



**Policy Options for Managing Population  
Growth in Harford County, Maryland**

Capstone in Public Policy  
Department of Public Policy  
University of Maryland, Baltimore County  
June 2007

## **Advising Faculty:**

Donald F. Norris, Ph.D.  
*Professor of Public Policy*

John R. Short, Ph.D.  
*Professor of Public Policy*

## **Capstone Course Students:**

Dominic Cirincione  
Elyse Grossman  
Erin Hood  
Sarah Morris-Compton  
Nduku Ndumbu  
Evan Perlman  
D. Philip Shockley  
Daniel Smyth

## Acknowledgements

There were many individuals who generously provided us counsel throughout the course of writing this policy analysis. First, Professors Donald F. Norris and John R. Short led our weekly seminar class during the fall of 2006 through which this document was developed and provided countless hours of guidance. Second, Anne Roland worked with us on our writing technique and style as well as provided assistance during the revision process. Finally, we could not have done the proper analysis without the many dedicated professionals within Harford County government who furnished us the data we needed. A note of special thanks goes to Cristen Callon and Anne Gessner of the Harford County Budget Office, Don Morrison of Harford County Public Schools, Michael Novotney from the Center for Watershed Protection, Tom Patti from the Harford County Division of Water and Sewer, Daniel Rooney from the Harford County Department of Planning and Zoning, Jim Richardson of the Office of Economic Development, Bob Thomas from the Sheriff's Office, Diane Flint from the Harford County Volunteer Fire and Ambulance Foundation, Inc., Tom Schaeck of the Harford County Fire and EMS Association, Jane Eickoff of the Harford County Public Library, Bob Ernst of Harford County Recycling, Jerry Scanlan of the Harford County Disposal Center, Chris Skaggs of the Harford County Waste-to-Energy Facility, and Joseph Pfaff of the Harford County Parks and Recreation Department. We are indebted and offer thanks to all these individuals for their support of us and this project.

<i>Dom Cirincione</i>	<i>Elyse Grossman</i>
<i>Erin Hood</i>	<i>Sarah Morris-Compton</i>
<i>Nduku Ndumbu</i>	<i>Evan Perlman</i>
<i>Phil Shockley</i>	<i>Dan Smyth</i>

## Table of Contents

<b>Acknowledgements .....</b>	<b>iii</b>
<b>Table of Contents .....</b>	<b>iv</b>
<b>List of Tables and Figures.....</b>	<b>vi</b>
<b>Executive Summary .....</b>	<b>vii</b>
<b>Introduction.....</b>	<b>1</b>
<b>Purpose of Analysis.....</b>	<b>2</b>
<b>Impact of Maximum Growth on Infrastructure .....</b>	<b>3</b>
Roads and Highways.....	5
Public Water and Sewage Treatment .....	6
Solid Waste .....	8
Parks and Open Spaces .....	10
Recreation Facilities and Trails.....	10
Schools .....	11
Fire and Emergency Medical Services.....	12
Sheriff’s Deputies and Corrections .....	13
Library System .....	14
Summary of Infrastructure Elements .....	14
<b>Alternatives.....</b>	<b>15</b>
Alternative 1: Minimum Growth.....	15
Alternative 2: Moderate Growth .....	16
Alternative 3: Maximum Growth.....	16
Impact of Alternatives on Infrastructure .....	16
Alternative 1: Minimum Growth.....	17
Alternative 2: Moderate Growth .....	21
Alternative 3: Maximum Growth.....	25
Summary of Impact of Growth on Infrastructure.....	29
<b>Evaluation of Alternatives with Policy Criteria.....</b>	<b>31</b>
Description of Policy Criteria .....	31
Political Feasibility.....	31
Environment .....	32
Impact on Local Culture.....	33
Housing Affordability .....	33

Cost.....	34
Revenue.....	35
Evaluation of Policy Criteria.....	36
Alternative 1: Minimum Growth.....	36
Alternative 2: Moderate Growth.....	38
Alternative 3: Maximum Growth.....	40
<b>Recommendations.....</b>	<b>43</b>
<b>Appendix A. Context, Tables and Calculations for Schools.....</b>	<b>46</b>
<b>Appendix B. Water Usage Calculations and Context.....</b>	<b>51</b>
<b>Appendix C. Sewage Usage Calculations and Context.....</b>	<b>54</b>
<b>Appendix D. Solid Waste Management Calculations and Context.....</b>	<b>57</b>
<b>Appendix E. Fire and EMS Calculations and Context.....</b>	<b>59</b>
<b>Appendix F. Sheriff’s Deputies Calculations and Context.....</b>	<b>61</b>
<b>Appendix G. Library Services Calculations and Context.....</b>	<b>62</b>
<b>Appendix H. Recreational Facilities Calculations and Context.....</b>	<b>64</b>
<b>Appendix I. Parks and Open Spaces Calculations and Context.....</b>	<b>67</b>
<b>Appendix J. Cost Calculations.....</b>	<b>68</b>
<b>Appendix K. Revenue Calculations.....</b>	<b>73</b>
<b>Appendix L. Environment Calculations.....</b>	<b>75</b>

## List of Tables and Figures

<b>Table 1: Infrastructure Impacts .....</b>	<b>5</b>
<b>Table 2: Alternatives.....</b>	<b>15</b>
<b>Table 3: Alternative 1 Impacts .....</b>	<b>19</b>
<b>Table 4: Alternative 1 Impact on Schools.....</b>	<b>21</b>
<b>Table 5: Alternative 2 Impacts .....</b>	<b>23</b>
<b>Table 6: Alternative 2 Impact on Schools.....</b>	<b>24</b>
<b>Table 7: Alternative 3 Impact on Schools.....</b>	<b>27</b>
<b>Table 8: Infrastructure Capacity Impacts for Each Alternative.....</b>	<b>30</b>
<b>Table 9: Ratings of Alternatives by Policy Criteria.....</b>	<b>43</b>

# **Policy Options for Managing Growth in Harford County, Maryland**

## **Executive Summary**

UMBC public policy master's students prepared this analysis to examine the impact of expected population increases in Harford County due to growth stemming from the Base Realignment and Closure (BRAC) Commission's plans to reorganize U.S. military bases. The analysis looked at the impact of three levels of population growth on the county's infrastructure (water and sewage, solid waste, parks and open space, recreational facilities and trails, public schools, and libraries) and on staffing needs in schools, fire and EMS, sheriff's deputies and libraries. The analysis also examined each growth alternative in terms of political feasibility, cost, revenue and impacts on the environment, local culture, and housing affordability.

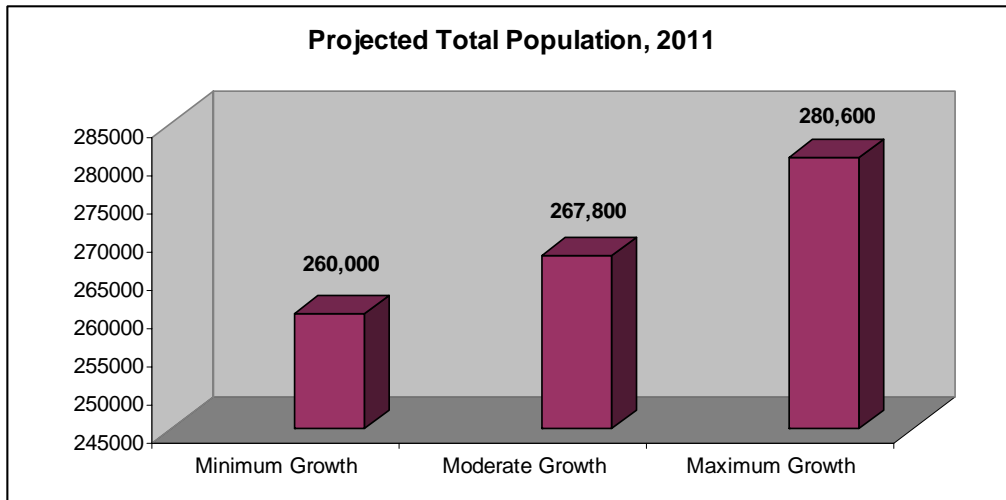
The study found that Harford County, Maryland schools will be significantly affected by BRAC-recommended base expansion at Aberdeen Proving Ground. If the full population increase expected from expansion of Aberdeen Proving Ground is allowed to settle in Harford County, county schools will experience severe overcrowding and a deficit in teachers, firefighter and EMS providers, sheriff's deputies and library staff and items.

Harford County officials believe that population growth expected by 2011, while advantageous for the economy, could strain elements of the public infrastructure. Total population in Harford County is expected to grow by 43,400 to 280,600 in 2011. Normal projected population growth in the county would add 19,800 people, while the Aberdeen Proving Ground base expansion would add 23,600 people. The study found deficits in the infrastructure required to accommodate this growth, including a shortage of 1,191 acres of parks, 5,500 school spaces, 343 teachers, 221 volunteer firefighters and EMS providers, 53 sheriff's deputies, 41 library staff members, and 184,480 library items such as books and CDs. School overcrowding

is particularly significant because the Harford County Zoning Code's Adequate Public Facilities Ordinance (APFO) restricts issuance of building permits in areas where schools are over capacity, placing further limitations on growth and development in the county.

After looking at growth alternatives, the study recommends that Harford County adopt a moderate growth plan that would limit population growth to 31,600 through 2011, including normal population growth, and one-half of the anticipated growth from the Aberdeen Proving Ground expansion (see Figure 1). Moderate growth will give the county time to plan, finance, and develop new schools, avoid APFO restrictions, and address other deficits that occur, while adhering to the county's commitment to accept some BRAC growth. Moderate growth also rates better in terms of environmental impacts, local culture and overall cost.

**Figure 1**



*Source: Table 2 – Alternatives, page 15.*

## Introduction

On November 9, 2005, Congress approved the recommendations of the Base Realignment and Closure (BRAC) Commission to reorganize America's military bases.<sup>1</sup> The Department of Defense (DOD) will close 22 major military bases and realign an additional 33 by September 15, 2011.

The Aberdeen Proving Ground (APG) in Harford County, Maryland is one of the military bases affected by the Commission's recommendations. APG currently houses 66 agencies, including the U.S. Army Corps of Engineers and the Chemical Materials Agency.<sup>2</sup> APG will expand to include at least six additional laboratories and four general officer's headquarters,<sup>3</sup> and will lose the Ordinance Center and the Army Environmental Center.

Prior to BRAC, projected Harford county population growth between 2006 and 2011 was about 19,800 new residents. This would have produced a total county population in 2011 of 257,000. The base expansion is estimated to increase the projected county population by an additional 23,600 residents, for a total population of 280,600 persons by 2011.<sup>4</sup> This projection excludes persons expected to fill new jobs at Aberdeen Proving Ground who may already live in the county or who already live outside of the county but within commuting distance of APG. It also excludes persons expected to move to the broader region to work at APG but who will live

---

<sup>1</sup> Miles, Donna. (2006, November 9). BRAC deadline expires; DOD to begin closures, realignments. American Forces Information Service. U.S. Department of Defense. Retrieved Nov. 22, 2006 from <[http://www.defenselink.mil/news/Nov2005/20051109\\_3280.html](http://www.defenselink.mil/news/Nov2005/20051109_3280.html)>

<sup>2</sup> APG tenants. (2006). Aberdeen Proving Ground, U.S. Army. Retrieved Nov. 22, 2006 from <<http://www.apg.army.mil/apghome/sites/tenants/tenants.asp>>

<sup>3</sup> Aberdeen Proving Ground. (2005). Headquarters, Dept. of the Army. Retrieved on Nov. 22, 2006 from <<http://www.hqda.army.mil/acsim/brac/StateInstallationBreakdown/MDAberdeenProvingGrounds.pdf>>

<sup>4</sup> Richardson, J. Director of the Harford County Office of Economic Development. Personal communication, September 2006.

outside of the county. Therefore, the only new people counted in our analysis are those who will actually be living in Harford County.

## **Purpose of Analysis**

In this study, we examine the impact of the expected population increase from both “normal” growth and BRAC-related growth (a total increase of about 43,000 persons) on Harford County's public infrastructure and selected staff.<sup>5</sup> Throughout the rest of our analysis we will refer to this as “total growth.” Harford County officials believe that the population growth expected by 2011, although advantageous for the economy, may strain at least some elements of public infrastructure. After the BRAC Commission officially announced its recommendation to expand APG, David R. Craig, Harford County Executive, remarked, “Our next step is to ensure that we are fully prepared for the influx of these new jobs and families that will call Harford home.”<sup>6</sup>

Public infrastructure is any physical asset provided by the government that helps with the functioning of society.<sup>7</sup> It can include buildings, facilities, goods, or resources. For this report, we are also examining some staffing issues, especially in areas where BRAC growth will produce a staffing shortfall. Below, we investigate the magnitude of the impact of total growth on the county's public infrastructure. We develop three alternatives to address this growth and

---

<sup>5</sup> We are not able to project needs for new offices, buildings or equipment; these are not accounted for in our discussion of infrastructure. Additionally, we are only addressing selected staffing needs – for instance, we address teachers and sheriff department staff, but not parks & recreation employees.

<sup>6</sup> Collins, Susan. (2005, August 25). Government, business, military's hard fought campaign pays off. Maryland ready website. Retrieved Oct. 5, 2006 from <[http://www.marylandready.com/downloads/pressreleases/oed\\_BRAC\\_CECOMMvote082505\\_2.pdf#search=%22Harford%20County%20BRAC%20infrastructure%20David%20Craig%22](http://www.marylandready.com/downloads/pressreleases/oed_BRAC_CECOMMvote082505_2.pdf#search=%22Harford%20County%20BRAC%20infrastructure%20David%20Craig%22)>

<sup>7</sup> Eberts, Robert. (1990). Public infrastructure and regional economic development. Economic Review. Quarter 1, Vol. 26, No.1. pp. 15-27.

evaluate the impacts of each alternative on Harford County’s public infrastructure. We then provide our recommendations on how the county can best manage this growth.

## **Impact of Maximum Growth on Infrastructure**

In this section we evaluate the capacity of nine elements of public infrastructure. This analysis is based three assumptions. First, the county will absorb the full population increase (43,418 persons) from “normal” and BRAC-related growth. Second, the county will desire to maintain at least current levels of services in each infrastructure area. Third, the current settlement pattern (i.e. 80 percent of Harford County residents living inside the Development Envelope and 20 percent living outside of it) will continue.<sup>8</sup> The Development Envelope is an area of Harford County that encompasses the three municipalities of Aberdeen, Bel Air, and Havre de Grace, and their surrounding suburbs.<sup>9</sup>

The elements of public infrastructure that we examine include: 1) roads and highways, 2) water and sewage, 3) solid waste, 4) parks and open space, 5) recreational facilities and trails, 6) public schools, and 7) libraries. We also examine the county’s needs for staffing in the following areas: schools, fire and EMS, sheriff’s deputies and libraries. Table 1 summarizes the impact of growth on each of these elements of infrastructure, which are then addressed in detail.

In this analysis, we used available information about the county’s current plans to add to its existing infrastructure. We reviewed plans for water facilities, public schools, and solid waste management. We are unaware of any formal county plans for roads, wastewater, fire and

---

<sup>8</sup> Harford County Department of Planning and Zoning. (2004). *Master Plan and Land Use Element Plan*. Harford County, Maryland, p. 14.

<sup>9</sup> The Harford County Department of Planning and Zoning, June, 2006 and Development Envelope Map.

EMS, sheriff's deputies, libraries, parks and open spaces, and recreation facilities and trails.<sup>10</sup>

Therefore, our projections for the latter group of infrastructure and staff elements may overestimate deficits in capacity.

