

Aberdeen Proving Ground BRAC Impacts on Seven Jurisdictions

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The Chesapeake Science & Security Corridor (CSSC), home to Aberdeen Proving Ground, includes Baltimore, Cecil, Harford Counties and Baltimore City, MD, and has expanded to include York, Chester, and Lancaster, PA; New Castle County, DE; two metropolitan planning councils (Baltimore and Wilmington); the Greater Baltimore Committee and the Economic Alliance of Greater Baltimore, bringing together eight jurisdictions in three states. CSSC planning ensures a successful BRAC implementation and quality of life for those who live and work in our growing defense community. www.apg-cssc.com

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Executive summary

Introduction

The latest round of U.S. Department of Defense base realignment and closure (BRAC) has been described as representing the most important economic event in Maryland since World War II. Unless one considers the mass mechanization of the 1950s and 1960s, the commercial real estate and banking boom of the 1980s, or the business/technology investment boom of the 1990s as representing single events, that characterization is probably correct.

This analysis confirms what many have said and what others have heard. BRAC will be a significant source of economic and demographic expansion. This analysis estimates the economic, fiscal and public policy implications of BRAC-related growth at Aberdeen Proving Ground (APG) through 2017 for a seven-jurisdiction area that includes Harford, Cecil, Baltimore, New Castle, Lancaster and York counties and the City of Baltimore.

The analysis makes heavy use of publicly-sourced data and uses standard econometric methodologies. The study team also conducted the analysis under three separate scenarios: mid-case, low and high. By calculating employment, income, population and other impacts, the study team was able to identify by jurisdiction the most problematic elements from the perspective of ongoing BRAC accommodation, including prospective shortfalls in housing, school capacity, water/sewer capacity and wastewater treatment capacity through 2017, the final year forecasted.

Results

Exhibit E1 presents results across three scenarios for each of the seven analyzed jurisdictions. All told, APG BRAC will be responsible for the creation of a predicted 27,620 jobs within the seven-jurisdiction area, 16,682 additional households, 45,042 additional population, and 10,927 public school children.

Exhibit E1: Summary of mid-case scenario impacts by jurisdiction

Jurisdiction	Employment	Households	Population	Public school population
Harford County	19,237	7,059	19,059	4,624
Baltimore County	4,849	5,168	13,954	3,385
Cecil County	1,460	1,984	5,357	1,300
Baltimore City	941	877	2,368	575
York County	586	835	2,254	547
Lancaster County	266	379	1,025	247
New Castle County	281	380	1,025	249
Total	27,620	16,682	45,042	10,927

BRAC-related households will have average incomes of \$109,000 in 2007 dollars. Roughly 86 percent will live in owner-occupied housing with the balance living in rental housing. Among those purchasing a home, the average home price is estimated to be approximately \$400,000 in 2007 dollars. Average rents are predicted to be in the neighborhood of \$1,500 to \$2,000 per month. BRAC will also create aggregate demand for 3.6 million square feet of office space and 1.1 million square feet of retail space under the mid-case scenario. Exhibit E2 summarizes fiscal implications.

Each jurisdiction is anticipated to experience net positive fiscal impacts once all BRAC effects are in place. In the aggregate, the net positive fiscal impact of BRAC approaches \$37 million per annum in 2007 dollars among the seven jurisdictions studied in this analysis. State of Maryland gross tax receipts will be boosted by \$113 million per annum by 2017, most of which will be needed to address infrastructure and other issues, including \$200+ million simply to improve intersections impacted by APG.¹

Exhibit E2: Estimated BRAC-related cost of services compared to mid-case fiscal impacts per annum (millions)

<i>Jurisdiction</i>	<i>Total cost of services related to BRAC</i>	<i>Fiscal impacts related to BRAC</i>	<i>Net fiscal impact of BRAC</i>
Harford County	\$36.6	\$52.8	\$16.2
Baltimore County	\$25.9	\$36.4	\$10.5
Cecil County	\$8.2	\$12.3	\$4.1
Lancaster County	\$0.3	\$0.7	\$0.4
New Castle County	\$0.4	\$0.9	\$0.5
Baltimore City	\$6.7	\$10.5	\$3.8
York County	\$0.7	\$2.1	\$1.4
Total	\$78.8	\$115.7	\$36.9

Implications

The challenge will be to leverage future resources into present action. The study team has identified the following shortfalls in the macroeconomic environment into which BRAC effects will have to be absorbed:

- housing shortfalls in Harford County, emerging as early as 2012 and then worsening, with possible shortfalls in Cecil and Baltimore counties;
- strained public school capacity in Harford, Cecil and Baltimore counties, with potential shortfalls in Cecil County by 2012 or earlier;
- substantial public wastewater treatment capacity issues in New Castle and Cecil counties, though much of this is not necessarily related to BRAC effects; and
- significant increases in traffic at I-95/Exit 85, particularly as morning commuters approach APG from the west and along various points of US-40, MD-7, MD-22, MD-24, MD-755 and MD-543.

