serve farmers in

¹¹³ Butler, Erika. "As Harford prepares to preserve 2,400 acres of farmland, council member attempts to discontinue program," *The Aegis*. March 4, 2019.

¹¹⁴ Refer to the Appendix on Zoning and Land Use for an appraisal of Harford County's current TDR program, which is primed for significant improvements that would benefit the County's preservation goals in Creswell.

¹¹⁵ Brabec, Elizabeth and Chip Smith. "Agricultural land fragmentation: the spatial effects of three land protection strategies in the eastern United States." *Landscape and Urban Planning*, 58(2-4), Feb. 2002.

¹¹⁶ Brabec and Smith.

¹¹⁷ Brabec and Smith; Pruetz, Rick and Noah Standridge. "What Makes Transfer of Development Rights Work?" *Journal of the American Planning Association*. Vol. 75, No. 1, Winter 2009.

¹¹⁸ TDR is a complex program requiring coordinated efforts between landowners, developers, and municipal leadership. A watered-down TDR, or a TDR program with loopholes that enable developers to achieve full density in other ways, will not have the same success. See Pruetz, Rick and Noah Standridge (2009) for a thorough discussion.

perpetuity, and the sort of bounded growth that meets previously identified needs to protect rural character, farming heritage, and environmentally sensitive features.

Implications of Conservation Easement Programs

One major implication of the existing easement programs to the future of Creswell is the effect that development may have on the value of surrounding agricultural land. The addition of public sewerage and water, coupled with the development that may follow, will likely drive up the fair market value of acreage with existing development rights in the area. This would in turn be expected to increase HALPP's per-acre costs in Creswell, meaning that more cost-efficient PDR opportunities would be located in the Priority Preservation Area, where agricultural land value is presumably stable. This may add to the call to implement an improved and carefully controlled TDR program in Creswell, where private money could be leveraged to meet preservation needs or to influence development patterns when funding for PDR is no longer enough. In sum, the Harford Agricultural Land Preservation Program has been critical to conserving more than 2,000 acres of prime farmland in Creswell and ensuring that the farming community is as vibrant and successful as it is. To drive conservation and growth in Creswell, Harford County should explore revamping its TDR program to work in tandem with PDR.¹¹⁹ Wielded together, and with open-space or conservation subdivision design structuring future development, the County may be able to bring about alternatives that protect the future of farming while still allowing for growth.

Conclusion

Bearing in mind the real, multifaceted challenges that Harford County faces in solving its projected housing shortage, it is the conclusion of this research that the County can design a pattern for growth that ensures that agriculture continues to define the character of Creswell. There will be tradeoffs, but with a landscape-scale vision and careful planning at the parcel level—and smaller—it appears that the County may be able to forge an alternative future with farming securely at its core. Such an idea must gain public support for successful implementation. The point, however, is that coordinated revisions to the available planning tools could bring about a future where farming is and remains the “cornerstone of the community.”

¹¹⁹ Refer to the Appendix on Zoning and Land Use for additional discussion of the pros of cons of Harford County's current TDR program.

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Appendix D: Rural Character

By AnnaLinden Weller

Executive Summary

The Creswell area is defined by a distinct and valued rural character built around the agricultural history of Harford County. Agricultural land uses, integrated with forested areas and preserved open space and dotted with ponds and weirs as well as historical buildings from the eighteenth and nineteenth century, produce a complex landscape with high visual impact – one which will be changed, and inevitably compromised by development. Development pressures will need to be balanced with the preservation and conservation of landscape elements, land uses, and historical continuity, and should take into account the varied and sometimes contentious local value judgments belonging to the multiple stakeholders in the Creswell area. Table 1 provides an overview of the opportunities and constraints examined in this appendix.

Table 1. Executive Summary Matrix

Planning/Regulatory Factors	Opportunities and Constraints	Implications
Valued Rural Character & Agricultural History	The cultural landscape of Creswell is defined by historical rural/agricultural uses and forested areas; development will inevitably bring change which may be unwelcome.	Scenarios must carefully consider what landscape elements, land uses, and historical continuity are the most important to preserve.
Characteristic and Exceptional Landscapes	These include the Churchville Quarry, <u>Stoney</u> Demonstration Forest, and agricultural landscapes dotted with small ponds & weirs.	Both unusual and fundamentally characteristic <u>viewsheds</u> and places are significant in maintaining Creswell's cultural landscape.
Significant Historical Sites	There is a rich architectural history of early farm estates in the study area; in addition, there are several buildings that speak to the presence of Black communities in Harford County.	While the agricultural/architectural history of Creswell is well-protected by National Historic Landmark designations, the history of the Black community in the area is not. In addition, many historical buildings are on active farms.
Preserving a Sense of Place During a Time of Change	Opportunities: <u>Roadscaping</u> and other 'edge landscape' design; development patterns which reflect the geological and hydrological landscape Concerns: Community engagement around sites of particular local value may be contentious.	Careful selection of development sites and considerations of innovative methods of managing the transition areas between urban and rural can help preserve Creswell's cultural landscape.

Creswell in the Context of Harford County

The opening paragraphs of *HarfordNEXT* make the County's position on its rural character and agricultural history very clear, stating "Harford County has strived to maintain its rural character and identity while balancing the needs of a diverse and growing population."¹²⁰ Much of the County's master plan is devoted to finding ways to puzzle through that balancing act: presenting policies and strategies which can both preserve rural identity while responding to the needs of new residents, changing demographics, and economic pressures on the agricultural community. Harford is focused on preserving the historical and cultural resources which reflect its long history, particularly agricultural land uses and opportunities for future farmers. The Creswell area is no exception. Creswell has been designated either Tier III (well and septic sewer only) or Tier IV (no sewer permitted) under Maryland SB 236 – the Sustainable Growth and Preservation Act of 2012, which limits public sewer in areas prioritized for agricultural and/or ecological uses. Thus, the County has in the past considered this study area to be a site of preservation, rather than one which would be developed.

Opportunities & Constraints

Creswell's Long Agricultural History

Creswell has been farmed since the seventeenth century – a history which is reflected in its architecture as well as its land use pattern. Many of the most significant historic buildings in the Creswell area are old farmhouses, barns, and agricultural infrastructure, as well as the homes of those farmers who worked the land in the 18th century. The County itself recognizes this history and is unwavering in its commitment to local food systems, maintaining rural heritage, and ensuring that future generations of farmers have a central place in Harford.¹²¹ However, Creswell is far south from the County's Priority Preservation Area, where most of its agricultural preservation resources are located, and instead is nestled into the corner of the Development Envelope. Continuation of the area's long history of farming will require access to a stable farmland base – which may not be viable in a situation where the Creswell area is folded into the development envelope.

¹²⁰ *HarfordNEXT*, Harford County Government, 2.

¹²¹ *HarfordNEXT*, Harford County Government.

Significant Historical Sites – But No Historic District Designation

Within the Creswell area are five sites registered as National Historic Landmarks, and an additional three Harford County registered historic sites. Along with these are more than one hundred structures or areas which are inventoried historical sites. The great majority of all of these sites date from the eighteenth and nineteenth centuries, and include agricultural buildings¹²², examples of rural vernacular architecture of the period (both middle-class¹²³ and landowner¹²⁴), Gothic-Tudor architecture¹²⁵, Second Empire style¹²⁶, and properties whose primary significance derives from their original owners or builders. These sites include Tudor Hall, a structure belonging to the Booth family from which John Wilkes Booth hailed (see Figure 1), and various buildings belonging to the Baker family, a locally prominent group active in the furniture and canning industries.

Figure 1. Tudor Hall, former home of the Booth family, including John Wilkes Booth. Designated a National Historic Landmark.



¹²² i.e. Mount Adams, a 114-acre working farm, significant for its builder and resident of 50 years, Captain John Adams Webster, whose travels exposed him to more cultural influences than most of his fellow Harford County gentlemen – details reflected in the architecture of Mount Adams, particularly the mantels, which cover two stylistic eras, from the delicate Federal/Adamesque trim in the 1817 section to the heavier Greek Revival c. 1850 additions.

<https://mht.maryland.gov/nr/NRDetail.aspx?NRID=1022&COUNTY=Harford&FROM=NRCCountyList.aspx>

¹²³ An example is the Gorrell-Volz house on Cavalry Road.

<https://mht.maryland.gov/secure/medusa/PDF/Harford/HA-1292.pdf>

¹²⁴ i.e. Buena Vista Farm (also known as Best Endeavor), a significant example of the domestic vernacular architecture of Harford County, reflecting accretive growth and remodeling over time from about 1740 through the mid-19th century.

<https://mht.maryland.gov/nr/NRDetail.aspx?NRID=1080&COUNTY=Harford&FROM=NRCCountyList.aspx>

¹²⁵ i.e. the national historic site of Tudor Hall, a Gothic-Revival cottage built as a country retreat by Junius Brutus Booth (1796-1852), the head of a family famous on the American Shakespearean stage throughout the 19th century – including its most infamous member, John Wilkes Booth.

<https://mht.maryland.gov/nr/NRDetail.aspx?NRID=133&COUNTY=Harford&FROM=NRCCountyList.aspx>

¹²⁶ i.e. Fair Meadows, a residence executed in a richly ornamented but conservative interpretation of the Second Empire style, embodying the distinctive characteristics of a period and type of architecture that, while popular in the U.S. in the 1860s and 1870s, was rarely used in its "high style" form in rural Maryland. It was also the residence of Clement Dietrich, an entrepreneur who substantially expanded the Harford Furnace Iron Works to include flour and saw mills and a large chemical manufacturing plant.

<https://mht.maryland.gov/nr/NRDetail.aspx?NRID=657&COUNTY=Harford&FROM=NRCCountyList.aspx>

There is also an architectural record of the history of Harford County's African American population in Creswell. This record is exemplified by the Asbury A.M.E. Church (see Figure 2), one of the County's historic landmarks, located in Churchville. The Asbury A. M. E. church was known as "Big Asbury", since it was the only church open to Harford's African American community when it was organized in 1838.

Figure 2. Asbury A.M.E. Church



The ground for the church was donated by Nathan Cooper, who acquired it from Malinda Cooper and Mary A. Brown, two slaves from Peach Bottom, Pennsylvania. The current surviving structures include a one-story, gable-roofed frame building dating from 1881; the present church, still in active use, was dedicated on June 8, 1924.¹²⁷ Surrounding the church are other houses from the same period, three of which are now owned by the Churchville Charge

group of historically Black churches. These structures form the heart of one of Harford's earliest African-American faith communities, and present a different, equally important visual historical record of the Creswell area's residents – one which emphasizes other community members aside from the majority-white agricultural community.

Creswell's history – as an agricultural seat in an agricultural county, with a complex history of both African American and White residents – is visually present in these buildings, and visually *integrated* into the active agricultural landscape which surrounds them. None of Creswell's historical sites are isolated from their surroundings. Whether they are in the rural village of Churchville, on the campus of Harford Community College, or integrated into the working farms and easemented agricultural land so characteristic of the area, Creswell's historical sites are intertwined with the rest of its landscape, and form a distinct part of its rural character.

The Best Endeavor / Buena Vista Farm (see Figure 3) is a historic farm complex and house date from the late 18th century (1770s). Includes not only the main residential building but many contemporaneous farm buildings and is designated a National Historic Landmark. This farm is surrounded by other structures of historic interest that date from the same era and represent the Calvary/Creswell farming community.

¹²⁷ <https://mht.maryland.gov/secure/medusa/PDF/Harford/HA-1267.pdf>

However, it is worth noting that there is no official historic designation for most of these sites – a registered site does not provide protections or design guidelines for the use of the building, and the only buildings which have stronger protections are the nationally - or County-recognized ones.

Furthermore, there is no historic district designation for any part of Creswell, including the Churchville rural village area. These sites, while clearly part of the area’s distinctive rural character, are not protected from development pressures or alterations of that rural character.

Figure 3. Best Endeavor / Buena Vista Farm



Implications

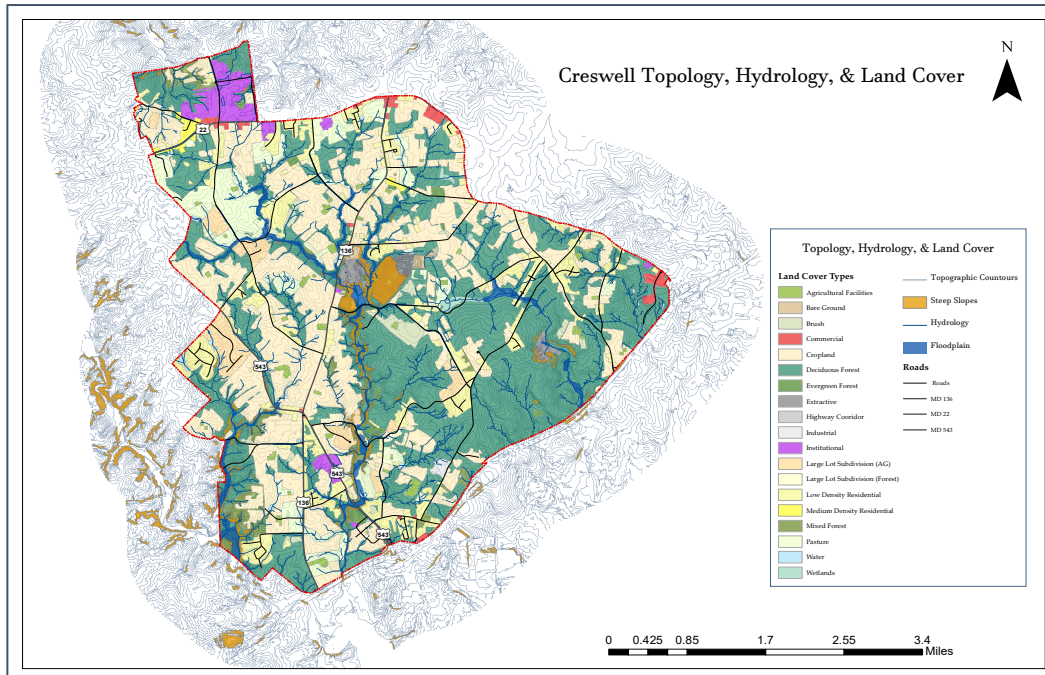
The Creswell study area is a region of Harford County which has a great deal of history but not very many formal guidelines to help preserve that history in any situation of development – including the ‘business as usual’ scenario which has so far resulted in the current large and small lot residential developments that are encroaching on both agricultural land and forest land. Creswell has a distinct rural character, but an indistinct identity – it is patchworked both visually, in terms of land use, and in terms of cultural value to current and future residents.

Furthermore, that patchwork is not universal: different groups of residents in Creswell value different *sorts* of viewsheds, history, and land use as being fundamental to the area’s traditional rural character. Thus, development scenarios must carefully consider what landscape elements, land uses, and historical continuity are the most important to preserve – and for whom.

Characteristic and Exceptional Landscapes

The Creswell area lies in the Piedmont region of northern Maryland, and displays both characteristic landscapes of the region as a whole, and also exceptional and distinctive landscape features particular to Creswell itself. Figure 4 shows the topology, hydrology, and current land cover in Creswell.

Figure 4. Creswell Topography, Hydrology and Land



Opportunities & Constraints

In general, the area is composed of gently rolling slopes surrounding streams, cut through by narrow, well-paved roads. Where the land is not under active human use, there is a mixed deciduous and evergreen forest (see Figure 5), with areas of hydric soils and wetland (see Figure 6). This forested area has high levels of biodiversity,¹²⁸ both of flora and fauna, despite being a landscape in the process of being reclaimed by plant and animal life – none of these forests are mature.

Figure 5. Eastern Creswell, showing the mixed deciduous and evergreen pattern of forest growth



Nevertheless, some of the plants present include silver maple, American elm, ash, black locust, Virginia pine, eastern red cedar, hackleberry, and sycamore; tulip tree, red mulberry, and musclewood in the higher undergrowth; and spicebush, viburnum, wood nettle, poison ivy, wild grapes, honeysuckle,

¹²⁸ See the Environmental appendix for a detailed examination of biodiversity in Creswell.

and cross vine in the lower undergrowth.¹²⁹ In addition, there are some oak trees, a sign of a maturing forest.¹³⁰

Figure 6. Creswell's Flora and Fauna



Where there are agricultural uses in the Creswell area, the landscape reflects both row crops and pasturage¹³¹. These agricultural landscapes are dotted with small ponds and weirs, which produce a distinctive visual identity for the area's farms. The farms are also, in many cases, integrated with the preserved open space of the forest landscape and the historical buildings from the eighteenth and nineteenth centuries, creating a viewshed pattern

which, coupled with the area's rolling hills, allows residents and drivers on Creswell's roads to see all of the area's characteristic landscape patterns at once (see Figure 7).

Figure 7. Characteristic Agricultural Landscape in southern Creswell



Implications

Development in Creswell will disturb both the characteristic and exceptional landscapes in the Creswell area, even under conditions of careful subdivision design. In addition, the forest in eastern Creswell requires management by foresters to become healthy and productive – currently it is marked by a substantive number of invasive species, including the oriental strangler vine, and also has not been managed in such a way as to support an active and financially productive forestry

¹²⁹ Godfrey, Michael A. *Field Guide to the Piedmont: the natural habitats of America's most lived-in region, from New York City to Montgomery, Alabama*. Chapel Hill: University of North Carolina Press, 1997.

¹³⁰ Interview with licensed forester, April 16, 2019.

¹³¹ For a discussion of particular crops and animal husbandry in the Creswell area, see the Agricultural appendix.

industry.¹³² Furthermore, most of the characteristic viewsheds of both agricultural and forest landscape are only accessible to drivers traversing MD 543 or MD136 – or to those individuals who have purchased large-lot residential homes abutting these views. Essentially, the views of Creswell’s landscape – the historic buildings, the working farms, and the forest growth – are used by different stakeholders in different ways, and development will create ample opportunity for conflicts to arise between a desire to preserve the appearance of Creswell and the actual uses of land in the area. A strict ‘preservation’ of cultural landscape – leaving as much unchanged as possible – is likely to be in conflict with both development pressures and ‘conservation’ pressures – whether that conservation is of working farms or green infrastructure and biodiversity.

Agricultural History and Community

Farming and the long history of agricultural community in Harford County is a central part of the County’s identity and desired future. While there are economic challenges to continued working farms in the Creswell area,¹³³ the community of farmers in Creswell is committed to conserving the industry and encouraging its vitality.

Opportunities & Constraints

Easements and Working Farms

Creswell’s prime soils¹³⁴ form the core area of the working farms. These soils are well-utilized by farmers for row crops, specialty crops, pasturage, and agritourism businesses. Many of these farms are multigenerational, or have been worked continuously for centuries – or both. There is also a large amount of farmland in easement under Harford County’s Harford Agricultural Land Preservation Program (HALPP) and Maryland’s Maryland Agricultural Land Preservation Foundation (MALPF) easement programs: these programs are particularly beneficial to farmer-landowners, as those who go into the easement programs are able to continue to farm on their land as long as it is financially feasible for them to do so, and are less burdened by inheritance taxes now that their land no longer is associated with any development rights.¹³⁵ landowners who go into the easement program get to keep their land and continue farming as long as it is financially feasible. In addition, once development rights are sold and retired, the land loses some of its value, making it less tax-burdensome to future generations as inherited property.¹³⁶ Many of these properties in easement are farms integrated with forested areas and historical sites.

¹³² Interview with licensed forester, April 16, 2019.

¹³³ See the Agricultural appendix for a discussion of the economics of farming in Creswell.

¹³⁴ See the Environment appendix for a discussion of prime soils in the Creswell area.

¹³⁵ Harford County Agricultural Preservation Advisory Board, Meeting Minutes, March 5, 2019. http://www.harfordcountymd.gov/AgendaCenter/ViewFile/Minutes/_03052019-1097 (accessed April 2019).

¹³⁶ For further discussion of the easement programs in Harford County, see the Agriculture appendix.

Farms in Creswell both provide “cultural landscape” views for the residents of large-lot single-family detached homes, but are also economic and historical drivers. A working farm may not be as visually appealing as a non-working farm, but conservation of rural character depends not only on visual identity but on cultural and historical identity and continuity of land use.

Agritourism

Harford County was one of the first counties in Maryland to allow on-farm agriculture-commercial zoning, a prerequisite for agritourism operations. Such zoning has been permitted since 2008,¹³⁷ and farms and farmers in Creswell have taken ample advantage of it: despite possessing only 6% of the County’s agricultural land, the Creswell area has 33% of its agritourism businesses (five out of a total fifteen). This suggests that Creswell’s proximity to the development envelope, mix of farming types (including specialty farms that encourage agritourism, like wildflower growing, dairies – Broom’s Bloom Dairy Farm, renowned statewide as part of Maryland’s “Ice Cream Trail”, for example, takes advantage of the County’s regulations to allow an on-premise 30-seat restaurant on agricultural properties as part of its agritourism zoning codes – and vegetable and mushroom farms), and association with the County’s long history of rural and agricultural character could encourage a nexus of agritourism-related businesses which would thrive, even in – or perhaps especially in – a situation of increased growth and development.¹³⁸

Implications

Agricultural land uses in Creswell are not isolated from other aspects of rural character. They are instead deeply integrated with them. Agricultural land use produces some of the characteristic landscapes and viewsheds in Creswell; the historic architecture of the area is historic *farming architecture*, including houses of landowners and their farm staff; and the history of agriculture and farming in Creswell has helped make the area an agritourism destination, a place which is deeply associated with agricultural production and excellent food and natural resources to be enjoyed by residents and non-residents alike. To maintain these elements of rural character, a contiguous, stable farmland base of prime soils will be necessary, no matter what sort of residential or commercial development occurs.

Agritourism could be an economic driver which would lend itself to preserving the rural character of farming in Creswell. The strength of the agritourism landscape currently might, in fact, benefit from higher levels of urbanization. Agritourism requires a place. Population growth in Creswell could bring new audiences for direct sales of agritourism products, and several studies have shown that farms in the

¹³⁷ Maryland Department of Agriculture. “Summary of Planning and Zoning Issues Related to Agritourism/Agriculture at the County Level.” 2014. https://mda.maryland.gov/about_mda/Documents/Planning-Zoning-Issues.pdf (accessed April 2019).

¹³⁸ University of Maryland Extension. “Agritourism.” extension.umd.edu/mredc/specialty-modules/agritourism (accessed April 2019).

Northeastern United States which exist at a metropolitan fringe gain financially from proximity to urban areas, especially those which are densifying.¹³⁹ However, locational advantage and tourist appeal can easily be swamped by the presence of more traditional urban commercial establishments, or by disturbance of the rural character of Creswell to such a degree that agritourism is no longer part of the identity of the area.

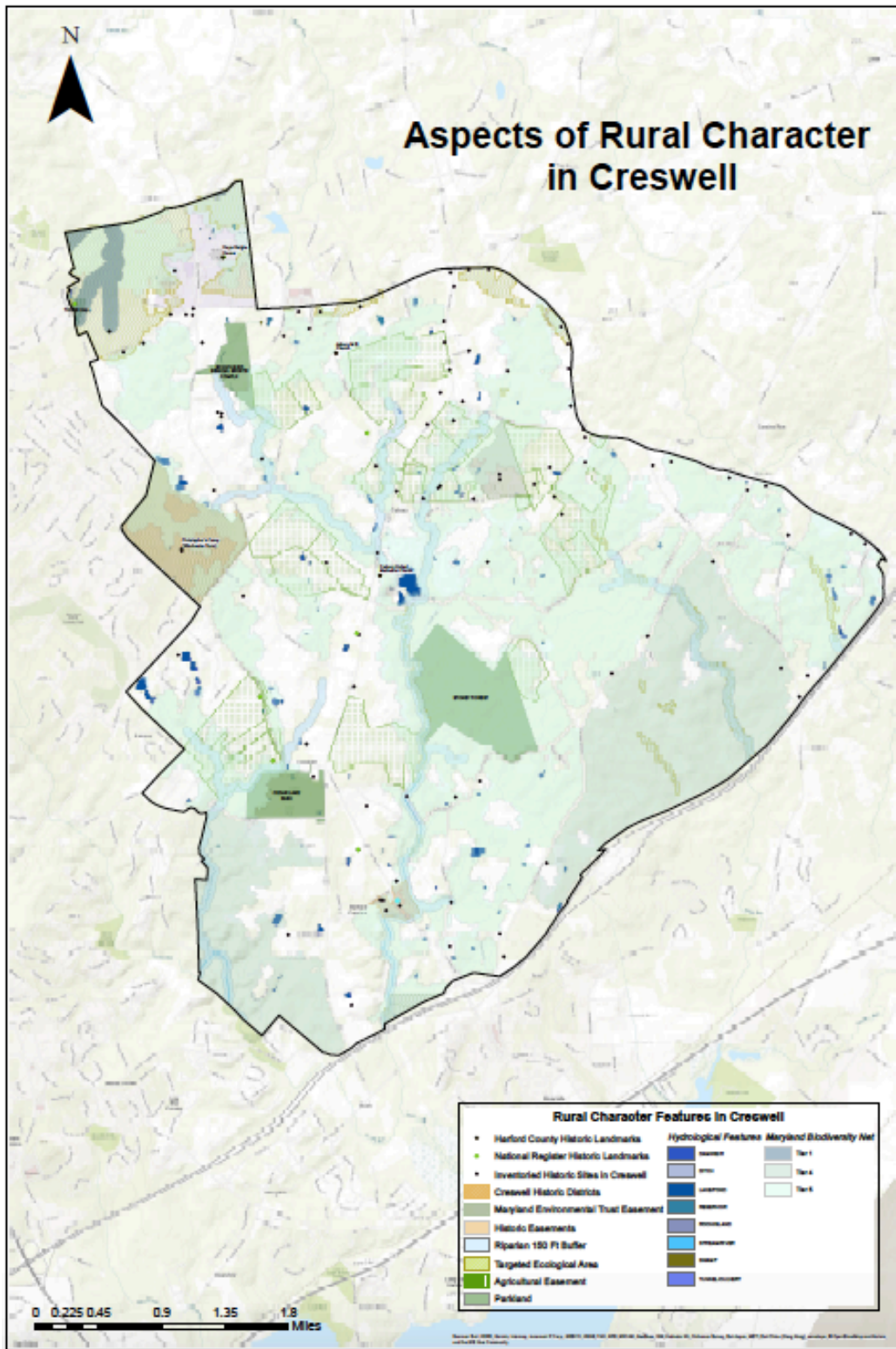
Conclusion: Rural Character Index

Rural character in the Creswell area is not comprised of one single factor, but is a combination of a layered spectrum of elements which give Creswell its particular identity (see Figure 8). These include agricultural land uses; the presence of historic structures, characteristic landscape elements including mixed deciduous and evergreen forest, small ponds and weirs, farmland integrated with preserved open space; and viewsheds which combine elements of all these factors, particularly in areas where access to those viewsheds is maximized. Along with all these elements is the cultural context of current and historical community usage of sites, areas, and properties. Any consideration of which areas in the Creswell region should be conserved for preservation of rural character is thus deeply dependent on context and combination of elements. Ideally, such a consideration would be done in concert with an extensive community engagement effort.

Barring such an effort, a composite index method of determining regions of higher and lower rural character value may be an appropriate method to make a back-of-the- napkin determination which will, at least, prevent development efforts from failing to take into account rural character at all. For further discussion of the composite index developed for this framework plan and its integration into the model for development allocation, see the Modeling appendix.

¹³⁹ Larson, Findeis, and Smith, 2001.

Figure 8. Aspects of Rural Character in Creswell



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Appendix E: Sewer and Water Infrastructure

By AnnaLinden Weller

Executive Summary

In order to provide adequate public facilities for the Creswell area in a situation of residential growth, new options for water and sewer infrastructure are required. In any development scenario, an expansion of the County’s current water and sewer service lines into the Creswell area is necessary, and this expansion will have to occur before the current maximum capacity date for the Harford County development envelope (approximately 2035). Additionally, Harford County will also need to locate a new water source to accommodate development in Creswell along with continued development within the Development Envelope For every additional 5,000 residential DUs, Harford County will need to provide approximately 2.0 MGD of sewer flow and treatment capacity, and approximately 1.5 MGD of potable water – an average of 250 GPD of water per dwelling unit and 200 GPD of wastewater production per dwelling unit. If development approached 10,000 new homes, the Sod Run wastewater treatment plant begins to reach its design capacity of 20.0 MGD – requiring expansion or the construction of a new wastewater treatment plant.

Providing adequate public sewer and water infrastructure to support development must also take into account the debt-to-income ratio of the Sewer and Water Enterprise Fund, the hydrological and topographic constraints of the Creswell area, and the history of sewer and water demand in the region, including the concerns of Harford Community College and the Churchville rural village. Table 1 provides an overview of this appendix’s findings.

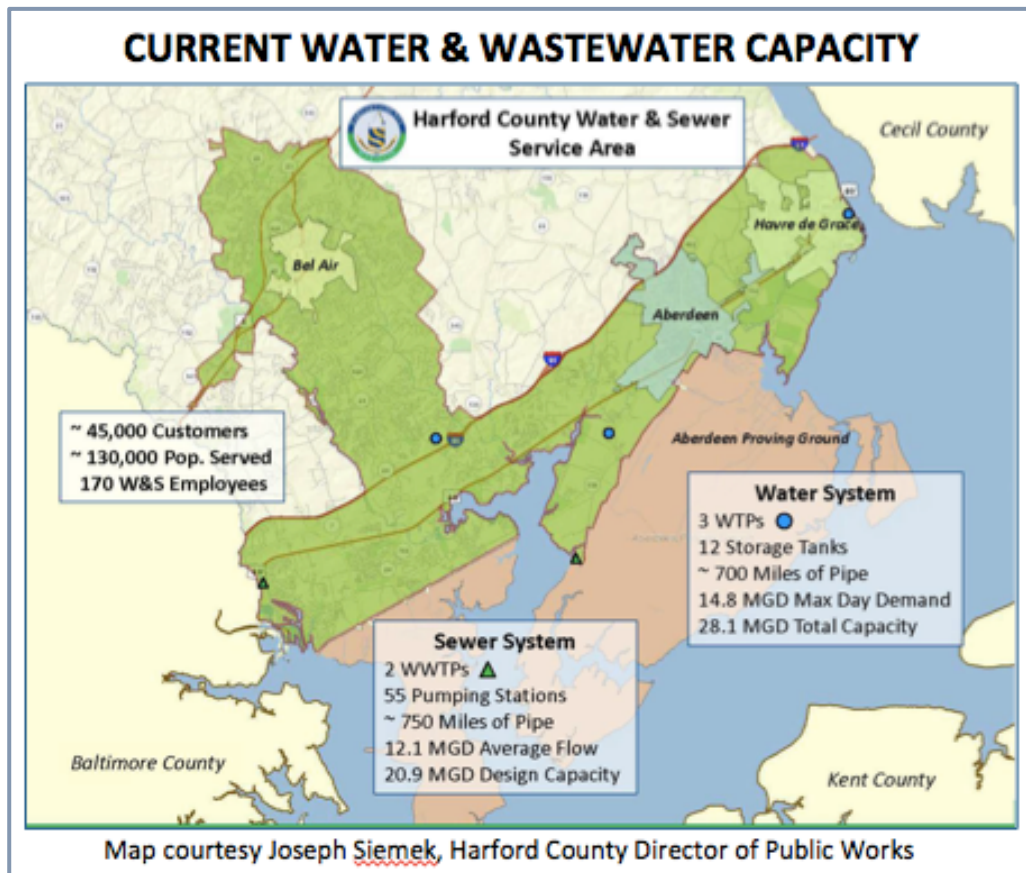
Table 1. Executive Summary Matrix

Planning/Regulatory Factors	Opportunities and Constraints	Implications
Development Envelope & Other Regulations Public sewerage is not permitted outside the development envelope.	Current sewer and water regulations are problematic in a development scenario for Creswell which implies density greater than rural, including the County’s development envelope and Maryland SB 236.	Scenarios must consider regulatory adjustments and outside-the-box possibilities for sewer and water within the current regulatory system.
Current & Future Demand	The capacity of Harford County’s sewer and water systems is already strained; development in Creswell will increase demand further.	Any development scenario must include a sewer/water solution.
Topographic & Hydrological Challenges	The water table in Creswell is high, and there is considerable topological variation.	Traditional gravity sewer engineering costs will be high; some innovative systems are inappropriate for this area.
Choosing Between Innovative & Gravity Systems	A traditional gravity sewer system will be costly and environmentally damaging to construct, but creates the largest opportunity for development. Innovative systems are less costly, more environmentally friendly – and less supportive of density.	The choice between gravity sewer and other systems will drive development patterns, no matter the scenario.

Current and Future Capacity of Sewer & Water in Harford County

Harford County is growing, and along with growth comes a corresponding increase in residential water and sewer demand – as well as a related increase in commercial and industrial demand throughout the County. Currently, Harford County provides sewer and water to the development envelope, aside from the cities of Aberdeen and Havre de Grace and the town of Bel Air. Maryland American Water Works, a private utility, provides water service to Bel Air while sewer service is provided through the Harford County system.¹⁴⁰ Aberdeen and Havre de Grace each provide water and sewer service to their respective residents, and Aberdeen also provides water and sewer service to the Aberdeen Area of Aberdeen Proving Ground. Figure 1 shows the current capacity and usage of the public water and sewer infrastructure in Harford County, as well as the locations of the water treatment plants (WTPs) and wastewater treatment plants (WWTPs).

Figure 1. Current Water & Wastewater Capacity



Projected public water and sewer needs have been calculated by the Harford County Department of Planning and Zoning. The most recent predictions concluded that

¹⁴⁰ Sewer and Water Master Plan, Harford County. 2018. 57.

there are an estimated 19,308 potential dwelling units left to build in the development envelope, and that approximately 700 new units would be built per year – resulting in 83,000 total dwelling units within the development envelope by 2035. Coupled with population estimates, which suggest that there will be approximately 293,000 people living in Harford County by the year 2035, including about 18,500 people in the City of Aberdeen, about 9,000 people in the Town of Bel Air, and about 15,500 people in the City of Havre de Grace, it is clear that population growth and residential expansion – even just within the development envelope – will result in new pressures on water and sewer capacity and supply by the middle of the next decade, as seen Table 2.