---

<sup>10</sup> The Sheriff's Office has submitted a proposal to County Executive David Craig to add 210 deputies during the next five years. However, we do not include this number in our analysis because the county has not approved the proposal. Furthermore, according to Jane Eickhoff, Associate Director of the Harford County Public Library, funding is already available to double the size of the Whiteford branch from 7,000 square feet to 14,000 square feet and initial plans are underway to add another library in Churchville. The Harford County Public Library system also plans to increase staff and add materials over time as population increases. However, neither of these plans is factored into our capacity projections.

**Table 1: Infrastructure Impacts**

Public Infrastructure	Needed	Available	Surplus (Deficit)
<b>Facilities:</b>			
Water (MGD)	25.8	39.6	13.8
Sewage (MGD)	19.8	28.3	8.5
Solid Waste (tons)	339,300	634,061	295,536
Parks and Open Spaces (acres)	7,698.8	6,507.5	(1,191)
Recreation Facilities	572	684	112
Recreational Trails (miles)	29.3	27.6	(1.7)
Student Capacity	46,821	41,304	(5,517)
<b>Staff and Supplies:</b>			
School Teachers	2,931	2,588	(343)
Volunteer Firefighters & EMS Providers	1,312	1,109	(203)
Paid EMS Providers	108	90	(18)
Sheriff's Deputies	343	290	(53)
Library Staff	267	226	(41)
Library Items	1,192,177	1,007,697	(184,480)

Sources: Harford County Department of Public Works. (2006). *Harford County Water and Sewer Master Plan*. Harford County, Maryland and Harford County Land Preservation, Parks, and Recreation Plan for 2005

## Roads and Highways

Most residents in Harford County drive cars instead of using public transportation. Currently, the average Harford County household owns 1.92 vehicles, resulting in an estimated 167,400 vehicles in Harford County. By 2011, assuming that current vehicle-to-household ratios

remain constant, we project that the incoming households will bring an additional 30,500 vehicles to the County roads.<sup>11</sup> This represents an 18 percent increase in vehicles. Over 63 percent of those vehicles will be on the roads during daily commuting times, which will likely increase congestion.

Currently, the average commute time for Harford County residents is 31.7 minutes. This gives a rough estimate of the commuting conditions on the county's roads. Roads that are already exhibiting peak-hour congestion will become worse.<sup>12</sup> At a minimum, these roads include: 1) MD 24, beginning south of Main Street in Bel Air; 2) US 40 through Aberdeen; 3) I-95 near MD 24; 4) MD 22 between Aberdeen and Bel Air; and 5) MD 155 between Aberdeen/Havre de Grace and Bel Air. County-maintained roads that may be effected include: 1) Tollgate Rd, near MD 24; 2) Edgewood Rd, near MD 7; 3) Abingdon Rd, near MD 7; 4) Tollgate Rd, near US Business 1; and 5) Moore's Mill Rd, near US Business 1.

### **Public Water and Sewage Treatment**

Six water treatment plants provide water for 68 percent of the Harford County residents living in the Development Envelope.<sup>13</sup> Residents who do not receive water from these water treatment plants (including 32 percent of the residents living in the Development Envelope) receive it from either private wells or community water systems.<sup>14</sup> The water treatment plants

---

<sup>11</sup> U.S. Census Bureau. (2005). American FactFinder: Selected housing characteristics for Harford County, MD and MD. Retrieved on November 19, 2006 from [http://factfinder.census.gov/home/saff/main.html?\\_lang=en](http://factfinder.census.gov/home/saff/main.html?_lang=en)

<sup>12</sup> Maryland State Highway Administration. (2006). Harford County Traffic Map. Harford County, Maryland. Retrieved December 18, 2006 from <http://www.sha.state.md.us/SHAServices/mapsBrochures/maps/OPPE/tvmaps.asp>

<sup>13</sup> Harford County Department of Public Works. (2006). Harford County Water and Sewer Master Plan. Harford County, Maryland, Table 3-2, p. 3-93.

<sup>14</sup> *Ibid.*, p. 3-20.

also provide water for industrial use. In 2005, total water consumption in Harford County was approximately 16.6 million gallons per day (MGD).<sup>15</sup>

In 2011, we project that the water treatment plants will need to provide water for 196,000 residents. Since we cannot predict where new residents will live, we assume that all new residents to the Development Envelope (i.e. 80 percent of the total incoming population) will receive public water. The county estimates that residents consume an average of 110 gallons of water per day.<sup>16</sup> Therefore, we estimate that residential water consumption in 2011 will be 21.6 MGD. The county expects industries to have an average peak consumption of at least 4.25 MGD.<sup>17</sup> Thus, we project the total water consumption for the county in 2011 will be 25.8 MGD.

Currently, the total capacity of all the water treatment plants in Harford County is 29.6 MGD. The county plans to expand the capacity of one of its water treatment plants, making the combined capacity of all six plants equal to 39.6 MGD by 2011.<sup>18</sup> Thus, the demand for water in 2011 should not exceed the capacity of the county's water treatment plants.<sup>19</sup>

Five sewage treatment plants handle sewage for 61 percent of the residents living in the Development Envelope.<sup>20</sup> The remaining residents (including 39 percent of the persons living inside the Development Envelope) use private sewage systems or septic tanks.<sup>21</sup> The county's sewage treatment plants also handle wastewater from industries, as well as rain and ground water

---

<sup>15</sup>Ibid., Table 3-2, p. 3-93.

<sup>16</sup> The Water and Sewer Master Plan estimates that residents used 105 gallons per day in 2005 and project that residents will use 110 gallons per day in 2010.

<sup>17</sup> Harford County Department of Public Works. (2006). *Harford County Water and Sewer Master Plan*. Harford County, Maryland, Table 3-2, p. 3-93.

<sup>18</sup> Ibid., p. 3-27.

<sup>19</sup> County Executive David Craig has indicated that there are plans to increase capacity to 50 MGD.

<sup>20</sup> Harford County Department of Public Works. (2006). Harford County Water and Sewer Master Plan. Harford County, Maryland, Table 4-1, p. 4-33.

<sup>21</sup>Ibid., p. 4-10, p. 4-27.

that drains into the sewer system.<sup>22</sup> In 2005, the sewage treatment plants treated about 16.8 MGD.

As with water treatment plants, we cannot predict where new residents will live. Thus, we assume that the sewage treatment plants will treat water for all new residents to the Development Envelope (i.e. 80 percent of the total incoming population). We project that in 2011 the sewage treatment plants will have to treat sewage for 178,500 residents. The county estimates that each person produces an average of 90 gallons of wastewater per day.<sup>23</sup> This will produce an estimated total of 16.1 MGD of sewage in 2011. The county also estimates that industrial flow and infiltration/inflow will total 1 MGD and 2.69 MGD, respectively.<sup>24</sup> Therefore, we estimate that the county's sewage treatment plants will have to treat 19.8 MGD in 2011.

The total capacity of all the sewage treatment plants in Harford County is currently 28.3 MGD. Considering the population growth expected from natural growth and from BRAC, the amount of sewage that the county's sewage treatment plants will have to treat in 2011 (19.8 MGD) will not exceed the capacity of the sewage treatment plants.

## **Solid Waste**

The county government manages the disposal of residential waste, commercial waste, and used tires.<sup>25</sup> Solid waste goes to the Harford Waste Disposal Center (landfill), is burned in the Harford Waste-to-Energy Facility, or is recycled. Other types of solid waste, including cars,

---

<sup>22</sup> Ibid., p. 4-21.

<sup>23</sup> We do not know where within the Development Envelope that new residents will live. Therefore, we use the average amount of sewage produced by residents in the Harford County service area.

<sup>24</sup> Industrial flow is sewage generated by industries. Infiltration flow is rainwater that enters the sewage system.

<sup>25</sup> Harford County Department of Public Works. (2004). *Harford County Solid Waste Management Plan*. Harford County, Maryland, p. 3-1 to 3-17.

asbestos, and medical waste, are managed by private companies, nearby counties, or the State of Maryland.

The county estimates that each resident generates an average of 3.43 pounds of waste per day.<sup>26</sup> Currently, total residential waste is about 148,500 tons per year. By 2011, we estimate that residents will produce approximately 176,000 tons of waste per year. The county estimates that there will be at least 159,000 tons of commercial waste and 4,300 tons of used tires.<sup>27</sup> Therefore, in 2011, we estimate that the county will have to manage about 339,300 tons of total solid waste, a 20 percent increase from 2005.

The county estimates that in 2011 the landfill will be able to accept 271,000 tons of solid waste.<sup>28</sup> This estimate accounts for planned expansions. Also, the county estimates that the waste-to-energy facility, with its planned expansion, will have the capacity to burn 208,000 tons of solid waste, and the county's recycling program will be able to recycle 156,000 tons.<sup>29</sup> With these expansions the county will have the capacity to handle a total of 634,000 tons of solid waste in 2011. Therefore, the projected amount of solid waste in 2011 will not exceed the county's capacity to manage solid waste.

---

<sup>26</sup> Ibid., p. 3-6.

<sup>27</sup> The Solid Waste Management Plan made these projections before BRAC. Furthermore, our estimates for trash production for each alternative (outlined in the following section) are conservative because they assume no BRAC-related increase in commercial waste.

<sup>28</sup> Ibid., Table 5-1, p. 5-3. We converted the estimate of the Solid Waste Management Plan for the capacity of HWDC at the end of 2010 from cubic yards to tons. This gave us HWDC's capacity for 2011.

<sup>29</sup> According to Chris Skaggs, Deputy Director of HWTEF, the facility will expand its capacity by 240 tons per day by 2011. This translates to 87,600 tons per year. Thus, HWTEF will increase its current capacity of 120,000 tons of waste per year to 207,500 tons. Furthermore, the Solid Waste Management Plan projects that in 2011 residents in the county will choose to recycle 46 percent of the waste stream for residential waste, commercial waste, and used tires. This projection excludes the recycling of ash from HWTEF. Forty-six percent of the 338,525 tons of total waste is 155,722 tons.

## **Parks and Open Spaces**

Harford County currently has about 6,500 acres of parks and open space or 27.7 acres per 1,000 residents.<sup>30</sup> The Maryland Department of Natural Resources, through Program Open Space, suggests that the state's counties have at least 30 acres of parks and open space per 1,000 residents. To maintain the current number of acres per resident, the county will need to acquire 1,200 more acres by 2011 of parks and open space.

## **Recreation Facilities and Trails**

Harford County has 684 recreation facilities and about 28 miles of trails.<sup>31</sup> Recreation facilities include: a) softball and baseball diamonds; b) football, field hockey, soccer and lacrosse fields; c) basketball courts; d) tennis courts; e) golf courses; f) swimming pools; g) playgrounds; and h) boating ramps.

To maintain the current levels of service, the Harford County Parks and Recreation Department will need a total of 572 recreation facilities in 2011. The current number of facilities (684) is greater than the population-driven demand (572) that will occur in 2011. This overall figure, however, masks deficits for certain types of facilities. In order to maintain current levels of service, the county will need 26 more softball/baseball diamonds, one more tennis court, three more golf courses, two more boating ramps, and 1.7 more miles of trails. Thus, while overall the number of recreation facilities is adequate for the expected population, deficits will occur among certain types of facilities and miles of trails.

---

<sup>30</sup> Harford County Parks and Recreation Department. (2005). *Harford County Land Preservation, Parks, and Recreation Plan*. Harford County, MD, Table 3.4.

<sup>31</sup> *Ibid.*, Table 3.5.

## Schools

The Harford County Public School System (HCPS) is comprised of 33 elementary schools, nine middle schools, and ten high schools.<sup>32</sup> Approximately 40,000 students attend these schools. The Development Envelope contains about 33,000 of these 40,000 students.<sup>33</sup>

Currently, 16 of 32 elementary schools, three of eight middle schools, and six of nine high schools are overcrowded, based on state standards. That is, they have enrollments that are greater than 110 percent of capacity. HCPS has struggled with school over-crowding for several years. The county has adopted three policies to address public concerns related to overcrowding.

First, the Harford County Zoning Code restricts the issuance of building permits in areas where schools are “overcapacity.” The Adequate Public Facilities Ordinance requires HCPS to report twice a year on current and projected school capacity.<sup>34</sup> Under this ordinance, by 2009, a school will be considered overcrowded when it exceeds 110 percent of capacity, or its three year projections exceed that capacity.<sup>35</sup> In such a case, the Office of Planning and Zoning will not issue residential permits for building projects exceeding five housing units or lots in the school’s attendance area.<sup>36</sup>

Second, the school board approved a redistricting plan in 2006 to shift the student population toward schools with excess capacity.

---

<sup>32</sup> The John Archer School and Harford Tech High School serves student populations that require special services and accept students from throughout the county. Therefore, they are not included in our capacity tables for the 80/20 split or our appendix which lists schools inside and outside of the Development Envelope. This results in greater overall capacity when the county’s elementary and high school capacities are totaled.

<sup>33</sup> Harford County Public Schools. (2006) School statistics.

<http://www.hcps.org/>

<sup>34</sup> Harford County Department of Planning and Zoning. (2006). *Zoning Code*. Harford County, Maryland.

<sup>35</sup> This threshold is currently 105 percent, but was amended such that from 2009 on, 110 percent of capacity will be used to determine when issuance of new residential permits should be limited. For the purpose of this analysis, we use this similar threshold in our discussion of school capacity unless otherwise stated.

<sup>36</sup> Currently there are no restrictions on the number of permits issued for units under five housing units under the Adequate Public Facilities Ordinance.

Third, HCPS has two construction projects underway and three that are proposed but not yet funded.<sup>37</sup> It is important to note however that HCPS has not thus far included BRAC-related growth in its strategic planning for enrollment and school capacity.

Including BRAC-related population growth, we estimate that a total of 46,800 pupils will attend school in Harford County in 2011. (See Appendix A for detailed calculations). Assuming that HCPS funds and completes its aggressive plans for six major construction projects by 2011, HCPS will still be over capacity by 5,517 students, and will require space for nearly 1387 students just to get below the 110% - of- capacity threshold.<sup>38</sup> This additional student population will require both new school space and more teachers.

### **Fire and Emergency Medical Services**

Twelve volunteer fire and emergency medical service (EMS) companies currently serve county residents.<sup>39</sup> There are 1,100 active fire and EMS volunteers, or 4.7 volunteers per 1,000 residents. To maintain this current ratio, the county will require 1,300 fire and EMS volunteers. This will leave the county with a deficit of 200 volunteers.

The Harford County Volunteer Fire and Ambulance Foundation, Inc. funds an additional 90 paid EMS providers primarily to serve residents in the Development Envelope.<sup>40</sup> This means

---

<sup>37</sup> Funded projects include Patterson Mill Middle School/High School and an addition to N. Harford HS. Additional projects that have been submitted to the county executive but not yet funded include; a Bel Air High School addition which would increase capacity by 137 spaces by 2009, an Edgewood High School addition which would increase capacity by 221 spaces by 2010, and an Aberdeen High School addition that would increase capacity by 300 students by 2009. There is also a plan for an elementary school north of Bel Air with capacity for 600-750 students, but this is also currently unfunded.

<sup>38</sup> This is based on total capacity of all schools for illustrative purposes. In reality, capacity problems will be spread unevenly across the county resulting in restrictions on building in some areas and not others. This calculation is based on calculating 110 percent of planned capacity (45,434) and subtracting from projected enrollment associated with BRAC-related and current population growth.

<sup>39</sup> T. Schaech. President of the Harford County Fire and EMS Association. Personal communication. October 16, 2006.