¹ Maryland Department of Transportation, SHA APG traffic study.

It is possible that MARC service will significantly reduce these predicted traffic counts. For instance, MARC service is currently available between Perryville and Aberdeen. MARC service also links Baltimore City and Baltimore County to Aberdeen, which also may serve as another reason for households to live in these jurisdictions. By implication, any related opportunities to engage in transit-oriented development should be exploited.

To the extent that planned expenditures on classroom space, water/sewer capacity, wastewater treatment capacity, office and retail space are not made according to current timetables, these shortfalls will worsen. As an example, by 2017 water supply capacity in Harford and Cecil counties is expected to increase by over 80 percent. Should these and other planned investments not transpire in a timely manner, these jurisdictions will not absorb as much economic activity as this analysis estimates. This will result in greater spillover effects into proximate jurisdictions, which is the primary source of estimation error in this analysis. It should also be noted that Cecil County in particular has an opportunity to capture far greater BRAC employment share by situating office space in the county between now and 2010. The study team's impact estimates reflect the current lack of available office space there.

Conclusion

Based on this analysis, the long-discussed BRAC impacts are real and large. The economic activities that BRAC will unleash in the seven-jurisdiction study area will be of a type that should permit ascendant quality of life, including through support for public investment, job availability, and support for higher quality retail/entertainment amenities.

All told, APG BRAC will create nearly 28,000 jobs, attract nearly 17,000 households and boost population by roughly 45,000 between now and 2017 in the seven-jurisdiction study area. Associated with this will be demand for 3.6 million square feet of additional office space and 1.1 million square feet of retail space.

There is considerable preparatory work to be done in the near-term. The analysis identifies existing shortfalls of housing, water/sewer capacity, wastewater capacity, and classroom capacity in various jurisdictions. Many of these shortfalls will evaporate if planned investments move forward. To the extent that they do not, BRAC impacts will be accommodated differently than has been predicted in this analysis, though the study team carefully considered the likely timing of infrastructure completion by jurisdiction to predict and allocate BRAC impacts and these considerations are embedded in estimates.

Finally, this report has not endeavored to calculate the dynamic/transformational effects of BRAC. BRAC will bring to Central Maryland and to a lesser extent to Delaware and Pennsylvania large numbers of scientific and technical personnel. This population will join an already formidable scientific/technical community; one that is increasingly innovative and global in scope. This now larger innovative community may be capable of generating an array and level of economic impacts that are presently unfathomable.

I. Introduction

Purposes and objectives

This Sage Policy Group, Inc. (Sage) analysis estimates the likely economic and fiscal impacts associated with the prospective relocation of thousands of employees to Aberdeen Proving Ground (APG). The analysis is unique in that it estimates a variety of impacts for a seven-jurisdiction area by jurisdiction and also provides policymakers with guidance related to necessary public investments and potential infrastructure-related and other bottlenecks.

The report provides estimates over a ten-year horizon stretching to 2017. While every effort has been made to comprehend and estimate the future impacts of BRAC on Harford, Cecil, Baltimore, New Castle, Lancaster, and York counties and Baltimore City, no claims of omniscience are made. Indeed, we can guarantee that projections made in this report will prove to be somewhat inaccurate.

The study team has, however, worked aggressively to minimize potential error, and has made its assumptions as explicit as the English language permits so that this report's vast array of stakeholders can make adjustments to the results presented below by superimposing their own assumptions of how the matter is likely to evolve. As additional BRAC experience is gained, it will be possible for local officials and other stakeholders to incrementally adjust projections and estimates to account for new information and developments.

As an example, there is a degree of uncertainty with respect to where jobs associated with the so-called defense contractor tail will ultimately be situated. Each jurisdiction in the study area has reason to believe that a significant proportion of jobs will find its way into their locale, including due to availability of office inventory, proximity to labor markets, etc. Over the next three to four years, it will become more obvious where these jobs will be, allowing policymakers to react according to circumstances. That said, this report has been designed to provide as much reliable forewarning as possible and has taken into consideration volumes of presently known information.

Methodology

This analysis addresses prospective BRAC-related impacts on seven jurisdictions. These are: Harford, Cecil, Baltimore, New Castle, Lancaster, and York counties and Baltimore City. It is expected that there will be some marginal impacts outside of this region, but that the lion's share of APG-related impacts will fall within this seven-jurisdiction territory.