Table 2. Projected Water and Sewer Demand

	Harford Development Envelope Dwelling Units	Water Demand (MGD)	Sewer Demand (MGD)
2017	63,700 DUs	14.8 MGD (53% of capacity)	12.1 MGD (58% of capacity)
2035	83,000 DUs	28 MGD (99% of capacity)	21 MGD (101% of capacity)

Opportunities & Constraints

The Sewer and Water Master Plan projects that Harford County as a whole has adequate source water to serve projected development and contractual obligations until approximately 2038. At full build-out, the water supply demand for the development envelope will be around 28 million gallons per day (MGD) for an average of around 255 gallons per day (GPD) per every dwelling unit. If full build-out of the development envelope occurs, the Aberdeen Proving Ground continues to expand, and any development occurs outside of the development envelope (whether within the Creswell area or elsewhere), additional water sources will need to be found before 2038.¹⁴¹ And, if development is to occur in the Creswell area at all, both water and sewer piping will be required – a major infrastructure project and investment.

To begin with, there are hard capacity constraints on both the water treatment plants and wastewater treatment plants in Harford County. The capacity of the three water treatment plants (Abingdon WTP, Perryman Wells, and Havre de Grace WTP) currently operating under the supervision of the county government can be seen in Figure 2:

¹⁴¹ Sewer and Water Master Plan, Harford County. 2018. 109-112.

Figure 2. Water Treatment Plant Capacity

	<u>EXISTING CAPACITY</u>	<u>FUTURE CAPACITY</u>
• Abingdon WTP	19.0 mgd	23.75 mgd
• Perryman Wells	5.2 mgd	4.39 mgd
• Havre de Grace WTP	3.6 mgd	5.40 mgd
• Havre de Grace (city)	1.3 mgd	0 mgd
• Total	29.1 mgd	33.54 mgd

Source: Harford County Sewer & Water Master Plan

The Havre de Grace WTP treats the Susquehanna River source. In order to reach the planned future capacity of this plant, activation of a third 2 MGD treatment unit and associated raw and finished water pumps and piping, as well as improvements to the backwash waste and clarifier waste facilities will be necessary. These improvements are scheduled to begin after Havre de Grace City begins to buy back the County's water allocation from the City's plant – i.e. sometime in the mid-2020s.¹⁴² As for the Abingdon WTP, in July of 2012, Harford County received a commitment from the City of Baltimore to allow the County to purchase an additional 5 million gallons per day of raw water. This will raise the amount of available raw water at the Abingdon WTP to 25 MGD, but the treatment plant must be expanded to be able to treat the additional water – an expansion which needs to occur before 2035.¹⁴³ Lastly, the Perryman Well Field provides 5.2 MGD of finished water. Included in the Perryman Well Field capacity listed above is the expectation that well field yield will be reduced in the future due to development within its recharge area, primarily owing to impervious surfaces. The impact of development in the recharge area was estimated by the engineering firm of CH2M Hill in 1997 to be a 15±% decrease of available water if the impervious surface due to development is limited to 50% of the gross acreage. Since the study, Harford County has adopted a well head protection ordinance as part of the Zoning Code which limits imperviousness to 50%. Therefore, the future yield of the well field is anticipated to be 4.39 million gallons per day – less than its current capacity.¹⁴⁴ More residential expansion in the Creswell area or elsewhere will reduce the well field yield faster.

A hard limit on sewer treatment plant capacity is also present. Harford County presently has 3 wastewater treatment plants, 52 sewer pumping stations, 6 interceptor lines, and 40 collector lines running along 750 miles of underground sewer mains. The three major wastewater treatment plants (WWTPs) in the County

¹⁴² Sewer and Water Master Plan, Harford County. 2018. 109.

¹⁴³ Sewer and Water Master Plan, Harford County. 2018. 110.

¹⁴⁴ Sewer and Water Master Plan, Harford County. 2018. 110-11.

are the Joppatowne, Sod Run, and Spring Meadows plants (see Figure 3), of which the Sod Run plant is the largest, with a capacity of 20.9 million gallons per day (MGD). (The Joppatowne and Spring Meadows WWTPs are much smaller, with design capacities of 0.95 MGD and 0.01 MGD respectively, and both plants currently operate at over 80% of their design capacity).¹⁴⁵ Sod Run currently experiences an average flow of 12.1 MGD (47% of its design capacity).

Figure 3. Wastewater Treatment Plan Capacities

WASTEWATER TREATMENT PLANT	NPDES PERMIT (MGD)	EXISTING AVERAGE FLOW (MGD)	DESIGN CAPACITY (MGD)	2017 AVERAGE FLOW AS % OF DESIGN/PERMITTED CAPACITY
JOPPATOWNE	0.950	0.830	0.950	87
SOD RUN	20.0	9.78	20.0	49
SPRING MEADOWS	0.010	0.008	0.010	80

Source: Harford County Sewer and Water Master Plan

Thus, the Sod Run plant is able to serve 18,518 additional dwelling units above its current service level. This implies that residential development, *if that development is only within the development envelope*, can be served by the Sod Run plant until 2035.¹⁴⁶ Residential expansion into the Creswell area will place pressure on the capacity of the Sod Run plant sooner than that.

It is worth noting that two currently proposed projects, the James Run development and the Monarch Glen development, are not subject to the capacity issues discussed above, as they are both folded into the County’s current predictions. The James Run development – a mixed-use office complex¹⁴⁷ – impinges upon the south-central region of the study area. This development has received planning permission to run sewer and water lines underneath I-95 (using the James Run as the trunk sewer line). However, the pipes for this expansion are relatively small and sized only for a full build-out of this mixed-use office development. As ground is expected to be broken on this project within the next year, the pipe sizing is unlikely to change or be a part of the cost calculation of running a much larger trunk sewer up James Run in a development scenario for the Creswell area.

Implications

For every additional 5,000 residential DUs, Harford County will need to provide approximately 2.0 MGD of sewer flow and treatment capacity, and approximately 1.5 MGD of potable water – an average of 250 GPD of water per dwelling unit and 200 GPD of wastewater production per dwelling unit, with small variances by type

¹⁴⁵ Sewer and Water Master Plan, Harford County. 2018. 66.

¹⁴⁶ Sewer and Water Master Plan, Harford County. 2018. 66-68.

¹⁴⁷ Butler, E. "New James Run development plan includes residential, retail and a hotel." *The Baltimore Sun*. Dec 26, 2018.

(i.e., a multifamily apartment uses slightly less water and produces slightly less wastewater than a single-family detached home).¹⁴⁸

In addition, the Harford County Adequate Public Facilities Ordinance (APFO) requires ‘fire flow’ water to be available in amounts adequate to serve every residential unit and every square foot of commercial or industrial space in a development.¹⁴⁹ These flows must also be adequately pressurized, and the water pipe infrastructure sufficiently large to accommodate them.¹⁵⁰ It should also be noted that the water needs of new residential dwelling units are not the only concern for the County’s water supply, as new residential development will generate new schoolchildren, and schools have specific additional water needs. Water supply and water treatment infrastructure should be expanded to prepare for a new elementary school or significant expansion of an existing school. Figure 4 outlines the water consumption estimates for schools according to the Planner’s Estimating Guide.

Before Harford County can begin to think about the type of infrastructure needed to support development in the Creswell area, it will need to identify additional water sources and consider the hard limits of the WTPs and WWTPs, including planning for expansion or new construction. Building excess WTP and WWTP capacity sooner rather than later is also a sound resiliency strategy for Harford County, particularly if the new capacity results from new plants rather than expansion of extant ones – a system which is solely reliant on one large node, like the Sod’s Run WWTP, might be subject to catastrophic failure in the event of a disaster. A system which distributes the capacity of water treatment over more sites helps to mitigate this issue.¹⁵¹

Figure 4. Water Consumption Estimates - Schools

Unit of Measure	Required Water Flow (GPD)
Student	25
Cafeteria (per seat)	5
Gymnasium (per seat)	5

It might seem simplest, given that the study area lies partially within the Bynum Run watershed and partially within the Bush River watershed, to consider extending the extant sewer and water system in the Bynum Run watershed to serve at least the western portions of Creswell in a development scenario. However, the Bynum Run’s capacity is designed to accommodate the growth of the development envelope only, and shifting it to service Creswell will create a ‘robbing Peter to pay Paul’ type of situation, and create capacity issues within the extant development envelope before the current predicted date of 2035. As an illustrative example, the Bynum Run trunk

¹⁴⁸ Connect Our Future: Place Types and Community Types. Matt Noonkester in partnership with the Centralina Council of Governments and the Catabwa Regional Council of Governments.

¹⁴⁹ “Harford County Code.” § 267-126(B)(2). Adequate Public Facilities. (2018): 359-366.

¹⁵⁰ 2018 International Fire Code. Appendix B – Fire Flow Requirements for Buildings. Accessed at <https://codes.iccsafe.org/content/IFC2018/APPENDIX-B-FIRE-FLOW-REQUIREMENTS-FOR-BUILDINGS>

¹⁵¹ Cutter, S. L., W. Solecki, N. Bragado, J. Carmin, M. Fragkias, M. Ruth, and T. J. Wilbanks, 2014: Ch. 11: Urban Systems, Infrastructure, and Vulnerability. Climate Change Impacts in the United States: The Third National Climate Assessment, J. M. Melillo, Terese (T.C.) Richmond, and G. W. Yohe, Eds., U.S. Global Change Research Program, 282-296.

sewer line, which runs about 10 miles (6,600 linear feet) from just north of Bel Air and ends east of Edgewood at the Bush Creek pumping station, is currently being upgraded. At the moment, the Bynum Run interceptor has a daily flow rate of 9.6 MGD, and provides nearly 80% of the wastewater flow which is processed by the Sod's Run WWTP.¹⁵² After the upgrade of the interceptor, its capacity will reach 15 MGD – but all of this excess is meant to be absorbed by growth in the development envelope, and cannot be used to accommodate Creswell's development.¹⁵³

Challenges Presented by the Regulatory Framework

Harford County, like the rest of Maryland, has adequate public facilities requirements governing sewer and water access for both commercial and residential buildings. In addition, the Harford County Development Envelope, which represents the County's growth management program, is designed to direct development toward suitable areas which can be provided with necessary public services – including sewer and water – and direct development away from less suitable areas. The Creswell area lies outside of the development envelope. A second layer of regulatory constraints on public sewer derives from Maryland State Bill 236 – the Sustainable Growth and Agricultural Preservation Act of 2012 – which designates four tiers of sewerage service throughout the state, designed to limit the development of subdivisions in areas which are marked for preservation and conservation.

Opportunities & Constraints

The Development Envelope

Harford County's Development Envelope is an area generally defined by I-95 / Route 40 and the Route 24 corridor north to Bel Air and Forest Hill. Within the development envelope, public sewer and water are a given; outside of it, public sewer and water are heavily discouraged. Harford County's Sewer and Water Master Plan explicitly states: "Public water supply and sewerage systems will be extended only into existing communities or areas where planned growth is consistent with the current Harford County Land Use Element Plan, the Transportation Plan, the other master plans and this Plan. The cost to provide these services will be supported by the persons who are benefited by the extension."¹⁵⁴ Thus, under current regulations, it is clear that Harford does not plan to provide sewer and water to areas not inside the designated development envelope (see Figure 5), and has not formulated its capital budget to support such expansion.

¹⁵² Harford County Fiscal Year 2019 Approved Capital Budget and Capital Improvement Plan, Harford County. July 2018.

¹⁵³ Interviews with William Bettin, Harford County Public Works, March-April 2019.

¹⁵⁴ Sewer and Water Master Plan, Harford County. 2018. 16.

SB 236 - The Sustainable Growth and Agricultural Preservation Act of 2012

In addition, the regulatory constraints on sewer which were codified by Maryland SB 236 – the Sustainable Growth and Agricultural Preservation Act of 2012 – present a further hurdle to sewerage the Creswell area. SB 236 creates four tiers of sewerage service (see Figure 6), designed to limit the development of subdivisions in areas which are marked for preservation and conservation. Most of the Creswell area is currently designated Tier IV, which prevents both gravity sewer and subdivisions on septic. Portions of the area – presently developed residential subdivisions, Harford Community College, and the rural village of Churchville, in specific – are designated Tier III, which does allow for subdivisions on septic.

Figure 5. Harford Development Envelope

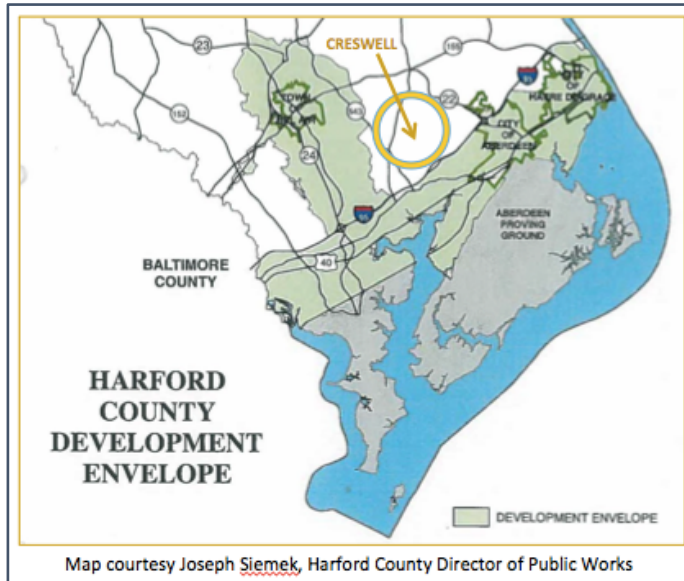
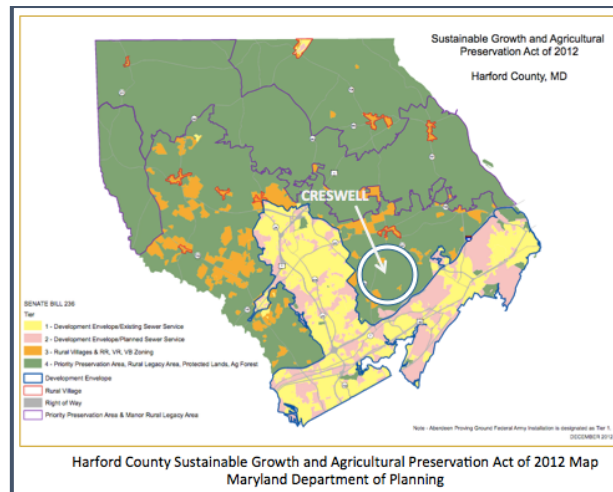


Figure 6. Harford Sewer Tiering



Implications

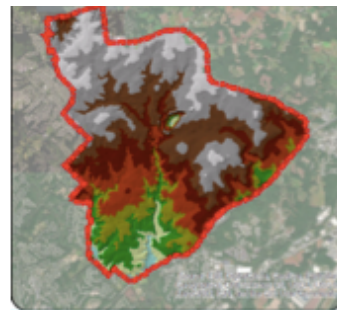
Any residential expansion into the Creswell area which requires public water and sewer will at minimum necessitate a change in the development envelope regulations, service maps, and/or an expansion of the development envelope to include the areas which are to receive service. This will involve substantive changes to the Harford County master plan, including redrawing the development envelope, rezoning the areas which are to receive public water and sewer, and adjusting the Preferred Funding Area (PFA) boundary. After these changes are made, the Sewer and Water Master Plan and the SB 236 regulatory framework easily fall into place, because both the SB 236 bill text and the Sewer and Water Master Plan text provide clear methods for revision.

The key text in the Sewer and Water Master plan reads as follows: “The following types of revisions are considered during the semi-annual review process: [...] 2. Changes in the other components of the County’s Master Plan that may impact on this Plan [...]”¹⁵⁵, implying that changing the development envelope allows for changes to the sewer and water service regulations as well. Similarly, a provision in the text of SB 236 allows for changes in tier designations if they are first changed in a county’s master plan and zoning code. Harford County is thus in control of its own sewer tier designations because it is in control of its own master plan. Development in the Creswell area will be prefigured on adjustments to the master plan and devolved regulations which follow.

Hydrological and Topographic Considerations

Providing water and sewer to the Creswell area also is subject to topographic and hydrological challenges related to watershed boundaries. As mentioned above, the Creswell area is within two watersheds: the Bush River watershed, which covers the central and eastern portions of the area, and the Bynum Run watershed, which covers the western section. The Bynum Run watershed is also the watershed containing Bel Air and the stretch of the development envelope between Bel Air and I-95.

Figure 7. Elevation Contours



In addition, Creswell’s elevations vary over 350 feet (see Figure 7), with the highest elevations near the community college and the lowest at the site of the Churchville quarry and near the I-95 corridor.¹⁵⁶

Opportunities & Constraints

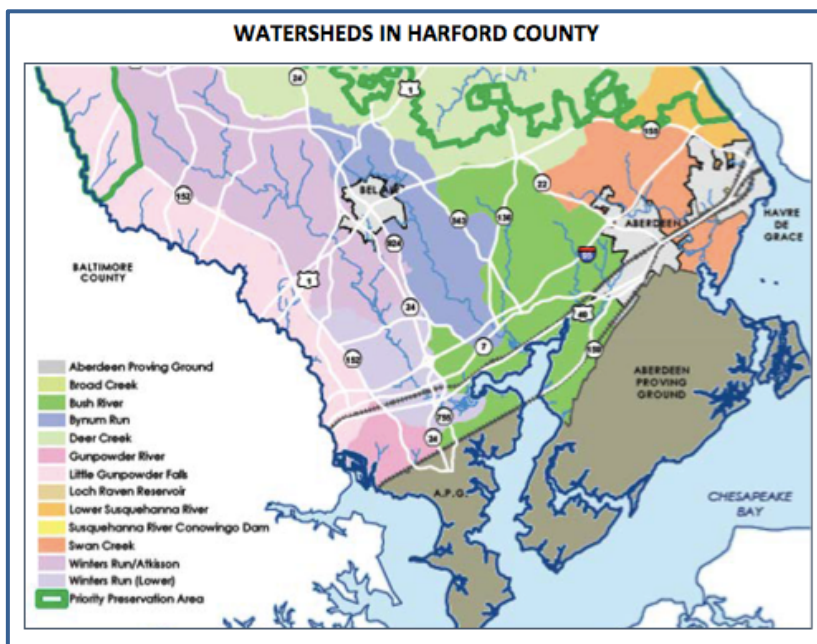
In general, the Creswell area presents a rosy picture for sewer and water installation, as the topography favors a gravity sewer that runs down the Bush River watershed (see Figure 8). Such a gravity sewer would not need a great number of pumping stations, as it would in general run from higher elevations to lower ones. Additionally, the steepest slopes which would create difficulties in maintaining adequate fire flow water pressures are located in areas unlikely to see development, like the Churchville quarry.

Nevertheless, some significant challenges remain: most pressingly, if a trunk sewer is run up the James Run, service to the southwestern part of the study area, adjacent

¹⁵⁵ Sewer and Water Master Plan, Harford County. 2018.

¹⁵⁶ Graduate Landscape Architecture Creswell Analysis. Studio II. University of Maryland. Fall 2018.

Figure 8. Harford Watersheds



Source: Harford County Sewer and Water Master Plan

to the development envelope, will require a pumpover via a lift station from the this new trunk sewer line in the Bush River watershed into the Bynum Run watershed.¹⁵⁷ This increases the expense of initial sewerage.

Furthermore, any new gravity sewer installation will most likely require open trench construction and deep excavation, possibly in excess of fifteen feet below

ground¹⁵⁸; this sort of construction is disruptive to travel, daily life, and the local environment. The environmental factors are particularly salient in the study area, which contains important elements of Harford County’s green infrastructure network. If topography dictates a deep sewer excavation, dewatering will likely be required considering the relatively high water table in the Creswell region. Dewatering can produce unexpected changes in the water table, including the ingress of salt water, an increase in silt and other particulates, and shock to vegetation nearby.¹⁵⁹

Implications

Providing municipal sewer and water to support residential development in the study area will require a new gravity sewer trunk line which is best placed to run up James Run towards Harford Community College, in parallel to the smaller James Run pipe which will serve the James Run mixed-use office development. If the market for residential development in the Creswell region continues to be strong, and development reaches the eastern portion of the study area, a second trunk line which traverses the northeastern subwatershed will also be necessary. Topologically, this trunk sewer is best constructed along Cranberry Run.

¹⁵⁷ Interviews with William Bettin, Harford County Public Works, March-April 2019.

¹⁵⁸ Water Environment Research Foundation (2016, February 1 - June 30). Decentralized Systems Performance and Costs Fact Sheets. Retrieved from Water Environment Research Foundation: <http://www.werf.org/>

¹⁵⁹ Tse, Nigel and McAdie, Don. (2009). Comparison of risks, costs, and environmental impacts of wastewater treatment systems. Retrieved from Water New Zealand: https://www.waternz.org.nz/Article?Action=View&Article_id=917

These sewer and water lines can be built in phases, but the nature of sewer and water infrastructure – which is most efficient when constructed with pipe capacity large enough to serve the maximum buildout of expected development – implies that even phased development should take into account the possibility of a maximum growth scenario, so as to adequately serve the new residents. Conversely, limiting the size of the built pipes to the threshold of desired maximum growth in the study area would be an effective growth management mechanism for guiding development.

Sewer & Water at Harford Community College

Harford Community College (HCC), located in the northwestern part of the Creswell study area, is an anchor institution in the County, providing workforce development programs, undergraduate education, vocational training, and both youth and adult extension education programs. HCC currently runs on a well and septic system for providing potable water and collecting wastewater. This system has limited the ability of HCC to expand.

Opportunities & Constraints

Harford Community College has been requesting access to public water and sewer for decades, and both HHC's internal analyses and white papers prepared by Harford's business community have been clear about the limited ability of the College to offer new programs or build new facilities unless that access is provided.¹⁶⁰ In the 2014 update to the HCC Facilities Master Plan, the college reported that: "In order to support continued growth at the College, it is imperative that the campus pursue connection to the County water supply system. These efforts have been ongoing with County officials and local engineers with little progress. The County water supply is located within one mile of the College property."¹⁶¹ However, little to no progress has been made in the five years since. HCC did, in 2013, work with the Maryland Department of the Environment and the Harford County Health Department to obtain approval for a centralized wastewater treatment facility on campus that processes all wastewater from campus buildings – approximately 16,000 GPD in 2014. The treatment plant has a maximum design capacity of 25,500 GPD. This plant is insufficient to support further growth at HCC.¹⁶²

However, HCC is located on high ground, and between the campus and the extant sewer lines within the development envelope are some of the steepest slopes in the study area – slopes which additionally lie within an environmentally sensitive region highlighted for preservation in Harford's 2018 draft green infrastructure

¹⁶⁰ HarfordNEXT White Paper, Greater Harford Committee. 2016. Accessed at <http://www.greaterharford.org/education/>

¹⁶¹ Harford Community College Facilities Master Plan – Five Year Update – 2014, Harford Community College. 2014. Accessed at <https://www.harford.edu/~media/PDF/Capital%20Projects/2014%20Update.ashx>

¹⁶² Harford Community College Facilities Master Plan – Five Year Update – 2014, Harford Community College. 2014. Accessed at <https://www.harford.edu/~media/PDF/Capital%20Projects/2014%20Update.ashx>

plan.¹⁶³ Building sewer and water lines to connect to HCC through this topography is difficult, expensive, and environmentally destructive. Furthermore, the County government has been adamant about enforcing its sewer regulations regarding public connections outside the development envelope, and the negotiations between the College and the County have come to an impasse.

Implications

Bringing public sewer and water to HCC by running a trunk sewer up James Run in the Bush River watershed would not only provide for the College's long-wished-for connection, but also avoid the topographic difficulties which bringing public sewer and water over from the Bynum Run watershed would entail. Such a sewer line would be welcomed by the College and enable substantive expansion of the campus. Expansion could even possibly include the development of dormitories for undergraduate students seeking a more traditional college experience while still remaining in their home County and benefiting from the affordable education offered by a flagship community college.¹⁶⁴

Nevertheless, running a sewer and water line up to HCC from the base of the study area creates an immense expense – if such a line did not have to reach the College, development could be more easily confined to the southern portions of the study area, and the infrastructure costs would be correspondingly reduced. Bringing this hypothetical line all the way up to HCC would create substantive pressure on the Water and Sewer Enterprise Fund which might not be recouped by development progress for a substantial period of time.¹⁶⁵

Innovative Septic Options

Even in a development scenario for the Creswell area, some locations currently on well and septic – like the Churchville rural village – would not be close to a proposed new sewer line. These areas are currently on individual well and septic systems for each parcel. As part of a general infrastructure improvement for the study area which would accompany development, innovative shared septic systems might be an option for these clustered developments which would not have access to gravity sewerage or where planned sewer extension had not yet arrived.

¹⁶³ See the Environment appendix later in this volume

¹⁶⁴ Interview with community college representative

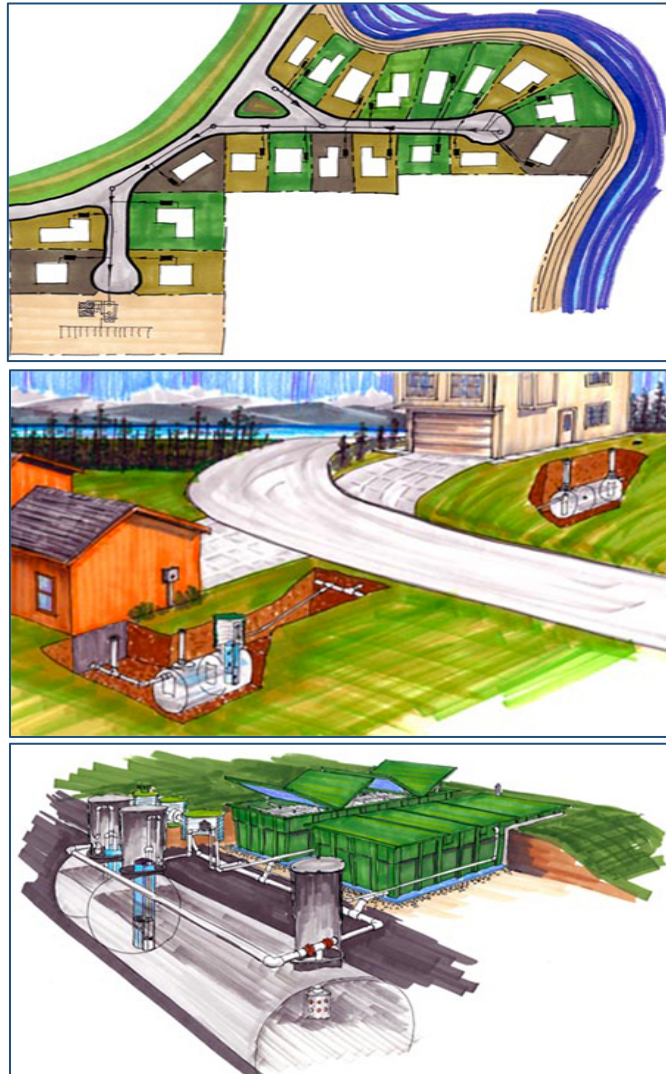
¹⁶⁵ Interviews with William Bettin, Harford County Public Works, March-April 2019.

Opportunities & Constraints

The state of the art in innovative shared septic systems are exemplified by ‘cluster systems’ (see Figure 9), which collect wastewater from a small number of homes (5-100) and transport it via a sewer pipes to a pretreatment and land absorption area. There is no surface discharge of effluent. Cluster systems are cost-effective for small, dense communities which are not part of a larger urban fabric, like Churchville, and they have a variety of design options. These include pressure sewer systems that are less expensive to install than the large pipes used in a centralized gravity sewer. Pressure systems do not require the deep excavations that gravity sewer installation does, and are therefore much less disruptive to local culture, ecosystems, and landscape during construction – as well as being cheaper.¹⁶⁶ Some cluster systems, like ORENCO pressure sewer systems, are especially effective in areas with high water tables, like those found in the study area – reducing nitrogen effluent by 60-70% compared to standard septic.

However, these systems require high levels of community coordination and homeowner commitment. Each unit participating in the cluster requires an on-site septic tank in addition to the central treatment system, and responsibility for maintenance of the tank falls on the homeowner rather than the County or municipality. Furthermore, ORENCO-type systems are in conflict with State Bill 236, which requires substantive Maryland Department of the Environment permitting and studies for any septic system which will handle more than 5,000 GPD of

Figure 9. Cluster System Examples



Source: ORENCO Fact Sheet

¹⁶⁶ ORENCO Fact Sheet - Sewer Systems: Construction Considerations. Accessed at <https://www.orengo.com/Portals/0/Documents/Technical%20Papers/Sewer%20Construction%20Considerations.pdf>

wastewater.¹⁶⁷ At an average rate of 200 GPD of wastewater per DU, an ORENCO-style system would only be suitable for approximately 25 homes before major permitting work would be required.

Box 1. ORENCO Case Study – Commentary on Figure 9

An example ORENCO cluster from Anchorage, AK. This system is designed to handle 4,000 GPD of wastewater from 20-23 homes. A downhill lot contains the treatment system.

Each home has its own steel septic tank from which the effluent flows via gravity to liftstation tank down the street. The liftstation sends the septic tank effluent up to a 12,000 gallon steel recirculation tank. Two AdvanTex AX100 filters treat the effluent before it is discharged into the leech field underneath the subdivision's parking lot at regular intervals.

This developer set up a homeowner's association that owns the water well and wastewater treatment system as a private utility. The association dues pay for the system monitoring and maintenance.

Implications

Innovative septic systems might best be used as a phasing tool to provide an alternative to well-and-septic for more clustered developments before public sewer arrives.

With willingness to engage with MDE permitting requirements, and location of a suitable leech field which would not overburden the Bush River watershed with source point pollution, an ORENCO system might provide the rural village of Churchville with alternatives that would increase water quality and control septic system failure. Similarly, other clustered developments which might emerge during a period of growth in the study area would benefit from considering innovative septic rather than waiting for the arrival of public sewer. The Harford County Sewer and Water Master Plan supports this in concept, as it reads: "...low pressure sewer systems may be considered if the present worth cost is less than a conventional sewer system & the site does not require public sewer beyond the subdivision [...] environmental constraints and topographic conditions may also be taken into consideration."¹⁶⁸

¹⁶⁷ Maryland Senate Bill 236. 2012. Accessed at <http://mgaleg.maryland.gov/2018RS/bills/sb/sb0236t.pdf>

¹⁶⁸ Sewer and Water Master Plan, Harford County. 2018.

The Sewer & Water Enterprise Fund

The existing sewer and water system in Harford County is financed via the Water & Sewer Enterprise Fund, which has a budget of fifty million dollars per year. The fund is supplied in two ways: revenues from system users (i.e. connection fees and usage fees), and capital bonds. In Fiscal Year 2019, the County budget appropriated an additional \$24.5 million for sewer and water capital projects, 14% of the total capital budget for the County.¹⁶⁹ All remaining operating costs for the extant sewer system were covered via revenue from system users.

Opportunities & Constraints

The structure of the enterprise fund supports large capital projects and makes them cost-effective for the County – if, and only if, there is sufficient developer buy-in to the area newly being serviced by municipal sewer and water that the user fees generated by connections and usage are high enough to begin to offset the burden of debt servicing of capital bonds which the fund would have to take on to complete an infrastructure project of this size and scope.

The County has been conservative with debt under the current administration. This level of infrastructure investment, while supportable by the County and the Enterprise Fund, would require solid political commitment.

Implications

It might be useful to consider additional sources or methods of funding sewer and water expansion, at least for the early portion of construction before developer buy-in to the new system reaches critical mass. Some of these other financing methods might include developer-based financing (perhaps linked to the County's Adequate Public Facilities ordinance or conservation subdivision regulations), or the designation of a new sewer or water sub-district with special connection or usage fees, though this latter option may slow developer-driven growth.

All in all, the fiscal health of the Sewer and Water Enterprise Fund should remain a central consideration in the pace of development in the study area, so that a healthy ratio of debt to income can be preserved within the County as a whole.

¹⁶⁹ Harford County Fiscal Year 2019 Approved Capital Budget and Capital Improvement Plan, Harford County. July 2018.

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Appendix F: Transportation

By Russell Ottalini

Executive Summary

This appendix covers the research done on existing transportation conditions in Harford County, focused primarily on multimodal transportation, including the roadway network and vehicular travel behavior in Creswell, Harford Link and MTA bus lines, and bicycle and pedestrian facilities, including regional trails. Through this research, three main factors were determined to be of particular importance. Although the roadway network is generally adequate for existing use, as an area situated between major employment, residential and commercial destinations locally (Bel Air, Aberdeen, Aberdeen Proving Grounds) and regionally (Baltimore), Creswell experiences significant congestion at key links in its major roadway network. This congestion is especially severe during peak-hour commuting windows along state arterials (MD 22 and MD 543) and major collectors (MD 136), all of which have poor access controls. While public transit, biking and walking do not at present have a large share of the area’s modal split, the past several years have seen a refocusing of planning activity and real investment in expanding multimodal mobility in the greater area. If development of the study area is to occur in the future, this research suggests the need for further investments both in existing and new road infrastructure, revisiting of regulations around marginal access controls to higher functioning roads, and serious consideration for non-motorists’ mobility, summarized in Table 1. The key findings of this review, in the event of increased development in Creswell, included the need for a new thoroughfare plan and roadway reclassification map, proposing stronger enforcement of existing access control sub-regulations, and the potential expansion of public transit service into the study area in addition to bike and pedestrian infrastructure improvements.