<sup>40</sup> David Flint. Operations Manager for the Harford County Volunteer Fire and Ambulance Foundation, Inc. Personal communication. October 18, 2006. Several paid EMS providers do rotate from areas in the Development Envelope and serve residents in Fallston, an area outside of the Development Envelope. Nevertheless, D. Flint says

that there are 0.53 paid EMS providers per 1,000 residents in the Development Envelope. To maintain this current ratio, the county will require 108 paid EMS providers. This will leave the county with a deficit of 18 paid providers

### **Sheriff's Deputies and Corrections**

The Harford County Sheriff's Office currently has 290 authorized deputies.<sup>41</sup> This means that there are 1.2 authorized deputies per 1,000 residents.<sup>42</sup> The county will require an additional 53 deputies in 2011 to maintain this ratio.<sup>43</sup>

The Detention Center currently employs 143 personnel, and has 460 beds.<sup>44</sup> The average daily population, as of March 2007, was 427 inmates.<sup>45</sup> This means that there is one staff member for every 1,659 residents, and one occupied bed for every 556 residents. In order to preserve this ratio by 2011, the County will need to add, at a minimum, 26 personnel and 44 beds.

---

that, for purposes of our analysis, we should assume that the number of paid EMS providers will increase relative to the population increase in the Development Envelope.

<sup>41</sup> This number includes 27 currently vacant positions.

<sup>42</sup> Robert B. Thomas. Public Information Officer for the Harford County Sheriff's Office. Personal communication. October 12, 2006.

<sup>43</sup> The Sheriff's Office has submitted a proposal to County Executive David Craig to add 210 deputies during the next five years. However, because the county has not approved the proposal, we do not include this number in our analysis.

<sup>44</sup> Correctional Services Bureau Website: <http://www.harfordsheriff.org/CORRSVC.HTM>

<sup>45</sup> Phone conversation with Capt. Jackson of Correctional Services, April 10 2007

## **Library System**

The Harford County library system has 11 branches and 226 full time staff members (0.95 full time staff members per 1,000 residents).<sup>46</sup> The branches contain about 1,007,696 items, or 4,300 items per 1,000 residents.<sup>47</sup> Items include books, magazines, DVDs, tapes, etc. The county will require an additional 41 staff members and about 184,000 items to maintain the current ratios of staff members and items to residents.

## **Summary of Infrastructure Elements**

In this section we examined the current capacities of each element of infrastructure and projected capacities for 2011. Roads and highways in Harford County have areas of congestion and population growth will bring more cars and cause increased congestion. Capacities for public water and sewage treatment, as well as for solid waste management, will be adequate for the projected 2011 population. Park and open spaces will have a deficit in acres of parks and open space per resident, and recreation facilities and trails will be adequate in some areas and have deficits in others.

Harford County Public Schools will be over the 110% of capacity mark by nearly 1,400 students and will need to hire more teachers to meet the needs of the projected 2011 population. There will be deficits in fire and emergency medical services personnel, sheriff's deputies, and library staff and library items. We now present our alternatives for managing the projected growth in Harford County.

---

<sup>46</sup> Branches and hours. Harford County Public Library. Retrieved Nov. 22, 2006 from <<http://www.hcplonline.info/services/brancheshours.html>>

<sup>47</sup> Harford County Public Library. (2004). Annual report. Harford County, Maryland.

## Alternatives

In addition to the Maximum Growth Alternative, we developed two other alternatives to determine the impact of various growth levels on the county’s public infrastructure. The first alternative uses local zoning to limit growth to the estimated amount that would occur without the effect of BRAC, plus a small fraction of additional growth. The second alternative provides a midpoint, limiting growth less severely than Alternative 1 (see Table 2).

As mentioned earlier, the pattern of development over the past 25 years in Harford County has resulted in about 80 percent of residential development occurring within the Development Envelope, while 20 percent has occurred outside of it. Our alternatives assume that this pattern will continue.

**Table 2: Alternatives**

Alternatives	New Residents into Harford County By 2011			Total residents in county by 2011
	Total	Inside DE (80%)	Outside DE (20%)	
1. Minimum Growth	23,800	19,000	4,800	260,000
2. Moderate Growth	31,600	25,200	6,300	267,800
3. Maximum Growth	43,400	34,700	8,700	280,600

\* All numbers are rounded

### **Alternative 1: Minimum Growth**

This alternative assumes that nearly no BRAC-related growth is permitted, and would impose the greatest limit on population growth in the county. The County had projected growth to be 19,800 by 2011, but we felt that it is unreasonable to propose a complete ban on BRAC growth. Therefore, for Alternative 1, we based the population projections on historical growth

trends, which yield a higher projection. In 2005, Harford County had 237,000 residents. The county has previously projected a 2010 population of around 257,000, or an increase of 20,000 new residents.<sup>48</sup> Over the last 15 years, roughly 4,000 persons have moved into the county on average per year. Using this average growth figure, we project that the county will see 23,800 new residents by 2011. This will produce a total population of 260,000 residents. This is the estimated amount of growth that would occur without the effect of BRAC.

### **Alternative 2: Moderate Growth**

This alternative allows the full amount of normal growth (based on the County's projection of 19,800 people), plus approximately half of the BRAC-related growth (11,800) to occur by 2011. This alternative would produce a total population growth of 31,600 and a total county population of 267,800.

### **Alternative 3: Maximum Growth**

This alternative would place no limits on population growth and would allow the total growth (43,400 persons) to occur by 2011.

---

<sup>48</sup> Harford County Department of Planning and Zoning. (2006). Harford County Demographic Data and Growth Trends. Harford County, Maryland.

## **Impact of Alternatives on Infrastructure**

In the following section, we describe the impacts of the growth projections from all three alternatives on the county's principal elements of public infrastructure. Unless otherwise noted, we assume that current (2006) ratios or levels of service for public infrastructure will remain constant for 2011.

Regarding roads, our projections are based on the assumption that Harford County households use, on average, 1.2 cars for commuting to and from work.<sup>49</sup> We further assume that restricting population growth will result in the excess population settling in surrounding areas and commuting to Harford County for work. This is also expected to contribute to congestion. More sophisticated projections are beyond the scope of this analysis because 2011 traffic patterns are dependent on where the population settles and where they work, both of which are unclear.

We are able to estimate how many vehicles will be on the road. However, we do not know whether any of the alternatives will produce unacceptable levels of congestion and as this is a matter of individual judgment. That is, some levels of congestion are inconvenient to some persons but unacceptable to others. We do know that more vehicles on the roadways will increase congestion.

Table 9 at the end of this section provides a matrix to summarize our findings.

### **Alternative 1: Minimum Growth**

This alternative would limit population growth in Harford County to 23,800 new residents over the next five years, resulting in a total of 260,000 persons living in Harford

---

<sup>49</sup> U.S. Census Bureau. (2005) American FactFinder: Selected Housing Characteristics for Harford County, MD and MD. Retrieved on November 19,2006 from <[http://factfinder.census.gov/home/saff/main.html?\\_lang=en](http://factfinder.census.gov/home/saff/main.html?_lang=en)>

County by 2011. We discuss the impact of this alternative on each element of infrastructure below (see also Table 3).

*Roads and Highways.* The Minimum Growth alternative should generate the least impact on roads of the three alternatives. We estimate that it will allow 16,700 new cars into the county, or an increase of 10 percent, of which we project that 10,500 will be used for daily commuting. However, people working in Harford but living outside the county will drive on county roads. These persons will introduce approximately 9,000 more vehicles to the county during peak commute hours.

*Water and Sewage.* Growth from this alternative should not adversely impact Harford County's water or sewage capacity. We project that there should be a surplus water capacity of 15.5 MGD and a surplus sewer capacity of 9.9 MGD.<sup>50</sup>

*Solid Waste.* This alternative should not adversely affect Harford County's solid waste capacity. We project that there should be a surplus solid waste capacity in 2011 of 302,200 tons.

---

<sup>50</sup> We estimate total projected capacity based on Harford County's own Spring 2006 Master Plan; we consider only total capacity, and not components of that (such as hydraulic capacity).

**Table 3: Alternative 1 Impacts**

Public Infrastructure	Needed	Available	Surplus/Deficit
<b>Facilities:</b>			
Water (MGD)	24.1	39.6	15.5
Sewage (MGD)	18.3	28.3	9.9
Solid Waste (tons)	326,235	628,397	302,162
Parks and Open Spaces (acres)	7,229	6,508	(721)
Recreation Facilities	533	684	151
Recreational Trails (miles)	27	27.6	.06
Student Capacity	43,546	41,304	(2,242)
<b>Staff and Supplies:</b>			
School Teachers	2,813	2,588	(225)
Volunteer Firefighters & EMS Providers	1,220	1,109	(111)
Paid EMS Providers	100	90	(10)
Sheriff's Deputies	319	290	(29)
Library Staff	249	226	(23)
Library Items	1,108,697	1,007,697	(101,000)

Sources: Harford County Department of Public Works. (2006). *Harford County Water and Sewer Master Plan*. Harford County, Maryland and Harford County Land Preservation, Parks, and Recreation Plan for 2005

*Parks and Open Spaces.* To maintain the ratio of 27.7 acres per 1,000 residents, Harford County will require 721 new acres of parks and open spaces.

*Recreation Facilities.* Under this alternative, we estimate that the county could need an additional 12 softball/baseball diamonds, two golf courses, and one boating ramp. The remaining facilities should be adequate.

*Schools.* The addition of 23,800 new Harford County residents should produce approximately 3,600 new students into the public schools. Elementary schools should be at approximately 112 percent of capacity, indicating a modest space deficiency.<sup>51</sup> To maintain the current student teacher ratio (16:1), the county will need to hire 225 new teachers.<sup>52</sup>

Under this alternative, we project that all schools inside of the Development Envelope would be under maximum capacity (see Table 4). However, we also project that all schools outside of the Development Envelope would be over maximum capacity, some significantly. Even if the county funds the proposed construction projects (658 spaces county-wide), schools outside of the development envelope would still be over capacity.

*Fire and EMS.* To maintain the ratio of 4.7 active volunteers per 1,000 residents, Harford County will require an additional 111 volunteers. To maintain the ratio of 0.53 paid EMS providers per 1,000 persons in the Development Envelope, the county will require an additional 10 paid EMS providers.

*Sheriff's Deputies.* To maintain the ratio of 1.2 deputies per 1,000 residents, Harford County will require 29 additional deputy sheriffs.<sup>53</sup>

---

<sup>51</sup> As noted previously, our projections for elementary school populations may overestimate the population as they are based on 2005 enrollment. Since 2005 elementary school enrollment has decreased.

<sup>52</sup> Based on current student: teacher ratio from Harford County Public School District information website. <http://www.homes101.net/pa-schools/harford-county-public-schools-d2980/>

<sup>53</sup> County Executive David Craig told us that the county projected needing 60 additional deputy sheriffs.

**Table 4: Alternative 1 Impact on Schools**

School type	Projected Capacity (N)	Projected enrollment (N)	Percent Capacity (%)
Elementary School			
Inside D.E.	14,783	16,023	108%
Outside D.E.	3,068	4,006	131%
Middle School			
Inside D.E.	9,596	8,079	84%
Outside D.E.	1,116	2,020	181%
High School*			
Inside D.E.	10,292	10,734	104%
Outside D.E.	1,529	2,684	176%
Total*			
Inside D.E.	34,671	34,836	100%
Outside D.E.	5,713	8,710	152%

\* Does not include Harford Tech High School, which draws from the whole county

*Libraries.* Under this alternative, Harford County will require 23 additional staff members and 101,000 new library items to maintain current ratios.

This alternative has the least impact of all three alternatives on elements of public infrastructure. This is because the growth allowed under this alternative is similar to Harford County’s “normal” growth trends. Water, sewer and solid waste are adequate under Alternative 1, as they are under all three alternatives. With a few exceptions, recreation facilities and trails will also have adequate capacity with Alternative 1.

The number of volunteer firefighters and EMS providers, paid EMS providers, and deputies will have deficits, although they are not significant. The areas that are most affected by this alternative are schools outside of the Development Envelope and library items.

**Alternative 2: Moderate Growth**

This alternative will limit population growth in Harford County to 31,600 new residents over the next five years, resulting in a total of 267,800 persons living in Harford County by 2011.

We discuss the impact of this alternative on each element of infrastructure below (see also Table 5).

*Roads and Highways.* This alternative will allow 23,600 new cars into the county, or an increase of 14 percent, of which we project that 14,800 will be used for daily commuting. Residents of other counties who commute to jobs in Harford will bring in about 4,000 more vehicles during peak commute hours. This will be more vehicles than under Alternative 1 but fewer than under Alternative 3.

*Water and Sewage.* Growth from this alternative will not adversely impact Harford County's water or sewage capacity. We project a surplus water capacity of 14.8 MGD and a surplus sewer capacity of 9.3 MGD in 2011.

*Solid Waste.* This should not adversely affect Harford County's solid waste capacity. We project that there will be a surplus solid waste capacity of 300,701 tons in 2011.

*Parks and Open Spaces.* Under this alternative, Harford County will require 932 new acres of parks and open spaces.

*Recreation Facilities.* Under this alternative, we estimate that the county will need 18 softball/baseball diamonds, two golf courses, two boating ramps, and 0.2 miles of trails. The remaining facilities should be adequate to meet demand.

*Schools.* We estimate that this alternative will produce approximately 5,200 new students into the public schools. This will bring total student population to 45,184, or 3,880 over capacity. This will, however, be under the 110% capacity mark by 250 students. To maintain the current student teacher ratio (16:1), the county will need to hire an additional 327 teachers.

**Table 5: Alternative 2 Impacts**

Public Infrastructure	Needed	Available	Surplus/Deficit
<b>Facilities:</b>			
Water (MGD)	24.8	39.6	14.8
Sewage (MGD)	18.9	28.2	9.3
Solid Waste (tons)	330,523	631,224	300,701
Parks and Open Spaces (acres)	7,440	6,508	(932)
Recreation Facilities	547	684	137
Recreational Trails (miles)	27.8	27.6	(0.2)
Student Capacity	45,184	41,304	(3,880)
<b>Staff and Supplies:</b>			
School Teachers	2,915	2,588	(327)
Volunteer Firefighters & EMS Providers	1,256	1,109	(147)
Paid EMS Providers	114	90	(24)
Sheriff's Deputies	331	290	(41)
Library Staff	256	226	(30)
Library Items	1,142,111	1,007,697	(134,414)

Sources: Harford County Department of Public Works. (2006). *Harford County Water and Sewer Master Plan*. Harford County, Maryland and Harford County Land Preservation, Parks, and Recreation Plan for 2005

Under this alternative, we project that elementary schools inside of the Development Envelope will be over maximum capacity. The middle schools and high schools inside of the Development Envelope will not be over capacity under Alternative 2 (see Table 6). We further project that all schools outside of the Development Envelope will be over maximum capacity, some significantly. However, if all currently proposed high school construction projects are funded (658 spaces county-wide), capacity should be less of an issue in grades 9 through 12.<sup>54</sup>

Under Alternative 2, with no additional planning, some elementary and middle schools will be overcrowded and the Office of Planning and Zoning would be legally required to restrict housing permits in those areas of the county.

**Table 6: Alternative 2 Impact on Schools**

School type	Projected Capacity (N)	Projected enrollment (N)	Percent Capacity (%)
Elementary School			
Inside D.E.	14,783	16,626	112%
Outside D.E.	3,068	4,156	135%
Middle School			
Inside D.E.	9,596	8,383	87%
Outside D.E.	1,116	2,096	188%
High School			
Inside D.E.	10,292	11,138	108%
Outside D.E.	1,529	2,785	182%
Total			
Inside D.E.	34,671	36,147	104%
Outside D.E.	5,713	9,037	158%

*Fire and EMS.* Under this alternative, Harford County should require an additional 147 volunteers and 24 paid EMS providers.

<sup>54</sup> In addition, some high school students outside the Development Envelope will attend Harford Tech (965 spaces-county-wide).