The principal data sources for the analysis include a series of data requests made to individual jurisdictions. In other words, much of the data used to support the analysis are from official government sources. Data provided by the jurisdictions were supplemented by:

- earlier analyses of BRAC impacts in Maryland;
- data from the Maryland Department of Planning;
- data from the Baltimore Metropolitan Council;
- jurisdictional water and sewer plans;
- the U.S. Census Bureau; and
- miscellaneous other sources.²

The analysis is built around the establishment of a baseline scenario and three separate scenarios that estimate BRAC impacts based on differing assumptions. The baseline is defined as reflecting expected future conditions in a world lacking BRAC-related relocations to APG. Thus, there has been a concerted effort to estimate baseline conditions free of BRAC effects (what the world would have looked like but for the impending BRAC effects). For example, the Baltimore Metropolitan Council works with Harford and Baltimore counties and Baltimore City (as well as other local governments) to forecast population, households, and other variables. The most recent forecasts are known as Round 7 and embody various estimates of the influence that BRAC will have on future population, the number of households, and so forth. This analysis used Round 6B, an earlier forecast, which local officials have indicated are broadly unaffected by BRAC-associated considerations.

Because this baseline represents long-term forecasts, shorter-term cyclical factors may not be fully reflected in the study team's estimation of impact. As an example, the active inventory of unsold homes has risen sharply in the study area over the past two years. The implication is that a higher proportion of BRAC's household generation impacts will be accommodated by existing housing than would have been the case in the absence of the ongoing housing downturn. That said, as of July 2007, the active inventory of unsold homes remained well below 5 percent in most of the study area and the magnitude of estimated BRAC impacts is large enough to swamp short-term term cyclical factors.

To examine long-run BRAC effects, the analysis generated three scenarios defined by different levels of economic activity that might be created by BRAC. These scenarios include the mid-case—assumed to be the most likely scenario—and a low and high case. The scenarios are defined primarily by the direct increase in employment at APG and the extent to which this new employment creates additional employment for firms under direct contract to APG, the contractor tail. These scenarios have been designed to address the uncertainties that surround the likely effects of BRAC, one of the key purposes of the analysis.

In theory, the impacts of BRAC could under certain circumstances overwhelm the ability of local jurisdictions to absorb growth in a way that permits support for existing quality of life. In such a case, the analysis assumes that there are spillover effects on adjacent jurisdictions. For example, a shortage of housing at appropriate price points or public water in Harford County could result in households moving further from APG and settling in Cecil, Lancaster, or other jurisdictions. One of the sources of inaccuracy is

² A complete list of data sources and other referenced materials are listed at the end of the report.

that estimations are based upon the best information currently available regarding the future construction of housing, supply of key public services (e.g., water and sewer), etc. To the extent that these investments are not made in a timely manner, this analysis will overestimate impacts for certain areas and by implication underestimate them for others.

Assumptions

The assumptions made in this analysis are identified in the text and many are also discussed in detail in Appendix A. Among the most important assumptions is that the jobs arriving at APG and the associated defense contractor tail will neatly translate into labor force and population growth over time. While certainly some of the new jobs associated with BRAC will be filled by current residents of the region, the relatively low unemployment rate that characterizes the region implies that to the extent that there are vacancies created through job transfer, there will need to be an expansion in the labor force to backfill vacated jobs. This assumption has been made both with respect to the direct jobs at APG and the associated contractor tail.

But this assumption is prone to imprecision. As an example, Baltimore City has relatively greater unemployment and perhaps underemployment. For city residents, BRAC represents an expansion in employment opportunities and this may induce present or latent labor force members to expand their supply of labor to the marketplace. To the extent that this occurs, the analysis will have overestimated population increases and related economic and fiscal effects. Of course, the assumption as it stands is also a reflection of likely skills mismatches between current unemployed and underemployed residents and the requirements of BRAC-associated jobs.

Another key Sage assumption revolves around likely commuting patterns. Many jobholders have expressed a preference for shorter commutes, and to the extent that the study team's modeling excessively reflects these stated/survey quantified preferences, projections may overstate the extent to which households will locate in housing proximate to APG. While shorter commutes represent a broadly shared preference, the region's historic experience is that significant proportions of workers spend 30, 45, or 60+ minutes driving each way to work. The long-term pattern suggests that commutes in and around Central Maryland will become longer over time. The study team has worked to generate estimates that reflect both stated preferences and emerging commute time realities, but as with virtually any analytical assumption, the study team's may prove to be excessively weighted one way or the other.

II. New Jobs at APG and their Multiplier Effects

Over the next 7 to 10 years, increasing APG employment will generate a significant multiplier effect that will increase the demand for services, office space, retail space and other items. New households come with employment, and these create their own set of economic impacts and also unleash new demand for classroom space and a variety of public services. The discussion below describes the succession of predicted impacts that will be traceable to new APG employment and their public policy implications.

Net changes in jobs at APG and associated employment impacts

Changes to come in the study area as a result of BRAC fundamentally stem from the anticipated net increase in jobs at APG. Some of these jobs have already begun to materialize as developers and others position themselves for the transformations and associated opportunities to come, but the vast majority of impacts will not occur until the end of the current decade and during the first years of the next.