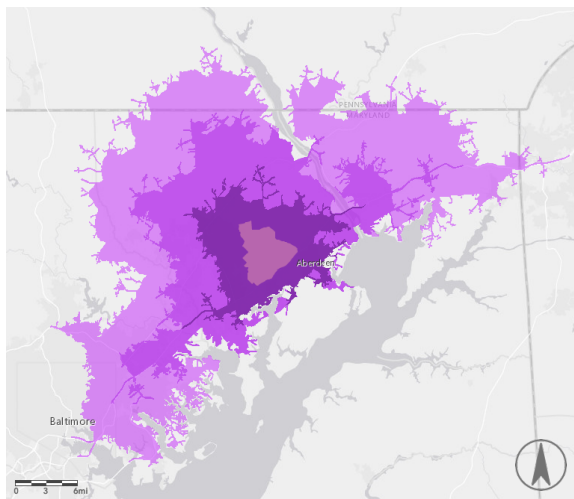
Table 1. Executive Summary Matrix

Planning/Regulatory Factors	Opportunities and Constraints	Implications
Congestion and Connectivity Vehicular traffic volumes along major road network	<ul style="list-style-type: none"> Location of Creswell between housing and major regional job centers puts burden on roadway network Lack of network connectivity in Creswell must be addressed 	<ul style="list-style-type: none"> A new thoroughfare plan including classification needed, and amendments to the Harford NEXT Transportation Element
Access Management Access to roads is controlled by Functional Classification via subdivision regulations	<ul style="list-style-type: none"> Classification of key area roads and applicable regulations in Creswell 	<ul style="list-style-type: none"> Our alternatives propose a reclassification map and suggest stronger enforcement of existing sub-regulations
Multi-Modal Mobility Road network in Creswell offers limited support for transit riders, cyclists and pedestrians	<ul style="list-style-type: none"> Momentum for improvements in pedestrian and cycling infrastructure Character of roadways and perceptions of safety Countywide VMT slightly increasing Low overall transit ridership; density unsupportive 	<ul style="list-style-type: none"> Our alternatives should address strategies to expand mobility and support alternative modes of transportation

Existing Conditions

The Creswell Study Area is bounded on four sides by its major regional roadway network. To the north and east by MD 22 / Churchville Road, to the west by MD 543 (which also intersects the study area), and to the south by I-95 (between MD 543 and MD 22). Most of the development envelope is reachable within a 10-20 minute drive, while the majority of Harford County and parts of Cecil County, Baltimore County and Pennsylvania are within 30 minutes in uncongested conditions (Figure 1). Due to its central adjacency to major residential, commercial and employment centers in the county - Bel Air, Aberdeen, and Aberdeen Proving Grounds (APG) – as well as regional employment hubs, notably Baltimore and Baltimore County, Creswell experiences severe congestion at certain intersections in its roadway network, despite generally adequate conditions for commuters.

Figure 1: Creswell Driveshed Analysis



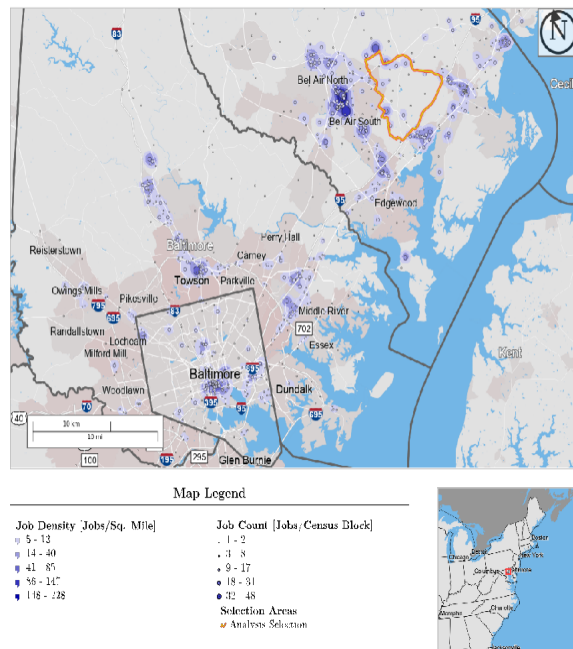
One of the key goals stated by the Harford Next comprehensive plan was “Mobility and Connectivity”, the objective being to enhance the ease of movement between its diverse communities and in doing so enhance their vitality through increased connection. To this extent the mobility and connectivity goal stated several key principles:¹⁷⁰

1. Taking a Universal Approach to Transportation Planning Integrating Transportation and Land Use Planning
2. Establishing a Safe, Robust Network of Bicycle and Pedestrian Facilities Accommodating Users of All Levels
3. Improving Transit Service Offered
4. Finding Alternative Ways to Manage Congestion
5. Expanding Transportation Demand Management (TDM) Programs

¹⁷⁰1 Harford County Department of Planning and Zoning, *Harford Next: A Master Plan for the Next Generation*, 2016, 90

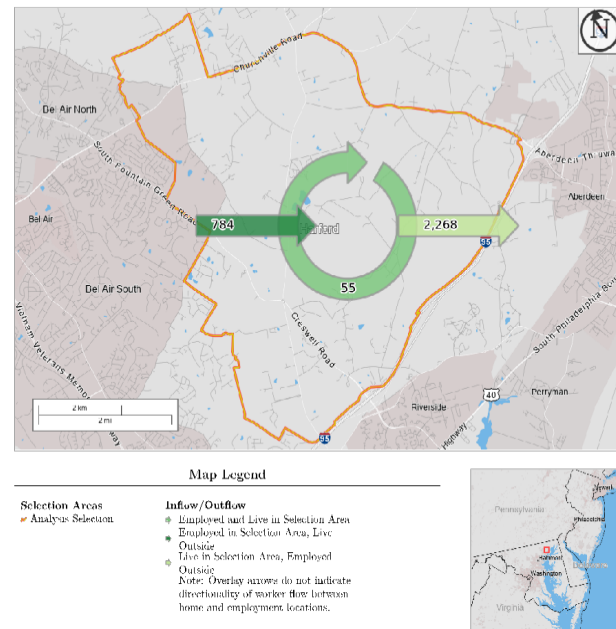
Of the factors spoken to by these principles, the most important with respect to Creswell were deemed to be improving existing congestion levels and mitigating any potential increase from scenario development projections, as well as in supporting complete streets and multimodal transportation. Harford county has experienced rising VMT in the past several years. A 2017 study by the Maryland Department of Transportation (MDOT) found that total miles driven in Harford increased 4% or roughly 98 million miles in 2016 compared to 2015, primarily in urban areas such as those directly adjacent to Creswell.¹⁷¹ While this is very moderate growth with respect to the annual 2-3% increase in households reflected in this study's housing appendix, this is likely only to increase as expansion of the I-95 toll road makes Harford County more accessible to the rest of the state. While APG is a major employer for residents in the Creswell area, a 2012 JMT study that examined travel patterns on MD 22 found that only 20-25% of vehicles traveling on MD 22 during morning peak hours were headed towards APG.¹⁷² Figures 2 and 3 display the inflow/outflow commute patterns of Creswell residents and workers. The study area received less than a third of the workers it sent elsewhere on a

Figure 2: Location of Primary Job for Creswell Residents



Source: On the Map, US Census Bureau, 2015 LEHD Origin Destination Employment Statistics (LODES) Data

Figure 3: Inflow/Outflow Analysis



Source: On the Map, US Census Bureau, 2015 LEHD Origin Destination Employment Statistics (LODES) Data

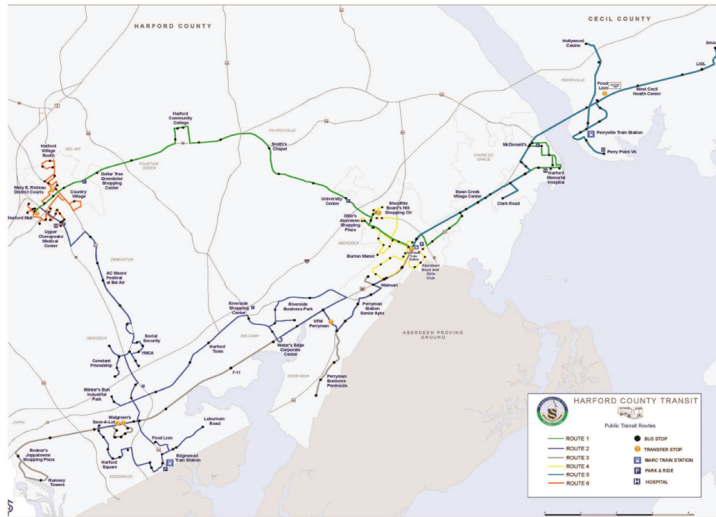
¹⁷¹ Maryland Department of Transportation. 2017 Maryland State Highway Mobility Highway Report. I.A.9, Figure I-5

¹⁷² Johnson, Mirmiran & Thompson, Inc. (JMT). MD 22 Corridor Study, Harford County, MD. 2012, 11-9.

daily basis in 2015,¹⁷³ a sharp contrast with countywide inflow/outflow averages (53% of residents working in the county).¹⁷⁴ In order of degree, regional job centers for the 2,323 workers living in the study area that year were Bel Air, the Baltimore metro area, Harford Community College (HCC), and APG. Only 55 workers both lived and worked in Creswell in 2015.

Modal split in the county reflects rising VMT, with a majority of county residents commuting by single-

Figure 4: Harford County Transit Routes, 2019



Source: Harford Link

commuting by single-occupancy vehicle and primarily by themselves.¹⁷⁵ Alternative modal shares for study area commuters are relatively low, with an estimated 17 bus riders, 45 cyclists, and 25 residents who walk to work.¹⁷⁶ The greater Creswell area is served by both County and State public transportation. The MTA operates several commuter buses that run through Aberdeen and Bel Air before proceeding to Baltimore. Countywide, Harford Link attracts less

than 1,000 riders per day,¹⁷⁷ although ridership is increasing.¹⁷⁸ Route 1 runs from Bel Air to Aberdeen along MD 22, thus running along the northern border of the study area (Figure 4). The county has also held to a commitment to TDM strategies and to increase capital investments in bike and pedestrian facilities along major roadways. Priority letters to the State Highway Administration (SHA) over the past two years request state support on multimodal improvements along MD 22 that include HOV lanes and cycling facilities¹⁷⁹, while the county works with area employers to encourage ride sharing, vanpooling, and remote work eligibility (Harford NEXT). In the case of HCC, alternative course scheduling arrangements are also proposed as solutions to partially alleviate peak hour congestion on roadways in the JMT MD 22 Study.

¹⁷³ On the Map, US Census Bureau, 2015 LEHD Origin Destination Employment Statistics (LODES) Data

¹⁷⁴ Harford County, Harford NEXT, 2016, 94

¹⁷⁵ Ibid. 94

¹⁷⁶ US Census Bureau, ACS 2012-2017 5 Year Estimates for Census Tracts 3011.02 and 3037, 2017

¹⁷⁷ US Census Bureau ACS 2012-2017 5 Year Estimates for census tracts 3011.02 and 3037, 2017

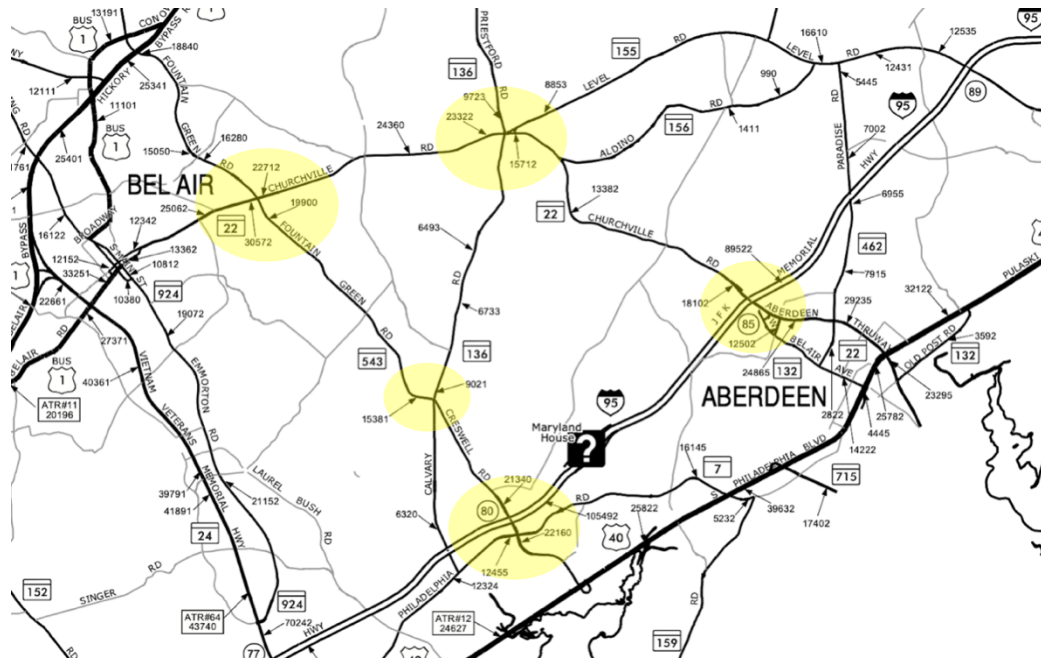
¹⁷⁸ Baltimore Sun, "Harford planning to streamline bus service, reduce ride times, extend weekday hours", January 9 2019

¹⁷⁹ Harford County, Harford County Transportation Priorities 2018, 2018, 1

Congestion and Mobility

Congestion was identified as one of the most pressing issues in transportation planning, emphasized by County staff as an area of prime concern in any scenario (trend, growth or otherwise). A 2015 study of Annual Average Daily Traffic along the state highways in the study area revealed significant volumes along MD 22, MD 543, MD 136 (Figure 5).¹⁸⁰ MDOT's State Highway Administration (SHA) recorded bidirectional volumes ranging from 6,300-6,400 vehicles (MD 136, north and south of MD 543) to well over 22,000 vehicles at the busiest intersections and links. As

Figure 5: Average Annual Daily Traffic Counts (bidirectional) along Creswell's regional roadway network.



Source: MDOT, "Harford County Traffic Volume Map 2017 Annual Average Daily Traffic" (emphasis added).

mentioned above, a majority of households both in the county and in the study area rely on private automobiles for their transportation needs, and while just over half of county residents work in the county,¹⁸¹ an estimated 98% of Creswell residents commute outside of the study area, consistent with its dominant agricultural and residential land uses.¹⁸² 70% of these primary jobs are located within 24 miles, while approximately 40% of these residents are estimated to travel less than 10 miles to their primary job. While many Creswell residents work in Harford County, their employment outside the study area generates additional traffic in the direction of Bel Air, Aberdeen, APG, and Baltimore. In concert with the thousands of other county residents who use the regional access provided by Creswell's arterial

¹⁸⁰ MDOT SHA, *Harford County Traffic Volume Map 2017 Annual Average Daily Traffic*, 2017.

¹⁸¹ Harford County, *Harford NEXT*, 2016, 94

¹⁸² On the Map, US Census Bureau, 2015 LEHD Origin Destination Employment Statistics (LODES) Data

roadways, this places stress on key intersections in the study area during peak hours.

This is reflected on the 2015 county congestion map done by SHA, which identifies the most heavily burdened portions of the county’s network at AM and PM peak hours (Figure 6 and 7). In that study sections of both MD 543 and MD 22 received “Heavy Congestion” ratings from the Department, correspondingly in the direction of I-95 along both roadways and towards Aberdeen Proving Ground on MD 22. Sections of both roads also received “Moderate Congestion” ratings at sections between intersections with MD 136, which itself received the same rating in the direction towards 22 in the morning and I-95 in the evening. This bidirectional traffic flow from within the community confirms that demand for access to Baltimore area job centers and APG contribute to traffic in the direction of I-95, and traffic towards Bel Air (another important job center) along MD 22. However, improvements in peak hour congestion LOS at other key intersections demonstrate that perceptions of congestion may be worse than actual performance in some cases (see Table 2).

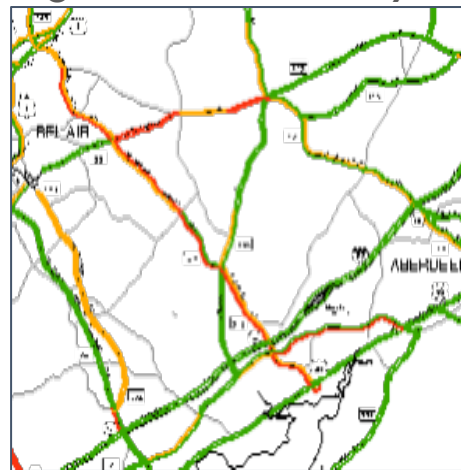
Table 2: Signalized Intersection Capacity Analysis: Peak Hour Level of Service.

Intersection	LOS 2014/5	LOS 2016/7
MD 22 / Thomas Run Road	D	C
MD 22 / MD 136	C	C
MD 22 / MD 543	D	C
MD 22 / Aldino Stepney Road	F	F

Source: Harford County Harford County Annual Growth Report 2017, 2018

Opportunities and Constraints for Congestion and Mobility

Figure 6 and 7 demonstrate the lack of major east-west connections through the heart of the study area as a significant constraint on development alternatives. With the exception of a few collector roads such as E Wheel Road, Carsins Run Road, Nova Scotia Road and Snake Lane, very few connections between MD 24/ MD 924 and MD 22 exist, putting additional burden on the few rural arterials that run through Creswell’s core. In consideration of potential development alternatives, the lack of these east-west connections could create severe levels of congestion in excess of those already experienced in the area. However, development alternatives also present the opportunity to create additional connections, especially those linking with the major arterials. In the case that Creswell were to experience moderate to high growth,



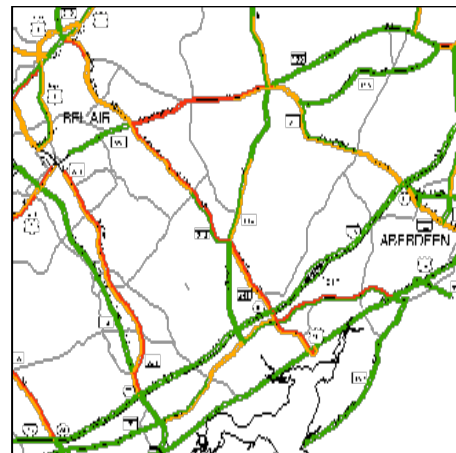
there would be an opportunity to require the construction of new roadways through parcels sold for subdivision, as well as to potentially provide a strong justification for the expansion or improvement of existing collectors and arterials. Such roads would include sections of MD 543 and MD 22 (already identified as part of the 2012 JMT corridor study's recommendations, including temporary use of its shoulder and conversion of the eastbound left lane as an HOV lane in the mornings from Old Post Road to APG Gate¹⁸³) and which has right of way and shoulder capacity that might be converted into additional travel lanes. There was also an opportunity identified in high growth alternatives to create an additional interchange between MD 543 and MD 22. This option was studied in a 2008 Base Realignment and Closure (BRAC) study focusing on APG, which projected a decrease of over 7,000 vehicles on MD 543 in 2030 then compared to a no-build condition (31,900 instead of 39,000).¹⁸⁴

Lower-cost opportunities to improve existing roadway performance, such as signal optimization, are also currently being implemented, and might be expanded in the future.

An additional opportunity and constraint on roadway construction considered is increasing political support for expanding transportation options and to some extent limiting exclusive investment in auto-oriented network improvements. Harford County's Master Plan (2012)¹⁸⁵, Harford NEXT, and priority letters from recent years all speak to a renewed focus on multimodal transportation: investments in bike and pedestrian infrastructure, improving and expanding existing bus service, and reorienting community design towards walkable, transit-connected neighborhoods that reduce auto dependence. However, as noted above 2017 American Community Survey 5-year estimates reflect low transit ridership and cyclists commuting in the study area and the county overall, indicating that new road construction will remain an important consideration in growth alternatives.

Figures 6 (above) and 7 (below): AM and PM peak hour congestion maps. In order of severity, red segments are "heavily congested", orange "moderately congested", and green "slightly congested".

Source: MDOT SHA



Implications

While the study area's location between major employment centers almost ensures sustained pressure on its roadway network regardless of future development, congestion management practices and infrastructure improvements are necessary

¹⁸³ Harford County, Harford County Transportation Priorities, 2018, 2

¹⁸⁴ MDOT SHA, *Traffic and Intersection Improvement Studies for BRAC Aberdeen Proving Ground Summary Report 2008*, 2008, 32-33

¹⁸⁵ Harford County, 2012 Master Plan and Land Use Element Plan, 2012, 18

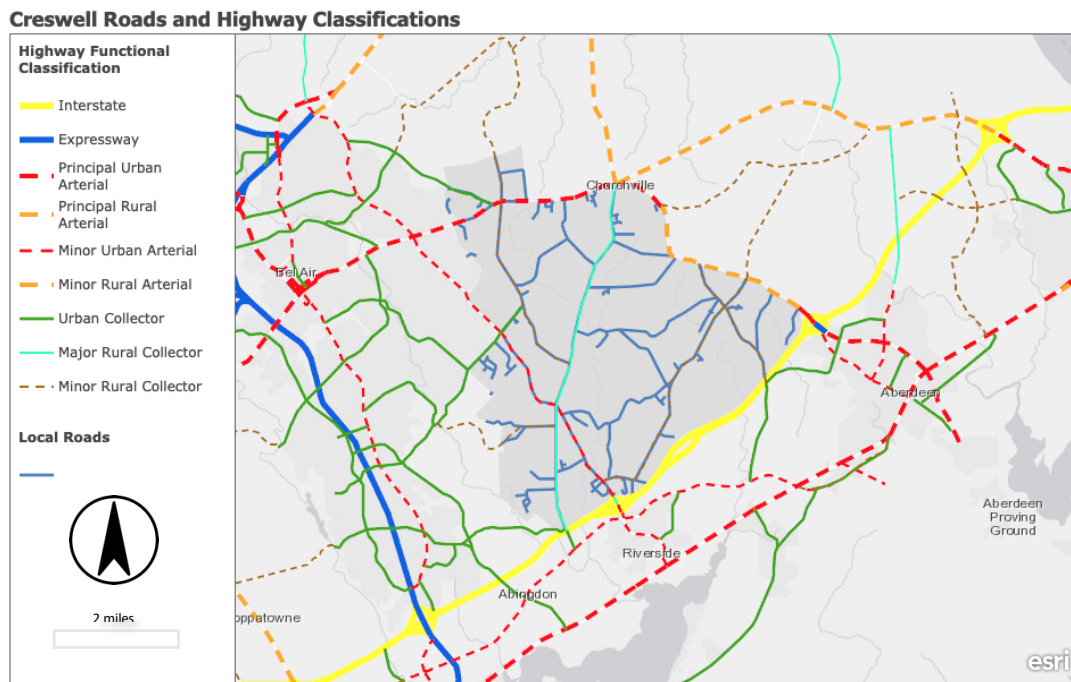
steps to mitigating the negative impacts of congestion on local residents and county's transportation system as a whole. New roadway creation was determined to be a necessary consideration in workshop growth alternatives, even with expansion of existing roadways. An officially adopted Road Thoroughfare Plan which would include a road reclassification map for existing and potential county roads by phase was determined to be an important requirement for development over several decades. This Plan would relate to and be referenced in the Subdivision regulations, as updated. The county's annual requests for funding to the State would account for this in concert with its ongoing efforts to improve existing roadways per past recommendations, such as those from the JMT MD 22 study.¹⁸⁶ However, alternative congestion management methods, including Traffic Demand Management (TDM) and support for multimodal corridors would also continue to receive great emphasis in these considerations. The Harford NEXT Transportation Element would also need to be updated to reflect new classifications and a revised network for the area, as well as to incorporate any additional guidance as determined by the alternative futures report (including the importance of increasing connections between the study area and access control sub-regulations, further discussed below).

¹⁸⁶ Harford County, *Harford County Transportation Priorities 2018*, 2018, 1

Access Control

Creswell’s road network experiences in limited direct access controls to its major arterials and major collectors. Like other jurisdictions in Maryland, Harford County’s highway classification map (see Figure 8) is ordered on the access to mobility spectrum, and ranges from Interstate and Urban Arterials to Minor Rural Collectors¹⁸⁷. The typical posted speed on local roads in Creswell is 25 mph and 40

Figure 8: Highway Classification and Local Roads Map



Data Source: Harford County Planning and Zoning.

mph along arterials, with even the highest functionally classified roads having two lanes along most sections, although MD 22 ranges from 2-4 lanes. Despite the high volume noted above on these roads and their functional classification, there are few existing access controls along any of the study area’s arterials. A 2010 access control survey by SHA found that there was no restriction on the secondary system that runs through Creswell.¹⁸⁸ Several existing residential and commercial properties have direct access to these higher-functioning roads, and the lack of parallel streets further contributes to the intensity of congestion at key links. The issues along MD 22 are currently being addressed by the county in its recent annual funding requests from SHA, which cite \$1.125 million in safety and operations improvements to access control per the 2012 corridor study conducted by JMT.¹⁸⁹

¹⁸⁷ Harford County, *Harford Next*, 90

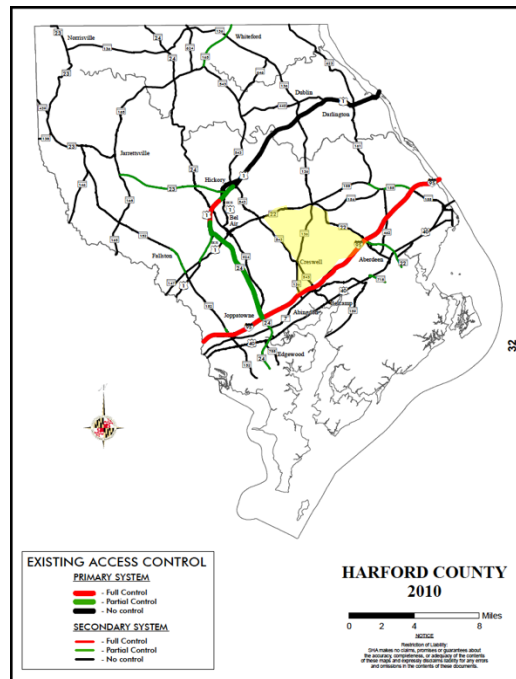
¹⁸⁸ MDOT SHA, *State Highway Access Control Study, Harford County*, 2010

¹⁸⁹ Harford County, *Harford County Transportation Priorities*, 2018, 17

Opportunities and Constraints for Access Control

Although there are many properties along major arterials that have direct driveway access, as noted above the county has existing subdivision regulations on road construction requirements for developments. Figure 9 depicts existing access control for Harford County. § 268-15. Streets, section H. of the County Zoning Code states that “Where a new subdivision involves frontage on an arterial or higher functionally classified road, particularly a controlled-access highway, the street layout should provide vehicular access to such frontage” by 1) a parallel street providing frontage for lots, 2) a series of cul-de-sacs or short loops, or a marginal, or 3) a marginal access street separated from the highway, offering access a suitable points.¹⁹⁰ These subdivision regulations are stricter than the State’s access control sub-regulations, but mandates are limited to arterial and higher functionally classified roads. Research on model access control sub-regulations in other jurisdictions recommends the creation of access management categories and commensurate access standards by functional classification, road characteristics, and land use goals.¹⁹¹

Figure 9: State Highway Access Control, 2010 (study area highlighting added).



Source: MDOT SHA.

These regulations present opportunities to more strongly enforce existing access control subdivision regulations on new subdivision developments adjacent to arterials both by code and as required improvements needed to mitigate new traffic. This would require developers to provide marginal access streets that filter traffic onto higher functionally classified roads, contributing to overall traffic management efforts.

The enforcement of the existing subdivision regulations might also connect with Traffic Impact Analysis required of developments expected to generate over 249 trips per day; this study area is expanded if it is expected to generate over 1,500

¹⁹⁰ Harford County Department of Planning and Zoning, *Harford County Subdivision Regulations*, 2014, 9

¹⁹¹ PennDOT, *Access Management Best Practices*, 2003, 3

trips.¹⁹² According to Harford County's Adequate Public Facilities Ordinance (APFO), if a development is expected to produce LOS D or lower at adjacent intersections outside of the development envelope, the developer is required to mitigate this traffic.¹⁹³ Additionally, if a tested intersection is already below the standard (LOS C), then the developer must provide or fund improvements that will maintain the existing LOS. If subdividers are unable to construct road improvements, they are required to deposit 125% of the necessary funds for the improvements into an escrow account with the County.¹⁹⁴ In 2018 the County reported a total of eight intersections operating at failing LOS (6 at LOS F, 2 at LOS E), and will require new developments impacting those to mitigate their impacts there as outlined above.¹⁹⁵ In recent years, APF relating to roads have not been a restricting factor on development in the county to the extent that schools and others have been.¹⁹⁶ The 2017 Annual Growth Plan reported that all roadway improvements were consistent with the State Consolidated Transportation Plan.¹⁹⁷ However, the total cost of improvements required by APF are not recorded in this report.

Implications

Increasing access control is likely to have a positive impact on the overall performance of the roadway network as travel demand rises. Growth alternatives would likely require not only the strict enforcement of existing subdivision regulations on marginal access road provision for new subdivisions, but also a more granular set of standards for developments adjacent to lower functionally classified roads. As marginal access roads increase with residential development, travelers will queue at suitable points dedicated for entry into the higher functionally classified roadway system. However, excessive requirement of marginal access roads alone may be impractical given that areas for potential growth identified by this study (suggested receiving parcels for a strengthened TDR program). Ensuring the development of these marginal access roads would necessitate greater enforcement of existing subdivision regulations, expansion to include major collectors, and broadening to cover other traffic mitigation methods like additional center turn lanes or provision of alternative transportation infrastructure, such as cycling lanes.

This would likely also result in adjustments to APF TIA requirements for developers generating significant traffic at heavily congested intersections (those with an LOS of D or lower). Harford County utilizes APF in part to support its goal to direct a majority of development into its priority funding area envelope (84.5% in 2017).¹⁹⁸

¹⁹² National Center for Smart Growth, I-li. "Adequate Public Facilities Ordinances in Maryland: An Analysis of their Implementation and Effects on Residential Development in the Baltimore Metropolitan Area". 2006

¹⁹³ Harford County, 17, "2017 Annual Growth Report", 2017

¹⁹⁴ Ibid

¹⁹⁵ Maryland Sustainable Growth Commission, 3, "APFO Workgroup September 2018 Report", 2018

¹⁹⁶ Maryland Sustainable Growth Commission, 12, "Adequate Public Facilities Ordinances in Maryland: Annual Report Review – 2012", 2012.

¹⁹⁷ Harford County, 22, "2017 Annual Growth Report", 2017

¹⁹⁸ Harford County, 22, "2017 Annual Growth Report", 2017

However, a National Center for Smart Growth (NCSG) study indicated that APF in Maryland can redirect growth by as much as 10% from designated areas to rural areas outside of development envelopes, to neighboring counties or even other states.¹⁹⁹ Building industry professionals in Maryland have stated previously that while intended to support smart growth, APFOs do not motivate or generate growth, have resulted in “no-growth” manifestos, and are used rather as growth control tools than as a signaling system for infrastructure gaps.²⁰⁰ Indeed, a report by the Maryland Sustainable Growth Commission in 2013 found that APFO was poorly linked to capital improvement plans in the state as a whole.²⁰¹ If APF will be exercised in the future to require developers’ mitigate traffic impacts at congested intersections in the study area, the importance of ensuring that they are linked to capital improvement plans (CIP) in the County is critical, particularly given that the area is outside of the development envelope.

A parallel example may be found in APF school needs, for which in years past CIP priority has been given to jurisdictions not indicating the highest capacity shortfalls.²⁰² Finally, the APFO’s high bar for LOS standards outside of the development envelope should be reexamined in development alternatives. At present, the LOS C standard is higher than the LOS D standard inside the PFA, which has far-reaching implications for impact fees along lower-volume collector roads adjacent to developable parcels in the study area. The practice of setting high standards such as this one has been questioned for PFAs, which we interpret as a preferred development area that might one day include the Creswell study area. In its 2006 report, NCSG recommended that it might be more reasonable to lower LOS standards for preferred development areas, reducing the need for costly traffic mitigation projects that may ultimately reduce intersection delays by just a few seconds.²⁰³ Further investigation is needed into the costs and benefits of higher LOS standards outside the development envelope, and of alternatives such as targeted application of lower standards for a study area overlay district.

Multimodal Transportation

As mentioned above, a major focus of Harford Next’s Mobility and Connectivity element is a renewed emphasis in planning and investment for multimodal transportation, to include pedestrian and cycling facilities, trails, and public transit.²⁰⁴ Despite its proximity to the development envelope, at present the

¹⁹⁹ Maryland Sustainable Growth Commission, 3, “Adequate Public Facilities Ordinances in Maryland: Annual Report Review – 2012”, 2012.

²⁰⁰ National Center for Smart Growth, I-li. “Adequate Public Facilities Ordinances in Maryland: An Analysis of their Implementation and Effects on Residential Development in the Baltimore Metropolitan Area”. 2006

²⁰¹ Maryland Sustainable Growth Commission, 3, “Adequate Public Facilities Ordinances in Maryland: Annual Report Review – 2012”, 2012.