*Sheriff's Deputies.* Under this alternative, Harford County will require 41 additional deputy sheriffs.

*Libraries.* Under this alternative, Harford County will require 30 additional staff members and 134,414 new library items.

Permitting some BRAC-related growth will affect certain elements of infrastructure more than the no growth of Alternative 1, but less than full growth in Alternative 3. Roads and highways will continue to experience increased congestion as the numbers of residents and commuters place more vehicles on the roadways, especially at peak times. Water, sewer, and solid waste are adequate under all alternatives. Unlike Alternative 1, however, there will be some strains on recreation facilities, ball fields in particular. The county would also experience deficits in volunteer firefighters and EMS providers, paid EMS providers, and deputy sheriffs, as well as library staff and items.

The infrastructure element that is most affected by Alternative 2 is schools. Schools outside of the development envelope will be significantly over capacity and a few elementary schools inside of the development envelope will reach the 110 percent capacity mark. This will require the Department of Planning and Zoning to restrict building permits in those school's attendance areas.

### **Alternative 3: Maximum Growth**

This alternative will allow a total population growth in Harford County of 43,400 new residents over the next five years, resulting in a total of 280,600 persons living in the county by

2011. The section, “Impact of Maximum Growth on Infrastructure” starting on page 3 provided a detailed analysis of the impact of Maximum Growth on the county’s infrastructure, with the impacts summarized in Table 1. We discuss the findings again here briefly.

*Roads and Highways.* This alternative should have the most negative impacts on roads. We project this will allow 30,900 new cars into the county, an increase of 18 percent, of which 19,300 will be used for daily commuting. This alternative assumes that the majority of people working at new jobs in the county will also reside in Harford, and so there should not be a significant number of new commuters from outside the county.

*Water and Sewage.* Growth from this alternative will not adversely impact Harford County’s water or sewage capacity. We project a surplus water capacity of 13.8 MGD and a surplus sewer capacity of 8.5 MGD.

*Solid Waste.* This will not adversely affect Harford County’s solid waste capacity. We project a surplus solid waste capacity of 295,500 tons.

*Parks and Open Spaces.* Under this alternative, Harford County will require almost 1,200 new acres of parks and open space.

*Recreation Facilities.* Under this alternative, we estimate that the county will need an additional 26 softball/baseball diamonds, one tennis court, three golf courses, two boating ramps, and 1.7 miles of additional trails. The remaining facilities should be adequate to meet demand.

*Schools.* We estimate that the addition of 43,400 new Harford County residents will bring approximately 6,900 new students into the Public School System. To maintain the current student teacher ratio (16:1), the county will need to hire an additional 430 teachers.

Under this alternative, we project that all elementary schools and high schools inside of the Development Envelope will be over maximum capacity (see Table 7). Without restrictions on this growth, by 2011 they should reach 117 percent and 112 percent of capacity, respectively. If we add in the capacity associated with proposed (not funded) construction, some of the high schools overcrowding will be alleviated by bringing capacities back down below 110 percent of capacity.

**Table 7: Alternative 3 Impact on Schools**

School type	Projected Capacity (N)	Projected enrollment (N)	Percent Capacity (%)
Elementary School			
Inside D.E.	14,783	17,229	117%
Outside D.E.	3,068	4,307	140%
Middle School			
Inside D.E.	9,596	8,686	91%
Outside D.E.	1,116	2,172	195%
High School*			
Inside D.E.	10,292	11,542	112%
Outside D.E.	1,529	2,885	189%
Total*			
Inside D.E.	34,671	37,457	108%
Outside D.E.	5,713	9,364	164%

\*Does not include Harford Tech High School, which draws from the whole county

We also project that all schools located outside of the Development Envelope will be severely over maximum capacity. Regardless of attendance area, elementary schools should be over maximum capacity throughout much of the county.

The Maximum Growth Alternative would cause the county to be approximately 1,400 students over the 110 percent capacity threshold used under the Adequate Public Facilities

Ordinance. This would require the Department of Planning and Zoning to enforce permit restrictions in the attendance areas of schools where the overcapacity exists. Some of the areas affected will include key areas within the Development Envelope.

By limiting the areas where new residents can build inside of the Development Envelope, school overcrowding under Alternative 3 may indirectly change the 80/20 development trend in Harford County. As new development is directed to areas of the Development Envelope, schools may be pushed beyond capacity. Additionally, the option to redirect development to areas outside of the Development Envelope may exacerbate the overcrowding in schools outside of the Envelope.

*Fire and EMS.* Under this alternative Harford County would require 203 volunteers and 18 paid EMS providers.

*Sheriff's Deputies.* Under this alternative, Harford County will require 53 additional deputy sheriffs.

*Libraries.* Under this alternative, Harford County will require 41 additional staff members and 184,500 new library items.

Roads and highways will be the most negatively impacted by this alternative because it allows the greatest number of people and, therefore, the greatest number of cars into the county. This will create the greatest amount of additional congestion. While Alternative 2 creates deficits in some recreation facilities and trails, these deficits become even more pronounced under this alternative. The deficits in volunteer firefighters and EMS providers, paid EMS providers, deputy sheriffs, library staff and items also increase under this alternative.

Schools are the most impacted by this alternative. All elementary schools inside of the development envelope will be over capacity as well as some high schools. All school levels

outside of the Development Envelope will be significantly over capacity. Middle schools inside of the development envelope will not be over capacity. Inside of the Development Envelope, the capacities of elementary schools in particular, but some high schools as well, will require the Department of Planning and Zoning to restrict building permits in a number of areas. Building permits will be restricted in the attendance areas of the overcapacity schools. The number of areas where permits will be restricted not only increases compared to Alternative 2, but restricts residential development in a number of areas within the development envelope. This increased restriction is significant in its effect on the 80/20 development trend.

### **Summary of Impact of Growth on Infrastructure**

Table 8 summarizes the impact of the growth assumed under the alternatives on each element of public infrastructure in Harford County. Specifically, the table shows whether an infrastructure element is adequate or not for the amount of growth under each alternative. We rate the impact of the alternatives on each element of infrastructure with a “Y” (for yes, adequate) or an “N” (for no, inadequate).

As mentioned earlier, we do not know what level of traffic will produce levels of congestion that county residents will believe are unacceptable. We do know that Alternative 1 will increase congestion the least, and Alternative 3 will increase congestion the most.

In our estimates, we compare the impacts of growth to current levels of service and staffing, assuming that the county does nothing beyond plans it has already developed (e.g., water, solid waste and schools). We know that local governments expand facilities and services over time as a result of demands from according to increased population and also based on funding capabilities. Therefore, although this is not reflected in our estimates, we expect that Harford County will make adjustments over time to address these deficits.

**Table 8: Infrastructure Capacity Impacts for Each Alternative**

(Y=adequate, N=not adequate, ?= not determined)

Alternative	Water	Sewage	Solid Waste	Roads	Schools	
	Capacity of Supply & Demand	Treatment capacity	Capacity of Landfills	Traffic Congestion	Capacity	
					Inside D.E	Outside D.E.
<b>1. Minimum Growth</b>	Y	Y	Y	?	Y	N
<b>2. Moderate Growth</b>	Y	Y	Y	?	N	N
<b>3. Maximum Growth</b>	Y	Y	Y	?	N	N

Alternative	Fire	EMS	Police	Libraries		Recreation Facilities	Parks
	Number per 1,000 residents	Number per 1,000 residents	Number per 1,000 residents	Books	Staff	Number of Centers	Number of Acres
<b>1. Minimum Growth</b>	N	N	N	N	N	N	N
<b>2. Moderate Growth</b>	N	N	N	N	N	N	N
<b>3. Maximum Growth</b>	N	N	N	N	N	N	N

## **Evaluation of Alternatives with Policy Criteria**

In this section, we evaluate our three growth alternatives by six criteria that are used in standard policy analyses: 1) political feasibility, 2) environment, 3) impact on local culture 4) housing affordability 5) costs, and 6) revenue. These are standard criteria used in policy analyses.<sup>55</sup>

### **Description of Policy Criteria**

#### **Political Feasibility**

Political feasibility is defined as whether a proposal will be adopted by Harford County government. An alternative is likely to be adopted if it is supported by key local groups and county residents and adopted by major policy makers.

The urban literature tells us there will be pro-growth and anti-growth forces. The pro-growth forces typically include business organizations, developers, realtors, banks and major newspapers. The anti-growth forces typically include good government groups, environmentalists, anti-sprawl groups, and community organizations that oppose growth/change.<sup>56</sup>

We do not have any hard evidence showing whether Harford County residents will support or oppose any specific growth alternative. However, recent news articles, anecdotal

---

<sup>55</sup> Bardach, E. (2005). A practical Guide for policy analysis: The eightfold path to more effective problem solving. Washington, D.C.: CQ Press. pp. 25-35.

<sup>56</sup> Vogel, R.K. & Swanson, B.E. (1989, September). The growth machine versus the antigrowth coalition: The battle for our communities. Urban Affairs Quarterly. pp 69-72.

stories, and the incident regarding the Aberdeen annexation suggest that growth will be a contentious issue.<sup>57</sup>

Using this information and past literature, we evaluated the political feasibility of each alternative. Alternatives that are more likely to be adopted received higher ratings.

## **Environment**

The environmental impacts in this analysis include water and air pollution. The Chesapeake Bay Foundation reports that more than “90,000 acres (nearly 150 square miles) of open land are consumed annually by growth in the Bay states.”<sup>58</sup> Greater development creates more impermeable surfaces. This creates more runoff. Runoff is often polluted and it carries those pollutants into the streams and the Bay. We will estimate the amount of phosphorous, a common water pollutant, produced from increased development to determine water quality (in pounds per developed unit).

As more persons move into Harford County, they will own more automobiles. This will result in a greater amount of harmful vehicle emissions in the region. We estimated the total amount of automobile exhaust based on Environmental Protection Agency (EPA) standards.<sup>59</sup> Specifically, we will estimate the amount of air pollutants produced per vehicle driven (in

---

<sup>57</sup> Fenton, Justin. (2006, Dec. 8). Aberdeen growth fails: Voters in city and proposed annexation area say no. [The Baltimore Sun](#).

<sup>58</sup> Growth, sprawl and the Chesapeake Bay: Facts about growth and land use. (2002). [The Chesapeake Bay Foundation](#). Retrieved Nov. 22, 2006 from <[http://www.cbf.org/site/PageServer?pagename=resources\\_facts\\_sprawl](http://www.cbf.org/site/PageServer?pagename=resources_facts_sprawl)> & Water pollution in the Chesapeake Bay. (2003). [The Chesapeake Bay Foundation](#). Retrieved Nov. 22, 2006 from <[http://www.cbf.org/site/PageServer?pagename=resources\\_facts\\_water\\_pollution](http://www.cbf.org/site/PageServer?pagename=resources_facts_water_pollution)>

<sup>59</sup> These four pollutants are hydrocarbons, carbon monoxide, oxide of nitrogen, and carbon dioxide. All are measures used by the EPA to determine air quality. Environmental Protection Agency. (2000, April). [Emission facts: Average annual emissions and fuel consumption for passenger cars and light trucks](#). Office of Transportation and Air Quality. Retrieved on November 23 from <<http://www.epa.gov/otaq/consumer/f00013.pdf>>

pounds). Alternatives that produce higher amounts of air and water pollution will earn lower ratings.

### **Impact on Local Culture**

Some current Harford County residents believe that the influx of new persons will change the local culture of the county.<sup>60</sup> Some residents may expect that such changes will be favorable while others may expect that such changes will be unfavorable. We do not attempt to determine whether the impact on local culture will be positive or negative, but simply to describe the magnitude of the impact. We assume that more new residents cause greater changes to the local culture. Therefore, alternatives that allow greater population growth receive numerically lower ratings.

### **Housing Affordability**

Population growth in Harford County is likely to increase the demand for housing. It is well documented in the scholarly literature that if housing stock is limited and the demand for housing is stable or rising, housing prices will increase.<sup>61</sup> For this analysis, housing affordability is measured according to the U.S. Department of Housing and Urban Development (HUD) housing affordability threshold. According to HUD, housing is unaffordable when it costs more

---

<sup>60</sup> Fenton, Justin. (June 2006). Meeting to Focus on BRAC. The Baltimore Sun.

<sup>61</sup> Olsen, Edgar. (Sept., 1969). A competitive theory of the housing market. The American Economic Review. Vol. 59, No. 4, Part 1. pp. 612-622. &

Hanushek, Eric & Quigley, John. (August, 1980). What is the price elasticity of housing demand? The Review of Economics and Statistics. Vol. 62, No. 3. pp. 449-454. &

Newman, Sandra & Struyk, Raymond. (May, 1983). Housing and poverty. The Review of Economics and Statistics. Vol. 65, No. 2. pp. 243-253.

than 30 percent of monthly income.<sup>62</sup> In our analysis, we assume that the average annual income remains constant.<sup>63</sup>

The 2005 American Community Survey estimated that 23,700 or 27 percent of all households in Harford County pay 30 percent or more of their income for housing.<sup>64</sup> Housing in Harford County is more affordable than in Maryland as a whole, where 38 percent of households have housing costs at or above 30 percent of income.

Under each alternative, the demand for housing remains constant. That is, according to Harford County, approximately 43,400 persons are expected to want to move to Harford County. This would be the case regardless of any alternative. Therefore, alternatives that place greater constraints on the housing supply will earn lower ratings, meaning they will decrease housing affordability.

## **Cost**

We define cost as the total expenditures for water, sewer, schools, fire/EMS, sheriff deputies, and libraries to the general fund, capital budget, and enterprise funds of the county.<sup>65</sup>

<sup>66</sup>Cost to the county general fund and capital budget typically are funded through taxes and/or borrowing. Cost to enterprise funds are typically covered with fees (e.g., water, sewer, and solid waste fees). We estimate the cost associated with each element of infrastructure to produce a

---

<sup>62</sup> U.S. Department of Housing and Urban Development. (2005). [Affordable Housing Needs: A Report to Congress on the Significant Need for Housing](#). Office of Policy Development and Research. Retrieved on November 12, 2006 from <http://www.huduser.org/publications/affhsg/affhsgneed.html>

<sup>63</sup> We assume this because the county has no projections for the salaries for the new jobs at APG. Average annual income for Harford County households is \$73,380.

<sup>64</sup> U.S. Census Bureau. (2005) [American FactFinder: Selected Housing Characteristics for Harford County, MD and MD](#). Retrieved on November 19,2006 from [http://factfinder.census.gov/home/saff/main.html?\\_lang=en](http://factfinder.census.gov/home/saff/main.html?_lang=en)

<sup>65</sup> The county may have plans in development to address the infrastructure areas where we projected costs, however, if the county was unable to provide these plans to us, they are not included in our analysis.

<sup>66</sup> Readers should note that these are total, and not recurring, costs.

total cost for each alternative.<sup>67 68</sup> (See Appendix J for calculations). Alternatives with higher cost earn lower ratings.

## Revenue

We define revenue as money collected by the county government through the residential, commercial and industrial property tax and the local income tax.<sup>69</sup> We estimated the per household residential property tax by dividing the total residential property tax revenue in fiscal year 2005 by the number of households in 2005. This estimation produced the residential property tax per household, which was \$1,580.<sup>70</sup> We then multiplied that average by the number of new households for each of the alternatives. We estimated the commercial and industrial property tax by multiplying the revenue from these sources for fiscal year 2005 by the percentage of expected population growth projected from each alternative.<sup>71</sup> We estimated the local income tax by dividing the income tax received by the county in fiscal year 2005 by the 2005 population. This estimation produced the amount of income tax per capita, which was \$601.<sup>72</sup> We then multiplied the per capita amount by the additional population increment for each of the alternatives. We measured revenue by the total additional monies collected under each alternative, with alternatives with higher revenues earning higher ratings.