There remains some uncertainty with respect to the number of jobs that will be located at APG. In a recent presentation to the Harford County Council, Garrison Commander Colonel John Wright³ of APG indicated that fewer than 50 people had already transferred from Fort Monmouth, New Jersey. Ultimately, Colonel Wright estimated a net increase of approximately 8,200 jobs at APG.⁴

Alternatively, in its study of BRAC activities in Maryland, Science Applications International Corporation (SAIC) estimated that there would be a net increase of 9,154 jobs at APG. As shown in Exhibit II-1, this net increase includes an estimated modest decrease in the number of military personnel at the base and a substantial increase of civilian defense personnel and embedded contractors. Embedded contractors are defined as those operating out of government-supplied, on-base space. As will be discussed later, the population of embedded contractors is not defined to include a substantial number of workers who are also under contract to the government, but who work either off base or in privately developed space on base known as EUL or enhanced use lease.⁵

Exhibit II-1: Net change in jobs at APG

<i>Employer</i>	<i>Transfers</i>	<i>Base Operations Support</i>	<i>Total</i>
Military	(228)	(317)	(545)
Civilian defense	7,014	23	7,037
Embedded contractors	2,662		2,662
Total	9,448	(294)	9,154

Source: SAIC

³ Now retired.

⁴ Mike Silvestri, "Army informs county of effects of BRAC's population influx," *The Baltimore Examiner*, June 21, 2007, page 13.

⁵ "BRAC Activities Affecting Aberdeen Proving Ground, Andrews Air Force Base, Bethesda Naval Hospital, and Fort Meade and in the State of Maryland," draft final report, Science Applications International Corp., March 31, 2006.

In its analysis, SAIC assumed that 30 percent of those currently working in New Jersey at jobs that would be transferred to APG would relocate. Under this assumption, almost 3,000 workers now in New Jersey would ultimately relocate to Harford County and the surrounding region. As shown in Exhibit II-2, most of these relocating workers are civilian Department of Defense employees.

Exhibit II-2: Relocations from New Jersey to APG

<i>Employer</i>	<i>Total jobs</i>	<i>Those relocating (1)</i>
Civilian defense	7,037	2,111
Embedded contractors	2,662	799
Total	9,699	2,910
Source: SAIC		

The two estimates of net increased employment at APG define the range of direct BRAC impacts that this analysis will consider. The low case is predicated on a net increase of 8,200 jobs at APG while the high case is predicated on a net increase of 9,154 jobs. The mid-case for this analysis is defined as the midpoint between these two estimates, that is, a net increase of 8,677 jobs.

In addition to the on-base jobs, the shift of economic activity to APG will include a number of federal contractors who work directly with and for DOD agencies that will become base residents. These companies and their workers are collectively referred to as the “contractor tail.” From the perspective of economic and fiscal impacts, these jobs will act in a manner similar to the new jobs located at APG. This is because the jobs are qualitatively similar even though some are on base and some are off, and therefore the broader regional economic impacts are comparable.

The size of the contractor tail is subject to even more uncertainty than is the number of jobs that will be created on base.⁶ Estimates have reportedly run as high as six jobs in the contractor tail for each net job increase at APG.⁷ The implication is that the contractor tail could generate nearly 50,000 jobs by itself.

The study team views that as unlikely. Better documented estimates of the ratio of contractor-tail jobs to on-base jobs are less ambitious. In its assessment of the jobs created by BRAC in Maryland, RESI estimated that 8,000 contractor-tail jobs would be created statewide in addition to the 15,272 direct jobs at federal facilities in Maryland.⁸ This amounts to slightly more than one contractor-tail job for every two direct/on-base jobs.

The experience of Arlington County, Virginia, provides another estimate of the likely size of the contractor tail that will envelop APG and impact the broader study territory. In the prior BRAC round, the Naval Sea Systems Command moved from 1.2 million

⁶ See Appendix A for discussion of contractor tail.

⁷ Personal communication from Daniel Rooney, Comprehensive Planner, Harford County Department of Planning and Zoning, June 21, 2007.

⁸ “BRAC Task #3 Report,” draft, RESI of Towson University, June 15, 2006, page 4.

square feet of leased office space in Arlington County to the Navy Yard in Washington, D.C. Along with that move, an additional 1 million square feet of office space that had been leased by contractors was vacated. Assuming that contractors and military personnel use about the same space per worker, this experience suggests that a little over 0.8 contractor jobs are associated with each Department of Defense job.⁹

This analysis uses these two estimates of contractor-tail jobs as the low case and mid-case estimates. The high case estimate is calculated by adding the difference between the low case and mid-case to the mid-case estimate and is thereby represents a ratio of about 1.1 contractor-tail jobs per Department of Defense job.

By utilizing these three variations of the ratio of contractor-tail jobs to Department of Defense jobs, an estimate of the total direct jobs created by BRAC at APG can be calculated. Exhibit II-3 presents the estimated direct jobs associated with these three cases. The mid-case, the most likely case from the study team’s perspective, would encompass 15,908 on-base and contractor-tail jobs. For the low case, this total is 12,495 jobs, while the total for the high case is 19,320 jobs.