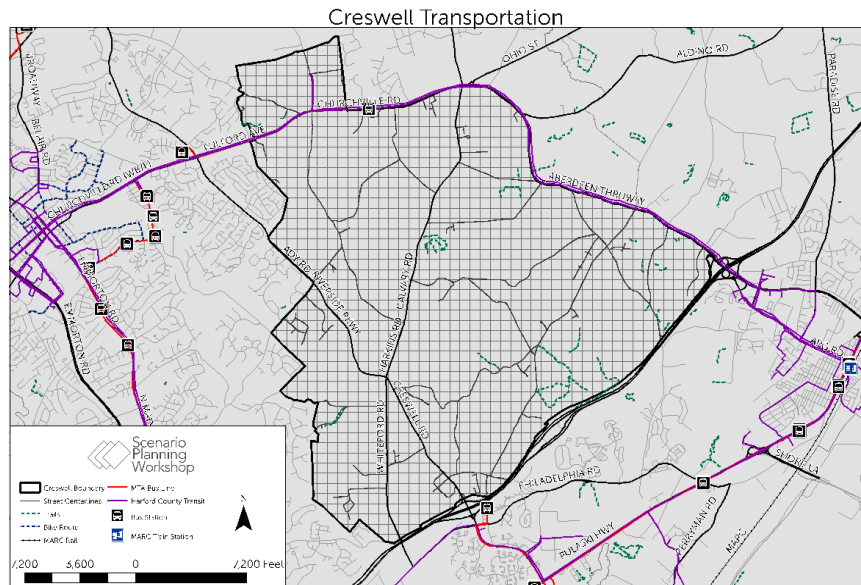
²⁰² National Center for Smart Growth, I-li. “Adequate Public Facilities Ordinances in Maryland: An Analysis of their Implementation and Effects on Residential Development in the Baltimore Metropolitan Area”. 2006

²⁰³ Ibid, x-xi

²⁰⁴ Harford County, Harford Next, 90

Creswell study area has limited multimodal transportation infrastructure and service in place. Creswell is located between major axes of public transit service in Harford County. Route 1 runs along MD 22, while Route 3 runs along MD 24/924, MD 7 (Philadelphia Road), both of which connect Bel Air and Aberdeen. MTA commuter buses also run along these corridors. While the periphery of the study area is served by these transit lines, at present there is no dedicated bus route that runs through the study area. Pedestrian trail access is similarly situated. While there are a few local trails in the vicinity, currently there is no integrated trail network that links with others regionally. As an auto-

Figure 10: Public Transportation, Bike Routes and Trails in Creswell



oriented area outside of the development envelope, Creswell also has limited existing sidewalk infrastructure for pedestrians beyond major intersections and the Churchville rural village. While bicycle lanes are similarly scarce, there is an ongoing effort to implement recommendations for dedicated infrastructure to support bike travel along MD 22, which has requested state funding for restriping and other necessary improvements along the arterial.²⁰⁵

Opportunities and Constraints: Multimodal Transportation

Low transit ridership in both Creswell and the county as a whole limits the short-term efficacy of implementing a new route through the study area. This study identified an opportunity to expand service to and through the community, which does not have an identified multimodal corridor at present.²⁰⁶ Harford NEXT states that physical limitations and fiscal constraints at the state and local level preclude the exclusive expansion of roadways as a sustainable traffic congestion solution,

²⁰⁵ Harford County, *Harford County Transportation Priorities*, 2018, 4

²⁰⁶ Harford County, *Harford NEXT*, 2016, 95

paving the way for greater investments in multimodal mobility.²⁰⁷ There is a secondary opportunity for transit extension to connect existing lines and to expand the service area of the network for all riders, both locally and to regional destinations, like the Aberdeen MARC station or Perryman Employment Center. New trail planning through major green infrastructure corridors might be planned to connect with those in existence, such as that which runs along MD 22.²⁰⁸ Opportunities to extend existing cycling lanes up 543 are present as well, although the high volume of traffic may serve as a limiting factor on its success without significant roadway improvements, such as a median barrier or parallel shared use path. Likewise, there is opportunity as growth alternatives play out to plan pedestrian sidewalks such that they overlap with areas with good connections to residential areas, multimodal transit options, and nonresidential attractions that serve the community.

Implications

To achieve the successful implementation of multimodal transportation options outside the development envelope will require creativity and community and developer buy-in. While ridership would not support a permanent new route at present, route testing might be undertaken using existing vehicles and services, such as the RouteShout app (that could be used to disseminate knowledge of the trial). This would likely also indicate the need for origin-destination studies and community surveys to determine where existing residents find accessibility gaps in the regional transit network. In consideration of the benefit assessment district discussed in the fiscal impact analysis recommendations of this alternatives report, a benefit assessment district might also provide transit subsidies to those communities living adjacent to new bus routes to further incentivize use of public transportation. Further surveys of area cyclists, proposed at the countywide scale in the 2013 Bicycle and Pedestrian plan, would also serve as a basis for new bicycle lane investment. Sidewalk construction and pedestrian connection design will need to be revisited as new forms of subdivision, including the Open Space Subdivision discussed in the Framework Report, are reviewed. Finally, as potential subdivision development parcels are identified, a contiguous trail connecting to a regional network that serves both pedestrians and cyclists may be laid out as part of an overall trails plan.

Conclusion

The Creswell study area has excellent access to two of Harford County's key urban areas, and some of its most significant employment centers in APG and Baltimore. The area serves as a conduit for commuters countywide, and despite high volumes, limited access control and severe peak hour congestion, LOS is at passing levels at many key intersections with some notable exceptions, such as MD 543 and I-95 and

²⁰⁷ Ibid. 92

²⁰⁸ Harford County, 2013 Bicycle and Pedestrian Plan, 2013.

MD 22 and Aldino Stepney Road.²⁰⁹ A lack of multimodal transportation options at present is in the process of remediation both in terms of adopted policy via Harford NEXT, but requires additional investment. However, serious consideration of high-growth alternative futures could precipitate the need not only for more roadway connections, but also a greater expansion of transit service, bike and pedestrian infrastructure. In addition to supporting the county's current efforts to mitigate congestion and encourage alternative transportation options, the findings of this background research underlined the importance of proposing new highway classification map and potential new roadways and segment alignments; suggesting more stringent enforcement of existing access control subdivision regulations, as well as reexamining APFO requirements and standards; and the expansion of existing transit service, bicycle and trail networks. In concert with the principles expressed in Harford NEXT, the implementation of transportation system improvement policy should position the county to deliver better service while increasing mobility for all residents in the study area.

²⁰⁹ Harford County Department of Planning and Zoning, *Harford County Annual Growth Report 2017, 2018*

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Appendix G: Fire and EMS

By Philip Clites

Note: This is one of three appendices that follow a somewhat different format from the rest. This provides background information as well an impact analysis. They were produced in a parallel planning course on Infrastructure prior to the development of the final Framework Plan alternatives and thus use slightly different numerical totals.

Executive Summary

Fire and EMS service is an important aspect of growth. As the number of households increases, as well as the area which those households cover, consideration must be given to whether they will be adequately covered by Fire and EMS service.

There is another consideration unique to the Creswell Study Area. Harford County is currently served by an all-volunteer emergency department, but they are beginning the transition over to an all-professional emergency department, which will require salaries and benefits to be incorporated into annual operating costs.

Harford County completed a Fire and EMS Master Plan in 2009. This study relies on estimates from that report. However, given that the report is over 10 years old, costs have been adjusted for inflation at an annual rate of 1.5 percent.

At the time of the 2009 Fire and EMS Master Plan, Harford County contained a total of 91,849 households which were served by 25 Volunteer Fire Companies and 1,075 full-time equivalent volunteers. The proposal for growth in the Creswell Study Area will significantly increase the number of households in the County by up to 24,500, which is upwards of 25 percent. In 2019, Harford County was served by 28 Volunteer Fire Companies, an increase of three, but not enough to maintain the same station-to-household ratio should the maximum growth scenario be pursued. The five possible growth scenarios by phase are presented below in Figure 1.

Figure 1. Number of new households by scenario by phase

Scenario	2025	2030	2035	2040	Total
WE1	5,250				5,250
WE2	5,250		12,250		17,500
WE3	5,250		12,250	7,000	24,500
EW1		7,000			7,000
EW2		7,000		17,500	24,500

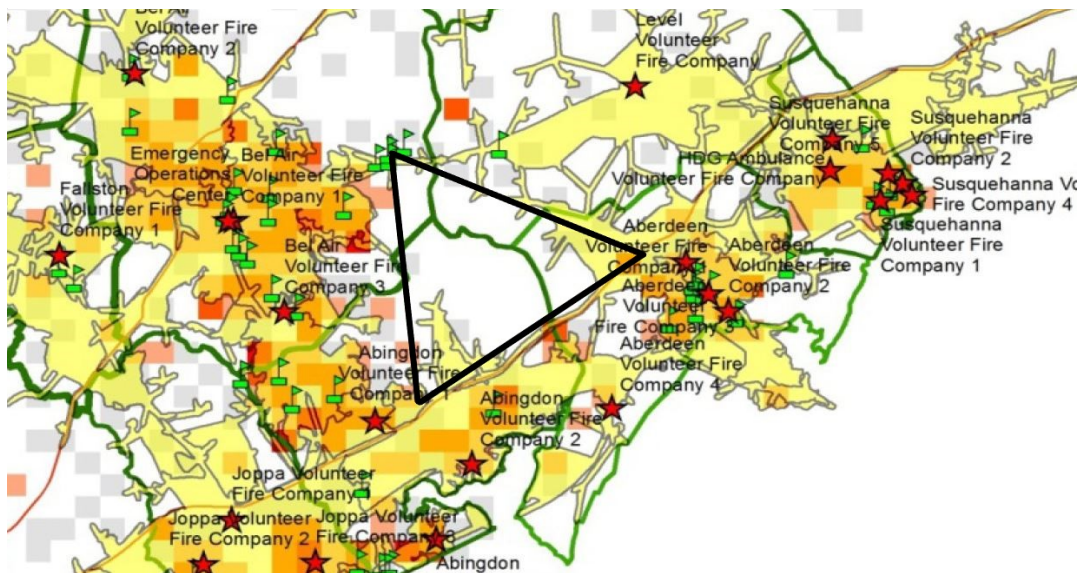
Adding these households while maintaining an adequate level of service will be a challenge both operationally and financially. The area is almost completely outside of the 8-minute response time catchment area. New stations will require more

personnel, which will require salaries under the new career-based system. It will be necessary to consider these challenges when determining the optimal scenario to pursue.

Existing Conditions and Challenges

Emergency services are evaluated by response time, which measures the time starting when units begin their route to an emergency incident and ending when units arrive on the scene. Coverage in Harford County is evaluated based on both an 8-minute response time and a 4-minute response time. The Creswell Study Area, shown roughly as the black triangle in Figure 2 below, is currently served primarily by the Abingdon Volunteer Fire Company District, but also includes areas of the Bel Air, Level, and Aberdeen Fire Company Districts. The map comes from the 2015 Harford County Master Plan Final Summary Report (the “Master Plan”) and shows 8-minute response times in yellow. Fire Company Districts are designated by green lines and the study area is shown roughly as the black triangle.

Figure 2. Harford County Volunteer Fire Company 8-minute response time



As the map clearly shows, most of the study area lies outside of the 8-minute response time catchment area. According to the Master Plan, 90 percent population coverage is an industry-wide standard which Harford County seeks to achieve. At the time the Master Plan was published, Harford County was reporting an 80 percent population coverage county-wide, which is lower than their target. This means that if new dwelling units are constructed in the Creswell Study Area, the population coverage would drop since almost all new dwelling units would be located outside of the 8-minute response time coverage area. Accordingly, if any scenario is implemented, at least one new fire station will need to be constructed to service the Creswell Study Area.

Also, the Insurance Services Organization (ISO) stipulates that “the built-upon area of the city should have a first-due engine company within 1.5 miles and a ladder-service company with 2.5 miles” (Fire EMS Master Plan, page 109). Sections of the Study Area are up to 4 miles away from the nearest station, another reason why at least one more new station would have to be built to serve the Creswell area in the event the development envelope is expanded. In order to adequately serve the number of households, additional stations may be necessary as well.

Methodology, Analysis, and Findings

In terms of operating costs, at a minimum, one new fire station would require one pumper fire truck and one ALS ambulance. The National Fire Protection Association provides limited guidance on staffing, suggesting that “the number of on-duty fire suppression members shall be sufficient to perform the necessary fire-fighting operations given the expected fire-fighting conditions” and “EMS staffing requirements shall be based on the minimum levels needed to provide patient care and member safety.” (National Fire Protection Association, 2016). According to the 2009 Harford County Fire and EMS Master Plan (page 169), each pumper fire truck requires four staff at any given time and each ALS ambulance requires two staff at any given time. The Harford County Fire and EMS Master Plan also notes that to staff one position for 24 hours per day and seven days per week, Harford County would be required to hire 4.8 employees. As such, running a fire company with just a pumper fire truck and an ALS ambulance would require 28.8 full-time employees (six positions, each requiring 4.8 full-time employees to reach 24/7 coverage).

In terms of needs, the Harford County Fire and EMS Master Plan estimated a total full-time staff of 1,075 in 2009 (Fire and EMS Plan, page 169). At the time the plan was written, the number of households in Harford County was 91,849 (Fire and EMS Plan, page 3). This corresponds to approximately 11.7 full-time staff per 1,000 households in Harford County. Figure 3 below shows the level of staffing needed for each scenario in order to maintain the same staffing ratio.

Figure 3. Total level of staffing required by scenario

Scenario	WE1	WE2	WE3	EW1	EW2
New Households	5,250	17,500	24,500	7,000	24,500
Staff per 1,000 households	11.7	11.7	11.7	11.7	11.7
New staff required	61	205	287	82	287

Minimum staffing for a fire station with one pumper and one ALS ambulance is 28.8 full-time employees, as mentioned above. A more robust high-level fire station might consist of one pumper (four staff at all times), one ladder truck (four staff at all times), one rescue squad (four staff at all times), and one ALS ambulance (two staff at all times). At the same level of staffing (4.8 full-time employees for each 24/7

staffed position), this hypothetical fire station would contain 67.2 full-time employees. Since scenarios WE3 and EW2 would increase the number of households over the 2009 total number of households by 25%, as estimated in the 2009 Harford County Fire and EMS plan, it is clear that a significant number of new fire and EMS resources must be added. Figure 4 below gives a hypothetical example of how many low-staffed (28.8 full-time employees per station) and high-staffed (67.2 full-time employees) might be required to maintain a similar level of service.

Figure 4. Estimated new fire stations by scenario

Scenario	WE1	WE2	WE3	EW1	EW2
New Households	5,250	17,500	24,500	7,000	24,500
Staff per 1,000 households	11.7	11.7	11.7	11.7	11.7
New staff required	61	205	287	82	287
New low-staffed stations (28.8 FTEs per station)	2	2	3	1	3
New high-staffed stations (67.2 FTEs per station)	0	2	3	1	3

Cost estimates for each scenario assume these two types of station, low-staffed stations and high-staffed stations. In terms of costs, projections will assume that fire stations will be built as development is built, timed with the same phases of unit construction as described above in Figure 1.

Cost Considerations

There are two important cost considerations for this analysis. First, the cost of constructing a new fire station. Second, the cost of maintaining a career fire company as opposed to a volunteer fire company, which Harford County has operated in the past. Harford County is planning to convert from all-volunteer fire companies to all-career fire companies. The costs reflected in this report consist only of the costs to build a new fire station and operate it with an all-career fire company. The costs in this report do not include the costs that will be required to convert the rest of Harford County to all-career fire companies.

In terms of new construction costs, estimates of the cost of replacement for a fire station can be found in the Harford County State of Facilities Report. For purposes of cost estimates, we can assume that the cost of a new fire station for the Creswell Study Area will be the cost of land plus the cost of construction, which can be estimated from the cost of replacement of a similarly sized fire station. Using this information, we can estimate the cost of new construction and the 10-year life cycle

cost for the two potential fire station sizes listed in Figure 3 (low-staffed and high-staffed). For purposes of these projections, two recently stations near to the Creswell Study area will be used.

For the low-staffed fire station, a similarly sized Abingdon Fire Company 3 was recently constructed in 2010 and has a Total Replacement Cost of about \$2,000,000 and a 10-year life cycle cost of about \$30,000. A similarly sized fire station constructed in 2001, the Susquehanna Volunteer Fire Company 5, has a 10-year life cycle cost of about \$200,000. For purposes of these projections, we can assume similar costs for a new fire company: \$2,000,000 for construction, \$30,000 for the first ten years of maintenance, and \$200,000 for the second ten years of maintenance, updated for an annual inflation rate of 1.5 percent. These can be shown below in Figure 5.

For the high-staffed fire station, a similarly sized Bel Air Fire Company 1 was recently constructed in 2000 and has a Total Replacement Cost of about \$8,000,000 and 10-year lifecycle costs of about \$500,000. We can use this number as estimates for the second ten years of maintenance and then estimate the first ten years of maintenance at 15 percent of this number, the same ratio from the small-staffed fire station. This leaves \$75,000 for the first ten years of maintenance and \$500,000 for the second ten years of maintenance. These can be shown below in Figure 6 as well.

Figure 5. Capital and Maintenance Costs by Fire Station Type

Station Type	Capital Costs	Annual	Annual
Low-staffed station	2,000,000	3,000	20,000
High-staffed station	8,000,000	7,500	50,000

Appendix G-1 shows the costs, with inflation, required for each of the scenarios, based on the suggested number of fire stations listed above in Figure 4.

In terms of the cost of career fire fighters, cost estimates can be found in the Harford County Fire and EMS Master Plan. A new fire station would require the equivalent of at least 4.8 full-time employees to be staffed full-time. Each employee would require salary and benefits. The Harford County Fire and EMS Master Plan lays out the estimated total cost of salary and benefits per employee as \$57,000 per employee. However, these reflect 2010 dollars. The following table shows the estimated salary and benefits per employee every five years assuming 1.5 percent annual inflation rate, along with the operating costs per year for hiring a full-time staff. The staffing levels are based on staffing per 1,000 households as described above in Figure 2. The operating costs in Figure 6 below assume that new stations are completed as each phase is complete. The operating costs assume that each fire station will be 100 percent staff the moment construction is complete.

Figure 6. Annual operating costs by scenario

Year	Scenario	WE1		WE2		WE3		EW1		EW2	
		Cost per employee	FTEs Cost	FTEs Cost	FTEs Cost	FTEs Cost	FTEs Cost	FTEs Cost	FTEs Cost		
2025		71,263	61 4,347,057	61 4,347,057	61 4,347,057	61 4,347,057	0	-	0	-	
2026		72,332	61 4,412,263	61 4,412,263	61 4,412,263	61 4,412,263	0	-	0	-	
2027		73,417	61 4,478,447	61 4,478,447	61 4,478,447	61 4,478,447	0	-	0	-	
2028		74,518	61 4,545,623	61 4,545,623	61 4,545,623	61 4,545,623	0	-	0	-	
2029		75,636	61 4,613,808	61 4,613,808	61 4,613,808	61 4,613,808	0	-	0	-	
2030		76,771	61 4,683,015	205 15,738,001	205 15,738,001	205 15,738,001	82 6,295,200	82 6,295,200	82 6,295,200	82 6,295,200	
2031		77,922	61 4,753,260	205 15,974,071	205 15,974,071	205 15,974,071	82 6,389,628	82 6,389,628	82 6,389,628	82 6,389,628	
2032		79,091	61 4,824,559	205 16,213,682	205 16,213,682	205 16,213,682	82 6,485,473	82 6,485,473	82 6,485,473	82 6,485,473	
2033		80,277	61 4,896,927	205 16,456,887	205 16,456,887	205 16,456,887	82 6,582,755	82 6,582,755	82 6,582,755	82 6,582,755	
2034		81,482	61 4,970,381	205 16,703,740	205 16,703,740	205 16,703,740	82 6,681,496	82 6,681,496	82 6,681,496	82 6,681,496	
2035		82,704	61 5,044,937	205 16,954,296	205 16,954,296	205 16,954,296	82 6,781,719	82 6,781,719	82 6,781,719	82 6,781,719	
2036		83,944	61 5,120,611	205 17,208,611	205 17,208,611	205 17,208,611	82 6,883,444	82 6,883,444	82 6,883,444	82 6,883,444	
2037		85,204	61 5,197,420	205 17,466,740	205 17,466,740	205 17,466,740	82 6,986,696	82 6,986,696	82 6,986,696	82 6,986,696	
2038		86,482	61 5,275,382	205 17,728,741	205 17,728,741	205 17,728,741	82 7,091,496	82 7,091,496	82 7,091,496	82 7,091,496	
2039		87,779	61 5,354,512	205 17,994,672	205 17,994,672	205 17,994,672	82 7,197,869	82 7,197,869	82 7,197,869	82 7,197,869	
2040		89,096	61 5,434,830	205 18,264,592	287 25,570,429	287 25,570,429	82 7,305,837	287 25,570,429	287 25,570,429	287 25,570,429	

Implementation and Conclusion

These scenarios for Harford County provide opportunities to grow the development area, but also come with many side consequences that must be considered. Additional Fire and EMS service is necessary given that most of the Creswell Study Area lies outside of the 8-minute response time catchment area and that the number of households in the County will increase by up to 25 percent in the event of the maximum growth scenario. The projections listed in this report and the Appendices reflect the potential costs related to Fire and EMS for each of the five possible scenarios.

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Appendix G-1 – Facility Costs by Scenario

Capital and Maintenance Costs by Fire Station Type

Station Type	Capital Costs	Annual	Annual
Low-staffed station	2,000,000	3,000	20,000
High-staffed station	8,000,000	7,500	50,000

2 low-staffed stations in 2025

Scenario WE1	Capital - 2015 Dollars	Operating - 2015 Dollars	Total - 2015 Dollars	Total with Inflation
2025	4,000,000	6,000	4,006,000	4,649,127
2026	-	6,000	6,000	7,068
2027	-	6,000	6,000	7,174
2028	-	6,000	6,000	7,281
2029	-	6,000	6,000	7,391
2030	-	6,000	6,000	7,501
2031	-	6,000	6,000	7,614
2032	-	6,000	6,000	7,728
2033	-	6,000	6,000	7,844
2034	-	6,000	6,000	7,962
2035	-	15,000	15,000	20,203
2036	-	15,000	15,000	20,506
2037	-	15,000	15,000	20,813
2038	-	15,000	15,000	21,126
2039	-	15,000	15,000	21,443
2040	-	15,000	15,000	21,764
Total 16 year cost	4,000,000	150,000	4,150,000	4,842,544

2 low-staffed stations in 2025 and 2 high-staffed stations in 2030

Scenario WE2	Capital - 2015 Dollars	Operating - 2015 Dollars	Total - 2015 Dollars	Total with Inflation
2025	4,000,000	6,000	4,006,000	4,649,127
2026	-	6,000	6,000	7,068
2027	-	6,000	6,000	7,174
2028	-	6,000	6,000	7,281
2029	-	6,000	6,000	7,391
2030	16,000,000	21,000	16,021,000	20,029,968
2031	-	21,000	21,000	26,649
2032	-	21,000	21,000	27,048
2033	-	21,000	21,000	27,454
2034	-	21,000	21,000	27,866
2035	-	55,000	55,000	74,077
2036	-	55,000	55,000	75,188
2037	-	55,000	55,000	76,316
2038	-	55,000	55,000	77,461
2039	-	55,000	55,000	78,623
2040	-	140,000	140,000	203,132
Total 16 year cost	20,000,000	550,000	20,550,000	25,401,822

2 low-staffed stations in 2025, 2 high-staffed stations in 2035, and one of each in 2040

Scenario WE3	Capital - 2015 Dollars	Operating - 2015 Dollars	Total - 2015 Dollars	Total with Inflation
2025	4,000,000	6,000	4,006,000	4,649,127
2026	-	6,000	6,000	7,068
2027	-	6,000	6,000	7,174
2028	-	6,000	6,000	7,281
2029	-	6,000	6,000	7,391
2030	16,000,000	21,000	16,021,000	20,029,968
2031	-	21,000	21,000	26,649
2032	-	21,000	21,000	27,048
2033	-	21,000	21,000	27,454
2034	-	21,000	21,000	27,866
2035	-	55,000	55,000	74,077
2036	-	55,000	55,000	75,188
2037	-	55,000	55,000	76,316
2038	-	55,000	55,000	77,461
2039	-	55,000	55,000	78,623
2040	10,000,000	76,000	10,076,000	14,619,725
Total 16 year cost	30,000,000	486,000	30,486,000	39,818,415

1 of each station type in 2030

Scenario EW1	Capital - 2015 Dollars	Operating - 2015 Dollars	Total - 2015 Dollars	Total with Inflation
2025	-	-	-	-
2026	-	-	-	-
2027	-	-	-	-
2028	-	-	-	-
2029	-	-	-	-
2030	10,000,000	10,500	10,010,500	12,515,448
2031	-	10,500	10,500	13,324
2032	-	10,500	10,500	13,524
2033	-	10,500	10,500	13,727
2034	-	10,500	10,500	13,933
2035	-	10,500	10,500	14,142
2036	-	10,500	10,500	14,354
2037	-	10,500	10,500	14,569
2038	-	10,500	10,500	14,788
2039	-	10,500	10,500	15,010
2040	-	70,000	70,000	101,566
Total 16 year cost	10,000,000	175,000	10,175,000	12,744,386

1 of each station type in 2030 and 2 of each station type in 2040

Scenario EW2	Capital - 2015 Dollars	Operating - 2015 Dollars	Total - 2015 Dollars	Total with Inflation
2025	-	-	-	-
2026	-	-	-	-
2027	-	-	-	-
2028	-	-	-	-
2029	-	-	-	-
2030	10,000,000	10,500	10,010,500	12,515,448
2031	-	10,500	10,500	13,324
2032	-	10,500	10,500	13,524
2033	-	10,500	10,500	13,727
2034	-	10,500	10,500	13,933
2035	-	10,500	10,500	14,142
2036	-	10,500	10,500	14,354
2037	-	10,500	10,500	14,569
2038	-	10,500	10,500	14,788
2039	-	10,500	10,500	15,010
2040	20,000,000	91,000	20,091,000	29,150,943
Total 16 year cost	30,000,000	196,000	30,196,000	41,793,763

Appendix G-2 – Total Costs by Scenario

Scenario WE1	Facility Costs	Personnel Costs	Total Costs
2025	4,649,127	4,347,057	8,996,183
2026	7,068	4,412,263	4,419,330
2027	7,174	4,478,447	4,485,620
2028	7,281	4,545,623	4,552,905
2029	7,391	4,613,808	4,621,198
2030	7,501	4,683,015	4,690,516
2031	7,614	4,753,260	4,760,874
2032	7,728	4,824,559	4,832,287
2033	7,844	4,896,927	4,904,771
2034	7,962	4,970,381	4,978,343
2035	20,203	5,044,937	5,065,140
2036	20,506	5,120,611	5,141,117
2037	20,813	5,197,420	5,218,234
2038	21,126	5,275,382	5,296,507
2039	21,443	5,354,512	5,375,955
2040	21,764	5,434,830	5,456,594
Total 16 year cost	4,842,544	77,953,032	82,795,575

Scenario WE2	Facility Costs	Personnel Costs	Total Costs
2025	4,649,127	4,347,057	8,996,183
2026	7,068	4,412,263	4,419,330
2027	7,174	4,478,447	4,485,620
2028	7,281	4,545,623	4,552,905
2029	7,391	4,613,808	4,621,198
2030	20,029,968	15,738,001	35,767,969
2031	26,649	15,974,071	16,000,719
2032	27,048	16,213,682	16,240,730
2033	27,454	16,456,887	16,484,341
2034	27,866	16,703,740	16,731,606
2035	74,077	16,954,296	17,028,373
2036	75,188	17,208,611	17,283,799
2037	76,316	17,466,740	17,543,056
2038	77,461	17,728,741	17,806,202
2039	78,623	17,994,672	18,073,295
2040	203,132	18,264,592	18,467,725
Total 16 year cost	25,401,822	209,101,232	234,503,053

Scenario WE3	Facility Costs	Personnel Costs	Total Costs
2025	4,649,127	4,347,057	8,996,183
2026	7,068	4,412,263	4,419,330
2027	7,174	4,478,447	4,485,620
2028	7,281	4,545,623	4,552,905
2029	7,391	4,613,808	4,621,198
2030	20,029,968	15,738,001	35,767,969
2031	26,649	15,974,071	16,000,719
2032	27,048	16,213,682	16,240,730
2033	27,454	16,456,887	16,484,341
2034	27,866	16,703,740	16,731,606
2035	74,077	16,954,296	17,028,373
2036	75,188	17,208,611	17,283,799
2037	76,316	17,466,740	17,543,056
2038	77,461	17,728,741	17,806,202
2039	78,623	17,994,672	18,073,295
2040	14,619,725	25,570,429	40,190,155
Total 16 year cost	39,818,415	216,407,068	256,225,483

Scenario EW1	Facility Costs	Personnel Costs	Total Costs
2025	-	-	-
2026	-	-	-
2027	-	-	-
2028	-	-	-
2029	-	-	-
2030	12,515,448	6,295,200	18,810,648
2031	13,324	6,389,628	6,402,953
2032	13,524	6,485,473	6,498,997
2033	13,727	6,582,755	6,596,482
2034	13,933	6,681,496	6,695,429
2035	14,142	6,781,719	6,795,861
2036	14,354	6,883,444	6,897,798
2037	14,569	6,986,696	7,001,265
2038	14,788	7,091,496	7,106,284
2039	15,010	7,197,869	7,212,879
2040	101,566	7,305,837	7,407,403
Total 16 year cost	12,744,386	74,681,614	87,426,000

Scenario EW2	Facility Costs	Personnel Costs	Total Costs
2025	-	-	-
2026	-	-	-
2027	-	-	-
2028	-	-	-
2029	-	-	-
2030	12,515,448	6,295,200	18,810,648
2031	13,324	6,389,628	6,402,953
2032	13,524	6,485,473	6,498,997
2033	13,727	6,582,755	6,596,482
2034	13,933	6,681,496	6,695,429
2035	14,142	6,781,719	6,795,861
2036	14,354	6,883,444	6,897,798
2037	14,569	6,986,696	7,001,265
2038	14,788	7,091,496	7,106,284
2039	15,010	7,197,869	7,212,879
2040	29,150,943	25,570,429	54,721,372
Total 16 year cost	41,793,763	92,946,206	134,739,969

Appendix H: Schools

By Sacsheen Scott and Brooks Phelps

Note: This is one of three appendices that follow a somewhat different format from the rest. This provides background information as well an impact analysis. They were produced in a parallel planning course on Infrastructure prior to the development of the final Framework Plan alternatives and thus use slightly different numerical totals.

Executive Summary

While Harford County's largely undeveloped Creswell community is in an excellent location for development as it is situated between several of the county's town centers, constructing new and maintaining existing infrastructure will be necessary if the development is going to take place. With several schools proximate to the Creswell development site already at capacity, it is vital to consider how any planned additional nearby housing will affect the ability of schools to function for existing students. As it is a proposed new development area, current trends cannot be extrapolated to make predictions, and so different scenarios are used in our analysis to provide for a range of outcomes. In considering the proposed three levels of development scenarios, we have made separate recommendations for the construction of elementary, middle, and high school facilities. Under the assumption that the development would take place at a relatively even growth rate, we were also able to prioritize which facilities are needed first, and provide a rough construction timeline. A new elementary school is likely necessary already, but several additional school facilities would be needed in the highest level of build out. There is also an opportunity to relieve some of the overcrowded schools via the new facilities that the Creswell site will need to develop. Because Creswell sits in between the areas of Bel Air, Abingdon, and Aberdeen, it will both be able to have its students matriculate to schools in those communities where space is available and provide more capacity for those communities where schools are overwhelmed. Because the county requires that a school can be no more than 110% of its state-mandated capacity, we have also provided for helping to relieve the utilization rates at these schools. Redistricting will provide an opportunity to ensure that students are within a reasonable distance from their homes, ensuring that travel times are within the county's goal of 45-minutes.

Existing Conditions and Challenges

According to the Harford County Public Schools' *Harford County Educational Facilities Master Plan*, education is an important factor in the economic success of Harford County Public Schools (HCPS). The county has around 37,000 students within 54 schools and has the eighth largest student enrollment of the 24 public school systems in Maryland. Additionally, over 5,000 people are employed by the school system to provide educational services for students residing in the county (Harford County Public Schools 2018). Harford County School facilities are Harford

County’s largest asset, causing them to need to become a top priority for monitoring as well as investment. Despite the abundance of schools within in the county, many of the schools, specifically elementary schools within the unincorporated area of Creswell, are currently or projected to reach the state rated capacity of 110% (Harford County Government Department of Planning and Zoning, 2017). According to the *2017 Annual Growth Report*, twenty-nine of thirty-three elementary school in Harford County currently meet the established adequately standards. As a result, this would impact the Adequate Public Facilities Ordinance, a growth management tool that assess the availability of facilities needed to service vital services and future growth within three years (Harford County Government Department of Planning and Zoning, 2017). Additionally, this over capacity concern may raise the issues of redistricting given the schools current lack of capacity to accommodate students. Based on assessments of the current facility infrastructure for schools, this report will analyze the demand for new infrastructure to serve Creswell based on proposed growth scenarios. In order to analyze this important data, this report will analyze current conditions and challenges for local elementary, middle and high schools as well as present our methodology for determining specific actions steps based on analysis. Moreover, this report will consider placement of new school facilities and capital costs associated with the investment.

As noted in the *Harford County Educational Facilities Master Plan*, schools that function effectively are more likely to be desirable learning environments. Harford County Public Schools aims to provide adequate facilities and resources that support the physical, social, and academic development of students (Harford County Public Schools, 2018). Harford County School facilities are organized by elementary (grades pre-kindergarten through fifth grade), middle (grades sixth through eighth grade), and high school (grades nine through twelfth). Figure 1 depicts the County’s target classroom ratios. There are roughly 20 school facilities located in the Creswell region.

Figure 1. Classroom Ratios

School Type	Ratio
Elementary (Kindergarten-fifth grade)	20-1
Middle School	25-1
High School	25-1
<i>Source: Harford County Educational Facilities Master Plan</i>	

Elementary Schools

According to Harford County Board of Education, an elementary school facility can accommodate 500 to 750 students. Additionally, most elementary schools located in the Creswell area Elementary schools have less number of classes (in some cases there are only one classroom per grade) Some schools have to keep relocatable classrooms for class space needs. According to Harford County’s Department of Planning and Zoning’s *2017 Annual Growth Report* (AGR), the elementary school 2019-2020 utilization is 90% (M.Valentino, personal communication, April 4, 2019). See Figure 2 for school-specific capacity and utilization data. This further exacerbates the need for new infrastructure to help accommodate future

elementary school capacity as many of elementary school are close to the state rated capacity.