---

<sup>67</sup> Both costs and revenues will increase over time due to the effect of inflation. We have not discounted the figures to reflect future inflation.

<sup>68</sup> County officials provided us with costs for the different elements of infrastructure. Due to the complexities of the calculations, we were unable to obtain cost information on recreational facilities and trails, parks/open spaces and roads.

<sup>69</sup> 2006. Harford County Budget Office. 2006-2007 Capital Budget. Retrieved from <http://www.harfordcountymd.gov/budget/Prior/Budget2006/GeneralFund.pdf>. Our estimates do not include revenue from the federal or state governments in the form of aid and/or grants to assist the county with the expected population growth.

<sup>70</sup> See Appendix K for detailed revenue estimates.

<sup>71</sup> For Alternative I, II, and II, the population growth rates are 10.03%, 14.17%, and 18.31%, respectively. These percentages were calculated by dividing the projected population under each alternative by the current 2005 population.

<sup>72</sup> See Appendix K for detailed revenue estimates.

The revenue figures are annual estimates that are in addition to what the county is currently collecting and are based on the total residential, commercial, and industrial property tax and local income tax revenue received by the county in fiscal year 2005. We use fiscal year 2005 totals to maintain consistency with our 2005 population numbers. Furthermore, our revenue estimates in this analysis are conservative for several reasons. First, our estimates are based on property tax revenue collected in fiscal year 2005. Given recent real estate appreciation, property tax revenue is understated. Second, the state-shared revenue component of the county budget will increase, most notably as the county's school-eligible population increases, but we were unable to project the amount of additional revenue. Third, we do not take into account the increased value of fees paid for services, including water, sewer, and solid waste removal. Fourth, revenue will increase over time due to inflation.<sup>73</sup>

Readers should note that these are annual, not one-time, revenues.

## **Evaluation of Policy Criteria**

In this section, we evaluate the three growth alternatives using the six criteria discussed in the previous section. See Table 10 on page 45 for a summary presentation of this evaluation.

### **Alternative 1: Minimum Growth**

*Political Feasibility.* We estimate that this alternative has a low probability of being adopted by Harford County government. It is unlikely to generate wide support from some county officials because they view growth as important to the county's overall economic development.<sup>74</sup> For example, County Executive Craig, in last November's mid-term elections,

---

<sup>73</sup> While inflation will cause revenue to increase, costs will also rise.

<sup>74</sup> David's Accomplishments. (2006). David Craig: Harford County Executive home page. Retrieved December 18, 2006 from <<http://www.davidcraig.com/accomplishments.htm>>

stated that BRAC-related growth will be extremely important in determining Harford County's future.<sup>75</sup> Furthermore, this alternative would be unpopular among developers who stand to gain from increased growth. Although environmental groups might prefer this alternative because it limits development and promotes the preservation of farmland in Harford County, the literature reveals that it is doubtful that they will be strong enough to oppose the pro-growth forces. Therefore, we rate this alternative as a "1", meaning that it is unlikely to be politically feasible.

*Environment.* This alternative will increase land use and traffic due to development, and produce more runoff and air pollution. According to the Chesapeake Bay Foundation, "As land use patterns change and the watershed's population grows, the amount of nutrients entering the Bay's waters increases tremendously."<sup>76</sup> Under this alternative, we project that residents will produce 208 million pounds of air pollution and 3507.6 pounds of nonpoint source water pollution.<sup>77</sup> However, we rate this alternative as a "5", meaning it creates less pollution than Alternatives 2 and 3

*Impact on Local Culture.* Under this alternative, the lowest number of new residents (23,800) will move into Harford County. Therefore we rate it as a "5", meaning that it will have the least impact on local culture.

*Housing Affordability.* This alternative will constrain the supply of housing in Harford County the most. However, the demand for housing should remain constant. Therefore, we

---

<sup>75</sup> Craig, David. (2005). County Executive inaugural address to the county. Harford County, MD website. Retrieved December 18, 2006 from <<http://www.harfordcountymd.gov/Craig2005InauguralAddress.html>>

<sup>76</sup> Growth, sprawl and the Chesapeake Bay: Facts about growth and land use. (2002). The Chesapeake Bay Foundation. Retrieved Nov. 22, 2006 from <[http://www.cbf.org/site/PageServer?pagename=resources\\_facts\\_sprawl](http://www.cbf.org/site/PageServer?pagename=resources_facts_sprawl)> & Water pollution in the Chesapeake Bay. (2003). The Chesapeake Bay Foundation. Retrieved Nov. 22, 2006 from <[http://www.cbf.org/site/PageServer?pagename=resources\\_facts\\_water\\_pollution](http://www.cbf.org/site/PageServer?pagename=resources_facts_water_pollution)>

<sup>77</sup> Nonpoint source water pollution is defined by the MD Dept. of Natural Resources as "polluted runoff caused by storm water (rainfall or snowmelt) or irrigation water moving over and through the ground." Maryland Department of Natural Resources. (2003). Maryland nonpoint source program: Annual report. Retrieved December 18, 2006 from <[http://www.dnr.state.md.us/bay/czm/nps/publications/2003\\_annual\\_report.pdf](http://www.dnr.state.md.us/bay/czm/nps/publications/2003_annual_report.pdf)>

project that the price of housing would increase, thereby increasing the number of households in the county with unaffordable housing. We rate this alternative as a “1”, meaning that it hurts housing affordability the most.

*Cost.* Under this alternative, the cost to the county that we have estimated for the infrastructure and staff will be at least \$139.3 million, with the public school system incurring the majority of those costs. We rated this alternative as a “5”, meaning it costs the least.<sup>78</sup>

*Revenue.* Annually, this alternative will generate approximately \$13.8 million in additional residential property tax revenue, \$2.1 million in additional commercial and industrial property tax revenue, and \$14.3 million in additional local income tax revenue, for total additional revenue from these three sources of \$30.2 million per year. We rated this alternative as “1”, meaning it produces the least revenue.<sup>79</sup>

Alternative 1 has the least impact on the environment and on local culture because it accommodates the least amount of growth. However, this alternative is probably not politically feasible for the same reason, and it also has a negative effect on housing affordability. Also, while the costs associated with Alternative 1 are the lowest of the three alternatives, the revenue brought in is also the lowest of the three.

## **Alternative 2: Moderate Growth**

*Political Feasibility.* This alternative is more feasible than Alternative 1 but less feasible than Alternative 3. It is also likely to be supported by slow or no-growth forces, and likely to be opposed by other pro-growth forces, such as developers.

---

<sup>78</sup> County Executive Craig has indicated that he believes these costs to be underestimated.

<sup>79</sup> None of the projections for the alternatives take into account revenue generated from water & sewer cost recovery charges or hook-up fees.

However, several local governments have recently succeeded in passing anti-growth policies. For example, Prince William County, Virginia has passed a one-year freeze on most subdivisions, and Montgomery County, Maryland is discussing legislation to impose a temporary moratorium on most large developments.<sup>80</sup> Furthermore, residents of Aberdeen just voted to reject the annexation of 500 acres of land which is proposed for substantial housing development.<sup>81</sup> If residents county-wide respond in similar ways, then this alternative could conceivably be adopted. Therefore, we rate it as a “3”, meaning that is more politically feasible than Alternative 1 but less politically feasible than Alternative 3.

*Environment.* This alternative will produce 300.7 million pounds of air pollution and 3639.6 pounds of nonpoint source water pollution. Compared to Alternative 1, this constitutes a 45 percent increase in air pollution and a 4 percent increase in water pollution. Since growth will be limited under Moderate Growth, the total environmental impacts that would result from unrestricted growth will be lessened. Therefore, we rate this alternative as a “3”, meaning it creates less pollution than Alternative 3 but more pollution than Alternative 1.

*Impact on Local Culture.* Under this alternative, 31,600 new residents will move into Harford County. Therefore we rate it as a “3”, meaning it will have more impact on local culture than Alternative 1 but less impact than Alternative 3.

*Housing Affordability.* This alternative will also constrain the supply of housing in Harford County, but to a lesser degree than Alternative 1. Therefore, we project that although there should be an increase in the number of households in the county with unaffordable housing, this should be a smaller increase than would occur if the county implements alternative 1. We

---

<sup>80</sup> MacGillis, A. (2006, December 6). 3 counties attempt to put brakes on growth: Va., Md. Acts aimed at land-use limits. Washington Post. PA01.

<sup>81</sup> Wheeler, T.B. (2006, December 7). Influx at bases a test for Md.: Thousands of jobs, a need for homes and infrastructure. The Baltimore Sun.

rate this alternative as a “3”, meaning it decreases housing affordability more than Alternative 3 but less than Alternative 1.

*Cost.* Under this alternative, the cost to the county for expanding infrastructure will be at least \$217.3 million. This is almost 50 percent more than under Alternative 1. We rated it as a “3”, meaning it costs more than Alternative 1 but less than Alternative 3.

*Revenue.* Annually, this alternative generates approximately \$18.4 million in additional residential property tax revenue, \$2.8 million in additional commercial and industrial property tax revenue, and \$19 million in additional local income tax revenue. The total additional revenue from these three sources will be \$40.2 million per year. This equates to over 40 percent more than Alternative 1. We rated this alternative as a “3”, meaning it produces more revenue than Alternative 1 but less revenue than Alternative 3.

Alternative 2 has less of an impact on the environment and local culture than Alternative 3 and more than Alternative 1, because it accommodates half of the total growth expected from BRAC. Whereas this alternative may be more politically feasible than Alternative 1, it will be less so than Alternative 3. Housing affordability will be affected in a moderate way under this alternative because it will not cause prices to rise as much as the first alternative, but because growth is still being limited, prices are likely to be higher than they would be under Maximum Growth. Costs and revenue are also moderate under this alternative as they are greater than the first alternative and less than the second alternative.

### **Alternative 3: Maximum Growth**

*Political Feasibility.* This alternative has a high probability of being adopted by Harford County. County Executive Craig has promised to capitalize on the anticipated positive impacts of

BRAC, and plans are underway to make improvements to the county's infrastructure. This alternative would also likely have the support of developers and other pro-growth forces.

However, even though this alternative is likely to be politically feasible, there will still be opposition. Anti-growth forces (such as environmental groups) would likely be opposed because of the impacts associated with such high growth. Also, and as stated earlier, Aberdeen residents recently voted against annexing more land. If residents county-wide respond similarly, then this alternative might not be adopted. Overall, though, we believe that the pro-growth supporters will have more impact on the decision than the anti-growth. Because of that, we did rate this alternative as a "5", meaning it is the most politically feasible.

*Environment.* This alternative will produce 389 million pounds of air pollution and 3771.5 pounds of nonpoint source water pollution. Compared to Alternative 1, this constitutes an 87 percent increase in air pollution and a 7.5 percent increase in water pollution. Therefore, we rate this alternative a "1", meaning it creates the most pollution.

*Impact on Local Culture.* Under this alternative, 43,400 new residents will move into Harford County. Therefore we rate it as a "1", meaning that it will have the most impact on local culture.

*Housing Affordability.* This alternative will place no restrictions on the supply of housing in Harford County, while the demand for housing should remain constant. Assuming the current number of permits issued each year continues, there should be enough new housing units by 2011 for all 43,400 people to move into the county. Therefore, this is not likely to increase the number of households with unaffordable housing. We rated this alternative as a "5", meaning that it has the least effect on housing affordability.

*Cost.* Under this alternative, the cost to the county for improving infrastructure will be at least \$295.5 million, over twice as much as under Alternative 1. Therefore, we rated this alternative as a “1” because it costs the most.

*Revenue.* Annually, this alternative generates approximately \$25.2 million in additional residential property tax revenue, \$4 million in additional commercial and industrial property tax revenue, and \$26.1 million in additional local income tax revenue. The total additional revenue from these three sources will be \$55.3 million per year. This is almost double the revenue expected from Alternative 1. Therefore, we rated this alternative as a “5” because it produces the most revenue.

Alternative 3 has the greatest impact on both the environment and local culture as it accommodates all of the total growth from BRAC. It is however, the most politically feasible alternative. Availability of housing should not decrease as there will be no limits on building. Therefore there should be little to no effect on housing affordability. Both costs and revenue will be the highest under this alternative.

Table 9 summarizes our analysis of each alternative in relation to the evaluation criteria. This matrix provides a summary evaluation of the alternatives. A score of “1” means that alternative scores the lowest or worst under that particular criterion. For example, environment scores a “1” under Maximum Growth because it generates the most pollution and is therefore the worst for the county. A score of “5” means that the alternative scores the highest or best under that particular criterion. For example, cost scores a “5” under Minimum Growth because it costs the least.

**Table 9: Ratings of Alternatives by Policy Criteria**  
(1=lowest, 5=highest)

<b>Alternative</b>	<b>Political Feasibility</b>	<b>Environment</b>	<b>Impact on Local Culture</b>	<b>Housing Affordability</b>	<b>Cost</b>	<b>Revenue</b>
<b>1. Minimum Growth</b>	<b>1</b>	<b>5</b>	<b>5</b>	<b>5</b>	<b>5</b>	<b>1</b>
<b>2. Moderate Growth</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>3</b>
<b>3. Maximum Growth</b>	<b>5</b>	<b>1</b>	<b>1</b>	<b>1</b>	<b>1</b>	<b>5</b>

### **Recommendations**

The population growth that will occur in the next five years will clearly place additional burdens on Harford County’s infrastructure. We conclude that some of those burdens will be absorbed by existing or planned facilities, but other elements of infrastructure will be overwhelmed. We also conclude that the growth will have impacts in other areas than infrastructure, and that some of these effects will be large. Attempts to limit growth using the alternatives we present will reduce some of the negative impacts.

Solely from the perspective of limiting the burden to the county’s infrastructure, Alternative 1, Minimum Growth, would be the most appealing choice, but only slightly. Schools within the Development Envelope would be somewhat able to absorb growth, but in most other areas (emergency services, roads, recreation facilities, etc.) all three alternatives would result in overburdened infrastructure. The impacts would be smaller and thus less taxing on the county as a whole. After Minimum Growth comes Moderate Growth, followed by Maximum Growth.

Again, however, this is only from the perspective of limiting the burden on the county's infrastructure.

However, as we point out, the elements of infrastructure are not all that need to be considered. We also consider six criteria: political feasibility, environment, impact on local culture, housing affordability, costs, and revenue. When these criteria are considered, the appeal of Minimum Growth is eliminated. It fails the political feasibility criterion, and contributes least to revenue. If it will not be accepted politically, we cannot recommend it.

We believe that Moderate Growth can be politically feasible, and while it will still allow growth, the impacts of Modest Growth in Harford County are not as severe as they would be under Maximum Growth. As mentioned above, although all infrastructure areas that are over capacity under Maximum Growth will also be over capacity under this option, the impact will be less severe and more manageable under Moderate Growth.

A key finding of this analysis is the impact of growth on schools. As the *plans stand now*, schools under Maximum Growth will experience severe overcrowding, leading to insufficient classroom space and children being educated in temporary trailers. This alternative would create a greater teacher deficit, causing the student to teacher ratio to rise. Under this alternative, it is likely that the county's Adequate Public Facilities Ordinance will prevent further growth as individual schools pass 110 percent of capacity, and average capacity reaches a projected 109 percent (and much higher outside the envelope). Under Moderate Growth, school capacities on average will not approach the ordinance cutoff point, getting on average only to 104 percent, although schools outside the envelope will still be far beyond the limit.

We also found that Maximum Growth, under *current plans*, will score a “1” or “worst” in two criteria: environmental impact, and costs – although costs might be moderated by the revenue, (which is highest among the three alternatives).