Exhibit II-3: Estimated on-base and contractor-tail jobs

<i>Type of job</i>	<i>Mid-case</i>	<i>Low case</i>	<i>High case</i>
On-base	8,677	8,200	9,154
Contractor-tail	7,231	4,295	10,166
Total	15,908	12,495	19,320

Source: Sage

These new on-base and contractor-tail jobs will create new opportunities for businesses in Harford County and the surrounding region. These opportunities will arise from the need for a wide range of goods and services from office supplies to accounting services. Money spent for these goods and services will create revenues for regional businesses, which will use part of these revenues in turn for their own purchases of goods and services. The totality of cascading business-to-business transactions creates what is called the indirect effect of the new on-base and contractor-tail jobs.

The income earned by on-base and contractor-tail workers as well as by workers in the indirectly affected establishments will be largely spent in the study area. These consumer expenditures create yet another set of jobs, which are considered the induced effect of the on-base and contractor-tail impacts.¹⁰

Exhibit II-4 summarizes all jobs associated with the BRAC changes in employment at APG. For the mid-case, a total of 27,780 jobs would be created in Harford County and the surrounding region. The range for the low case and high case runs from 21,821 jobs to 33,739 jobs.

⁹ “The federal presence in the urban village: the economic impact of federal facilities in Arlington, Virginia,” Arlington Economic Development, Issue Paper No. 3, Arlington Economic Development, December 2003, page 4.

¹⁰ See Appendix A for discussion of methods to estimate indirect and induced employment.

Exhibit II-4: Total jobs associated with BRAC effects at APG

<i>Type of job</i>	<i>Mid-case</i>	<i>Low case</i>	<i>High case</i>
On-base	8,677	8,200	9,154
Contractor-tail	7,231	4,295	10,166
Indirect	3,440	2,702	4,178
Induced	8,432	6,623	10,241
Total	27,780	21,821	33,739
Source: Sage			

Households, population, and school-age population

The transfer of jobs to APG and the consequent creation of jobs in Harford County and the surrounding region will drive the demographic changes that the region will experience. The first step in estimating the size of these changes is to understand the relationship between employment and household formation. Based on recent experience in Maryland, it is estimated that there are 1.64 jobs per household for households likely to be participating in the labor force.¹¹ Based on average household size in Monmouth County, New Jersey, it is estimated that there are an average of 2.7 persons per household.¹²

By using these estimates of jobs per household and household size, the increase in households and population attributable to BRAC changes at APG can be projected. Exhibit II-5 presents the estimated increase in jobs, households, and population for the mid-case, low case, and high case. In the mid-case estimate, almost 17,000 households will end up in the study area that would not otherwise locate to the seven-jurisdiction area but for APG BRAC. These households will add over 45,000 persons to baseline population. The range for the low and high cases runs from over 13,000 to over 20,000 new households and a population increase that runs from almost 36,000 to over 55,000.

Exhibit II-5: Total households and population associated with BRAC effects at APG

<i>Type of job</i>	<i>Mid-case</i>	<i>Low case</i>	<i>High case</i>
Increase in jobs	27,780	21,821	33,739
Increase in households	16,910	13,283	20,537
Increase in population	45,657	35,863	55,451
Source: Sage			

There have been various estimates of the increase in jobs, households, and population associated with that net increase in employment at APG. A study by RESI of Towson University, estimated that BRAC would result in a total of 25,121 net new jobs and an increase of 15,603 new households. The estimates in Exhibit II-5 are higher in part because of Sage's estimate of contractor tail size. This analysis also appropriately models the contractor tail as a direct employment impact, which in economic impact modeling translates into greater economic impact than were these jobs modeled as indirect impacts.

¹¹ See Appendix A for discussion of this estimate.

¹² SAIC, page 2-8.

The conversion of jobs to households in this analysis is different from the conversion used by SAIC and RESI. In those analyses, a ratio of 1.5 jobs per household was used as opposed to the 1.64 ratio used in this analysis (see Appendix A for discussion). As a result, this analysis estimates fewer households for a given level of employment than is true in the SAIC and RESI analyses. The substantially larger estimates of employment associated with BRAC effects at APG used in this analysis, however, result in substantially larger estimates of households and population compared to the SAIC and RESI analyses. Sage believes its estimates to be more in line with reality because they are based precisely on existing data and also reflect the professional attributes of the households moving into the region. These attributes are more consistent with two-income households than the SAIC or RESI estimates reflect.

Relatively little data are available regarding the marital status and the number of dependents likely to be associated with this new population. Based on one survey conducted of employees at Fort Monmouth who were likely to relocate or were considering relocating to APG, it is estimated that there would be just over one school-age child (aged 5 to 18 years) per household. Approximately three out of four of the school-age children are estimated to be public-school students. It is assumed that the remaining school-age children will attend parochial or independent schools or will be home-schooled.