Figure 2. Creswell Proximate Elementary School Capacities

	Capacity	2018-2019 Enrollment	Utilization Rates	Available Seats
Nearby Elementary Schools				
Churchville	388	396	102%	-14
Prospect Mill	680	570	84%	110
Homestead/Wakefield	907	1003	111%	-96
Bakerfield	500	427	85%	-61
William Paca/Old Post Road	954	803	84%	151
Church Creek	793	738	93%	55
Abingdon	864	775	90%	89
Ring Factory	548	517	94%	31
Emmorton	549	610	111%	-61
Bel Air	500	507	101%	-7
Total Elementary School	6683	6346	95%	197

Source: Harford County Government Department of Planning and Zoning, (2017). Annual Growth Report.

Middle Schools

The capacity for teaching stations in grades six through twelve is calculated based on the formula of 25 students per teaching location with a 2019-2020 utilization of 85%. According to Harford County Board of Education, a middle school facility can accommodate 900 to 1,200 students (Howard County Department of Planning and Zoning, 2017). See Figure 3 for school-specific capacity and utilization data. According to the Harford County is committed to modernizing school facilities, most recently with a \$100 million Havre de Grace Middle/High School set to open during the 2020 school year. The 250,000 square-foot facility, designed with more classroom space, enhanced security, and modern technology, will serve 1,300 students (Harford County Public Schools, 2018).

Figure 3. Creswell Proximate Middle School Capacities

	Capacity	2018-2019 Enrollment	Utilization Rates	Available Seats
Nearby Middle Schools				
Southampton	1540	1219	79%	321
Bel Air	1318	1373	104%	-55
Patterson Mill	710	738	104%	-28
Aberdeen	1444	1144	79%	300
Total Middle School	5012	4474	89%	538

Source: Harford County Government Department of Planning and Zoning, (2017). Annual Growth Report

High Schools

The capacity for teaching stations in grades six through twelve is calculated based on the formula of 25 students per teaching station with a 2019-2020 utilization of 85%. (Howard County Department of Planning and Zoning, 2017) According to Harford County Board of Education, a middle school facility can accommodate 1,000 to 1,600 students. See Figure 4 for school-specific capacity and utilization data. With a lower utilization rate, combining of middle and high school facilities, and the redevelopment of one of the larger community schools in Havre De Grace (some of its boundary outside the Creswell area), the need for new high schools is not an immediate priority.

Figure 4. Creswell Proximate High School Capacities

	Capacity	2018-2019 Enrollment	Utilization Rates	Available Seats
Nearby High Schools				
Bel Air	1668	1544	93%	124
Aberdeen	1679	1459	87%	220
Patterson Mill	1013	827	82%	186
C. Milton Wright	1678	1421	85%	257
Total High Schools	6038	5251	87%	787

Source: Harford County Government Department of Planning and Zoning, (2017). Annual Growth Report

Projections

According to *Educational Facilities Master Plans*, in the 2018 school year, enrollment increased from 36,871 in 2017 to 36,939. However, Harford's Department of Planning projects that enrollment will remain relatively flat, averaging close to 37,000 (not accounting, of course, for the growth of Creswell. By the year 2027, Maryland Department of Planning projects that the total student enrollment will be 36,100. In order to understand the population of a school's pupils (or students), this information is determined by county dwelling type. As noted in the *Educational Facilities Master Plan*, students from single-family homes decreased since the previous assessment conducted in 2009. The county housing stock is approximately 60% single-family homes. The decrease in student from single-family homes could potentially justify the decreasing school enrollments seen over the past few years. Student from apartment/condominium housing increased since the 2009 study (Harford County Public Schools, 2018). The study concluded that if the trends remain the same, it is likely enrollment will continue to decline or remain relatively consistent.

Transportation

Elementary school students enrolled in a public elementary school in Harford County who reside more than one mile from the school which they attend are eligible for bus transportation (Harford County Public Schools, 2018). Secondary students who reside more than one and one-half miles from the school which they attend are eligible for bus transportation (Harford County Public Schools, 2018). HCPS buses transport approximately 35,000 children on 500 buses every day to and from school, travelling nearly 42,000 miles daily (Harford County Public Schools, 2018). According to Harford County Transportation Supervisor Matthew Bedsaul, the average travel time for students is approximately 25 – 30 minutes. Maximum travel time that they target is 45 minutes, however this is not always possible and some students who reside on the far reaches of an attendance area could be on the bus for nearly an hour (M. Bedsaul, personal communication, April 5, 2019).

Challenges

Per our analysis of the previously mentioned data, the biggest challenge for Harford County schools located in Creswell is utilization rates. For both elementary and secondary schools, the utilization percentages are well over 80%, meaning there will be a need for more student space soon (Harford County Public Schools, 2018). Additionally, according to the Harford County State of Facilities Report, the majority of current facilities are in need of mechanical systems. Seventy percent of the lifecycle need is forecasted to take place over the next ten years. School facilities are Harford County's largest asset, causing them to be also be prioritized for improvement. Based on this assessment, many school facilities could potentially require additional assistance or redistricting depending on county financial resources.

In order to invest in a new school facility, Harford County must consider transportation impacts for students. A new school facility may potentially lead to both extended ride times, even for students that live relatively close to the school. Additionally, there would be a need for additional resources for buses in order to provide the added service to the school. Another challenge in relation to transportation is the optimization of actual student ridership (M. Bedsaul, personal communication, April 5, 2019). M. Bedsaul also claims the county has a targeted ridership of 44 high school students, 50 middle school students on county school buses, and 55 elementary school students on county school buses. Each estimate includes two students to every bus seat in order to increase actual bus utilization. With the construction of new schools, Harford County Public School system would have to think about the best way to increase capacity for ridership utilization. Another consideration regarding transportation for a new school would be the structure of the community immediately surrounding the school. Harford County has a certainly a certain percentage developing envelope in order to preserve much of its natural landscape. This also would affect the number of buses needed if the surrounding community is not be eligible for transportation services (M. Bedsaul, personal communication, April 5, 2019).

Finally, according to the Harford County Department of Planning, under current law, preliminary plans for subdivisions of greater than five lots cannot be approved in school districts where the full-time enrollment currently exceeds, or is projected to exceed, 110 % capacity within three years. Therefore, a new school cannot be in close proximity to an older facility (Harford County Public Schools, 2018). Furthermore, Location of school sites in an undeveloped area cannot be accurately determined until the future land use in that area is established. Depending on the type of development there can substantial impact on educational facility needs. For instance, if a proposed area is planned as residential, the number and type of units planned per acre impacts pupil population, a major determinant of educational facility site needs (Harford County Public Schools, 2018).

Methodology

In order to project the need for future school facilities, we first estimated the growth projected in each of the three proposed scenarios for 2040. While currently the housing typology split in Harford County is 40% Single-Family Detached and 30% Single Family Attached and Multi-family, respectively, we conducted our analysis under the assumption that the development would be only 30% Single-Family Detached housing, with a rise to 35% for each Single-Family Attached and Multi-Family units. The difference in projected typology is assumed to account for Creswell being less rural than the county as a whole and because of the need for fewer Single Family Detached units with the county's aging population, which accordingly implies fewer students.

We then multiplied the split by the total number of dwelling units projected in each scenario to ascertain the total numbers of each housing type. Using the pupil yield factors from the Harford County Department of Planning's *Annual Growth Report* (AGR) from 2017 and rounding down the total projected dwelling units to 5,000, 15,000, and 20,000 for each respective scenario, we were able to extrapolate estimates for the total future facility needs. Because our development does not include specific provisions for mobile homes or condos, we disregarded the pupil yield rates for these types of units. When deciding on an implementation schedule, we presumed about 1,000 units (the high end of absorption; 500 is the low end) would be built per year, and made our phasing recommendations accordingly.

Our next task was to analyze the utilization rates and capacities of existing schools near the proposed Creswell development. Operating under the assumption that some redistricting will take place before 2020, we disregarded current school districts in favor of using their proximity to the new development area. Schools with longer than a 20-minute travel time from Creswell were disregarded, with the county's goal of a maximum 45-minute travel time adjusted to consider pick up and drop off times and future traffic increases. This led us to include 10 elementary schools, 4 middle schools, and 4 high schools in our analysis of current facilities. With some of these schools in the immediate vicinity are already beyond what the county supposedly allows (110% as the upper limit, though some schools in the county were as high as 115%), we provided for reducing these schools enrollment back to 100%. We also considered the projections up to 2022 (as used in the Annual Growth Report) for utilization rates in these schools in an attempt to build off of existing trends, rather using than existing utilization rates. For our recommendations, we also assumed that a new elementary school would have a rough capacity of 750 students, a middle school 1,300, and a high school 1,600, respectively.

Analysis and Findings

Each of the three scenarios suggested for the future of Harford County will require significant investment in infrastructure to maintain the high quality of life and to provide for adequate school facilities. Regardless of the eventual scale of the Creswell development, Harford County's schools are in many cases well over capacity already. Our conclusions for the necessary infrastructure in each scenario are also made under the assumption that some redistricting will occur and that existing schools will take on some of the additional students and that the new schools will help to relieve some of the schools that are over capacity.

Scenario 1

Figure 5. Scenario 1 Projections

Scenario 1 - 5,000 Dwelling Units				
Housing Unit By Type	Projected Students			Number of New Schools
Single-Family Detached	1500	Elementary	975	1
Single-Family Attached	1750	Middle	492	N/A
Multi-Family	1750	High	635	N/A

The first scenario plans for a low build out of 5,000 new dwelling units (see Figure 5). In this scenario, a new elementary school would be needed to keep pace with population growth, especially since several nearby elementary schools are already well over capacity. However, no new middle school would be needed due to the projected availability of 470 spaces in nearby schools, which could accommodate the projected 492 additional students despite the need to go slightly over capacity. An additional high school would also be unnecessary, with the existing high schools able to cover the projected needs easily. Even if a new middle or high school were desirable for decreasing students' commute times, there would not be enough students to warrant one unless as a replacement for another school. And though the new elementary school would eventually reach capacity, its slight over capacity

Scenario 2

Figure 6. Scenario 2 Projections

Scenario 2 - 15,000 Dwelling Units				
Housing Unit By Type	Projected Students			Number of New Schools
Single Family Detached	4500	Elementary	2930	4
Single Family Attached	5250	Middle	1477	1
Multi-Family	5250	High	1905	1

Should the level of build out reach that of Scenario 2, which plans for 15,000 dwelling units, it would demand a significantly larger infrastructure investment (see Figure 6). Four new elementary schools would likely be needed to keep up with the projected 2,930 new students, which would also build in additional capacity. A middle school and a high school would also need to be constructed, as the additional amount of students for each would outpace the current capacity quickly.

Scenario 3

Figure 7. Scenario 3 Projections

Scenario 3 - 20,000 Dwelling Units				
Housing Unit By Type		Projected Students		Number of New Schools
Single Family Detached	6000	Elementary School	3900	5
Single Family Attached	7000	Middle School	1970	1
Multi-Family	7000	High School	2540	1

In the third scenario, the largest build out, assumes that 20,000 dwelling units would be built in Creswell (see Figure 7). While this level of development would require a fifth elementary school, it is likely. However, should the level of development rise above what is described in scenario 3, additional middle and high schools will be necessary, as the new ones will likely be approaching capacity under this situation. Considering existing school facilities as well, most of the new growth could be accommodated in the facilities listed here without going over the county’s capacity limits. Because of the numbers of projected students, preemptively constructing an additional middle school or high school would inefficiently result in multiple schools with around 50% utilization rates.

Implementation

The first and most needed infrastructure is the construction of a new elementary school. It would begin to provide some of the needed capacity for each of the development scenarios, and is likely needed even in a no build scenario given the number of nearby schools that are already over capacity. Constructing one elementary school would also supply enough capacity for the projections outlined in Scenario 1, and we recommend that construction be programmed

In Scenario 2, we propose that a second high school and middle school be prioritized after the first two elementary schools before moving on to construction of additional elementary schools. While the elementary schools will be needed in the short-term, the middle school and high school would not be necessary until about 2026 or 2027 due to current capacity. The additional elementary schools would not be necessary until 2030 or later, and the middle and high school would provide enough capacity for the full build out. We recommend this approach because it would allow for significant readjustment should the high end of the build out not be reached.

With Scenario 3, a fifth elementary school would be needed. As it is the main difference in demand between Scenario 2 and 3, it would not be needed until much later in the development process. These implementation structures build off one

another because they assume a relatively even construction rate of 500-1000 dwelling units each year. If that rate is increased, the timeline for each of these school construction projects would need to be reevaluated, but should the development process slow the facilities could be delayed.

Cost Considerations

According to the Interagency Commission on School Construction Board (2018) the cost per square foot for project bids after July 1, 2019 is \$318 for building only construction and \$378 for construction and site development. Both numbers are adjusted by the county to consider a 5% increase in the Fiscal Year (FY) 2019 construction cost Interagency Commission on School Construction, 2018). Based on estimates by the Harford County Department of Housing, it does not distinguish between the type of school facility in order to determine the cost for construction. Given the high utilization rate of the elementary schools in Harford County (specifically serving Creswell) the three scenarios devised emphasize the priority for new facility construction to accommodate elementary school pupils. Based upon the scenarios proposed, the following cost considerations focus on the capital costs associated with the development of a new school building and site development for new construction, given much of Harford County's natural resources. Using the estimated square foot average developed by the Georgia Department of Education (2012) for elementary school facilities as a baseline guide, the total square footage needed for development was determined by multiplying the square footage needed per pupil and the total pupil estimated for the new school (see Figures 8, 9 and 10). Once the total square footage was determined, the total square footage is multiplied by the identified construction cost per square foot. The total for each scenario reflected is the total cost for construction of a new facility. While the cost considerations factor how much Harford County could potentially pay for a new facility, there is still a large growing need to accommodate current students. In addition to the projected scenarios, the county is encouraged to consider redistricting opportunities as construction costs solely for new facilities are costly.

Figure 8. Scenario 1 Cost Consideration

Capital Cost for New School Facility	
Square footage Per Pupil	110 x 975 = 107,250
Cost per square foot	107,250 x \$378 = \$40,540,500
Total	\$40,540,500

Figure 9. Scenario 2 Cost Consideration

Capital Cost for New School Facility	
Square footage Per Pupil	110 x 2930 = 322,300
Cost per square foot	322,300 x \$378 = \$121,829,400
Total	\$121,829,400

Figure 10. Scenario 3 Cost Consideration

Capital Cost for New School Facility	
Square footage Per Pupil	110 x 3900 = 429,000
Cost per square foot	429,000 x \$378 = \$162,162,000
Total	\$162,162,000

According to the Harford County Public Schools' *Harford County Educational Facilities Master Plan*, District Management policy suggests a maximum class size of 500 to 750 students for reasonable school and class populations. However, given the projected growth of the county's future population, it is suggested the county be flexible in adjusting the class size standards appropriately to accommodate the influx of primary school students. By doing so, the new facility could drastically address the elementary school facility need.

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Appendix I: Parks and Recreation

By Maria Espinoza, Elena Goldsborough and Bridget Kerner

Note: This is one of three appendices that follow a somewhat different format from the rest. This provides background information as well an impact analysis. They were produced in a parallel planning course on Infrastructure prior to the development of the final Framework Plan alternatives and thus use slightly different numerical totals.

Executive Summary

This report analyzes the existing and future parkland needs in the Creswell study area for three development scenarios: Scenario 1: A-West, Scenario 2: B-Center, Scenario 3: C-East. The demand for new infrastructure in Scenario 1: A-West projects an increase of 5,000 dwelling units from 2020-2030. The demand for new infrastructure in Scenario 2: B-Center projects an increase of 15,000 dwelling units from 2035-2050. The demand for new infrastructure in Scenario 3: C-East projects an increase of 20,000 dwelling units for 2040-2060. The analysis of each scenario involved a spatial distribution analysis, parkland acreage projection, and a cost analysis. The results of the analysis for Scenario A-West are that Creswell will need 90.86 acres of new parkland to maintain its standard of 29.50 ac/1000 people for its 20,672 projected residents in 2030. In Scenario B-Center, the Creswell area will need 849.01 acres of new parkland to keep 29.50 acres for its 46,372 projected residents in 2050. In Scenario C-East, the Creswell area will need 1,255.14 acres of new parkland to keep 29.50 acres for its 59,122 projected residents in 2040.

This needs analysis has several limitations. When calculating the projected park needs, a general calculation for population was used. Additional analysis is needed to determine how Harford County's projected population age groups will change the projected recreation needs. As well, this analysis did not specify by park type. Additional analysis is needed to examine the role of local, community, state, and regional parks in the projected acreage needed for each scenario. School facilities with joint use agreements should also be incorporated into future analyses and considerations.

Methodology

With the proposed growth to the Creswell study area, we have undertaken an analysis of the existing parkland supply, projected future demand, the costs associated with meeting this future demand and the placement of new parks. There are three scenarios for the Creswell study area that have increased density and buildout.

Spatial Distribution Analysis Park

Scenario A through C were all spatially evaluated to determine the amount of park space needed for future demands. Initially, the existing park and recreation area was given a ½ mile buffer. The ½ mile radius is the service area within the proposed development area that will be used for the development envelope area. The first map in each scenario case shows the existing parkland in relation to the scenario development to identify future distance LOS gaps.

In order to determine future suitable parkland within the Creswell study Area, a suitability analysis was conducted. Specifically looking into existing water features such as rivers and pond and their connectivity, as well as analyzing the contours, and existing vegetation massing within the study area to protect mature trees and sensitive areas. The second map in each scenario represents the implementation of the recreation and park needs in the Creswell study area. All new park areas were chosen to give future development the ideal amount of parkland and recreation to future residents to meet the County's LOS for both acreage and distance. All new park sites were chosen to protect the environment such as sensitive areas, green infrastructure, and manage natural resources currently existing in the Creswell study Area. Additionally, all existing farmland was protected from future development by implementing parks along edges of some farmland.

Parkland Acreage Projections

Projected Daytime Functional Population was calculated for each scenario using the following equation:

$$(Dwelling\ Units_x \times Average\ Household\ Size_y) + Existing\ Population_{2017}$$

For each scenario, the average projected house size of Hartford County in the first year of the scenario was utilized. Additionally, dwelling unit projections of 5,000 for Scenario A-West, 15,000 for Scenario B-Center, and 20,000 for Scenario C-East were used to for calculating future population.

The existing population for 2017 was calculated by adding the population estimates of the Creswell Census tracts 3011.02 and 3037 from the 2017 American Community Survey.

County Parks Acreage for 2017 is the total acreage of all county-owned parkland that is within the Creswell study Area as well as parkland with a ½ mile surrounding buffer that intersects the study area. School land was totaled and 60% of that total was utilized as existing parkland towards the existing LOS of 29.50 acres per 1,000 residents, as stipulated in the County's *2018 Land- Preservation Parks and Recreation Plan*. Additionally, park properties, owned and managed by the State of Maryland, within the Creswell study area as well as parkland with a ½ mile surrounding buffer that intersects the study area were totaled. However, the State Park property total was not counted towards existing demand or needed acres due

to the existing acreage falling below 60 acres per 1,000 residents, which is consistent with the methodology of Harford County’s *2018 Land- Preservation Parks and Recreation Plan Parkland needs assessment analysis*.

Cost Analysis

A cost analysis was developed for each scenario to determine the cost of improving existing parkland, acquiring new parkland, and developing the new parkland into useable recreation and parks facilities. The Improvement Costs Per Acre were derived from an average per acre cost of parks renovation based on the City of Goldsboro, NC Parks, and Recreation Master Plan Renovation Budget. The Improvement Costs Per Acre was multiplied by the County Park Existing Acres to get the Improvement Total. The Cost Per Acre of New Parkland was based on the recent sale of Perryman Forest to the Harford Land Trust in Harford County in April 2018. The Land Acquisition Total was calculated by multiplying by the Land Acquisition Cost Per Acre by the New Acres Needed. The Development Cost Per Acre is based upon the State of Colorado Small Community Parks and Recreation Standards. The Development Total was calculated by multiplying the New Acres Needed with the Development Cost Per Acre. The Project Total was calculated by adding the Improvement Total, the Land Acquisition Total, and the Development Total.¹

Existing conditions and challenges

Harford County, MD has 13,747.7 acres of parkland with a diverse physical infrastructure to support sports, passive leisure, water activities, and so much more. Figure 1 shows the existing distribution of the county and state parks both within

Figure 1. Existing Parks	
County Owned Parkland (Within Study Area)	
Cedar Lake Park	
Tudor Hall	
Schuck Regional Sports Complex	
County Owned Parkland (Within a 1/2 Mile Buffer of Study Area)	
Prospect Mill Park	
Bynum Run Conservation Area	
Churchville Recreational Complex	
State Owned Parkland (Within Study Area)	
Stoney Demonstration State Forest	
State Owned Parkland (Within a 1/2 Mile Buffer of Study Area)	
Bush Declaration	

the study area and within a ½ mile of the study area. As shown in Figure 2, the Creswell study area utilizes 459.81 acres of the County-owned parkland both inside and outside of the study area, which serves the existing population. Additionally, its population has access to 349.63 acres of state parkland. Finally, the Harford County Parks and Recreation Department has a multi-use agreement with Harford County

Public Schools to allow for community use of existing public school recreation spaces and properties in the off hours (Harford County Parks and Recreation Department, 2018). Currently one undeveloped school property site exists within our study area, which is next to Schuck Regional Sports Complex and Board of Education property in the Northwest tip of the study area.

Figure 2. Existing Parks Land-Use Needs					
Facility or Measure	Existing Acres		LOS Acres		Excess (Deficient) Supply
	Existing Acres 2017	Per 1,000 Functional Residents	Per 1,000 Functional Residents	Existing Demand	
Daytime Functional Population		7,522		7,522	
County Parks	459.81	61.13	29.50	221.90	237.91
School Land*	59.15	7.86		0.00	59.15
Subtotal Park	518.96	68.99	29.50	221.90	297.06
State Park Land**	349.63	46.48	0.00	0.00	349.63
Total	868.59			221.90	297.06
*60% of total school site acreage is applicable to LOS requirement					
**State Park Land is not applicable to LOS as it is below 60 acres per 1,000 residents					

The Parks and Recreation Department recognizes that the acquisition of new parkland in the development envelope is difficult due to the expense and scarcity of available land post-development (Harford County Parks and Recreation Department, 2018). Harford County has focused on a greenbelt strategy to acquire parkland at both a reasonable cost and distance for dense population centers. However, new parkland has not been acquired within the Creswell study area (Harford County Parks and Recreation Department, 2018). Acquiring new parkland before development occurs in this area will be critical. Parkland property should be identified to meet the demands of a higher population to ensure equal access, cost reduction, and effective placement of park resources.

For the current population of the Creswell study utilizing a ½ mile buffer and a 29.50 acres per 1,000 residents as the level of service (LOS) markers, the County is exceeding its LOS. Even though the Creswell study area is outside of the development envelope, we utilized a ½ mile buffer distance for all park types instead of the 5 miles for comparison with the scenarios as these assume Creswell's additional to the envelope. Under these parameters, county-owned acreage is more than double the required LOS at 61.13 acres per 1,000 residents. In total, the area has an excess demand of 297.06 acres plus an additional 349.63 acreage of state-owned parkland.

Scenario Analysis

Figure 3 provides an overview of the parameters for the three scenarios discussed in greater detail next

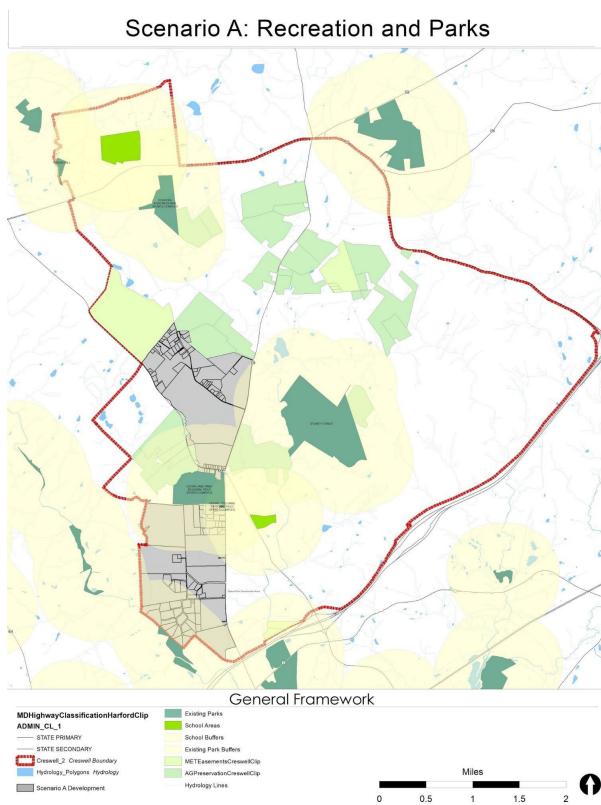
Figure 3. Overview of Scenario Parameters			
	Scenario A - West	Scenario B – Central	Scenario C-East
Projection Years	2020-2030	2035-2050	2040-2060
Total Dwelling Units	5,000	15,000	20,000

Scenario: A-West

Figure 4. Scenario A-West: Parks Land-Use Needs							
Facility or Measure	Existing Acres		LOS Acres		Excess (Deficient) Supply	Acres Needed 2020-2030	New Acres Needed 2020-2030
	Existing Acres 2017	Per 1,000 Functional Residents	Per 1,000 Functional Residents	Existing Demand			
Daytime Functional Population		7,522		7,522		20,672	
County Parks	459.81	61.13	29.50	221.90	237.91	609.82	150.01
School Land*	59.15	7.86		0.00	59.15	0.00	(59.15)
Subtotal Park	518.96	68.99	29.50	221.90	297.06	609.82	90.86
State Park Land**	349.63	46.48	0.00	0.00	349.63	0.00	(349.63)
Total	868.59			221.90	297.06	609.82	90.86

*60% of total school site acreage is applicable to LOS requirement
 **State Park Land is not applicable to LOS as it is below 60 acres per 1,000 residents

Figure 5. Scenario A: Existing Parkland Buffers

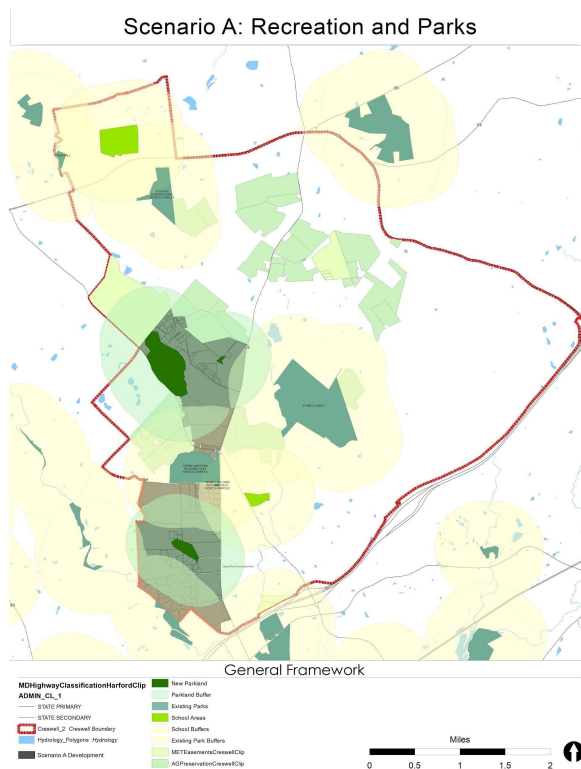


In Scenario A-West, the Creswell area will need 90.86 acres of new parkland to keep a 29.50 for its 20,672 projected residents in 2030. New parkland was calculated with an assumed build out of 5,000 dwelling units (see Figure 4). The 237.91 acres of existing parkland above the LOS for the area significantly lowers the amount of new parkland needed to make Scenario A-West feasible for the Harford County Parks and Recreation Department. The additional acreage needed equates to one regional park being created for the area or two smaller parks spread throughout the buildout area. As shown in figure 5, this also matches the spatial analysis of Scenario A-West as there are two areas, one north of Cedar Lane Park and one south of Cedar Lane Park (see Figure 5), which would not meet the distance LOS of within 1/2 mile buffer of a park. As

shown in Figure 6, Creswell will need approximately \$3,580,980 to improve the 459.1 acres of existing parkland, \$2,654,747 to acquire the approximately 91 acres of land needed and \$5,451,600 to develop those new acres into parkland. The total recreation and parks improvement and development costs needed for the Scenario A-West are \$11,687,327.

Figure 6. Scenario A-West: Improvement and Development Costs									
County Park Existing Acres 2017	Improvement Costs per Acre*	Improvement Total	Acres Needed 2020-2030	New Acres Needed	Land Acquisition Cost Per Acre**	Land Acquisition Total	Development Cost Per Acre***	Development Total	Project Total
459.1	\$7,800	\$3,580,980	609.82	90.86	\$29,218	\$2,654,747	\$60,000	\$5,451,600	\$11,687,327
*Includes updates such as signage, paved areas, bathrooms, park amenities (benches, picnic tables, water fountains) and landscaping.									
**Based on recent sales of undeveloped land in Harford County, MD									

Figure 7. Scenario A: Existing and Added Parkland



As shown in figure 7, in Scenario A - West 3 possible new park areas have been identified. These sites are one medium-sized park South of Cedar Lane Park, a large park Northwest of Cedar Lane Park and a small park site Northeast of Cedar Lane Park.

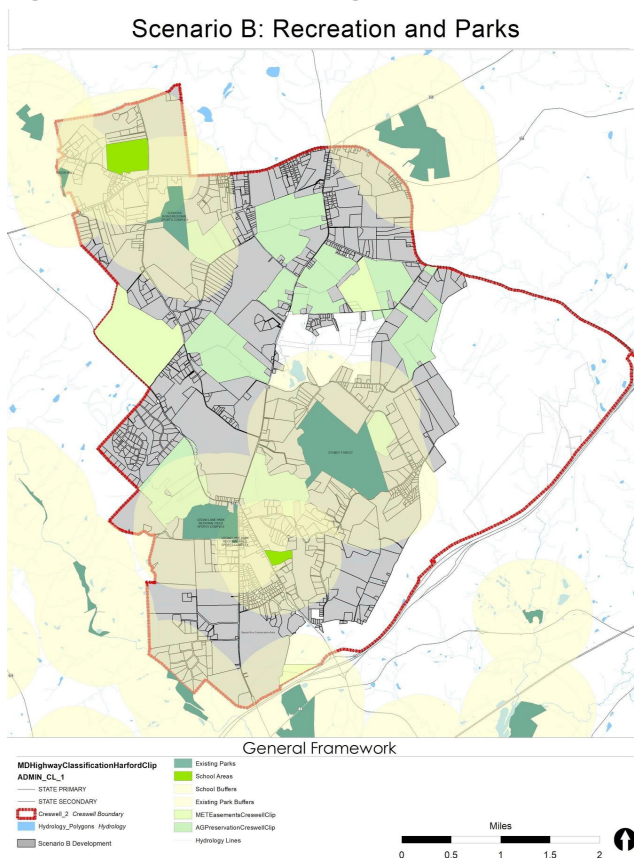
Scenario: B-Center

Figure 8. Scenario B-Center: Parks Land-Use Needs

Facility or Measure	Existing Acres		LOS Acres		Excess (Deficient) Supply	Acres Needed 2035-2050	New Acres Needed 2035-2050
	Existing Acres 2017	Per 1,000 Functional Residents	Per 1,000 Functional Residents	Existing Demand			
Daytime Functional Population		7,522		7,522		46,372	
County Parks	459.81	61.13	29.50	221.90	237.91	1,367.97	908.16
School Land*	59.15	7.86		0.00	59.15	0.00	(59.15)
Subtotal Park	518.96	68.99	29.50	221.90	297.06	1,367.97	849.01
State Park Land**	349.63	46.48	0.00	0.00	349.63	0.00	(349.63)
Total	868.59			221.90	297.06	1,367.97	849.01

*60% of total school site acreage is applicable to LOS requirement
 **State Park Land is not applicable to LOS as it is below 60 acres per 1,000 residents

Figure 9. Scenario B: Existing Parkland Buffers



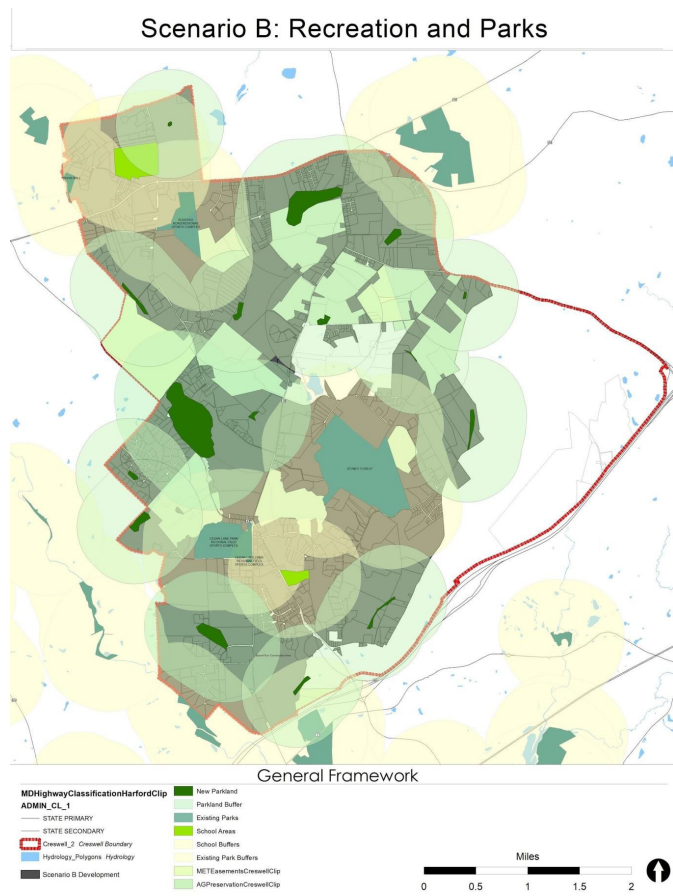
In Scenario B-Center, the Creswell area will need 849.01 acres of new parkland to keep 29.50 acres for its 46,372 projected residents in 2035 (see Figure 8). This scenario assumes a buildout of 15,000 dwelling units, which is three times the amount of Scenario A-West. At the peak of this scenario, several parks will need to be added over time either within or close to the boundaries of the Creswell study area to ensure the adequate LOS remains. As shown in Figure 9, in addition to LOS distance gaps from Scenario A-West, Scenario B-Center will have large gaps in the Northern portion of the development, Northeast & Southeast of the Stoney Demonstration State Forest. Finally, there are small gaps to the West of the Cedar Lane Park and Northeast of the large school

property in the Northwest top of the study area.