We also have reason to believe that Moderate Growth may be gaining political feasibility. Recently, residents of Aberdeen voted to reject an annexation plan which would permit additional development. If that represents a growing trend among county residents, and especially if BRAC becomes a symbol of “excessive growth” in the minds of the residents, the political will to moderate the incoming growth may become stronger.

For all of these reasons, and based on current Harford County plans for the expansion of infrastructure, we recommend that the county adopt Alternative 2, Moderate Growth.

## **Appendix A. Context, Tables and Calculations for Schools**

Below we demonstrate how we measured the impacts of each alternative on schools in Harford County with charts showing enrollment and capacity and a detailed description of our calculations. The projections in our charts include both current construction and future projects that have been approved for funding. These projects are Patterson Mill Middle/High School and an addition to North Harford High School.

The charts do not include numbers for recently proposed construction projects that will likely be funded by the county and state. However, the numbers for those additional capacities are presented in our paper and considered in our recommendations. These projects include; Bel Air High School addition which would increase capacity by 137 spaces by 2009, Edgewood High School addition which would increase capacity by 221 spaces by 2010, and an Aberdeen High School addition that would increase capacity by 300 students by 2009.

In an effort to fully illustrate both the current situation in Harford County Public Schools and the projected impacts for each alternative, we have provided three charts. The first represents the enrollment and capacity numbers for the entire county. The two tables that follow illustrate the population split in Harford County whereby 80 percent of residents reside inside the Development Envelope and 20 percent reside outside. They illustrate the differential effects of population growth on different parts of the county.

The tables in this appendix use 2005 U.S. Census Population Data, September, 2005 Enrollment Reports from Harford County Public Schools, and attendance area maps from Harford County Public Schools. While 2006 enrollment data was available, the decision was made to compare enrollment to population for the same year.

## Harford County Public Schools Enrollment and Capacity Impacts

Table A-1. Projected Impact of Alternatives on School Capacity County-wide

School Type	Total Capacity	Enrollment 2005	Projected Enrollment 2011			Projected Percent of School Capacity		
			Alt. 1	Alt. 2	Alt. 3	Alt. 1	Alt. 2	Alt. 3
Elementary	17,806	18,364	20,029	20,782	21,536	112%	117%	121%
Middle	10,012 (2005) 10,712 (2007)	9,272	10,099	10,479	10,858	94%	98%	101%
High School	11,740 (2005) 12,786 (2007)	12,311	13,418	13,923	14,427	105%	109%	113%
Total	41,304	39,947	43,546	45,184	46,821	105%	109%	113%

Table A-2. Projected Impact of Alternatives on School Capacity in the Development Envelope

School Type	Total Capacity	Enrollment 2005	Projected Enrollment 2011			Projected Percent of School Capacity		
			Alt. 1	Alt. 2	Alt. 3	Alt. 1	Alt. 2	Alt. 3
Elementary	14,783	15,309	16,023	16,626	17,229	108%	112%	117%
Middle	8,896 (current) 9,596 <sup>82</sup> (2007)	8,060	8,079	8,383	8,686	84%	87%	91%
High School <sup>83</sup>	9,246 (current) 10,292 (2007)	9,616	10,734	11,138	11,542	104%	108%	112%
Total	34,671	32,985	34,836	36,147	37,457	100%	104%	108%

<sup>82</sup> Include the addition of Patterson Mill Middle School/High School which is currently under construction.

<sup>83</sup> Does not include Harford Tech High School with a capacity of 965 students.

Table A-3 Projected Impact of Alternatives on School Capacity outside of the Development Envelope

School Type	Total Capacity	Enrollment 2005	Projected Enrollment 2011			Projected Percent of School Capacity		
			Alt. 1	Alt. 2	Alt. 3	Alt. 1	Alt. 2	Alt. 3
Elementary	3,068	3,055	4,006	4,156	4,307	131%	135%	140%
Middle	1116	1212	2,020	2,096	2,172	181%	188%	195%
High School	1529	1643	2,684	2,785	2,885	176%	182%	189%
Total	5713	5910	8,710	9,037	9,364	152%	158%	164%

#### Additional Notes on Calculations

1. All projections are rounded to the nearest whole number.
2. The projections assume that the ratio of students generated per household remains the same in years after 2005. Harford County Public Schools projection (pre-BRAC) showed a decline in the elementary student population after 2005, a trend that is not reflected here.
3. Data used for these calculations include: 2005 American Communities Survey (U.S. Census), 2005/06 September Enrollment Report (HCPS), Attendance Area Maps for Harford County (HCPS & Department of Planning and Zoning).

In order to project the number of new elementary, middle, and high school students that each alternative would bring into HCPS, we used the following formulas. The formulas assume that the ratios of students per household (student generation rates) across elementary, middle, and high schools will hold constant from 2005 rates. The formulas were derived by dividing the current population by 2.72 to calculate the number of households, then dividing households by the 2005 enrollment for each school level in the county, then using algebra to arrive at the formula. Below we demonstrate the steps used to create the formula.

### **Formula for Projecting Elementary School Pupils**

1.  $\frac{\text{2005 Population (239,259)}}{2.72} = 87,962.88$
2.  $\frac{\text{Number of Households (87,962.88)}}{\text{Elementary School Enrollment (18,364)}} = 4.79$
3. Number of Households = 4.79 \* Elementary School Enrollment
4.  $\frac{\text{Number of Households}}{4.79} = \text{Elementary School Enrollment}$

$$\frac{\text{Total Projected Households}}{4.79} = \text{Estimated Elementary Population}$$

### **Formula for Projecting Middle School Pupils**

1.  $\frac{\text{2005 Population (239,259)}}{2.72} = 87,962.88$
2.  $\frac{\text{Number of Households (87,962.88)}}{\text{Middle School Enrollment (9,272)}} = 9.5$
3. Number of Households = 9.5 \* Middle School Enrollment
4.  $\frac{\text{Number of Households}}{9.5} = \text{Middle School Enrollment}$

$$\frac{\text{Total Projected Households}}{9.5} = \text{Estimated Middle School Population}$$

### **Formula for Projecting High School Pupils**

1.  $\frac{\text{2005 Population (239,259)}}{2.72} = 87,962.88$
2.  $\frac{\text{Number of Households (87,962.88)}}{\text{High School Enrollment (12,311)}} = 7.15$
3. Number of Households = 7.15 \* High School Enrollment
4.  $\frac{\text{Number of Households}}{7.15} = \text{High School Enrollment}$

$$\frac{\text{Total Projected Households}}{7.15} = \text{Estimated High School Population}$$

**Schools Inside of the Development Envelope**

High Schools

Aberdeen  
Bel Air  
C.M Wright  
Edgewood  
Joppatowne  
Havre de Grace  
Patterson Mill

Middle Schools

Aberdeen  
Bel Air  
Edgewood  
Havre de Grace  
Magnolia  
Patterson Mill  
Southampton

Elementary Schools

Abingdon  
Bakerfield  
Bel Air  
Church Creek  
Deerfield  
Edgewood  
Emmorton  
Forest Lakes  
Fountain Green  
G. Lisby-Hillsdale  
Hall's Cross Roads  
Havre de Grace  
Hickory  
Homestead/  
Wakefield  
Joppatowne  
Magnolia  
Meadowvale  
Prospect Mill  
Ring Factory  
Riverside  
Roye-Williams  
William Paca/Old Post Rd  
William S. James

**Schools Outside of the Development Envelope**

High Schools

Fallston  
North Harford

Middle Schools

Fallston  
North Harford

Elementary Schools

Churchville  
Darlington  
Dublin  
Forest Hill  
Jarrettsville  
Norrisville  
North Harford  
North Bend  
Youth's Benefit

Note: Harford Tech High School accepts students from throughout the county and is therefore not included on either of these lists or our capacity tables for the 80/20 population split. This results in greater overall capacity when the County's high school capacity is totaled (as in Table A-1).

For similar reasons, the Alternative Education Center and Restoration Alternative Academy are also not included in the tables.

## Appendix B. Water Usage Calculations and Context

1. All numbers are from the Master Plan of Harford County and the Water and Sewer Master Plan for Water and Sewer – each has been updated through 2006.
2. We estimate that roughly 80 percent of the current population in Harford County will be served by public water. We use this figure because we do not know where growth will settle, except under trends. For each alternative, we multiplied projected population by 0.80 to estimate the population demands on public water.
3. Domestic Water-- We used Harford County's daily use estimate for 2010 of 110 GPCD. We determined this figure by finding the average of the per capita use in 2005 of 105 GD and the estimated use in 2010 of 110 GD.  
Current per capita water use in 2005 → 105 GD  
Current per capita projected use in 2010 → 110 GD
4. To project use and capacity for each alternative, we used all available Harford County Master Plan data.
5. To estimate total domestic (personal) water use, we multiplied our population figure (depending on the alternative) by the average 2010 per capita consumption rate (110 GD).
6. Industrial Water--We added the domestic usage to the already determined 2010 average total industrial peak use from the county and municipalities (4.25 MGD). This gave us an overall estimated total water use for the entirety of the county served by public water.  
County Average Peak Consumption (MGD) for Industry (2010) → 3.35 MGD  
Municipality Average Peak Consumption for Industry (2010) → 0.9 MGD  
Total Average Peak Consumption (2010) → 4.25 MGD
7. To calculate total capacity for water, we combined the 2005 capacities of all 6 water treatment plants and added on additional future expansions through 2011. This gave us a total expected capacity of 39.6 MGD.  
Harford County Water Plants (6 plants) Capacity (county, municipalities) → 29.6 MGD (2005)  
Harford County Water Plants Projected Capacity w/ upgrades → 39.6 MGD (2011)
8. Finally, we subtracted our estimated total use from our estimated expected total capacity for each alternative population to determine surplus or deficit.

## I. Minimum Growth (23,784 persons)

### Domestic Water

Current '05 population served by public Water (county, municipalities) → 161,300

Current BRAC projection for alternative I → 23,784 people

Current trend growth required to be supplied water →  $23,784 \times .80 = 19,027$  people

Projected population served in 2011 →  $161,300 + 19,027 = 180,054$  people

$180,054 \times 110 \text{ GD} = 19,805,940 \text{ GD (2011)}$

### Total Use (see descriptions above for methodology)

$19,805,940 \text{gd (domestic)} + 4,250,000 \text{gd (industrial)} = 24,055,940 \text{ MGD total consumption (2011)}$

### Difference (see descriptions above for methodology)

39,600,000 GD Total Capacity Estimated (2011)

- 24,055,940 GD Total Use Estimated (2011)

15,544,060 GD surplus estimated or 15.5 MGD

## II. Moderate Growth (31,600)

### Domestic Water (see descriptions above for methodology)

Current '05 population served by public Water (county, municipalities) → 161,300

Current BRAC projection for alternative II → 31,600 people

Current trend growth required to be supplied water →  $31,600 \times .80 = 25,280$  people

Projected population served in 2011 →  $161,300 + 25,280 = 186,580$  people

$186,580 \text{ people} \times 110 \text{ GD} = 20,523,800 \text{ GD (2011)}$

### Total Use (see descriptions above for methodology)

$20,523,800 \text{ gd (domestic)} + 4,250,000 \text{gd (industrial)} = 24,773,800 \text{gd total consumption (2011)}$

### Difference (see descriptions above for methodology)

39,600,000 GD Total Capacity Estimated (2011)

- 24,773,800 GD Total Use Estimated (2011)

14,826,200 GD surplus estimated or 14.7 MGD

### III. Maximum Growth

Domestic Water (see descriptions above for methodology)

Current '05 population served by public Water (county, municipalities) → 161,300

Current BRAC projection for alternative III → 43,418 people

Current trend growth required to be supplied water →  $43,418 \times .80 = 34,734$  people

Projected population served in 2011 →  $161,300 + 34,734 = 196,034$  people

$196,034 \text{ people} \times 110 \text{ GD} = 21,563,740 \text{ GD (2011)}$

Total Use (see descriptions above for methodology)

$21,563,740\text{gd (domestic)} + 4,250,000\text{gd (industrial)} = 25,813,740\text{gd total consumption (2011)}$

Difference (see descriptions above for methodology)

39,600,000 GD Total Capacity Estimated (2011)

- 25,813,740 GD Total Use Estimated (2011)

13,786,260 GD surplus estimated or 13.8 MGD

## Appendix C. Sewage Usage Calculations and Context

All numbers are from the Master Plan of Harford County and the Water and Sewer Master Plan for Water and Sewer – each has been updated through 2006.

Roughly 80 percent of the current population in Harford County is served by the public sewer system. Therefore, we assumed that 80 percent of the new growth will require public sewer. For each alternative, we multiplied projected population by 0.80 to estimate the population demands on public sewer.

### Calculations for Domestic Sewage Flow

To estimate total domestic sewage flow, we combined 2005 figures from the county and municipalities and added that to the 80 percent expected from each alternative. Finally, we used Harford County usage data that estimated a per capita daily sewage flow of 90 GD. We multiplied our total estimated population from each alternative by 90 GD to get our average daily domestic sewage flow.

### Calculations for Industrial Sewage Flow

Industry figures were calculated for 2010 in the Master Plan. We combined expected 2010 industrial sewage flow and combined estimated infiltration (rainfall, runoff) flow from the county and municipalities.

Projected Industrial Flow in 2010 → 1 MGD (county and service areas)

$(.6 + .2 + .2 + 0 + 0 = 1)$

Projected Infiltration Flow in 2010 → 2.69 MGD

$1.9 + .10 + .5 + .19 + 0 = 2.69$

Finally, for each alternative our total estimated flow for 2011 was calculated by adding domestic, industrial, and infiltration flows.

### Calculations for the Difference Between Use and Capacity

Total sewage flow capacity was already estimated by Harford County for the year 2010. To remain consistent with those findings, we used the combined capacities of all the sewerage systems in the county and municipalities for a total flow capacity of 28.2 MGD.

Total System Capacity in 2010 (county and service areas) → 28.2 MGD

$(20 + 4 + 3.3 + .95 + .01 = 28.2 \text{ MGD})$

We then subtracted total estimated use from the total sewage capacity figure to determine surplus or deficit.