Harford County projects public-school enrollments using a value per household lower than that derived from the survey taken of households likely to transfer from Fort Monmouth to APG. This value was also used to project BRAC-related public-school populations. See Appendix A for a discussion of school-age populations and associated likely public school attendance impacts.

As shown in Exhibit II-6, the mid-case estimate is that over 14,000 school-age children will be associated with BRAC effects at APG. Of these, over 11,000 will attend public school according to study team estimates. The range for the low case and high case runs from roughly 9,000 to approximately 21,000 school-age children, of whom roughly 7,000 to more than 16,000 would attend public school.

Exhibit II-6: School age and public school population associated with BRAC effects at APG

<i>Type of job</i>	<i>Mid-case</i>	<i>Low case</i>	<i>High case</i>
School age population	14,441	9,005	21,153
Public school age population	11,076	6,907	16,224

Source: Sage

Office space and retail space

In addition to demand for schools and other public services, BRAC will create new demand for commercial real estate. Two key types of commercial real estate are office space and retail space. Most of the jobs that BRAC will bring to Harford County and the surrounding region require office space, a reflection of the high proportion of professional/technical jobs. Associated consumer spending that will occur in the study area will create demand for additional retail space.

specific estimates of impact. It is difficult to dispute the notion that the locus of these impacts will be Harford County, but these impacts are likely to be felt throughout the region of interest and to a lesser extent to geographies beyond.

The allocation of these impacts is based largely on two factors. The first is where the direct jobs are likely to be located. For DOD employees, embedded contractors, and a material portion of the contractor tail, the location will likely be APG itself. Because there appears to be capacity for up to 3 million square feet of office space available to the contractor tail at APG and another 800,000 square feet of space just beyond the entrance to the base, it is theoretically possible that all direct office-based employment would be located at or adjacent to APG (i.e., nearly 16,000 jobs). However, there are other factors, including the efforts of economic development agencies in other jurisdictions, the desire to be between APG and some other institution or geography such as NIH, Washington, D.C. or Fort Monmouth, the desire to be more proximate to the densest regional labor markets (e.g., Wilmington, Baltimore), and considerations of affordable lease rates.

Another critical factor in reasonably allocating future impacts is commuting patterns. People generally seek to live close to work. This preference is also impacted by the presence of two-earner households, housing supply, housing choice, housing expense, school availability/perceived quality, and other factors including those related to difficult-to-model lifestyle selections. Given the diversity and variety of work opportunities, housing, and schools in the study area, it is assumed that it is possible to satisfy most households' housing needs and concerns within the bounds of traditional commuting patterns. Consequently, data regarding historic commuting patterns was a critical element in allocating and distributing the new households that will enter the region as a result of APG BRAC.

Exhibit II-8 summarizes recent commuting experience in Maryland and New Jersey. While the commuting experience of these two states is similar, New Jersey commuters spend slightly less time traveling to work than do their Maryland counterparts.

Exhibit II-8: Travel time to work

<i>Minutes</i>	<i>Maryland commuters</i>	<i>New Jersey commuters</i>
Less than 10	8.7%	11.9%
10-14	10.8%	12.8%
15-19	12.8%	13.5%
20-24	13.5%	13.2%
25-29	6.3%	5.6%
30-34	15.0%	13.1%
34-44	8.6%	7.0%
45-59	11.6%	9.4%
60-89	8.9%	8.9%
Over 90	3.7%	4.6%
Mean time	31.2	30.0
Source: 2000 U.S. Census		

The survey of those considering relocating from Fort Monmouth to APG included a question regarding preferred commuting times. Responses to this question are summarized in Exhibit II-9. Overall, preferred commuting times are similar to the actual commuting experience in Maryland and New Jersey. Preferences for very short commutes, those less than 10 minutes in length, are below actual commuting experience. Not surprisingly, few people prefer commuting an hour or more to work, whereas more than 12 percent of commuters actually travel for this length of time in both Maryland and New Jersey.

Exhibit II-9: Time relocating workers would consider commuting

<i>Minutes</i>	<i>Sure relocators</i>	<i>Possible relocators</i>
Less than 10	3.0%	1.0%
10-29	51.0%	48.0%
30-44	33.0%	38.0%
45-59	8.0%	10.0%
Over 60	1.0%	1.0%
No response	3.0%	3.0%

Source: October 2006 BRAC Survey results and analysis

In estimating the commuting patterns for new households coming to Central Maryland because of BRAC, this analysis has placed more weight on the experience of Maryland commuters than on the stated preferences of those who will likely become Maryland, Delaware or Pennsylvania commuters. The estimated one-way commute times used in this analysis are presented in Exhibit II-10 and are compared to U.S. Census estimates of Maryland commuting patterns and the commuting preferences of those responding to the aforementioned BRAC survey.