As shown in Figure 10, Creswell will need approximately \$3,580,980 to improve the 459.1 acres of existing parkland, \$24,806,082 to acquire the roughly 849 acres of land needed and \$50,940,000 to develop those new acres into parkland. The total recreation and parks improvement and development costs needed for the Scenario B-Center is \$79,327,062.

Figure 10. Scenario B-Center: Improvement and Development Costs									
County Park Existing Acres	Improvement Costs per Acre*	Improvement Total	Acres Needed 2035-2050	New Acres Needed	Land Acquisition Cost Per Acre**	Land Acquisition Total	Development Cost Per Acre***	Development Total	Project Total
459.1	\$7,800	\$3,580,980	1367.97	849.01	\$29,218	\$24,806,082	\$60,000	\$50,940,000	\$79,327,062
*Includes updates such as signage, paved areas, bathrooms, park amenities (benches, picnic tables, water fountains) and landscaping.									
**Based on recent sales of undeveloped land in Harford County, MD									
***Based on the State of Colorado Small Community parks and Recreation Standards. Price includes actively landscaped parkland, irrigation systems, single light, 3 trash cans, 5 benches, restroom and drinking fountain per acre.									

Figure 11. Scenario B: Existing and Added Parkland with Buffers



In addition to the new park sites identified in Scenario A - West, many small parks will be needed to fill LOS gaps. Figure 11 shows the optimal placement locations of new parks for this scenario. For the area West of Cedar Lane Park, two small park sites have been added. South of the Stoney Demonstration Forest, two small park sites have been identified and added as well as two small parks North of the Forest. In the Northern portion of the study area, five small park sites and one medium park site are pinpointed to filled LOS gaps. Finally, one small park Northwest and another Southwest of the large school property in the Northwest tip of the Creswell Study Area were added as potential park sites. These new park sites will address all LOS spatial distance

gaps with the exception of a small sliver of land located Northwest of the quarry.

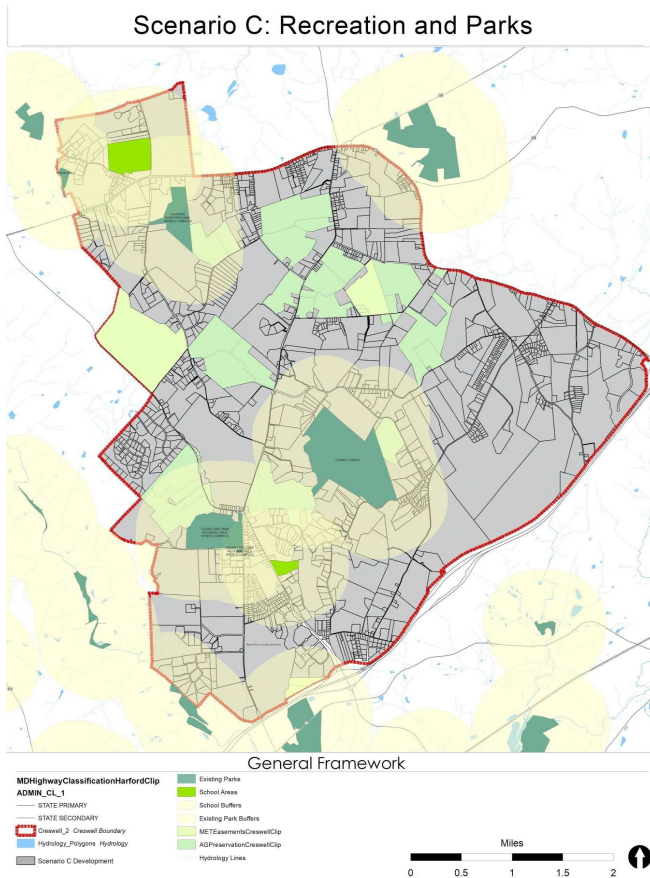
Scenario 3: C-East

Figure 12. Scenario C-East: Parks Land-Use Needs

Facility or Measure	Existing Acres		LOS Acres		Excess (Deficient) Supply	Acres Needed 2040-2060	New Acres Needed 2040-2060
	Existing Acres 2017	Per 1,000 Functional Residents	Per 1,000 Functional Residents	Existing Demand			
Daytime Functional Population		7,522		7,522		59,122	
County Parks	459.81	61.13	29.50	221.90	237.91	1,744.10	1,284.29
School Land*	59.15	7.86		0.00	59.15	0.00	(59.15)
Subtotal Park	518.96	68.99	29.50	221.90	297.06	1,744.10	1,225.14
State Park Land**	349.63	46.48	0.00	0.00	349.63	0.00	(349.63)
Total	868.59			221.90	297.06	1,744.10	1,225.14

*60% of total school site acreage is applicable to LOS requirement
 **State Park Land is not applicable to LOS as it is below 60 acres per 1,000 residents

Figure 13. Scenario C: Existing Parkland with Buffers



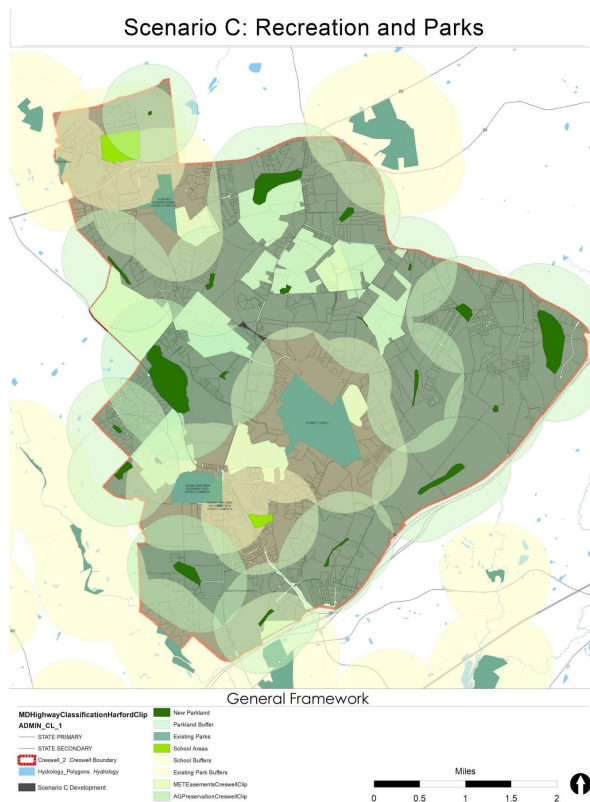
In Scenario C-East, the Creswell area will need 1,255.14 acres of new parkland to keep 29.50 acres for its 59,122 projected residents in 2040. This scenario assumes a build out of 20,000 dwelling units and a total buildout of the study area. Scenario C- East will require the largest addition of new parkland to the Creswell study area as demonstrated by the lack intersecting buffers in figure 13 as well as the projected needed acreage from figure 12. However, the projected total buildout will stress the amount of suitable land available for the creation of parks and open spaces. Aggressive parkland acquisition within or around the Creswell study area will need to become a major funding priority for the Harford County Parks and Recreation Department to maintain the 29.50 acres as their LOS.

Cost Considerations

In Scenario C-East, Creswell will need approximately \$3,580,980 to improve the 459.1 acres of existing parkland, \$36,668,590 to acquire the approximately 1255 acres of land needed and \$75,300,000 to develop those new acres into parkland. The total recreation and parks improvement and development costs needed for the Scenario C-East is \$115,549,570.

Figure 14. Scenario C-East: Improvement and Development Costs									
County Park Existing Acres	Improvement Costs per Acre*	Improvement Total	Acres Needed 2035-2050	New Acres Needed	Land Acquisition Cost Per Acre**	Land Acquisition Total	Development Cost Per Acre***	Development Total	Project Total
459.1	\$7,800	\$3,580,980	1744.1	1,255.14	\$29,218	\$36,668,590	\$60,000	\$75,300,000	\$115,549,570
*Includes updates such as signage, paved areas, bathrooms, park amenities (benches, picnic tables, water fountains) and landscaping.									
**Based on recent sales of undeveloped land in Harford County, MD									
***Based on the State of Colorado Small Community parks and Recreation Standards. Price includes actively landscaped parkland, irrigation systems, single light, 3 trash cans, 5 benches, restroom and drinking fountain per acre.									

Figure 15. Scenario C: Existing and Added Parkland with Buffers



In addition to the new park sites identified in Scenario A – West and Scenario B- Center, six additional parks will be needed to fill LOS gaps in Scenario C - East. In the Northeastern corner of the study area, one large park and two smaller ones have been added. This was determined by following natural futures within the site such as rivers, contours and tree massing, as well as LOS needs. In the Southern portions of the study area, three new parks filled the remaining LOS gaps. The three parks are medium size liner parks that follow current vegetation patterns. Adding these new parks will address all LOS spatial distance gaps in the study areas.

Conclusion

The Creswell study area's three scenario projections build off of one another beginning with Scenario A, which projects 5,000 additional dwelling units between 2020-2030. In Scenario A the Creswell area will need 90.86 acres of new parkland to keep a 29.50 for its 20,672 projected residents in 2030. The total projected cost of new needed parklands in Scenario A is \$11,687,327. Scenario B-Center, which projects 15,000 additional dwelling units between 2035-2050, 849.01 acres of new parkland are needed to keep 29.50 acres for its 46,372 projected residents in 2050. In Scenario B, a total projected cost of \$79,327,062 is necessary for proposed parkland and recreation space. In Scenario C-East, which projects 20,000 dwelling

units between 2040-2060, 1,255.14 acres of new parkland are needed to keep 29.50 acres for its 59,122 projected residents in 2060. Scenario C total projected cost for new projected parkland is \$115,549,570.

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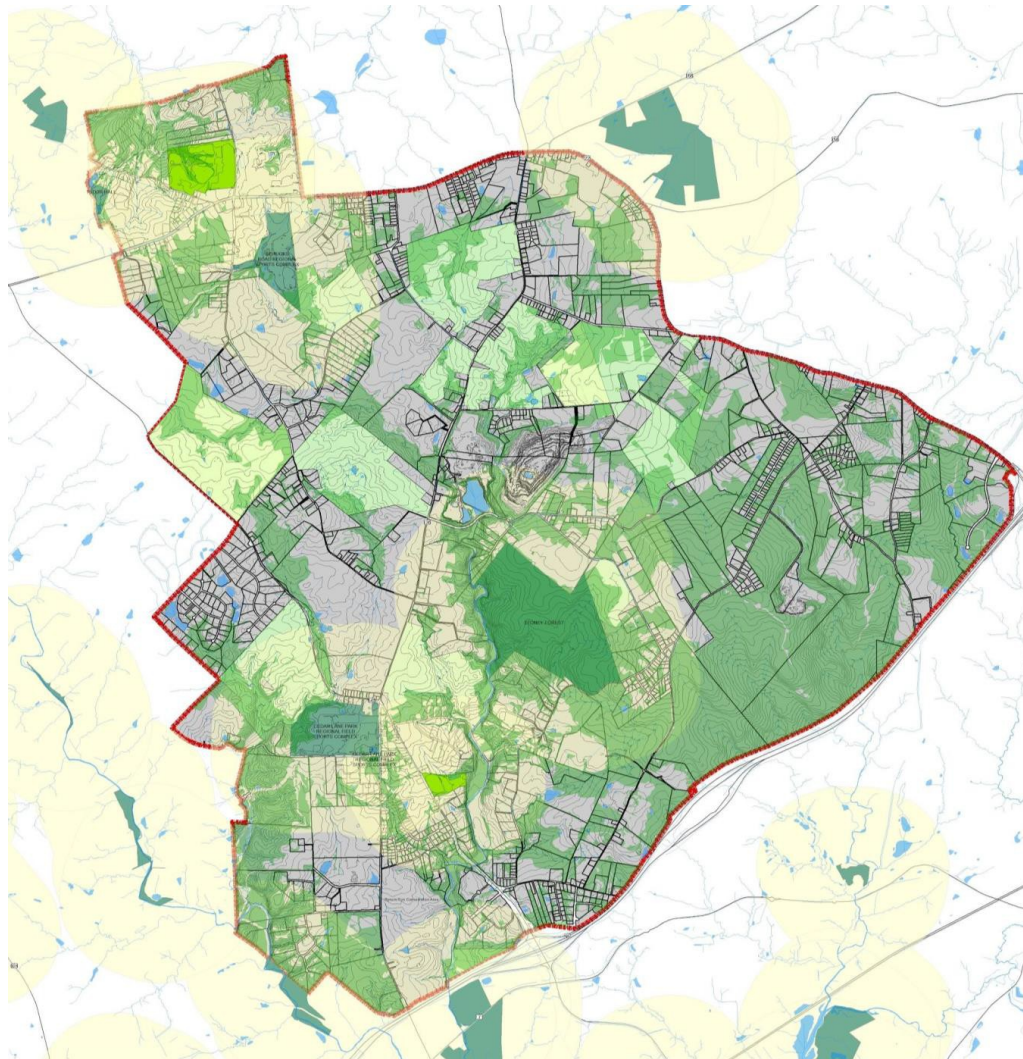
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Appendix I-1:
 Spatial Representation of Environmental Indicators Considered While Choosing

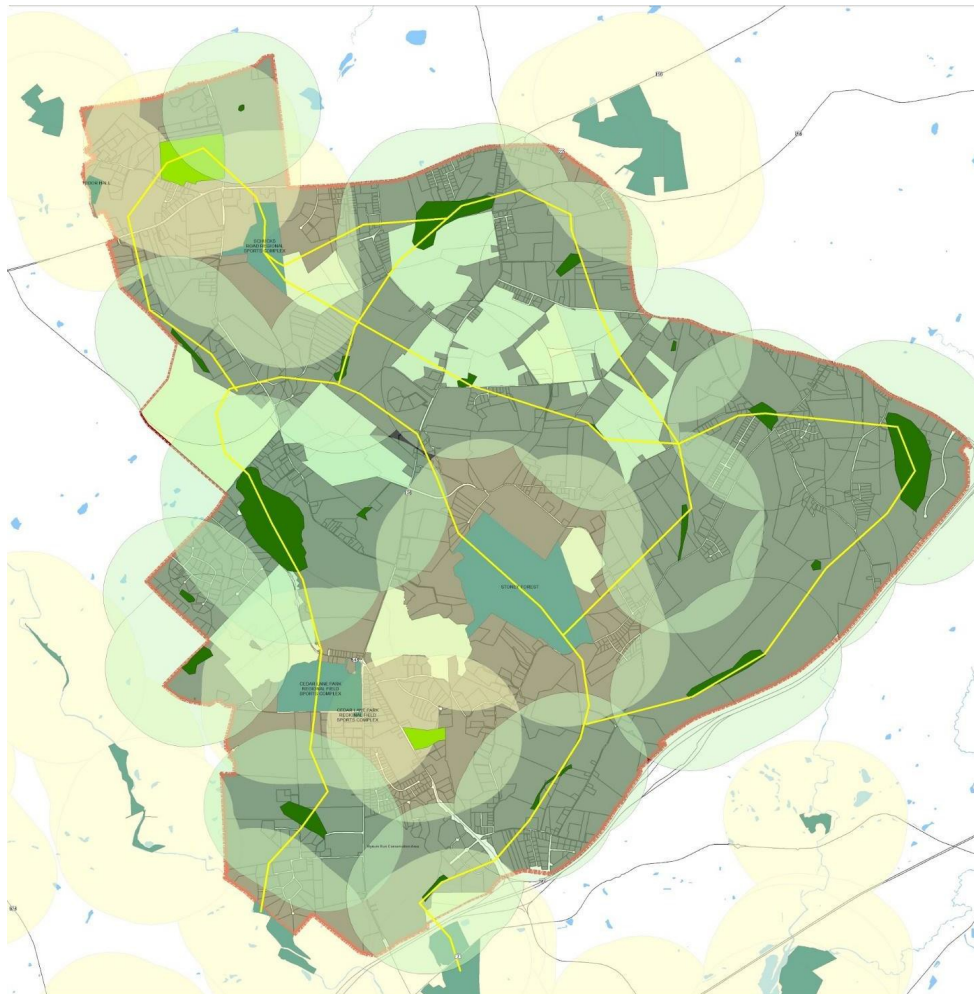


General Framework



Parkland.

Appendix I-2: Proposed Greenbelt Development Linking All Park and Development Area



General Framework

- | | | |
|---|----------------------------|------------|
| MDHighwayClassificationHarfordClip | New Parkland | Green Belt |
| ADMIN_CL_1 | Parkland Buffer | |
| STATE PRIMARY | Existing Parks | |
| STATE SECONDARY | School Areas | |
| Creswell_2 Creswell Boundary | School Buffers | |
| Hydrology_Polygons Hydrology | Existing Park Buffers | |
| Scenario C Development | METEasementsCreswellClip | |
| | AGPreservationCreswellClip | |



Appendix J: Land Use, Zoning and Growth Management

By Jerah Smith

Executive Summary

Harford County designated a growth area, known as the county's Development Envelope. However, land capacity to accommodate future growth is diminishing and will continue to evaporate over the coming decades. With the goal of controlling the impacts of growth outside of the Development Envelope in mind, Harford County's master plan, *HarfordNEXT*, called for a study to be conducted of the area east of the Development Envelope and north of I-95 (henceforth referred to as the "Creswell study area") to determine if the area can help to accommodate the county's current and future residential, business and institutional needs.²¹⁰ This appendix analyzes the existing conditions, opportunities and constraints offered by Harford County's land uses, zoning codes and growth management tools and contextualizes their implications for the future development of up to 15,000 new dwelling units in the Creswell study area. At present, several key barriers exist that prevent this from coming to fruition:

- The Creswell study area's current zoning districts limit land uses and densities, rendering the Creswell study area limited as to how much residential development can occur.
- The county's Transfer of Development Rights (TDR) program is constrained to a narrow definition of receiving and sending areas and is not protecting agricultural land from fragmentation.
- The code's special districts that are designed to cluster development and preserve open space either offer minimal incentives for their implementation or generally require only marginal percentages of developable property be set aside for conservation.
- Expansion of the county's Development Envelope, while not unprecedented, is rare and is an extraordinarily politically charged legislative act but is nonetheless essential to accommodate substantial future growth.
- The tests of the county's Adequate Public Facilities (APF) standards create a stalemate, as they are rigid and effectively render large-scale, mixed-use development projects financially infeasible unless the county makes substantial investments in providing additional growth accommodating infrastructure.

²¹⁰ "HarfordNEXT." *Harford County Department of Planning and Zoning*. (2016): 35.

Bearing in mind these substantial obstacles, this study has identified a variety of opportunities that the county can take advantage of in order to accommodate future growth outside of the Development Envelope as it is currently defined. Operationalizing and maximizing these opportunities will require considerable regulatory reform and the commensurate political will to take full advantage of them. The key findings of this analysis are summarized in Table 1.

Table 1. Executive Summary Matrix

Planning & Regulatory Factors	Opportunities and Constraints	Development Implications
Agriculture-Based Land Use and Zoning	<p>O: AG zone includes innovative aspects like retail uses and a TDR program</p> <p>O: Ample greenfield acreage could yield considerable density if upzoned</p> <p>O: There are a considerable number of large parcels capable of supporting large-scale, dense projects</p> <p>O: TDR program can be revised without disrupting an active, institutionalized market</p> <p>C: Euclidean zoning severely limits uses and densities</p> <p>C: TDR program is limited and little used</p> <p>C: Current OS requires inadequate OS preservation and CDS provides little incentive for use</p> <p>C: Upzoning likely to face considerable opposition</p>	<ul style="list-style-type: none"> County will need to amend zoning code and master plan and other plans to accommodate growth in study area. Concentration of large parcels and existing residential development along western and eastern borders suggests best location for concentrated development.
Growth Management Tools Restrict Development Expansion	<p>O: Development Envelope expansion is rare and usually marginal, but not unprecedented</p> <p>O: APF standards are strong enough to moderate growth where undesired and could be fine-tuned or made more flexible to allow for selective development</p> <p>C: Significant Development Envelope expansion will likely face public opposition and require considerable political will</p> <p>C: Schools, water and sewer likely to pose greatest fiscal infrastructure impediments to growth. Traffic growth likely to face the greatest public opposition.</p>	<ul style="list-style-type: none"> Growth will require the expansion of the Development Envelope in order to accommodate commensurate infrastructure needs. APF standards may need to be (selectively) amended PFA eligibility density must be achieved via a preliminary subdivision or site plan submission for incremental approvals or via meeting zoning threshold for larger scale approval. TDR program needs revamping if both concentrated growth and agricultural conservation are desired.

Agriculture-Based Land Use and Zoning

Harford County has a long and rich agricultural heritage, and values that tradition deeply. While those who drive down I-95 or through Bel Air may not realize it, the majority of the land found in Harford County (nearly 55%) is used for agricultural purposes.²¹¹ Like the county as a whole, the agricultural industry and the tradition of rural living are engrained characteristics of the Creswell study area.²¹² Consequently, protecting those are paramount to the county’s vision for the future and are reflected in the county’s land use regulations and zoning codes.

Existing Conditions

Agricultural Land Use and Zoning

The Agriculture district zone (AG) is intended to promote continued farming activities and conserve agricultural land by permitting agricultural uses at any

²¹¹ “HarfordNEXT.” (2016): 28.

²¹² Learn more about the Creswell study area’s Agriculture and Cultural Landscape in their respective appendices.

time.²¹³ As can be seen in Table 2: Creswell Study Area Zones and Table 3: Creswell Study Area Land Use, 88% (or 11,385 acres) of the study area is zoned for agriculture and 86% (or 11,108 acres) of the land is designated for agricultural purposes as of 2016.²¹⁴ A unique aspect of Harford County’s zoning code is the fact that it allows for up to 20% of AG zoned properties to be used for agricultural retail, allowing farmers to engage in agritourism.²¹⁵ Residential development is also permitted on AG zoned properties, but is generally limited to 1 new dwelling unit (DU) per 10 acres of property.

Table 2. Creswell Study Area Zones

Zones	Acreage	% of Study Area
Agriculture	11,385	88.4%
Rural Residential	886	6.9%
Light Industrial District	181	1.4%
Mixed Office	115	0.9%
Right of Way	89	0.7%
General Business District	55	0.4%
Urban Residential District (R1)	50	0.4%
Community Business District	44	0.3%
Village Residential District	28	0.2%
Village Business District	25	0.2%

Table 3: Creswell Study Area Land Uses

Existing Land Uses	Acreage	% of Study Area
Agriculture	11,108	86.3%
Parks	500	3.9%
University Center of Northeastern Maryland	408	3.2%
Harford Community College	347	2.7%
Mixed Office	218	1.7%
Low Intensity	164	1.3%
Churchville Rural Village	128	1.0%

Of the over 11,000 acres currently designated for agricultural purposes, 1,766 are under agriculture preservation easements. Properties that are under an agricultural

²¹³ "Harford County Code." Chapter 267 Zoning. § 267-53. AG Agricultural District. (2018): 147.

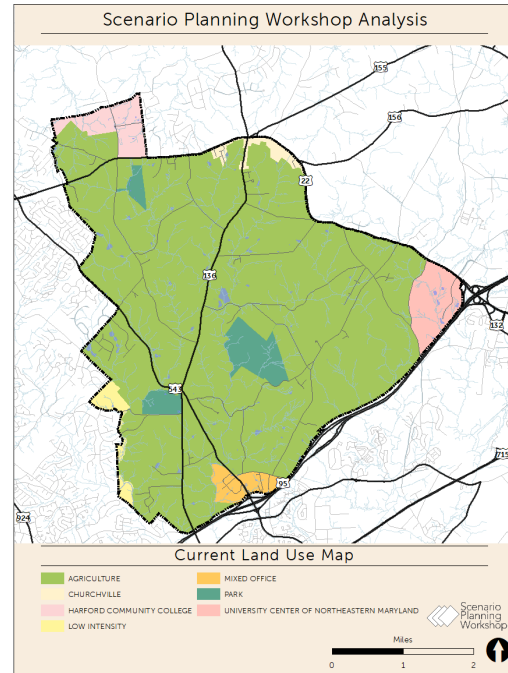
²¹⁴ It is important to distinguish the difference between zoning and land use. Zoning specifically defines what uses are permitted on specific parcels of land and includes design and development guidelines. Current Land Use, however, defines what the activities and uses the land is presently being used for. When future Land Use is found in a master plan, such as *HarfordNEXT*, it is an aspirational designation for what the land should be used for in the future, pending the passage of a zoning map amendment.

²¹⁵ Learn more about the Creswell study area’s agritourism industry in the Agriculture appendix.

preservation easement are protected from development in perpetuity, meaning they cannot be subdivided into 10 acre lots for residential development (or any other kind of non-agricultural development for that matter).²¹⁶

There are three other major land uses in the Creswell study area that are zoned as AG but are used for other purposes. First, the study area features three large parks that total 500 acres, as can be seen in Figure 1: Current Land Use Map, with Schuck’s Regional Park located just south of Harford Community College (HCC), the Bynum Run Conservation Area found in the southwest of the study area, and the Stoney Demonstration State Forest found in the center.²¹⁷ Second, there is the Martin Marietta Churchville Quarry, located in the center of the study area with 282 acres of property owned by Bluegrass Materials Company, LLC. While not all 282 acres of property are currently being mined for gravel, the quarry’s lease was recently extended, and it is estimated to have decades of operational capacity remaining. Last, HCC is located in the northwest wedge of the study area. The 347-acre campus features a wide array of buildings and uses, including instruction space, athletic facilities, food halls, libraries and more.²¹⁸

Figure 1: Current Land Use Map



Residential Land Use and Zoning

Unlike the comparably close alignment of agricultural land use and agricultural zoning, residential land use and zoning acreage differ considerably. The study area features four different zoning districts dedicated exclusively for residential development, as can be seen in Table 4: Creswell Residential Zones:

Table 4: Creswell Residential Zones

Residential Zones	Density (DU / acre)	Acreage	Study Area %
Rural Residential (RR)	1 / 2	886	6.9%
Urban Residential District (R1)	1.8 / 1	50	0.4%
Village Residential District (VR)	3 / 1	28	0.2%
Urban Residential District (R2)	3.5 / 1	0.2	<0.00%
TOTAL		964	7.5%

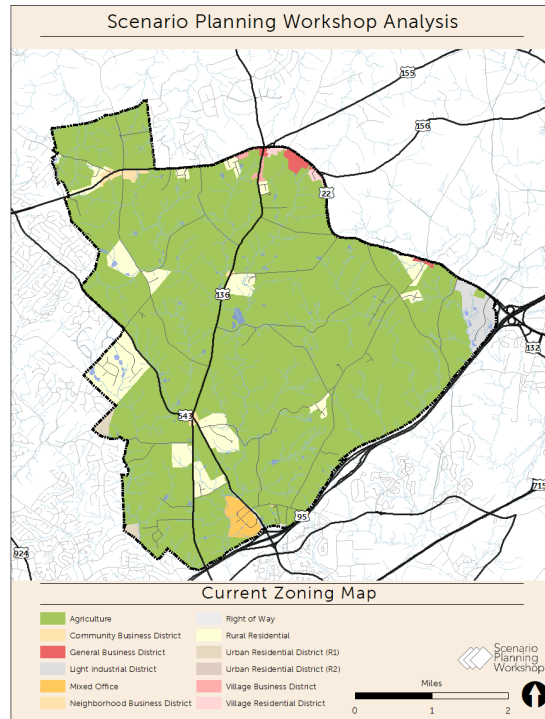
²¹⁶ Learn more about agricultural preservation easements in the Agriculture appendix.

²¹⁷ Learn more about the study area's forestry in the Environment appendix.

²¹⁸ "Harford Community College Facilities Master Plan." *Harford Community College*. (2017): 4-A-2.

Rural Residential (RR) zoning districts can be found throughout the study area, indicated as the light yellow areas found on Figure 2: Current Zoning Map. The remaining three zoning districts are primarily found adjacent to MD 22 along the northern and eastern border of the study area. The RR district's purpose is to allocate opportunities for low-density residential development in areas that do not interfere with agricultural activities.²¹⁹ Development in the RR district is permitted at 1 dwelling unit per 2 acres, offering residents the opportunity to experience the rural way of life in concentrated areas, ideally minimizing the demand for breaking apart agricultural land in piecemeal areas across Creswell.

Figure 2. Current Zoning Map



While 964 acres of the study area are zoned for residential use, only 164 acres have a designated land use of Low Intensity, which is defined as residential densities ranging from 1 to 3.5 dwelling units per acre.²²⁰ This divergence in acreage zoned explicitly for residential use and acreage actually used for it could be indicative of a weak residential market for housing at the AG and RR densities. However, the demand for housing at these densities and housing in Harford County (and Creswell specifically) could change considerably in the coming decades.²²¹

Churchville Rural Village

Churchville is an unincorporated community with a deep-rooted history and has long been considered central to Creswell's heritage. Churchville's residences and businesses are clustered in the northeast corner of the study area primarily at the intersection of MD 22 and MD 136, as can be seen in Figure 2.²²² Churchville's designated land use is a Rural Village, which means it serves the dual purpose of supporting the character and economic needs of the surrounding community, and absorbing most of the residential and commercial growth in agricultural areas. The

²¹⁹ "Harford County Code." § 267-54. RR Rural Residential District. (2018): 153.

²²⁰ "HarfordNEXT." (2016): 34.

²²¹ Learn more about Harford County and the Creswell study area's housing market in the Housing appendix.

²²² Learn more about Churchville and its contribution to the study area in the Cultural Landscape appendix.

Churchville Rural Village’s 122 acres²²³ are comprised of 11 parcels of land and feature four distinct zoning districts in Table 5:

Table 5. Churchville Zoning Districts

Residential Zones	Acreage	% of Churchville Area
General Business District (B3)	47.0	38.6%
Village Residential District (VR)	27.5	22.6%
Village Business District (VB)	25.1	20.1%
Rural Residential (RR)	22.2	18.2%

Churchville features all but 3 acres of the study area’s B3 districts and the entirety of the study area’s VR and VB districts. The VR and VB districts both allow a mix of residential, retail and service uses, but limit those uses and densities so that they conform with the surrounding character of the rural village.^{224,225} The B3 district is intended to provide a wide variety of retail, business and services to meet the needs of the area and the county as a whole.²²⁶ As B3 districts are generally located along arterial roads, the three parcels zoned as such in the study area are found at the intersection of MD 22 and MD 136, and slightly farther south along MD 22, as can be seen in Figure 2.

Office Space Land Uses and Zones

At present, the study area features two areas that are primarily intended to serve some of the county’s office space needs. First, the 408 acres located at the intersection of MD 22 and I-95 and seen in pink in Figure 1 is designated for the University Center of Northeastern Maryland’s Higher Education Center. The research office park features several technology-oriented companies and provides opportunities for students to engage in multi-disciplinary training and technology development.²²⁷ The area is split roughly in half with 227 acres zoned as part of the AG district and 181 acres zoned for Light Industrial (LI) use. LI districts are primarily intended to permit a mix of light manufacturing, warehousing and services, in addition to supporting retail uses.²²⁸

The second area intended to accommodate office needs can be found at the intersection of MD 543 and I-95 in orange on Figure 1 and Figure 2. Three hundred and thirty-three acres have a designated land use of Mixed Office (MO) though only 218 are currently zoned as MO. MO zones are primarily intended to create

²²³ Six acres of the Churchville Rural Village are located north of MD 22 and thus, are not part of the study area.

²²⁴ “Harford County Code.” § 267-57. VR Village Residential District. (2018): 171.

²²⁵ “Harford County Code.” § 267-58. VB Village Business District. (2018): 175.

²²⁶ “Harford County Code.” § 267-59. B1, B2 and B3 Business Districts. (2018): 179.

²²⁷ Vought, A. “Changes Planned at Aberdeen’s University Center.” *The Baltimore Sun*. May 14, 2018.

²²⁸ “Harford County Code.” § 267-57. CI, LI and GI Industrial Districts. (2018): 187.

significant job and investment opportunities by providing office space and supporting uses capable of attracting major corporate offices, research and development facilities and high-tech services.²²⁹ Aside from professional services and corporate office uses, allowable uses include supporting retail (up to 40% of the overall project)²³⁰ and residential space (up to 45% of the overall project floor area)²³¹.

Opportunities and Constraints for Land Use and Zoning

Perhaps one of the greatest barriers for the Creswell study area is the fairly Euclidean zoning districts, meaning they are simple and have limited flexibility when it comes to permitted uses and densities.²³² For instance, both the AG and RR districts essentially only allow for single family detached housing at the low densities, severely limiting housing choice and attainability. Considering over 95% of the study area is zoned as AG or RR, the type of residential development allowed in the study area is severely constrained. However, the AG zone does feature some more innovative aspects, including a transfer of development rights (TDR) program and the allowance of retail to promote agritourism.