## **I. Minimum Growth (23,784)**

### Domestic Sewage Flow

Projected population served in 2011  $\rightarrow 143,753 + 19,027 = 162,780$  people  
Per Capita Domestic Sewage Flow (1995-2010)  $\rightarrow 90$  GD  
 $162,780$  people  $\times 90$  GD =  $14,650,218$  GD

### Total Projected Flow

$14,650,218$  GD (domestic) +  $1,000,000$  GD (industrial) +  $2,690,000$  GD (infiltration) =  
 $18,340,218$  GD total sewage flow (2011)

### Difference

$28,200,000$  GD total capacity (2010)  
-  $18,340,218$  GD total estimated flow (2011)  
 $9,859,782$  GD total surplus capacity or 9.9 MGD

## **II. Moderate Growth (31,600)**

### Domestic Sewage Flow

2005 population served by public Sewer (county, service areas)  $\rightarrow 143,753$   
( $104,000 + 15,800 + 15,000 + 8,800 + 153 = 143,753$ )  
Current BRAC projection for alternative II  $\rightarrow 31,600$  people  
Current trend growth required to be supplied water  $\rightarrow 31,600 \times .80 = 25,280$   
people  
Projected population served in 2011  $\rightarrow 143,753 + 25,280 = 169,033$  people  
Per Capita Domestic Sewage Flow (1995-2010)  $\rightarrow 90$  GD  
 $169,033$  people  $\times 90$  GD =  $15,212,970$  GD

### Total Projected Flow

$15,212,970$  GD (domestic) +  $1,000,000$  GD (industrial) +  $2,690,000$  GD (infiltration) =  
 $18,902,970$  GD total sewage flow (2011)

### Difference

$28,200,000$  GD total capacity (2010)  
-  $18,902,970$  GD total estimated flow (2011)  
 $9,297,030$  GD total surplus capacity or 9.2 MGD

### **III. Maximum Growth (43,418)**

#### Domestic Sewage Flow

2005 population served by public Sewer (county, service areas) → 143,753  
(104,000 + 15,800 + 15,000 + 8,800 + 153 = 143,753)  
Current BRAC projection for alternative III → 43,418 people  
Current trend growth required to be supplied water →  $43,418 \times .80 = 34,734$   
people  
Projected population served in 2011 →  $143,753 + 34,734 = 178,487$  people  
Per Capita Domestic Sewage Flow (1995-2010) → 90 GD  
 $178,487 \text{ people} \times 90 \text{ GD} = 16,063,830 \text{ GD}$

#### Total Projected Flow

$16,063,830 \text{ GD (domestic)} + 1,000,000 \text{ GD (industrial)} + 2,690,000 \text{ GD (infiltration)} =$   
 $19,753,830 \text{ GD total sewage flow (2011)}$

#### Difference

$28,200,000 \text{ GD total capacity (2010)}$   
 $- 19,753,830 \text{ GD total estimated flow (2011)}$   
 $8,446,170 \text{ GD total surplus capacity or 8.4 MGD}$

## Appendix D. Solid Waste Management Calculations and Context

For each alternative, we show three different tables. First, we show the total amount of waste that the county should generate in 2011. This includes residential waste, commercial waste, and used tires. Second, we show the total capacity of the county to manage waste in 2011, given the projected capacities of the landfill, the waste-to-energy facility, and the recycling program. We account for the county's plans to expand the landfill and the waste-to-energy facility. Third, we show the total waste versus the total capacity of the county in 2011, and include our projection of surplus capacity.

### Alternative 1: Minimum Growth

Table D-1 Waste (tons)

	2011
Residential Waste (3.43 lbs per person per day)	163,348
Commercial Waste*	158,564
Used Tires*	4,323
Total Waste	326,235

\*The county made this projection in the Solid Waste Management Master Plan before BRAC

Table D-2 Capacity (tons)

	2011
Harford Waste Disposal Center (HWDC- landfill)	270,729
Harford Waste-to-Energy Facility (HWTEF)	207,600
Recycling*	150,068
Total Capacity	628,397

\*For purposes of this analysis, we consider the amount of waste that people choose to recycle to be a capacity. In 2011, the recycling rate will be 46 percent.

Table D-3 Total Waste v. Total Capacity (tons)

	2011
Total Waste	326,235
Total Capacity	628,397
Surplus/(Deficit)	302,162

### Alternative 2: Moderate Growth

Table D-4 Waste (tons)

	2011
Residential Waste (3.43 lbs per person per day)	167,636
Commercial Waste	158,564
Used Tires	4,323
Total Waste	330,523

Table D-5 Capacity (tons)

	2011
Harford Waste Disposal Center (HWDC- landfill)	270,729
Harford Waste-to-Energy Facility (HWTEF)	207,600
Recycling	152,895
Total Capacity	631,224

Table D-6 Total Waste v. Total Capacity (tons)

	2011
Total Waste	330,523
Total Capacity	631,224
Surplus/(Deficit)	300,701

**Alternative 3: Maximum Growth**

Table D-7 Waste (tons)

	2011
Residential Waste (3.43 lbs per person per day)	175,638
Commercial Waste	158,638
Used Tires	4,323
Total Waste	338,525

Table D-8 Capacity (tons)

	2011
Harford Waste Disposal Center (HWDC- landfill)	270,729
Harford Waste-to-Energy Facility (HWTEF)	207,600
Recycling	155,722
Total Capacity	634,051

Table D-9 Total Waste v. Total Capacity (tons)

	2011
Total Waste	338,525
Total Capacity	634,051
Surplus/(Deficit)	295,526

## Appendix E. Fire and EMS Calculations and Context

For each alternative, we calculate how many new fire and EMS volunteers and paid EMS providers the county will need by 2011 to maintain current ratios of volunteers and providers to residents. Currently, there are 1,109 active volunteers to 237,165 residents (or 4.7 active volunteers per 1,000 residents). Also, there are 90 paid EMS providers to 169,961 residents in the Development Envelope (or 0.53 paid EMS providers per 1,000 people in the Development Envelope).

### Alternative 1: Minimum Growth (260,949)

With this alternative, the county will have a population of 261,000 residents by 2011. There will be 208,800 residents in the Development Envelope. The county should need 111 new volunteers and 21 paid EMS providers to keep the current ratios.

#### Volunteers

$$\begin{aligned}(1,109/237,165) &= (x/260,949) \\ 237,165x &= 289,392,441 \\ x &= 1,220 \\ 1,109 - 1,220 &= -111 \\ \text{Deficit} &= 111 \text{ volunteers}\end{aligned}$$

#### Paid EMS Providers

$$\begin{aligned}(90/169,961) &= (x/208,800) \\ 169,961x &= 18,792,000 \\ x &= 111 \\ 90 - 111 &= -21 \\ \text{Deficit} &= 21 \text{ paid EMS providers}\end{aligned}$$

### Alternative 2: Moderate Growth

With this alternative, the county will have a population of 268,600 residents by 2011. There will be 214,480 residents in the Development Envelope. The county should need 111 new volunteers and 24 paid EMS providers to keep the current ratios.

#### Volunteers (firefighters + EMS)

$$\begin{aligned}(1,109/237,165) &= (x/268,600) \\ 237,165x &= 297,877,400\end{aligned}$$

$x = 1,256$   
 $1,109 - 1,256 = -147$   
Deficit = 147 volunteers

Paid EMS Providers

$(90/169,961) = (x/214,480)$   
 $169,961x = 19,303,200$   
 $x = 114$   
 $90 - 114 = -24$   
Deficit = 24 paid EMS providers

**Alternative 3: Maximum Growth (population = 280,583)**

With this alternative, the county will have a population of 280,600 residents by 2011. There will be 224,480 residents in the Development Envelope. The county should need 203 new volunteers and 29 paid EMS providers to keep the current ratios.

Volunteers (firefighters + EMS)

$(1,109/237,165) = (x/280,583)$   
 $237,165x = 311,166,547$   
 $x = 1,312$   
 $1,109 - 1,312 = -203$   
Deficit = 203 volunteers

Paid EMS Providers

$(90/169,961) = (x/224,480)$   
 $169,961x = 20,203,200$   
 $x = 119$   
 $90 - 119 = -29$   
Deficit = 29 paid EMS providers

## Appendix F. Sheriff's Deputies Calculations and Context

For each alternative, we calculate how many new deputies the county should need to maintain the current ratio of deputies to residents. Currently, there are 290 authorized deputies for 237,165 residents (or 1.2 deputies per 1,000 residents).

### Alternative 1: Minimum Growth

With this alternative, the county will have a population of 260,949 persons by 2011. The county should need 29 new deputies to keep the current ratio.

#### Deputies

$$(290/237,165) = (x/260,949)$$
$$237,165x = 75,675,210$$
$$x = 319$$
$$290 - 319 = -29$$
$$\text{Deficit} = 29 \text{ deputies}$$

### Alternative 2: Moderate Growth

With this alternative, the county will have a population of 267,165 persons by 2011. The county should need 41 new deputies to keep the current ratio.

#### Deputies

$$(290/237,165) = (x/267,165)$$
$$237,165x = 77,477,850$$
$$x = 331$$
$$290 - 331 = -41$$
$$\text{Deficit} = 41 \text{ deputies}$$

### Alternative 3: Maximum Growth

With this alternative, the county will have a population of 280,583 persons by 2011. The county should need 53 new deputies to keep the current ratio.

#### Deputies

$$(290/237,165) = (x/280,583)$$
$$237,165x = 81,369,070$$
$$x = 343$$
$$290 - 343 = -53$$
$$\text{Deficit} = 53 \text{ deputies}$$

## Appendix G. Library Services Calculations and Context

BRAC related population growth is expected to impact the programs and services the library system provides to Harford County residents and as a result the library system is weighing options on how to best deal with the anticipated demand. There are 226 full time staff members in the Harford County library system.<sup>84</sup> The ratio of staff to residents is 0.95 per 1000 people. The projections found in our analysis are based on the library system's current service capacity in relation to the anticipated BRAC related growth over the next five years.

### Alternative 1: Minimum Growth (260,949)

#### Staff

$$226/237,165=X/260,949=249$$

Deficit: 249-226=23 new staff members

#### Articles

$$1,007,697/237,165=X/260,949=1,108,754$$

Deficit: 1,108,754 -1,007,697= 101,057 new items

### Alternative 2: Moderate Growth (268,600)

#### Staff

$$226/237,165=X/268,600 = 256$$

Deficit: 256 -226 = 30 new staff members

#### Articles

$$1,007,697 / 237,165=X / 268,800 = 1,142,111$$

Deficit: 1,142,111 - 1,007,697 = 134,414 new items

### Alternative 3: Maximum Growth (280,583)

#### Staff

$$226/237,165=X/280,583= 267$$

Deficit: 267-226=41

#### Articles

$$1,007,697/237,165=X/280,583 = 1,192,177$$

Deficit: 1,192,177-1,007,697=184,480

---

<sup>84</sup> <http://www.hcplonline.info/services/aboutus/facts.html>

Table G-10. Projected Library Staff Increases Required Based on Alternatives

	GROWTH ALTERNATIVE		
	(1)Minimum	(2)Moderate	(3)Maximum
<b>POPULATION</b>			
<i>Current</i>	237,165	237,165	237,165
<i>Increase</i>	23,784	31,600	43,418
<i>Projected</i>	260,949	268,800	280,583
<b>LIBRARY STAFF</b>			
<i>Current</i>	226	226	226
<i>Projected</i>	249	256	267
<i>Deficit</i>	23	30	41
<i>% Increase</i>	10.03%	13.27%	18.31%

Table G-11. Projected Library Article Increases Required Based on Alternatives

	GROWTH ALTERNATIVE		
	(1)Minimum	(2)Moderate	(3)Maximum
<b>POPULATION</b>			
<i>Current</i>	237,165	237,165	237,165
<i>Increase</i>	23,784	31,600	43,418
<i>Projected</i>	260,949	268,800	280,583
<b>LIBRARY ITEMS</b>			
<i>Current</i>	1,007,697	1,007,697	1,007,697
<i>Projected</i>	1,108,754	1,142,111	1,192,177
<i>Deficit</i>	101,057	134,414	184,480
<i>% Increase</i>	10.03%	13.33%	18.31%

## Appendix H. Recreational Facilities Calculations and Context

For each alternative, we show two tables. First, we show the current supply of recreation facilities relative to the number of facilities needed to maintain current levels of service in 2011. Second, we show the current supply of miles of trails in relation to the number that residents should want to use in 2011. Our projections for the numbers wanted in 2011 and for surpluses and deficits are based on data from the Harford County Parks and Recreation Department.

### Alternative 1: Minimum Growth

Table: Supply v. Demand for Recreation Facilities in 2011

Activity	Type of Facility	Available	Needed	Surplus (Deficit)
Softball/baseball	Diamonds	179	191	(12)
Foot/FH/Soc/Lax	Fields	120	69	51
Basketball	Courts	139	80	59
Tennis	Courts	87	82	5
Golf	Courses	10	12	(2)
Swimming	Pools	28	17	11
Playgrounds	Playgrounds	109	69	40
Boating	Ramps	12	13	(1)
<b>TOTAL</b>		684	533	151

Table: Supply v. Demand for Trails in 2011

Trails	Available	Needed	Surplus (Deficit)
Miles	27.6	27.3	0.3

## Alternative 2: Moderate Growth

Table: Supply v. Demand for Recreation Facilities in 2011

<b>Activity</b>	<b>Type of Facility</b>	<b>Available</b>	<b>Needed</b>	<b>Surplus (Deficit)</b>
Softball/baseball	Diamonds	179	197	(18)
Foot/FH/Soc/Lax	Fields	120	71	49
Basketball	Courts	139	82	57
Tennis	Courts	87	84	3
Golf	Courses	10	12	(2)
Swimming	Pools	28	17	11
Playgrounds	Playgrounds	109	70	39
Boating	Ramps	12	14	(2)
<b>TOTAL</b>		<b>684</b>	<b>547</b>	<b>137</b>

Table: Supply v. Demand for Trails in 2011

<b>Trails</b>	<b>Available</b>	<b>Needed</b>	<b>Surplus (Deficit)</b>
Miles	27.6	27.8	(.2)

<b>Activity</b>	<b>Type of Facility</b>	<b>Available</b>	<b>Needed</b>	<b>Surplus (Deficit)</b>
Softball/baseball	Diamonds	179	205	(26)
Foot/FH/Soc/Lax	Fields	120	74	46
Basketball	Courts	139	86	53
Tennis	Courts	87	88	(1)
Golf	Courses	10	13	(3)
Swimming	Pools	28	18	10
Playgrounds	Playgrounds	109	74	35
Boating	Ramps	12	14	(2)
<b>TOTAL</b>		684	572	+112

**Alternative 3: Maximum Growth**

Table: Supply v. the Demand for Recreation Facilities in 2011

Table: Supply v. the Demand for Trails in 2011

<b>Trails</b>	<b>Available</b>	<b>Needed</b>	<b>Surplus (Deficit)</b>
Miles	27.6	29.3	(1.7)

## Appendix I. Parks and Open Spaces Calculations and Context

Harford County's Parks and Recreation Department is responsible for operating and maintaining space (passive and active), and providing a comprehensive program of leisure opportunities and activities for all segments of the population.<sup>85</sup> Currently, Harford County has 27.7 acres of parks per 1,000 residents. The projections found in our analysis are based on the current service capacity in relation to the anticipated BRAC related growth over the next five years. The calculations show a deficit for each alternative.

### Alternative 1: Minimum Growth (260,949)

If goal is 27.7 acres

$$0.0277 = X/260,949$$

$$X = 7228.29$$

Deficit:  $7228.29 - 6507.5 = 720.79$  New Acres

### Alternative 2: Moderate Growth (268,600)

If goal is 27.7 acres

$$0.0277 = X/268,600 =$$

$$X = 7440.22$$

Deficit:  $7440.22 - 6507.5 = 932.72$  New Acres

### Alternative 3: Maximum Growth (280,583)

If goal is 27.7 acres

$$0.0277 = X/280,583$$

$$X = 7772.15$$

Deficit:  $7772.15 - 6507.5 = 1264.64$  Acres

---

<sup>85</sup> [http://www.harfordcountymd.gov/parks\\_rec/](http://www.harfordcountymd.gov/parks_rec/)

## Appendix J. Cost Calculations

We estimated the costs associated with our alternatives on each of our impact areas except for recreation facilities and trails, parks/open spaces, and roads. We could not calculate costs for these areas given the complexity of the calculation, especially the uncertainty around the cost of potential land purchases. All costs assume providing the necessary infrastructure to support the population growth through 2011.<sup>86</sup>

### Alternative I

Table J-1. Total Infrastructure Costs for Alternative I

Infrastructure Area	Cost
Water	\$4,536,276
Sewer	\$12,450,000
Schools	\$116,763,478
Fire/EMS	\$280,000
Sheriff Deputies	\$3,828,000
Libraries	\$1,451,837
<b>Total</b>	<b>\$139,309,591</b>

### Alternative II

Table J-2. Total Infrastructure Costs for Alternative II

Infrastructure Area	Cost
Water	\$4,536,276
Sewer	\$12,450,000
Schools	\$192,679,864
Fire/EMS	\$325,728
Sheriff Deputies	\$5,412,000
Libraries	\$1,900,670
<b>Total</b>	<b>\$217,304,538</b>

---

<sup>86</sup> Each infrastructure area has a separate citation to note the source of the cost data.