Exhibit II-10: Estimated allocation of commuters

<i>Commuting minutes</i>	<i>Share based on Maryland commuting</i>	<i>Share based on commuting preferences</i>	<i>Sage estimate</i>
Under 20	32.3%	53.1%	30.0%
20-30	19.8%		25.0%
31-45	28.7%	36.6%	30.0%
45-59	9.8%	9.0%	10.5%
60 and over	9.5%	1.0%	4.5%
Total	100.0%	100.0%	100.0%

Sources: US Census, BRAC survey, Sage

By estimating travel times from APG to communities in Harford County and the surrounding region, it is possible to map commuting time bands. With one exception, travel times were estimated using MapQuest.

The exception is travel times from communities in eastern Baltimore County with ready access to I-95. The basic argument for this exception is that someone traveling from White Marsh or Rosedale would primarily use to I-95 to travel to APG. At peak commuting times, these individuals would be traveling against the flow of traffic. This

reverse commuting tends to reduce travel times, a phenomenon that may not be adequately factored by MapQuest travel times.

The Baltimore Metropolitan Council (BMC) routinely collects data on travel times during peak periods. According to BMC's most recent congestion monitoring reports, travel time on I-95 between the Baltimore Beltway and Harford County can be reduced by as many as 5 minutes by traveling against traffic. This benefit is not always available, however. The benefit of reverse commuting on I-95 between the Baltimore Beltway in Harford County can also be less than 1 minute. Reverse commuting on Pulaski Highway (US 40) and Belair Road (US 1) may reduce travel time between Baltimore County and Harford County by 3 minutes. Other major commuting routes from Baltimore County into Harford County analyzed by the Baltimore Metropolitan Council are not associated with reverse commuting benefits.

Exhibit II-11 lists travel time from APG to a number of potential residential communities within an hour or so from the base. As noted in the exhibit a few communities are presumed to benefit from reverse commuting, however, most communities are not. It should be noted that Fort Meade, the other major location for BRAC impacts in Maryland is estimated to be just over one hour from APG. Travel time to Annapolis, which like Fort Meade is in Anne Arundel County and outside of the region of interest, is estimated at 69 minutes.

Exhibit II-11: Travel time from APG to potential residential locations

<i>City</i>	<i>County</i>	<i>State</i>	<i>Minutes</i>	<i>Miles</i>
Aberdeen	Harford	MD	3	1.0
Havre de Grace	Harford	MD	15	9.2
Edgewood	Harford	MD	17	11.6
Churchville	Harford	MD	18	10.5
Perryville	Cecil	MD	18	11.1
Joppatowne	Harford	MD	18	14.0
White Marsh (1)	Baltimore	MD	20	18.3
Bel Air	Harford	MD	23	17.3
North East	Cecil	MD	26	18.3
Rosedale (1)	Baltimore	MD	29	24.6
Essex (1)	Baltimore	MD	30	24.6
Perry Hall	Baltimore	MD	31	20.2
Elkton	Cecil	MD	33	24.0
Jarrettsville	Harford	MD	36	27.2
Delta	York	PA	37	21.0
Lutherville	Baltimore	MD	39	33.6
Jenkins Corner	Lancaster	PA	40	22.8
Towson	Baltimore	MD	40	33.0
Jacksonville	Baltimore	MD	43	29.4
Fells Point	Baltimore City	MD	43	29.4
Roland Park	Baltimore City	MD	43	34.1
Wakefield	Lancaster	PA	44	26.1
Newark	New Castle	DE	44	34.5
Cockeysville	Baltimore	MD	46	39.6
Peach Bottom	York	PA	47	26.0
Fawn Grove	York	PA	47	29.0
Pikesville	Baltimore	MD	49	40.7
Elkridge	Howard	MD	50	41.5
Bethesda	Lancaster	PA	52	35.4
Wilmington	New Castle	DE	55	47.0
Columbia	Howard	MD	59	50.8
Stewartstown	York	PA	60	43.0
Fort Meade	Anne Arundel	MD	61	51.1
Annapolis	Anne Arundel	MD	69	60.6
Lancaster	Lancaster	PA	75	46.5
York	York	PA	78	58.9

Note. (1) Community is assumed to benefit from reverse commuting. MapQuest travel time has been reduced by 3 minutes.
Sources: Sage, MapQuest, and Baltimore Metropolitan Council

A visual presentation of the potential commuting region for APG is shown in Exhibit II-12. A direct radius of 50 miles probably represents the extreme limits of all but the hardest of commuters. It does clearly show, however, that commuters are likely to come from Pennsylvania and Delaware as well as from various locations in Maryland.