TDRs can be effective at preserving farmland if the program is designed correctly.²³³ However, the TDR program in its current form is limited and little used. At present, properties zoned in the AG district are granted 1 development right per 10 acres of property. The only properties that can receive these development rights are those designated as Rural Residential or Village Residential in the most recently adopted Land Use Map,²³⁴ or other AG zoned properties that are within a half-mile of the property sending its development rights.²³⁵ These strict rules and limited receivership areas actually offer two advantages. First, the fact that a TDR program exists means that it is not an unfamiliar tool for those who own AG zoned properties. Educating property owners and developers about the mechanics and advantages of TDRs can be very helpful when it comes to implementing a successful program.²³⁶ While this is not crucial, the fact that the program already exists is a good start. Second, the fact that TDRs are virtually unused means that programmatic revisions will not disrupt an engrained, institutionalized TDR market. Moreover, the county itself currently has a limited management role, experience or infrastructure in facilitating this tool. Thus, there is a clear opportunity to revise the TDR program to better suit the preservation and growth needs of the Creswell study area.

²²⁹ "Harford County Code." § 267-61. MO Mixed Office District. (2018): 195.

²³⁰ "Harford County Code." § 267-61(D)(d)[1]. MO Mixed Office District. (2018): 198.

²³¹ "Harford County Code." § 267-61(E). MO Mixed Office District. (2018): 198.

²³² Elliott, D. *A Better Way to Zone* (Washington, DC: Island Press, 2008).

²³³ Pruetz, R. & Standridge, N. "What Makes Transfer of Development Rights Work?" *Journal of American Planning Association* 75, no. 1 (2008): 78-87.

²³⁴ "Harford County Code." § 267-53(D)(4)(e). AG Agricultural District. (2018): 148.

²³⁵ "Harford County Code." § 267-53(D)(5). AG Agricultural District. (2018): 149.

²³⁶ Pruetz, R. & Standridge, N. "What Makes Transfer of Development Rights Work?" (2008).

One advantage to the current restrictive nature of these Euclidean zones is that the county possesses a considerable degree of power in revising development standards if it desires to revise zoning in parts of the study area. The county has the ability to tailor revised development standards so that increased densities and diversified uses minimize their impact on the environment, agricultural industry and rural character. However, the time that the county has to capitalize on this leverage is will run out sooner than later. Currently, there is limited demand for residential development at AG and RR densities evidenced by the fact that there are several residential subdivision projects that are approved in the study area, but remain undeveloped.²³⁷ At 1 dwelling unit per 10 acres, Harford County has a higher density in AG districts than any other county in the region which makes it particularly vulnerable to farmland subdivision as the regional supply of developable land diminishes,²³⁸ and demand for this type of large lot residential housing increases. Several other unknowns could also change the demand for residential development in the study area, including job growth at the Aberdeen Proving Grounds (APG) through future Base Realignment and Closure (BRAC) decisions, or the expansion of the regional commuter-shed made easier with innovations in autonomous vehicle technology.²³⁹

The county's zoning code offers several special districts with design standards intended to minimize the consumption and privatization of open space and farmland on properties zoned at lower densities. First, the county offers developers the opportunity to apply Conservation Development Standards (CDS) to proposals for single-family detached subdivisions in AG districts. The county's CDS requires a minimum of 75% of the subdivided parcel to be preserved,²⁴⁰ which is an admirably high threshold. However, CDS may only be applied on parcels larger than 35 acres, excludes all housing types other than single-family detached and offers no density bonuses or incentives that encourage developers to employ this conservation-driven development approach. Consequently, CDS is rarely used in the county. In addition, the county offers Conventional with Open Space (COS) design standards, which requires developers to preserve between 10% and 20% of a parcel's open space (depending on the density of the designated zone), but it is limited to the county's Urban Residential Districts of R1-R4.²⁴¹ Considering only 50 acres of the Creswell study area are zoned R1 and just one parcel of 0.2 acres is zoned R2, COS cannot be applied in the vast majority of the study area. This is particularly unfortunate considering developers in Harford County have often chosen to employ COS design standards over conventional design standards despite the lack of density bonuses or other mechanisms to incentivize its implementation. There is clearly a market for

²³⁷ Learn more about the county and study area's housing market in the Housing appendix.

²³⁸ Avin, U. "The Crunch for Housing in Central Maryland Draft Report." *National Center for Smart Growth*. (2019)

²³⁹ "Prospects for Regional Sustainability Tomorrow (PRESTO)." *National Center for Smart Growth*. (2018): 24.

²⁴⁰ "Harford County Code." § 267-72(A)(3). Conservation Development Standards. (2018): 284.

²⁴¹ "Harford County Code." § 267-70(C)(3)(a). Conventional with Open Space. (2018): 282.

residential development projects that emphasize open space, but at present, it has limited ability to help preserve open space in the Creswell study area.

From the perspective of developers, one of the greatest opportunities the Creswell study area offers is its sheer size. The Creswell study area has thousands of acres of greenfield development potential, which is usually cheaper and simpler to build on than brownfield or infill development. However, current zoning allowances (in conjunction with other regulatory and environmental constraints) indicate that Creswell can only yield 756 single-family detached homes and cannot accommodate any other type of housing.²⁴² Not only are there thousands of acres of developable property, but many of them are of considerable size, as can be seen in Figure 4 and Table 5. The study area's large parcels (and consolidatable medium-sized parcels) could offer sites for concentrated, nodal development with higher densities, a wider variety of housing types, and even supportive retail space that can help to minimize the dispersal of residential and commercial growth across the study area. Furthermore, large-scale parcels offer opportunities for integrated planning, facility exactions and continuity of green infrastructure.

Large parcels are also attractive to developers, as they generally offer more design flexibility and minimize the capital-intensive process of land acquisition and consolidation, which can sometimes prevent a project from getting off the ground even if pent-up demand exists.²⁴³

Implications for Land Use and Zoning

The implications for the future of the Creswell study area based on these existing conditions, opportunities and constraints are clear. If the county desires for the Creswell study area to absorb some of the county's future growth needs, it will

Figure 4: Parcel Sizes

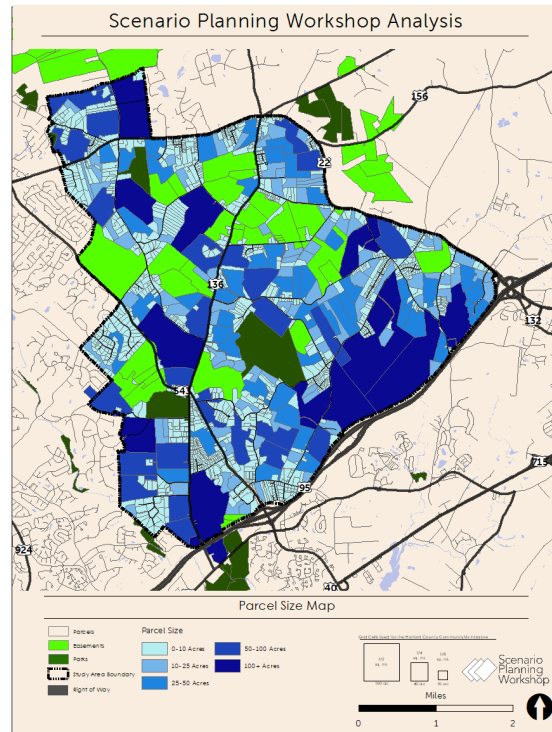


Table 5: Parcel Sizes

Size (Acres)	Number of Parcels
<10	1538
10 – 50	152
50 - 100	36
100 - 150	9
150 - 400	9

²⁴² This is an estimate derived during the process of this analysis using the growth allocation function of CommunityViz.

²⁴³ Curtis, C., Renne, J.L., Bertolini, L. *Transit Oriented Development: Making it Happen*. (Farnham, England & Burlington, VT: Ashgate Publishing Company, 2009)

necessitate upzoning at least some parcels of the study area. This will require amending the zoning code, master plan and other plans to accommodate this change in policy. In addition, the concentration of large parcels and existing residential development along the western and southeastern borders of the study area (which border the county's development envelope) suggests that these areas may be the best locations for concentrated development.

The county should be cautious, however, as zoning codes have the tendency to increase in complexity, which also tends to increase the amount of time and money it takes to administer the programs, making it imperative that labor-intensive tools be limited to the most important projects.²⁴⁴ Furthermore, increasing density would likely face considerable public opposition. This should come as no surprise considering market factors, public opposition and political intervention have increasingly pressured zoning related decisions. Public opposition to new development has steadily increased over time, especially if there is a perception that a new development could worsen traffic conditions or diminish property values.²⁴⁵

Growth Management Tools Restrict Development Expansion

Growth management generally refers to regulatory measures undertaken by a government entity to guide the location, density, use and timing of future development. Generally speaking, growth management is meant to control growth, rather than prevent or limit it. The term "Smart Growth" has become ubiquitous with the planning field, especially in Maryland. Of Smart Growth's many goals, the principles that perhaps pertain most directly to Harford County and the Creswell study area include limiting outward expansion of development, encouraging higher densities in established urban areas, and preserving open space.²⁴⁶

Harford County has done an admirable job at achieving these goals, though they will become increasingly challenging to maintain as the county's population continues to grow. Based on Harford County's projections, the county will need approximately 20,000 additional dwelling units by 2040 in order to accommodate population growth.²⁴⁷ This is troubling, as the county has estimated that the Development Envelope, where the county seeks to concentrate most of its growth, has a land capacity of only 15,375 dwelling units remaining.²⁴⁸ Consequently, it is essential that the county urgently address how to manage growth outside of the Development Envelope as capacity diminishes within it over the next 20 years if it seeks to minimize the loss of farmland and open space to residential development.

²⁴⁴ Elliott, D. *A Better Way to Zone*. (2008)

²⁴⁵ Ibid.

²⁴⁶ Downs, A. "Growth Management, Smart Growth, and Affordable Housing." *The Brookings Institute*. May 29, 2003.

²⁴⁷ "HarfordNEXT." (2016): 37.

²⁴⁸ "2017 Annual Growth Report." *Harford County Department of Planning and Zoning*. (2018): 6.

Existing Conditions

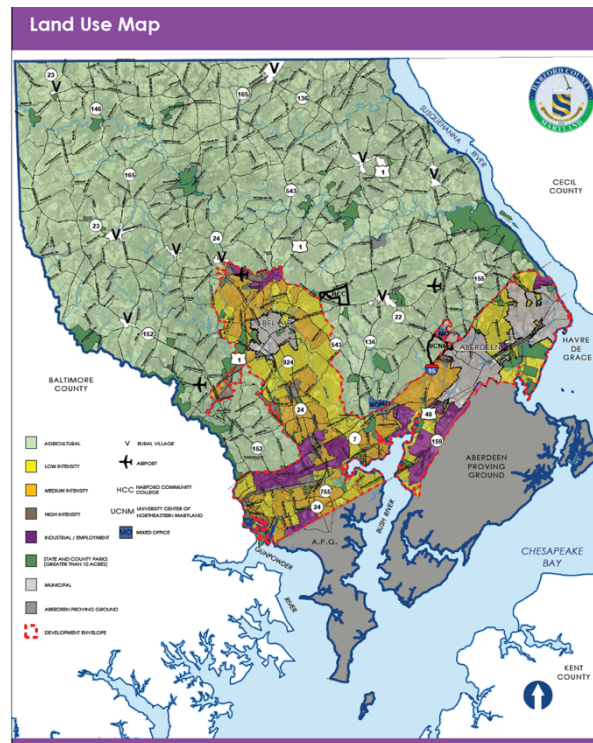
Development Envelope, PFAs and Sewer Tiering

One of Harford County's guiding lights for growth management is its urban growth boundary (UGB), more colloquially referred to as its Development Envelope (DE). Generally speaking, the DE helps to concentrate growth by defining where the highest intensity zoning districts should be established and where density-enabling infrastructure (e.g., public water and sewer) should be constructed. The DE was established in 1977 with the express intention of concentrating growth along the MD 924/24 and US 40/I-95 corridors. Harford County's distinct upside-down "T" Development Envelope is outlined by the dashed red line on Figure 5:

Development Envelope is outlined by the dashed red line on Figure 5: Harford County Land Use. The DE's boundaries can be as observable from the ground as is it from this aerial perspective. It is truly remarkable that an observer can stand on the border of the DE and sometimes find multi-family apartment buildings on the side of the road inside the DE and lush, rural greener on the opposite, outside of the DE. Between 1970 and 2012, 86% of residential development has been concentrated within the DE, and that figure has improved to 91% between 2012 and 2016.²⁴⁹

Two growth management tools that generally align with the DE are the county's Priority Funding Areas (PFAs) and water and sewer tiering. Local jurisdictions define the boundaries of their PFAs, though the areas generally must be scheduled to receive public water and sewer, and are zoned to have an average density of at least 3.5 dwelling units per acre.²⁵⁰ Since the passage of the Sustainable Growth and Agricultural Preservation Act of 2012, the scheduling of public water and sewer has been governed by a tiering system. As can be seen on Figure 6: Harford County Sewer Tiering, the vast majority of the Creswell study area does not have public water and sewer, nor is it planned to have it constructed until a later date. For the areas designated as Tier 3 in orange, subdivisions of 4 or more lots are permitted but must be run on septic systems. Almost the entirety of the Creswell study area is

Figure 5. Harford County Land Use



Source: HarfordNEXT

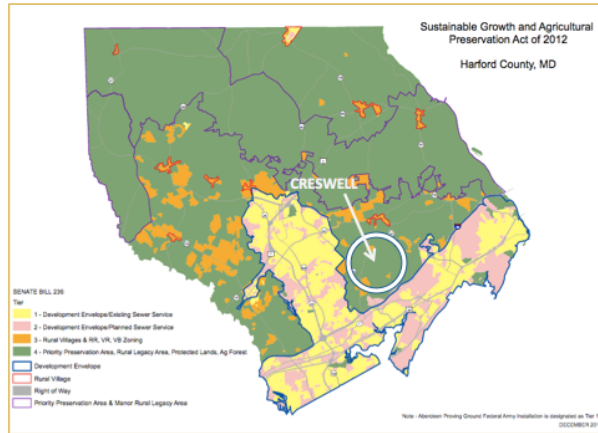
²⁴⁹ "HarfordNEXT." (2016): 32.

²⁵⁰ Knapp, G. "Using Incentives to Combat Sprawl." *Planning for States and Nation/States: A TransAtlantic Exploration Conference*. (2012)

designated as Tier 4 in green, meaning subdivisions are limited to 2 or 3 lots and must run on septic systems.²⁵¹

The PFA program is incentive-based, in that the state uses the PFAs to target state funds that assist jurisdictions in paying for growth-accommodating infrastructure. Harford County's PFAs include the DE, the nine Rural Villages and several other areas designated for economic development.²⁵² The areas designated as PFAs in the Creswell study area include HCC, the Churchville Rural Village, the Mixed Office area found at the intersection of I-95 and MD 543 and the area zoned as Light Industrial at the intersection of I-95 and MD 22. The Mixed Office and Light Industrial parcels are the only areas that currently have, or have future plans for, public water and sewer.

Figure 6. Harford County Sewer Tiering



Adequate Public Facilities

Another tool in Harford County's growth management toolbox is its Adequate Public Facilities (APF) standards. These standards tie the approval of development projects to the availability of public facilities and services, such as schools, roads and sewer. Put simply, APFs have a set of tests that determine if the existing public facilities can adequately absorb the growth of a proposed development project. Harford County has five areas of testing for adequacy: schools, sewage, water, roads and government facilities (fire, library and public safety).²⁵³ Development projects of 5 lots or less are generally not subject to APF adequacy tests. A simplified version of the adequacy tests can be seen in Table 6: APF Adequacy Tests:

²⁵¹ For more in-depth overview of the study area's septic tiering, refer to the Water and Sewer appendix.

²⁵² "HarfordNEXT." (2016): 35.

²⁵³ Given the complex nature of the ever-changing digitization of library resources, library adequacy is not within the scope of this project.

Table 6: AFP Adequacy Tests

Public Facilities and Services	Test for Adequacy ²⁵⁴
Schools	Enrollment must be less than 110% or is projected to be less than 110% within 3 years
Sewerage	Collector systems, interceptors and pump stations have sufficient available capacity to accommodate ultimate peak flows from the proposed development and other developable land within the drainage area; Treatment plant(s) have sufficient available capacity to accommodate expected annual average and maximum daily loadings.
Water	The water distribution system, booster stations and transmission mains have sufficient available capacity to provide maximum day demand.
Roads	<i>Inside the Development Envelope:</i> County and state roads connected to the point of entrance for the project must be capable of maintaining a Level of Service "D" or higher; <i>Outside the Development Envelope:</i> County and state roads connected to the point of entrance for the project must be capable of maintaining a Level of Service "C" or higher.
Fire & EMS	Developments are evaluated based on if they fall within an 8-minute or 4-minute response time.

If the APF tests determine that a development project would result in one or more of these services or facilities being inadequate, not all hope is lost. In most cases, the developer may move forward with the project if they enter into an agreement with the county in which they pay for the infrastructure improvements needed to meet the adequacy standards. However, these improvements can be very costly, and either render the project fiscally infeasible, or can even have the unintended consequence of intra- or inter-county deflection, in which developers choose locations that have excess capacity, but may not be in an ideal location from the perspective of the county.^{255,256}

Opportunities and Constraints for Growth Management

The county's primary growth management tools are largely geared toward maximizing development inside the DE and minimizing development outside of it, severely restricting the development potential of the Creswell study area. Undoubtedly, one of the greatest barriers to accommodating growth is the immobility of the DE's boundary. Since the boundary was first put in place in 1977, it has rarely been expanded. While the DE's boundary does not inherently prevent

²⁵⁴ "Harford County Code." § 267-126(B)(2). Adequate Public Facilities. (2018): 359-366.

²⁵⁵ To learn more about the existing conditions and adequacy of these public facilities, refer to the Infrastructure appendix.

²⁵⁶ There are a variety of financially-based growth management tools, including the county's Capital Improvement Program (CIP), value capture and impact fees. To learn more about these, refer to the Fiscal appendix.

growth outside of the envelope in and of itself, it does dictate the county's PFAs and sewer tiering. County law dictates that public water and sewer can only be extended to areas within the DE,²⁵⁷ and therefore restricts most of the Creswell study area to the use septic systems. Furthermore, the DE generally dictates where the higher intensity zoning districts capable of achieving PFA-eligibility are located. Therefore, without expanding the DE, the Creswell study area cannot receive the water and sewer infrastructure needed to accommodate large-scale growth, nor will it be capable of accessing the state's infrastructure improvement funds to help build said infrastructure.

It should be noted that the way in which the Maryland Department of Planning (MDP) calculates PFA entry provides an opportunity to allow for the preservation of open space and incremental entry on a subdivision plan basis, as opposed to requiring a 3.5 dwelling unit per acre density for the whole of the Creswell study area. MDP can calculate PFA entry on an individual, *submitted* subdivision plan basis, and if the net building area is at the required density, it can be separated from the residual open space and thus qualify. The only caveat is that in order to pre-qualify for PFA status on a *pre-subdivision plan* basis, the parcel as a whole must be capable of yielding a density of 3.5 dwelling units per acre.

Expansion of the DE is not unprecedented, though it is usually done at the margins. The county's most recent master plan included absorbing roughly 81 acres of new land into the DE, equating to an expansion of 0.36%.²⁵⁸ Clearly, this is a negligible expansion when compared to the nearly 13,000 acres within the Creswell study area.

Implications for Growth Management

In order to accommodate the scale of development discussed for the Creswell study area, the county will undoubtedly have to add its capacity for growth, most likely by expanding its Development Envelope. Perhaps most importantly, without doing so, the county will be incapable of expanding the water and sewer infrastructure needed to accommodate this level of growth. However, water and sewer is not the only infrastructure needed to accommodate a significant increase in dwelling units and the county simply cannot afford to unilaterally finance the resulting infrastructure needs. Thus, the county will also need to find mechanisms that facilitate densities of 3.5+ dwelling units per acre in order to achieve PFA status and access state funds.

The APF standards may need to be amended in order to address growth as well. Just as the county cannot pay for the study area's needed infrastructure improvements on its own, neither can the county expect developers to foot the bill in its entirety

²⁵⁷ Vought, A. "Frustrated residents of Fallston neighborhood told they may finally get sewer service – someday." *The Baltimore Sun*. Dec 27, 2017.

²⁵⁸ "HarfordNEXT." (2016): 32.

either. This could include revising the APF to allow for more flexibility in testing by tolerating inadequacies for a set timeframe, or allowing for alternative forms of mitigation. For example, developments located along scenic byways could pay a mitigation fee in lieu of road improvements. Furthermore, the APF could expand its options for mitigation, perhaps including negotiated exactions for school sites for larger development projects. Revising the APF standards will require considerable nuance so that it effectively manages growth in the Creswell study area, rather than simply slowing or preventing growth altogether.

Conclusion

Harford County's master plan, *HarfordNEXT*, lays out a clear vision for its future in which the agricultural industry and a rural way of life remain defining characteristics of its identity. However, the county's Development Envelope, which attempts to consolidate growth and contain urbanization, is forecasted to reach its buildout capacity within the next two decades. The Creswell study area appears to be one region in which the county could focus at least some of its future residential, business and institutional growth needs. To accomplish this, the county will need to grapple with the challenges of increasing densities and investigate new methods for maintaining adequate infrastructure. While the Creswell study area may not presently feel a tremendous amount of pressure to develop, it would appear as though this is all but inevitable, making it imperative that the county address how to best manage this growth if it truly hopes to conserve Creswell's agricultural heritage and rural legacy.

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Appendix K: Community Design

By Russell Ottalini

Executive Summary

This appendix reviews how traditional neighborhood design and conservation design strategies may be applied in the Creswell area. Existing zoning regulations that shape subdivision design and density and neighborhood character are key factors. As described in greater detail in the Land Use, Agriculture and Cultural Landscape appendices, Creswell is largely zoned for agricultural, rural residential and some village residential development. Present zoning sets the tone for site design and building typology. These requirements have strong implications for the character of neighborhoods and the extent to which they support different types of activities. Elements of these designs are explored. Comparisons with other subdivisions adjacent to Creswell will be examined for broader context on neighborhood design in the county.

Table 1: Executive Summary Matrix

Planning/Regulatory Factors	Opportunities and Constraints	Implications
<p>Subdivision Regulations Conditions shaping subdivision design and density</p>	<ul style="list-style-type: none"> • Different types of subdivisions allowed in zoning code • Limited Maximum lot coverage 	<p>Alternatives consider community forms that contribute to open space and clustering</p>
<p>Neighborhood Character Adding density while preserving and complementing existing character</p>	<ul style="list-style-type: none"> • Conventional design guidelines • Predominantly conventional subdivision planning, with only reliable connection between neighborhoods auto-oriented 	<p>Alternatives should address existing district and overlay zones, architectural vernacular and rural/community character</p>

Existing Conditions

There are few subdivision developments in Creswell built to densities greater than 1 du/acre due to its location outside of the development envelope and existing zoning. Most parcels in Creswell are zoned for rural residential (RR) or agricultural (AG) uses. Notable exceptions include a cluster of village residential and village business parcels in the immediate vicinity of the Churchville Rural Village at the northeastern border of the study area, as well as a few B1 and B2 (business) zoned parcels along MD 22. The median residential building (excluding mobile homes) in Creswell is just under 1,000 square feet (963). This reflects both the variety of subdivision types in rural residential (RR) and agricultural (AG) zoned areas of the area. Examples can be seen in Figures 1 and 2. More in depth overviews of existing densities are covered in the Land Use appendix.

Figure 1: Montreal Drive Residences, zoned RR.



Source: Esri Satellite Imagery.

Figure 2: Quail Creek Residences, zoned RR.



Source: Esri Satellite Imagery.

Existing housing is predominantly detached single family and follows conventional or large lot subdivisions standards for a majority of residential developments in Creswell. The dimensional requirements, such as building setbacks, of the RR and AG zoning districts have reinforced a low-density suburban pattern of residential development. (See Table 2)

Table 2: RR and AG District Lot requirements

District	Min. Lot Area (lots recorded ~1977 / after 1977)	Maximum Density (du/ga)
AG	20,000 ft ² / 2 acres	1*
RR	20,000 ft ² / 60,000	1

Source: Harford County Zoning Code, 2018, p. 153

* Maximum may vary depending upon family subdivision approvals.

Conservation Development Standards (CDS) are an alternative to conventional single-family detached subdivisions permitted in AG zoned parcels sized at least 35 acres or more.²⁵⁹ Up to 25% of the parcel may be developed, leaving at least 75% of its land in a permanent preservation easement that provides a community benefit, but is not publicly accessible. Application of CDS standards do not grant additional density to developers, and are restricted to single-family detached housing. Maximum lot sizes in parcels zoned AG may be just under 11 acres, reflecting the rural character and pastoral landscapes of the study area. Since 1977, agricultural lots for residential must be at least 2 acres. Such residential developments preserve large tracts of open space, but much of this is private. Furthermore, these subdivisions are typically oriented towards automobile traffic, with few facilities for cyclists or sidewalks for pedestrian use. Higher-density districts are directly adjacent to the Creswell study area inside the development envelope. Residential districts (R1-R4) and their permitted densities in various subdivisions are recorded in Table 3.

Table 3: Permitted densities in R1-R4 districts.

District	Conventional(du/ga)	COS (du/ga)	PRD (du/ga)
R1	1.8	2.0	N/A
R2	3.5	4.5	N/A
R3	5.0	7.0	10.0
R4	8.0	10.0	14.0

Source: Harford County Zoning Code, 2018

provided they preserve at least 10% open space (scaling to a minimum of 15 and 20% at R3 and R4, respectively) for community recreational use and which is protective of natural features²⁶⁰. Development is also not to exceed 25% of the entire parcel, preserving at a minimum 75% of its land.

In another alternative to conventional subdivisions, conventional with Open Space (COS) subdivisions afford slightly higher du/acre to developers, and are allowed on parcels with a minimum of 5 acres,

COS design standards mainly refer to the preservation of existing rural character, requiring the minimization of impact on natural and agricultural landscapes.

Table 4: Max Lot Coverage by Building Type

Dwelling Types	Maximum Building Coverage
Patio/court/atrium, semidetached, townhouse, multiplex and row duplex and cluster townhouse	40%
Garden, mid-rise and high-rise apartments	30%

Source: Harford County Zoning Code, 2018, p. 157.

Another alternative is a Planned Residential Development (PRDs) subdivision, restricted to R3 and R4 districts, also with a minimum parcel size of 5 acres. Open space requirements begin at 20% (R3), scaling to 25% (R4) and 30% (R4, high-rise).

²⁵⁹ Harford County, Harford County Zoning Code, 2018: 283-4.

²⁶⁰ Harford County Zoning Code, 2018: 282-4

In addition to the number of open space and landscape preservation subdivision types permitted, building coverage maximums are less than 50% in Harford County. This reflects general community preference for reduced building footprints and a commitment to open space, even on urban development sites. Table 4 displays maximum lot coverage allowable in R1-R4.

Opportunities and Constraints

The preference for preservation of open space, agricultural landscapes and natural resources expressed through zoning code regulations on subdivision design reflect both challenges and opportunities for any alternative which might see intensification of residential land uses in Creswell. The problem is that the present zoning and subdivision regulations in Creswell reinforce a low-density residential form. This erodes the agricultural potential of the area by fragmenting agriculture. In recent years, the county has introduced new overlay districts which may better direct exiting residential development potential into cohesive settlements without disrupting agricultural land use. Examples include the Magnolia Neighborhood Overlay District (MNOD)²⁶¹ and Edgewood Neighborhood Overlay District (ENOD), that are intended to spur transit adjacent residential areas that encourage a mix of both uses and housing types,²⁶² in line with the community design goals advanced by *HarfordNEXT*.²⁶³

Developers may not be interested in using new overlay districts in Creswell.²⁶⁴ One of the potential solutions to this dilemma is offering density incentives. As discussed in other appendices, the concept of an Open Space Subdivision (OSD), suburban counterpart of the Conservation Subdivision, was considered as a suitable fit in development alternatives. Performing in a similar fashion to existing open space preservation subdivisions in Harford County while affording developers bonuses to density in clustered patterns, OSD could serve as consensus-building solution. When adopted, conservation design standards often mandate significant open space preservation, and require “yield plans” that priority preservation areas are identified prior to subdivision plot layout, affording the opportunity not only to protect valuable natural resources, but also create a contiguous network of public green or open space for recreation between adjacent developments.²⁶⁵ A model OSD subdivision ordinance prepared by the Forestry and Environmental Outreach Program at NC State University suggests a bonus of one dwelling unit for each acre of open space preserved beyond 50% of unconstrained land area in the development.²⁶⁶ The alternative futures considered by the study area workshop incorporate OSD as a concept that might be implemented as a special overlay

²⁶¹ Harford County Planning and Zoning, Harford County Zoning Code, 2018, 263

²⁶² Harford County Planning and Zoning, Edgewood Small Area Plan, 2016

²⁶³ Harford County Planning and Zoning, HarfordNEXT, 2016, 19

²⁶⁴ Arendt, “*Designing Subdivisions to Save Land*”, 2019, 16

²⁶⁵ Arendt, *Designing Subdivisions to Save Land*, 16

²⁶⁶ NC State University Forestry and Environmental Outreach Program, *Open Space Subdivision Design – A Model Ordinance*, 11-12

district in Creswell, offering similar density bonuses that reinforce open space protection and rural landscape preservation.

Implications

As was discussed in the land use appendix, in a development alternative, rezoning of parcels currently zoned AG or RR would be a necessary step in community transition. Beyond this, the creation of a new overlay district that is specific to the Creswell neighborhood (as modeled by small areas like Magnolia and Edgewood) may also be necessary to encourage clustering of development that nonetheless preserves treasured natural landscapes and open space. The implementation of this new overlay district would also likely include specific site design guidelines that would serve to guide new development such that it complements local rural and community character.

Neighborhood Character

The visual and physical reflection of subdivision design on neighborhood character has been identified as a key consideration in the future of growth planning in Harford County. Harford NEXT includes a goal to incorporate design guidelines into the county's planning processes to a greater degree to enhance the architectural quality of new neighborhood development, such that it reflects local character.²⁶⁷ This is a point specifically mentioned in the ENOD site design guidelines recommendations, which speak to advancing a higher standard for building aesthetics and site plans.²⁶⁸ Such design standards might include the incorporation of at least two housing types, material choices for facades, the location of public spaces, and a grid pattern where viable. Existing subdivisions adjacent to the study area demonstrate that there is a lack of complete streets that offer multimodal connectivity. Curvilinear avenues that snake around lot lines and lack direct connections in the form of sidewalks or trails reduce a neighborhood's walkability, further reinforcing limited mobility options for non-motorists.

Opportunities and Constraints

As discussed above, developers are resistant to changing their standard practices: changing the pattern of their practice is more costly and doesn't necessarily generate additional profits without incentive.²⁶⁹ The implementation of density bonuses for such development is an opportunity to attract these developers while elevating neighborhood character in Creswell by clustering units with design standards and preserving natural landscapes and creating open space as a community asset. While no design standards specific to the study area exist, the creation of an OSD presents the opportunity to create such standards based upon those in existing overlay districts like ENOD and MNOD. These districts' site design guidelines are highly specific, referring to architectural character, diversity, layout

²⁶⁷ Harford County, HarfordNEXT, 38

²⁶⁸ Harford County, Edgewood Small Area Plan, 16

²⁶⁹ Arendt, 2019, 16

of streets, and other important considerations. In particular, they integrate Traditional Neighborhood Design (TND), a design and land use planning concept “incorporates traditional town planning techniques” which include such as a network of well-connected streets and blocks, a variety of housing types and public spaces that are within walking distance of commercial and civic amenities.²⁷⁰ ENOD also contains a provision for flexible first-floor mixed use space in multifamily housing that might serve as a residential unit for a time before converting to low-intensity retail that serves the community in the future.²⁷¹ The integration of flexible infrastructure into the design of neighborhoods is another opportunity in a design code, as was suggested in the Edgewood small area plan.

While ENOD is five years old and has yet to be widely used, pending the success of these overlay districts they might serve as a model that could be drawn upon in creating specific design standards for Creswell, particularly in reinforcing a network of pedestrian and bike facilities. These might be based in part on the existing rural character study and development guidelines that apply to the Churchville Rural Village, which mandate that new buildings reflect the surrounding architectural heritage in their site design.²⁷²

Implications

As recognized by the county, neighborhood character can be enhanced by the implementation of design standards that speak to residents’ vision for their community. The implementation of design guidelines to reinforce multimodal street connections, a mix of facades and core materials, and other layout considerations are key tools to elevating development standards and neighborhood connectivity. As the county considers the greater inclusion of such guidelines into its planning process, specific consideration could be given to reinforcing the unique qualities of Creswell neighborhoods by requiring design review and elevating standards for new development while shaping it to better serve pedestrians, cyclists and transit users. The success of existing models, ENOD and MNOD, should also be considered in evaluating whether to adopt similar design standards in the case of Creswell.

Conclusion

At present the study area’s AG and RR zoning precludes it from higher density development subdivision options that might support open space preservation and the creation of community amenities more effectively than traditional 1 unit per 2 acre maximums. An OSD overlay district was selected for analysis in the workshop’s alternatives as an option for creating a unique overlay that would combine the best aspects of density clustering while also affording an enforceable, high minimum percentage land preservation. This would also afford the opportunity to lay out contiguous open space networks that serve as connections between communities,

²⁷⁰ Harford County, Edgewood Small Area Plan, ii.

²⁷¹ Ibid. X.

²⁷² Harford County, Harford County Zoning Code, 2018, 175

serve as recreational areas, and enhance community character. In this way, the integration of TND and conservation design concepts into nodal development alternatives could further support Harford NEXT's goals to increase connectivity and mobility and to promote healthy communities with a high quality of life by increasing access to open space, public and potentially commercial amenities.