### Alternative III

Table J-3. Total Infrastructure Costs for Alternative III

<u>Infrastructure Area</u>	<u>Cost</u>
Water	\$4,536,276
Sewer	\$12,450,000
Schools	\$268,549,903
Fire/EMS	\$393,120
Sheriff Deputies	\$6,996,000
Libraries	\$2,599,674
<b>Total</b>	<b>\$295,524,973</b>

### Water

The county has already planned for additional water capacity in the future to accommodate growth. Since the county will have sufficient capacity to accommodate all growth alternatives with this upgrade, we use the cost listed in the county budget in our analysis. The county estimates this cost at \$4,536,276.<sup>87 88</sup>

Table J-4. Water Infrastructure Cost per Alternative

<u>Alternative</u>	<u>Total Cost</u>
Minimum Growth	\$4,536,276
Moderate Growth	\$4,536,276
Maximum Growth	\$4,536,276

### Sewer

The county has already planned for additional sewer capacity in the future to accommodate growth. Since the county will have sufficient capacity to accommodate all growth alternatives with this upgrade, we use the cost listed in the county budget in our analysis. The county estimates this cost at \$12,450,000.<sup>89</sup>

Table J-5. Sewer Infrastructure Cost per Alternative

<u>Alternative</u>	<u>Total Cost</u>
Minimum Growth	\$12,450,000
Moderate Growth	\$12,450,000
Maximum Growth	\$12,450,000

<sup>87</sup> General fund revenues: Fiscal Year 2005-2006. (2005). Harford County Budget Office. Retrieved December 18, 2006 from <<http://www.harfordcountymd.gov/budget/Prior/Budget2006/GeneralFund.pdf>>

<sup>88</sup> This cost refers to additional cost for expansion to the capacity, not total cost for all water.

<sup>89</sup> Ibid.

## Schools

The costs for this infrastructure area were divided into two categories: operating and capital. Operating costs include existing and additional staff salaries, current building maintenance, instructional supplies, and other items. Harford County Public Schools calculates its operating costs on a per-student basis. Currently, the county spends an estimated \$9,472 per student.<sup>90</sup> Capital costs include new facilities built to accommodate student population growth. To estimate the cost of additional facilities, we used the current estimated cost of the new Patterson Middle/High School (\$59 million) and divided it by the number of students the school will accommodate (1,600). This gave us a cost of about \$36,875 per student slot.<sup>91</sup>

Table A-1 in this appendix shows current student capacity county-wide. We subtracted this number from the future enrollment projection to arrive at the “Students Exceeding Capital Capacity” column in Table J-7 below. These calculations assume that the county desires to keep their facilities at or below capacity.

We separated the operating and capital costs here to show the various costs that comprise the school cost calculation. However, in our analysis, we used the combined total cost figure that includes both operating and capital costs.

Table J-6. School Operating Infrastructure Cost per Alternative

<u>Alternative</u>	<u>Additional Students</u>	<u>Cost per student</u>	<u>Additional Operating Cost</u>
Minimum Growth	3,599	\$9,472	\$34,089,728
Moderate Growth	5,237	\$9,472	\$49,604,864
Maximum Growth	6,874	\$9,472	\$65,110,528

Table J-7. School Capital Infrastructure Cost per Alternative

<u>Alternative</u>	<u>Students Exceeding Capital Capacity</u>	<u>Capital Cost per Student</u>	<u>Additional Capital Cost</u>
Minimum Growth	2,242	\$36,875	\$82,673,750
Moderate Growth	3,880	\$36,875	\$143,075,000
Maximum Growth	5,517	\$36,875	\$203,439,375

<sup>90</sup> Jim Jewell, Budget Director for the Harford County Public School System.

<sup>91</sup> Based on \$59 million cost of Patterson Mill/High School to accommodate 1,600 new students.

Table J-8. Total School Infrastructure Cost per Alternative

<u>Alternative</u>	<u>Additional Operating Cost</u>	<u>Additional Capital Cost</u>	<u>Total Cost</u>
Minimum Growth	\$34,089,728	\$82,673,750	\$116,763,478
Moderate Growth	\$49,604,864	\$143,075,000	\$192,679,864
Maximum Growth	\$65,110,528	\$203,439,375	\$268,549,903

### **Fire/EMS**

To maintain current staffing levels, the county will need to provide additional staffing for each alternative. There are currently 90 paid EMS providers. There are two types of paid EMS providers: (1) Advanced Life Support (ALS) providers and (2) Basic Life Support (BLS) providers. Of the 90 paid EMS providers, 38 are ALS providers and 52 are BLS providers. This translates to about 40 percent being ALS providers and 60 percent being BLS providers. For estimating costs, we assume that 40 percent of the new EMS providers will be ALS providers and that 60 percent will be BLS providers.

ALS providers make \$18.00 per hour and BLS providers make \$12.00 per hour. Both ALS and BLS providers work an average of 18 hours per week, thus translating to 936 hours per year.

Table J-9. Fire/EMS Infrastructure Cost per Alternative

<u>Alternative</u>	<u>Additional ALS Staff</u>	<u>ALS Staff Cost</u>	<u>Additional BLS Staff</u>	<u>BLS Staff Cost</u>	<u>Total Cost</u>
Minimum Growth	8	\$134,784	13	\$146,016	\$280,800
Moderate Growth	10	\$168,480	14	\$157,248	\$325,728
Maximum Growth	12	\$202,176	17	\$190,944	\$393,120

### **Sheriff Deputies**

To maintain current staffing levels, the county will need to provide additional staffing for each alternative. Staff costs for sheriff deputies have two components: salary and start-up costs. The salary cost of one additional staff member is estimated by the county to be \$65,131 and the start-up cost is estimated by the county to be \$66,869.<sup>92</sup> Start-up costs include a vehicle, equipment, training, etc.

<sup>92</sup> Bob Thomas, Public Information Officer, Harford County Sheriff's Office.

Table J-10. Police Infrastructure Cost per Alternative

<u>Alternative</u>	<u>Additional Staff</u>	<u>Staff Cost</u>	<u>Start-up Cost</u>	<u>Total Cost</u>
Minimum Growth	29	\$1,888,799	\$1,939,201	\$3,828,000
Moderate Growth	41	\$2,670,371	\$2,741,629	\$5,412,000
Maximum Growth	53	\$3,451,943	\$3,544,057	\$6,996,000

### Libraries

To maintain current staffing levels, the county will need to provide additional staffing for each alternative. The cost of one additional staff member is \$51,348.<sup>93</sup> Similarly, additional library items will be required to support our alternatives. The cost of one additional library item is \$2.68.<sup>94</sup>

Table J-11. Library Infrastructure Cost per Alternative

<u>Alternative</u>	<u>Additional Staff</u>	<u>Staff Cost</u>	<u>Additional Items</u>	<u>Item Cost</u>	<u>Total</u>
Minimum Growth	23	\$1,181,004	101,057	\$270,833	\$1,451,837
Moderate Growth	30	\$1,540,440	134,414	\$360,230	\$1,900,670
Maximum Growth	41	\$2,105,268	184,480	\$494,406	\$2,599,674

<sup>93</sup> Jane Eickhoff, Associate Director, Harford County Public Libraries. An exact staff salary could not be determined, however, the estimate here was derived using the current staff salary allocation divided by the number of current employees.

<sup>94</sup> Jane Eickhoff, Associate Director, Harford County Public Libraries. An exact cost for additional library materials could not be determined, however, the estimate here was derived using the current materials budget divided by the number of current material holdings.

## Appendix K. Revenue Calculations

In fiscal year (FY) 2005, Harford County received \$137,714,303 from residential property taxes, \$21,427,977 from commercial and industrial property taxes, and \$142,533,023 from local income taxes paid to the county.<sup>95</sup> We use these numbers in our estimations below.

Table K-1 Additional Property and Income Tax Revenue in FY 2005

	<u>2005 Population</u>	<u>Total Received in FY 2005</u>	<u>Per Capita Amount</u>	<u>Household Amount</u>
Residential Property Taxes	237,165	\$137,714,303	\$581	\$1580
Commercial/Industrial Property Taxes	237,165	\$21,427,977	\$90	N/A
Local Income Taxes	237,165	\$142,533,023	\$601	N/A

Table K-2 Additional Property and Income Tax Revenue per Alternative

<u>Alternative</u>	<u>Population Increase</u>	<u>Households</u>	<u>Percent Change in Population</u>	<u>Additional Residential Property Tax Revenue</u>	<u>Additional Commercial/ Industrial Property Tax Revenue</u>	<u>Additional Income Tax Revenue</u>
Minimum Growth	23,784	8,744	10.03%	\$13,815,520	\$2,149,226	\$14,294,184
Moderate Growth	31,600	11,617	13.32%	\$18,359,600	\$2,844,000	\$18,991,600
Maximum Growth	43,418	15,963	18.31%	\$25,221,540	\$3,923,463	\$26,094,218

### Minimum Growth Alternative

- Population Increase – 23,784 / 2.72 (number of individuals in a household) = 8,744 households
- Additional Residential Property Tax Revenue – \$1,580 (average property tax per household) \* 8,744 = \$13,815,520
- Additional Commercial and Industrial Property Tax Revenue - \$21,427,977 \* 10.03% (population growth rate expected through 2011 based on 2005 population) = \$2,149,226
- Additional Income Tax Revenue - \$601 (average local income tax per individual) \* 23,784 = \$14,294,184

### Moderate Growth Alternative

- Population Increase = 31,600 / 2.72 (number of individuals in a household) = 11,617 households
- Additional Residential Property Tax Revenue = \$1,580 (average property tax per household) \* 11,617 = \$18,359,600
- Additional Commercial and Industrial Property Tax Revenue = \$90 (per capita amount in 2005) \* 31,600 (new residents) = \$2,844,000

<sup>95</sup> This information was provided by Anne Gessner in the Harford County Treasurer's Office.

- Additional Income Tax Revenue - \$601 (average local income tax per individual) \* 31,600 = \$18,991,600

**Maximum Growth Alternative**

- Population Increase – 43,418 / 2.72 (number of individuals in a household) = 15,962 households
- Additional Residential Property Tax Revenue – \$1,580 (average property tax per household) \* 15,963 = \$25,221,540
- Additional Commercial and Industrial Property Tax Revenue - \$21,427,977 \* 18.31% (population growth rate expected through 2011 based on 2005 population) = \$3,923,463
- Additional Income Tax Revenue - \$601 (average local income tax per individual) \* 43,418 = \$26,094,218

## Appendix L. Environment Calculations

### Air Pollution

The table below shows estimated amounts of air pollution in Harford County as a result of BRAC related growth. The estimates are based on Environmental Protection Agency (EPA) emission standards.<sup>96</sup>

Alternative	Total Annual Pollution Emitted				
	Hydrocarbon 77.1 lbs	Carbon Monoxide 575lbs	Oxide of Nitrogen 38.2lbs	Carbon Dioxide 11,450lbs	Gasoline Consumption Gallons
<b>Minimum 16,913 Cars</b>	1,303,992	9,724,975	646,077	193,653,850	7,568,568
<b>Moderate 23,894 Cars</b>	1,842,227	13,739,050	912,751	273,586,300	10,692,565
<b>Maximum 30,876 Cars</b>	2,380,540	17,753,700	1,179,463	353,530,200	13,817,010
<b>Total Pollution and Gas Consumption</b>	3,146,219	41,217,725	2,738,291	820,770,350	32,078,143

Total amount of vehicle pollution = Number of Cars \* Pollution rates per mile traveled (based on an annual average of 12,500 miles)

### Minimum Growth

16,913 cars \* 77.1lbs Hydrocarbon = 1,303,992 lbs  
 16,913 cars \* 575lbs Carbon Monoxide = 9,724,975 lbs  
 16,913 cars \* 38.2lbs Oxide of Nitrogen = 646,077 lbs  
 16,913 cars \* 11,450lbs Carbon Dioxide = 193,653,850 lbs  
 16,913 cars \* 447.5 = 7,568,568 gallons

### Moderate Growth

23,894 cars \* 77.1lbs Hydrocarbon = 1,842,227 lbs  
 23,894 cars \* 575lbs Carbon Monoxide = 13,739,050 lbs  
 23,894 cars \* 38.2lbs Oxide of Nitrogen = 912,751 lbs  
 23,894 cars \* 11,450lbs Carbon Dioxide = 273,586,300 lbs

<sup>96</sup> These four pollutants are hydrocarbons, carbon monoxide, oxide of nitrogen, and carbon dioxide. All are measures used by the EPA to determine air quality. Retrieved on November 23 from [www.epa.gov/otag/consumer/f00013.pdf](http://www.epa.gov/otag/consumer/f00013.pdf)

23,894 cars \* 447.5 = 10,692,565 gallons

### Maximum Growth

30,876 cars \* 77.1lbs Hydrocarbon = 2,380,540 lbs  
30,876 cars \* 575lbs Carbon Monoxide = 17,753,700 lbs  
30,876 cars \* 38.2lbs Oxide of Nitrogen = 1,179,463 lbs  
30,876 cars \* 11,450lbs Carbon Dioxide = 353,530,200 lbs  
30,876 cars \* 447.5 = 13,817,010 gallons

### Water Pollution

We used the “Simple Runoff Estimation Model” to determine phosphorous load in runoff. Phosphorous is a necessary nutrient in soil and water, but too much in marine ecosystems can cause algae blooms and other negative consequences. This later contributes to poor quality of water and low dissolved oxygen levels.

Base Equation →  $L = [(P) (P_j) (R_v) / 12] (C) (A)$  (2.72), where:

L is the Load of Pollutant in pounds per year,  
P is the Annual Rainfall Depth in inches,  
P<sub>j</sub> is the fraction of rainfall events that produce runoff or 90% (.90) of storms  
R<sub>v</sub> = (0.05 + 0.009(I)), where I is the impervious coefficient of the area,  
C is the flow-weighted mean of the pollutant in runoff (30 mg/L),  
A is the area of development in acres

We completed the formula under the following assumptions:

- Harford County receives an average annual rainfall of 45.5”
- Development will consist of Medium Density Residential units with a coefficient of imperviousness of 0.28
- Phosphorous is the only measured pollutant in the analysis
- A will be set to .25 acre, or ¼ acre, because this is a good measure of medium density residential units
- L will be the total phosphorous produced by one housing unit

Formula Substitution →

$$\begin{aligned} L &= [(45.5) (.9) (.05 + .009(.28)) / 12] (.3) (.25) (2.72) \\ &= [(45.5) (.9) (.05252) / 12] (.3) (.25) (2.72) \\ &= [2.150694/12] (.3) (.25) (2.72) \\ &= [.1792245] (.3) (.25) (2.72) \\ &= .036561798 \end{aligned}$$

**Therefore, L = .036561798 lbs. per year of phosphorous from one medium density unit**

To determine overall phosphorous concentrations per year, multiply the number of households produced by each alternative and L. The finalized figures are below.

	<b>Minimum Growth</b>	<b>Moderate Growth</b>	<b>Maximum Growth</b>
<b>Phosphorous Runoff (lbs./year)</b>	3507.63	3639.58	3771.53

References:

Minnesota 2005 Stormwater Manual. (2005). Appendix L. Retrieved from <http://www.pca.state.mn.us/publications/wq-strm8-14as.pdf>.

Maryland Department of the Environment. (2006). Rainfall Resource Guide. Retrieved from <http://www.mde.state.md.us/assets/document/rainbyco-30sep06.pdf>.

Maryland Department of Natural Resources. (2006) A User's Guide to Watershed Planning in Maryland. Chapter 4: Desktop Assessment Methods. Retrieved from <http://www.dnr.state.md.us/watersheds/pubs/planninguserguide/UserGuideChapter4.pdf>