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Appendix L: Fiscal Impact

By Bilal Ali

Executive Summary

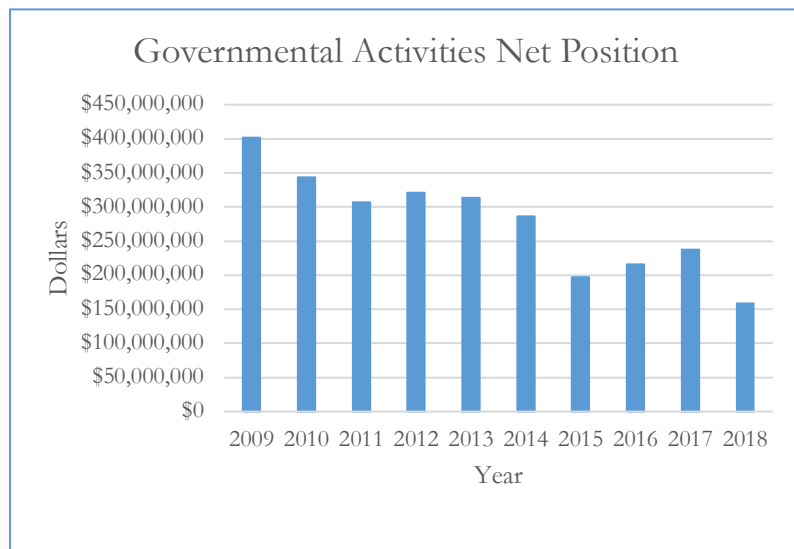
This appendix provides context for the County’s fiscal situation as it relates to any new potential development in the Creswell study area. Research was focused on identifying the infrastructure needs and understanding the County’s budget policies. As the study area is largely undeveloped, the infrastructure needs include adding a sewer and water line, improving roads and extending Fire and EMS services. In addition, given Adequate Public Facility Ordinance (APFO) requirements, there may be a need for a new elementary school in the study area in the short-run, and there will be a need for even more schools if development occurs. However, the County’s fiscal policy is conservative, focusing its capital spending on improvement and maintenance projects. Therefore, financing options that do not add a significant debt burden are explored. This appendix provides opportunities and constraints presented by a) the infrastructure needs, b) the County’s approach to fiscal management and c) the use of alternative financing techniques. Implications of the opportunities and constraints are discussed as well.

Investment Magnitude

Opportunities and Constraints of Investment Magnitude

Economic growth is a fundamental goal of the County. With the anticipated levels of population growth, Harford County must invest in expanding its services to accommodate it. In order to do so, the County must increase its economic base to raise revenues commensurate with its growth. Despite prudent fiscal management to pay down debts and balance the budget that has helped stabilize the County will face long term costs associated with a growing and aging population (see Figure 1). Moreover,

Figure 1. Governmental Activities Net Position



Source: Harford County Comprehensive Annual Financial Report FY 18

adding new residents to County is itself a significant source of economic development, as residents comprise nearly 78% of the County's tax base.²⁷³

Increasing the tax base of higher income residents through new development is an effective way to address the longer long-term economic development goals. Therefore, investing in infrastructure to support residential development can potentially yield a large revenue windfall from property and income taxes. A fiscal impact analysis of development in Creswell will be conducted and will capture these potential tax revenue increases as well as assess the costs of new residential development on the government's operating budget. It will help the County examine whether the magnitude of investment is justified by the impact on the budget. Additionally, the County should conduct an Economic Impact Analysis to understand the dynamic effects of new residents on economic growth; if new residents live and work in the County, they will also spend within the County, thus growing the economy. The economic impact should also be compared to the projected costs of infrastructure investment.

Still, despite the potential positive fiscal and economic impacts, in order to achieve it through development in this study area will require significant infrastructure investment given the large capital requirements to accommodate new growth. A glaring need is providing water and sewer. In Maryland, local jurisdictions can designate certain places as Priority Funding Areas (PFA), which indicate to the state where to prioritize investments to support future growth. As this is a potentially significant source of investment, several key changes need to occur in Creswell to qualify for the PFA, including planned public water and sewer²⁷⁴. Currently, water and sewer capacity is planned to accommodate the expected growth within the Development Envelope, meaning increased capacity will be required for new development outside of it. Indeed, providing a sewer line up the James Run is a key consideration for development in Creswell.

Furthermore, growth and development of Harford Community College (HCC), located at the North End of the study area, depends heavily on the provision of access to public water and sewer. HCC's central role within the community suggests it is a potentially valuable economic asset if developed. Therefore, one key reason to consider providing sewer up the James Run all the way to HCC is to promote further development of the College while at the same time providing access to public water and sewer to the West side of the study area, which would contribute to achieving PFA designation from the State. However, as with any new water and sewer line, a significant capital outlay is required. Whether or not the County's Water and Sewer Enterprise Fund can cover some of the financing for new water and sewer lines, capital and water sewer projects are still accounted for in the Capital Improvement Program and must be accounted for in the total cost of development.

²⁷³ Maryland Department of Assessments and Taxation, State Department of Assessments and Taxation, AIMS 2 Report, 2016.

²⁷⁴ Department of Planning. "Priority Funding Areas." Maryland.gov. February 2019.

Another infrastructure challenge in the study area that will increase the costs of new development is congestion, particularly on MD-22 and MD-543. These two roads are highly travelled and run through the heart of the study area as Creswell connects two of the County's largest urban areas, Aberdeen and Bel Air. While the Levels of Service (LOS) are currently deemed adequate on these roads, there are still high volumes, limited access control and severe peak hour congestion. Thus, improvements will need to be made to accommodate new growth. And, depending on the level of growth, there may be a need for more roadway networks, increased transit access and an expansion of bike and pedestrian infrastructure.

Also, Harford County is undergoing a gradual transition to a career Fire and EMS service. This structural shift in the delivery of emergency services will require a large increase in personnel on the County's payroll, regardless of development. The need would be exacerbated by new development, as the study area is mostly outside the 8-minute response time catchment area. Unlike transportation and education investment, fire and EMS do not have a direct link to some return in economic growth. They are a net negative in fiscal and economic analyses and given the needs of the study area and trends in the County generally, these costs are expected to be high.

Perhaps the costliest aspect of development is the need for a new school in the short run. Any development requires meeting the Adequate Public Facility Ordinance (APFO) requirements for schools, which is set at a capacity of 110%. In the short-term, there is system-wide capacity to accommodate new students of all ages, although the Elementary schools are more burdened than Middle and High Schools. However, one school beyond its APFO capacity is Homestead-Wakefield Elementary, which also happens to be the school nearest the study area.

As a result, assuming that re-districting in the short-run is not feasible, any new development would require new school construction immediately. However, given the system-wide capacity for new students, the County may have difficulty obtaining State resources for building this new school. This diminished State support may be somewhat offset because the County owns a site in the North part of the study area that was once intended for a new school. Nonetheless, imminent school construction must be planned for and would likely represent the largest new capital and operating costs from development. Using the cost for the new \$40 million Havre De Grace Middle/High School as an example, a new elementary may cost anywhere from \$20-30 million and possibly more.²⁷⁵

²⁷⁵ Harford County Approved Fiscal Year 2019 Annual Capital Budget. May, 2018. 36.

Another constraint is that impact fees in the County, which are at the highest \$6000 for single-family detached homes, lag behind other counties in Maryland (see Table 1). Moreover, Impact Fees in Harford County are dedicated to fund school capital funds only.²⁷⁶In many jurisdictions, there are fewer restrictions on what Impact Fees revenue may be spent on. Harford County’s restriction on using Impact Fees for school capital costs alone is not a

major hindrance to financing infrastructure in the study area, as school costs are a significant portion of the infrastructure requirements, although increased flexibility would only benefit the County.

Still, the County is potentially missing out on significant source of revenue when compared to the Impact Fees similar Maryland Counties have levied. With substantial increases in new unit construction expected should development of the study area occur, the total revenue raised by Impact Fees would be large, but it is worth considering whether or not the Impact Fees currently are indeed commensurate with the ‘impact’ of new residential units. Given the difference between Harford and comparable Counties, this may not be the case.

Table 1: Impact Fees in Maryland

County	FY 2017	FY 2018	FY 2019
Anne Arundel	\$12,473	\$12,963	\$13,390
Calvert	12,950	12,950	12,950
Caroline	5,000	5,000	5,000
Carroll	533	533	533
Charles	16,206	16,838	17,385
Dorchester	0	0	0
Frederick	14,881	15,515	15,515
Harford	6,000	6,000	6,000
Howard	\$2.43/sq. ft.	\$2.47/sq. ft.	\$2.72/sq. ft.
Montgomery	40,793	45,159	45,159
Prince George's	23,007	23,513	24,094
Queen Anne's	\$4.96/sq. ft.	\$5.29/sq. ft.	\$5.48/sq. ft.
St. Mary's	4,500	5,500	6,280
Talbot	7,176	7,427	7,680
Washington	\$1.00/sq. ft.	\$1.00/sq. ft.	\$1.00/sq. ft.

Source: Overview of Maryland Local Governments, Department of Legislative Services

Implications

Based on the road improvement needs, insufficient capacity at Homestead-Wakefield Elementary, the water and sewer requirements for PFA designation and the potentially inadequate revenues from Impact Fees, a major investment will be needed to support growth that maintains levels of services and quality of life standards. Development simply cannot proceed without critical investments that are required for the PFA-designation and APFOs. Nevertheless, a large investment may be justified by the need and stated intentions for economic development and growing the tax base, which the County does need to do to address its long-term

²⁷⁶ Harford County Approved Fiscal Year 2019 Annual Operating Budget. May, 2018. 63.

spending and revenue forecasts. A fiscal impact analysis of new development will be conducted and will help the County assess trade-offs of making the investment, although the results should be considered alongside an economic impact analysis and an impact fee study as well.

Fiscal Management

Opportunities and Constraints of Conservative Fiscal Management

In 2018, Harford County's AAA bond rating was reaffirmed by Moody's Investor Service, Fitch Ratings and Standard and Poor's. This is owed in large part to the County's "maintenance of sound reserves, a conservative approach to budget development, and timely revenue and spending adjustments,"²⁷⁷ which the county is determined to continue. The County's sound fiscal management will reduce the cost of borrowing to fund capital projects, which suggests that some direct investment in infrastructure would be feasible.

In addition, it is notable that these fiscal accomplishments have come without raising taxes. The property and income tax rate has remained unchanged since County Executive Barry Glassman took office in 2014. The attractive rates especially compared to nearby Baltimore City and Howard County can help to retain existing residents as well as attract new ones as the region grows.

However, despite the County's willingness to take advantage of its AAA credit rating – as evidenced by its recent \$40 million and \$50 million bond sale in 2019 and 2018 respectively²⁷⁸ – the full cost of the needed infrastructure improvements for development in the study area would certainly exceed \$50 million based on school, roads, fire/EMS and utilities needs. There is little precedent for the level of investment required in the short-run. Moreover, a core component of the County's approach to capital spending is prioritizing maintenance and upgrade of existing facilities.

Implications

Given the magnitude of investment required, which is at odds with approaches to spending by the current administration, the County is likely to consider alternative techniques to finance infrastructure improvements in the study area. Moreover, the County administration is determined to maintain the current tax rate and residents may be concerned that new development will affect this policy given the impact on

²⁷⁷ Harford County Approved Fiscal Year 2019 Annual Operating Budget. May, 2018. 865.

²⁷⁸ Anderson, David. "Harford County Prepares to Sell \$40 Million in Bonds, Retains Top AAA-bond Rating." *The Baltimore Sun*, January 10, 2019.

the budget. Thus, seeking financing techniques that protect residents outside of the study area from the cost burden of development is desirable.

Also, as mentioned earlier, an additional option for the County to consider is conducting an impact fee study to fully understand the costs of development that would fall on developers. Even by preserving impact fees as dedicated to school capital funding could provide considerable relief to the overall costs of development without undermining the County’s conservative approach to fiscal management.

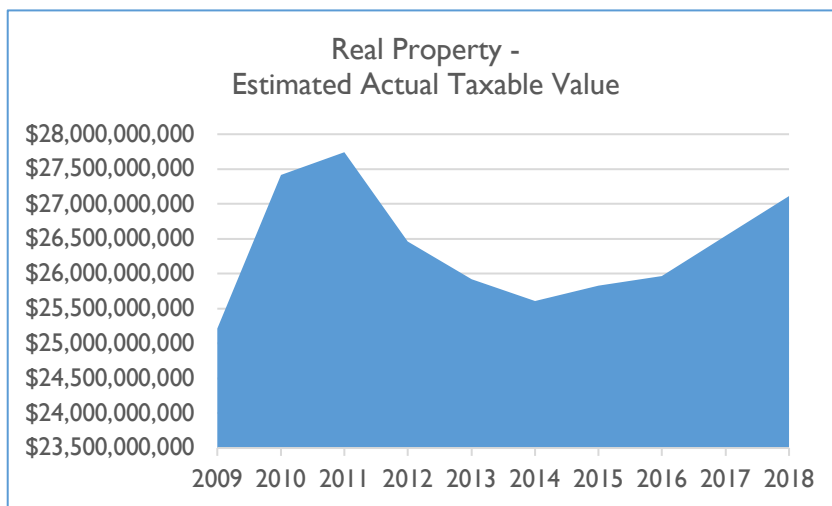
Alternative Financing Techniques

Opportunities and Constraints of Using Alternative Financing Techniques

In basic terms, ‘value capture’ is a financing strategy that seeks to recover increases in land value that occur as a result of infrastructure investment and development. Through some mechanism - including impact fees, ‘tax-increment financing’ (TIF), and ‘special assessment districts’ – the County would collect some portion of the value accrued to land that has benefitted from nearby development.

Since this increase in land value comes from public investment, it is appropriate to capture a portion of the total increased land value to pay down the costs of that investment. Given that much of the land in the study area is undeveloped, even the minimum level of infrastructure needed to support development could have a significant influence on land prices, which may benefit from speculation alone. Value capture is a common strategy for redevelopment in urban areas, where the change in land value is smaller than the change in value expected from developing undeveloped land.²⁷⁹

Figure 2: Estimated Taxable Value of Real Property



Source: Harford County Comprehensive Annual Financial Report FY 18

Increases in property values in Harford County, as shown in Figure 2, suggest it may be a viable candidate for value capture if property values in a new development follow these trends.

However, value capture strategies can be difficult to administer, and

²⁷⁹ Anderson, David. "Harford County Prepares to Sell \$40 Million in Bonds, Retains Top AAA-bond Rating." The Baltimore Sun, January 10, 2019.

many forms of value capture are novel and untested, especially in the Region. The Beech Creek (formerly Beechtree) development near Aberdeen is an example of the perils the County has faced with TIF projects. TIFs are funding mechanisms in which the local government issues bonds to raise funds for developers to use to make infrastructure improvements like adding roads and sewer lines. The developer then pays back the bonds over time from a tax assessed on the development.

The Beech Creek developer, Beechtree Properties LLC, was late on several of its TIF payments and the owner filed for bankruptcy with claims totaling nearly \$60 million. Despite coming up-to-date on taxes, homeowners have expressed concern that missed payments will eventually be passed on to them. As a result of the experience, the County has expressed weariness for TIF and the current administration has distanced itself from the original decision to implement one in the first place, which occurred in a prior administration²⁸⁰.

While there is some experience regionally with other forms of value capture, such as special assessment districts and split-rate property taxes, the long-term consequences are unclear and there is no model for the County to adopt that is analogous to the study area. Split-rate property taxes are an efficient form of value capture because it taxes land at a higher rate than built structures when calculating the property tax owed. Thus, it directly captures increases in land value that occurs as a result of government investment. However, this concept has almost no precedent in Maryland and is unlikely to be considered given potential legal challenges.

Implications

Special Assessment Districts and Impact Fees may be the two viable forms of value capture, although these options must be examined further. A legal memo comparing and analyzing various forms of value capture will be developed as part of the study. Initial results show that typically, Special Assessment Districts are used for specific infrastructure projects as opposed to large-scale, comprehensive projects. Thus, the legal, administrative and political constraints to adapting them must be considered.

Conclusion

While potentially costly, infrastructure investment in the study area may help to address the County's long-term economic development goals by helping to grow the tax base. However, this benefit must be weighed against capital needs of developing the area, which requires both new and improved infrastructure. As the County's conservative fiscal management has included prioritizing capital spending on improvement and maintenance projects, the County will likely investigate alternative financing mechanisms to issuing bonds for the full cost of the project.

²⁸⁰ Seltzer, Rick. "Six-figure Payment Brings Clark Turner's Beech Creek out of TIF Delinquency." Baltimore Business Journal, April 6, 2016.

Value capture, specifically impact fees and special assessment district are potentially viable options as property values have been growing healthily and the potential for large increases in land value from developing rural land. A fiscal impact analysis analyzing the effects of development on the operating budget and a legal analysis of value capture strategies should be developed and can help guide decision makers about fiscal trade-offs of development.

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Appendix M: Fiscal, Traffic, Rural Character and Land Modeling

By Bilal Ali, Russel Ottalini and Sarah Latimer

Executive Summary

The Framework Plan utilized three models in analyzing its impacts. A fiscal model assessed revenues and costs of accommodating growth in Creswell. A transportation model analyzed traffic demand changes with new growth, as well as impacts from road improvements and new road development. Lastly, a land use model combined and allocated agricultural, cultural, environmental, and land use data to examine the impacts of growth in Creswell. In addition, as part of the land allocation model, a rural character analysis created an index of rural character as a priority for preservation throughout the study area. This section will provide a brief overview of the models and analysis used in developing the Framework Plan for Creswell.

Fiscal Model

In consultation with the consulting firm TischlerBise, a fiscal model was developed to project revenues and costs related to development in the Creswell area. Three separate models were run: 1) 'Trend'; 2) 10,000 new units; and, 3) 16,000 new units. The 'trend' model considered the impact of the maximum 750 new units Creswell could accommodate under the current development density.

A fiscal impact model simply calculates annual revenues minus costs per new unit of residential or nonresidential land uses. The residential fiscal impact measure the revenues minus costs per each new home built. Furthermore, based on the data we had, the fiscal impact of nonresidential land uses was calculated per new employee. We used a standard estimate of employees per 1,000 square feet to figure out the fiscal impact per square foot. The per unit results for both types of land uses were them multiplied by the proposed number of new homes or new nonresidential space.

For the purposes of this project, costs were considered in two categories: operating costs and capital costs. The methodology used to determine revenue, operating cost and capital cost inputs for the models is described in the Fiscal Impact Analysis section of this Appendix. Each residential and nonresidential land use type is associated with certain costs and revenues as well as the total number of units

allocated to that land use under each development alternative considered. These are summarized below:

- **Number of new homes (residential)**
- **Amount of new square footage (nonresidential)**
- **Person per Household.** Operating costs were calculated on a per capita basis and then multiplied by this factor for each residential land use type
- **Real Property Value.** Assumed property value for all land use types
- **Real Property Tax Revenue**
- **Recordation Tax Revenue**
- **Transfer Tax Revenue**
- **Income Tax Revenue**
- **Impact Fee.** This is only associated with residential land uses. Also, as it is a one time fee, it is divided by the duration of the study period (20 years) to obtain its annual value.
- **Operating Costs**
- **School Capital Costs.** As it is a one time fee, it is divided by the duration of the study period (20 years) to obtain its annual value.
- **Fire/EMS Capital Costs.** As it is a one time fee, it is divided by the duration of the study period (20 years) to obtain its annual value.
- **Parks Capital Costs.** As it is a one time fee, it is divided by the duration of the study period (20 years) to obtain its annual value.
- **Highway Capital Costs.** As it is a one time fee, it is divided by the duration of the study period (20 years) to obtain its annual value.

The model outputs are:

- Total Revenues minus Operating Costs for Residential Land Uses
- Total Revenues minus Operating Costs for Nonresidential Land Uses
- Total Capital Costs for Residential Land Uses
- Total Capital Costs for Nonresidential Land Uses
- Total Impact Fee Revenue
- Overall Fiscal Impact (Total revenues - total operating costs minus total capital costs)

Transportation Model

In order to evaluate potential implications of land use decisions on traffic demand and congestion within Creswell, study alternatives were run through the Baltimore Metropolitan Council's (BMC) travel model by the consulting firm of JMT (Matt Wolniak), who assisted with this project. (This firm also executed the recent Route 22 study for Harford, for which they built a more detailed version of the BMC model) This model evaluates trips generated by Traffic Analysis Zones (TAZ), which represent the area's land use network, and are typically composed of census tracts and are separated by major roadways, natural features, or jurisdictional boundaries. TAZ's may represent multiple residential or business subdivisions, as well as

military installations, and also have socioeconomic or demographic data developed for them. These data are inputs in the travel model.

BMC's travel demand model is based upon the Four Step Process, which has been prevalent in transportation planning since the 1950s, and which projects traffic following the steps below²⁸¹:

1. Trip Generation: Each land use in the given study area is assigned trip generation rates. As travel is a function of derived demand (people travel out of need, not out of a desire for transportation itself), the type and size of developments on particular parcels are thus assumed to "create" trips. These trips are then further categorized by their occurrence during AM or PM peak-hour, or Saturday (as an approximation of weekend travel).
2. Trip Distribution: Destinations within the roadway network for the total number of generated trips for each development are determined. This determination may be based on a variety of sources, including previous traffic impact studies, data from metropolitan planning organizations (MPOs) and guidance from local jurisdictions. The locational context of the Creswell study area was one reason the BMC travel model was selected for analysis of alternative implications on traffic.
3. Modal Split: Determines the number of trips that use various modes of transportation (automobile, public transportation, cycling or walking, etc.). While some trips may involve multiple modes, the choice is often a function of available infrastructure. For example, if the study area is located near a freeway but not adjacent to public transportation options, less travelers will select a bus as their mode of choice. Given the study area's low transit ridership and high rates of private vehicle-based commuting, car use is assumed as the dominant mode of choice.
4. Trip Assignment: In this final step, routes are determined for each trip. The path is determined from origin to destination, and trips travel each road segment that accumulates along this line. These are often broken down by the time of day at which they take place: this study uses PM Peak Hour trips to approximate the period of the day at which there is the highest travel demand throughout the roadway network.

This model projects traffic volume to roadway capacity (v/c) ratios, which is an expression of congestion. Ratios range from 0 to over 1. A ratio below 1 (.01-.95) indicates relative free flow of travel, while a ratio of .95 or over indicates that the roadway experiences high congestion and may need improvements.²⁸²

²⁸¹ Maryland Department of Transportation Travel Demand Model Manual, Chapter IV

²⁸² US Department of Transportation, 2004. "Signalized Intersections: Informational Guide", Chapter 7. Accessed via <https://www.fhwa.dot.gov/publications/research/safety/04091/07.cfm> on May 4th, 2019.

However, for the purposes of this study, Level of Service (LOS) for links along the roadway network were set to the following v/c ratios:

LOS	V/C Ratio
A/B	0-0.58
C	0.58-0.75
D	0.75-0.9
E	0.9-1.0
F	>1.0

Land Allocation Model

The Creswell team built a CommunityViz model for the study area as a parcel-based analysis tool with the assistance of Matt Noonkester at City Explained, Inc. (owner of CommunityViz software). The model was used to approximate build out potential for the study area, inventory rural character, and evaluate alternative growth scenarios for developing the Framework Plan. The Creswell CommunityViz Model includes six modules: carrying capacity, external lookup tables, build-out potential, land suitability, growth allocation, and performance measures. A brief description of the software, its data, and each module in the model is provided below. More detailed information about CommunityViz software, and its applications for scenario planning, is available at www.communityviz.com.

Overview of CommunityViz Software

CommunityViz is an extension of ESRI's ArcGIS desktop software that facilitates the visualization and comparison of alternative growth scenarios. It was originally developed by the Orton Family Foundation, a non-profit group that focuses on technology and tools for more informed community decision-making.

There are two software components in CommunityViz. The first is Scenario 360, which is a two-dimensional map and data analysis component of the software. It adds the functionality of a spatial spreadsheet to ArcGIS for Desktop software, similar to how a spreadsheet program like Microsoft Excel handles numerical data. Dynamic calculations embedded in the spatial spreadsheet are controlled by user-written formulas that change value as referenced input values change. The impact of physical development or policy decisions under consideration may be measured side-by-side in two or more growth scenarios contemplated in the software.

The second component of CommunityViz software, Scenario 3D, is a visualization tool that constructs three-dimensional models of buildings, roads, landscapes or

entire communities using two-dimensional information generated in the Scenario 360 analysis. Scenario 3D was not used in the Creswell CommunityViz Model.

More information on CommunityViz and its capabilities for scenario planning is available on their website (www.communityviz.com) or *The Planner's Guide to CommunityViz* published by the American Planning Association in 2011.

Data Manipulation

Two new GIS data sets — development status and place types — were created for the Creswell CommunityViz Model. A description of both data sets and information used for creating the databases is provided below.

Development Status Assignments

Development status in Creswell told CommunityViz which set of equations to use for estimating the development yield of a parcel. And, when combined with the land suitability scores and place type assignments, it established the order and supply available for a parcel to receive future growth in the model.

A map depicting development status assignments for the Framework Plan is included in the technical appendix. Category descriptions are also included in the technical appendix.

Place Type Assignments

The Creswell CommunityViz Model introduced the concept of place types for the study area, which expanded on the current list of future land use categories in the Harford County Comprehensive Plan to describe, measure, and evaluate the built environment. New place type categories helped for rationalizing alternative growth scenarios and measuring their trade-offs with a comprehensive list of performance measures. Place types in the study area told CommunityViz which set of equations to use for estimating the development yield of a parcel. And when combined with the land suitability analysis scores and development status assignments, it established the order and supply available for a parcel to receive future growth in the model.

Place type values were assigned in the study area using a three step process: 1) parcels identified with a development status of 'protected open space' where assigned a place type of 'preserved open space', 2) parcels identified with a development status of 'developed' used 2018 aerial photography or topic-specific GIS data to assign place types, and 3) parcels identified with a development status of 'agriculture' or 'undeveloped' used different place type assignments based on rules for the alternative growth scenarios.

A map depicting place type assignments for the Framework Plan is included in the technical appendix. Category descriptions are also included in the technical appendix.

Carrying Capacity Analysis

Some land in the Creswell study area will never develop because of physical conditions on the site, land ownership, or the existence of state and local policies that prohibit development. These areas — referred to as “highly-constrained for development” — were removed from the study area to more accurately approximate buildable area for the Framework Plan. Internal scripts in the model removed “highly-constrained areas for development” from the build-out calculations using an overlap function. The presence of development constraints on a parcel was reported as an area statistic. The area(s) of a parcel remaining for development was calculated as the difference between total land area and the constraint statistics.

A site efficiency factor specific to each place type category was applied to vacant parcels in the study area to account for land typically set aside for on-site improvements (e.g., internal streets, utility easements, storm water management, open space, etc.) to support new development. The portion(s) of a parcel remaining after the removal of “highly-constrained areas for development” and land set aside for internal infrastructure was used to approximate buildable area for the study area.

Features in Creswell used to represent highly-constrained areas for development included:

- Steep Slope Areas;
- Rights-of-Way; and
- Government-Owned Land.

A highly-constrained areas map and contributing factors map for the carrying capacity analysis are included in the technical appendix.

External Lookup Tables

Some variables and values used in the calculations for the Creswell CommunityViz Model were linked to the analysis via external lookup tables, which updated automatically every time a change was made outside the software. The tables were used to capture general development characteristics associated with the different place types, and enumerate household and employment control totals for the growth allocation process.

General Development Lookup Table

A general development lookup table was linked to the Model using place type categories and watershed code values. Information in the lookup table was summarized under eighteen column headings, including:

General Characteristics

- Place Type Category
- Jurisdiction Code
- Watershed Name
- % Site Efficiency Factor
- % Residential Development
- % Non-Residential Development

Residential Development Characteristics

- Average Density
- % Single Family Development
- % Multifamily Development

Non-Residential Development Characteristics

- Average Floor Area Ratio
- % Service
- % Industrial
- % Commercial

Build-Out Potential Factors

- Single Family Development
- Multifamily Development
- Service Development
- Industrial Development
- Commercial Development

The general development lookup table is included in the technical appendix.

Growth Control Total Lookup Tables

A growth control total lookup table was used to store control totals for the assumed build-out yields for Creswell under different growth scenarios. Dwelling unit data was reported for single family and multifamily residential categories. Data for employees was reported for service, industrial, and commercial categories.

The growth control total lookup table is included in the technical appendix.

Performance Measures Lookup Table

Lookup tables for each performance measure were used to store the rate of impact per household or square foot of nonresidential development for infrastructure, impervious surfaces, environmental preservation, and agricultural preservation. Infrastructure lookup tables determined the water and sewer demand per dwelling

unit by density and square foot of nonresidential development by type allocated to measure total water and sewer demand. An impervious surface table provided rates of impervious surface by place type to estimate impervious surface generated by new development. An environmental lookup table measured percent of forest preserved on developed land according to the Maryland Forest Conservation Act. Lastly, the agricultural lookup table stored percent of open space by place type to measure agricultural open space remaining on parcels developed using Open Space Design

Allocation Categories Lookup Table

The allocation categories lookup table was a data set referenced in the “land uses” window of the Allocator 5 Wizard in CommunityViz. It assigned a numerical identifier to each growth allocation category that streamlined internal scripts and calculations in the software.

The Allocation Categories Lookup Table is included in the technical appendix.

Build-Out Potential

Build-out potential calculations for dwelling units and employees simulated a theoretical condition where all parcels in the study area assigned ‘undeveloped’ status were developed consistent with assigned place types and development lookup table values. Internal scripts in the software started with buildable area from the carrying capacity module, and applied rules for land use mix, density, or intensity from the general development lookup table to approximate a maximum number of new dwelling units or maximum number of new employees for the grid cells. A factor was applied in the employee calculations to convert maximum allowable non-residential square feet to total employees for the growth allocation process.

Build-out potential statistics were summarized using five development categories – single-family residential, multifamily residential, service, industrial, and commercial – and one horizon period. Build-out statistics were summarized by control total category for the growth allocation process consistent with control total categories and periods in the growth control totals lookup table. This information was used to represent ‘available supply’ for the growth allocation scripts in CommunityViz.

Land Suitability Analysis

Land suitability analysis (LSA) in a GIS environment measured the appropriateness of an area for a specific condition or use. For Creswell, it was used to identify locations attractive for growth and conservation (two separate LSA runs) based on known physical features or policies unique to the area. Physical features in and immediately surrounding the study area were layered over parcels in CommunityViz, and calculations performed to determine either percent overlap or proximity of features to individual parcels. A normalized scale (between 0 and 100) was used to rank the parcels from least to most suitable for future development and

least to most suitable for future conservation. Factors in the LSA could have a positive or negative correlation to desirability scores.

Factors are also weighted (using a scale of 0 – not important to 10 – most important) to put more or less significance on one factor compared to others in the calculations. A summary table of variables and weights for the LSA analyses in CommunityViz is included in the technical appendix. A composite map and contributing factor maps for the land suitability analyses – future development and future conservation – are also included in the technical appendix.

Growth Allocation

Growth forecasted for Creswell was allocated to parcels in the study area using the Allocator 5 Wizard in CommunityViz. The tool helped determine where growth would likely occur using a supply-and-demand approach and a series of probability-based algorithms internal to the software.

The allocation wizard also used a “randomness” factor of 2 (available settings range from 0 = strict order, follow LSA scores only to 10 = totally random, ignore LSA scores completely). This setting assumed a conservative amount of growth will locate in the study area irrespective of land suitability analysis scores. Information from previous steps in the modeling process — build-out potential analysis, land suitability analysis for future development, and growth control totals — were fed directly into the wizard for completing the allocation processes. Control totals for the twenty-year planning horizon – 2020 to 2040 – relied on socioeconomic data prepared by others.

Growth allocation data was summarized for five development categories: single-family residential, multifamily residential, service, industrial, and commercial. Results were saved in CommunityViz as individual columns in the parcel file.

Maps for the allocation of new dwelling units and new employees in the study area are included in the technical appendix.

Performance Measures

Performance measures were created to quantify the impacts and explain the differences between the alternative growth scenarios. Summary statistics for comparing the performance measures were created using CommunityViz software and the regional travel demand model. A list of the performance measures and their performance for the alternative growth scenarios is included in the technical appendix.

Rural Character Tier Model

Determining valuable elements of rural character in the Creswell area is a process of considering a multitude of factors in combination, namely: agricultural land use; the

presence of historic structures; characteristic landscape elements including forest, small ponds and weirs, and cropland or pasture which is integrated with preserved open space; viewsheds that maximize access to that characteristic landscape; and the cultural context of community usage of sites, areas, and properties. Thus, in order to determine the areas of Creswell which are of high rural character value, a composite index method seemed appropriate.

This index was a combination of evaluating individual parcels and applying a topographic and ecological overlay to those parcels which could be used by the CommunityViz suitability analysis to rank all portions of the map in an index from 1 (greatest rural character value) to 5 (not possessed of rural character value). Parcels were ranked by their land uses, land cover, and presence or absence of other distinguishing features, like integrated farmland and forest, historical sites, characteristic viewsheds, and ecotourism value. Parcels which contained more than one factor scored highest; parcels which were active farms scored higher than those which were merely zoned for agriculture; parcels which preserved tree cover while being otherwise developed scored higher than those that did not. Commercial development, large and small lot single family detached residential development, and institutional buildings without historical interest scored lowest.

Topographical and ecological factors were given a ranking of 1 for sites of significant green infrastructure, unique ecosystems, or Tier 2 streams; a ranking of 2 for the presence of any green infrastructure hubs or corridors, or other hydrological elements; and a ranking of 3 for any other area of preserved open space.

The combination of these two rankings created the rural character suitability analysis and revealed a 'preservation core' in which rural character is concentrated.

Conclusion

Using a fiscal impact, transportation, and land allocation model, the Framework Plan was able to identify and quantify the impacts of accommodating growth in Creswell. Using model impact analysis, The Framework Plan, despite permitting development in selected areas, is shown to still provide significant open space, agricultural and environmental quality, mitigate traffic, and generate positive fiscal revenues. These models, particularly the land use allocation model, will allow the county to implement the Framework Plan, monitor its progress and continue to test impacts of different policies, measures, and practices in the Creswell area.

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Avin has a 45-year career in the public and private sector and public sector, including serving as a former deputy director of planning in Harford County. His plans have been honored through 20 national or state awards. Noonkester's 25 years of experience also include public and private sector work across the U.S. He is

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