Exhibit II-12: Map of jurisdictions within approximately 50 miles of APG

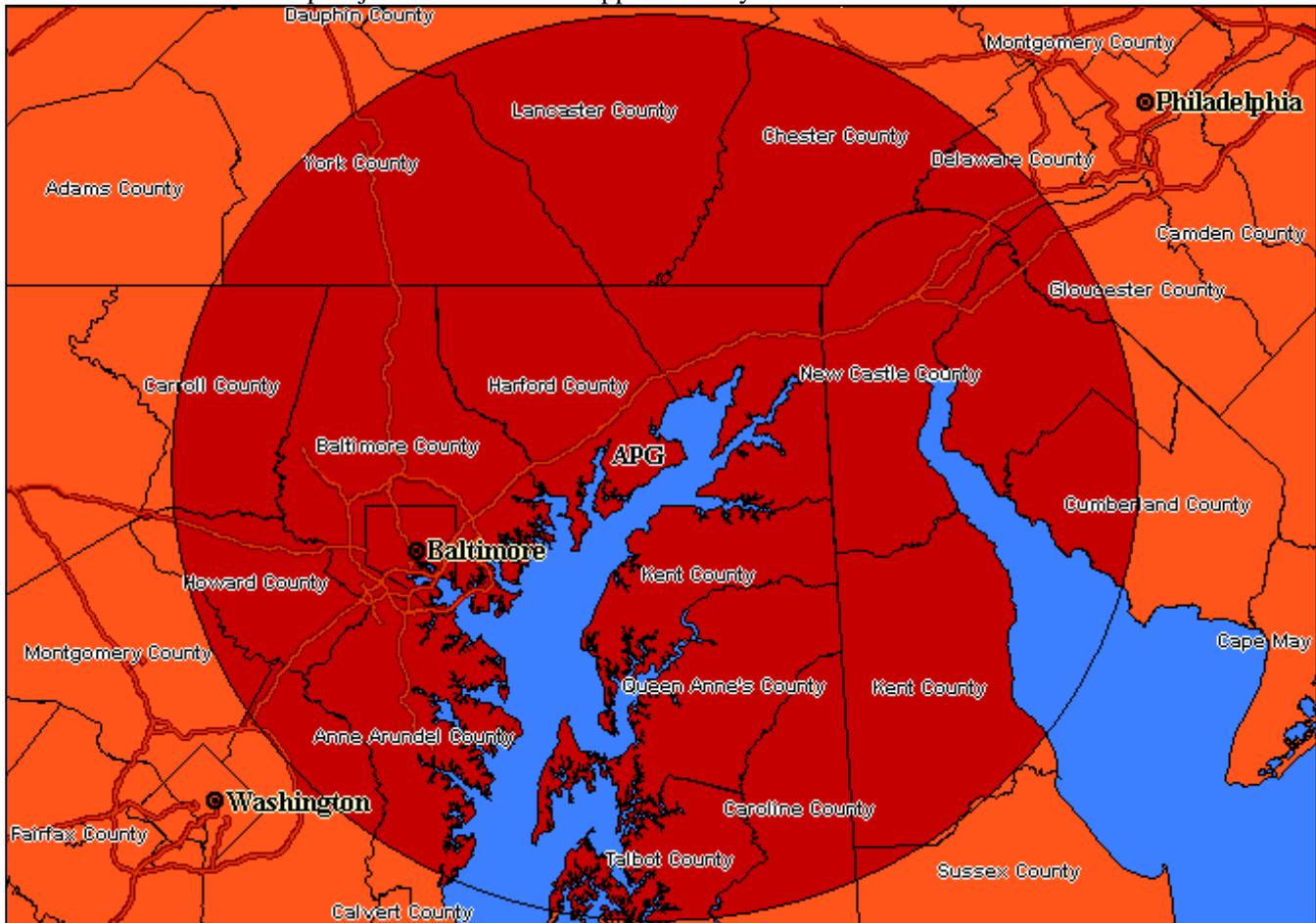


Exhibit II-13 identifies areas within counties for each of the major commuting bands from APG. When commuting 20 minutes or more, more than one county can be reached. In these cases, the share of commuters within a particular commuting band is allocated on the basis of population and travel times within the band. For example, commuting 20 to 30 minutes allows one to choose between Harford County in the vicinity of Bel Air, several Baltimore County communities along I-95, and most of Cecil County.

Because of greater population densities in these Harford County and Baltimore County communities compared to Cecil County, it is assumed that households commuting this distance would be twice as likely to locate in Harford County or Baltimore County than in Cecil County. The study team made this assumption because population density is presumed to correlate with housing supply, housing choice, school availability, and other factors households use in choosing residential locations, including availability of retail/restaurant amenities. The supply of infrastructure plays an obvious role in this dynamic since those areas with infrastructure in place are the same ones that can best absorb new development. Of course, development patterns can change over time, and to the extent that relative density shifts over time, the assumption will break down. One could also argue that the current level of cyclical weakness in the housing market will also impact housing decisions in ways that are difficult to predict.

For those willing to commute 31 to 45 minutes, there are even greater choices. In addition to population density, part of the judgment in allocating commuters in this commuting band was the fact that Baltimore City and much of Lancaster County are almost 45 minutes from APG. Because of this greater distance, Baltimore City and Lancaster County were allocated smaller shares of the commuters in this commuting band. Commuting an hour or more from APG would also allow one to locate in Anne Arundel or Howard counties, both outside the region of interest.

Exhibit II-13: Estimated allocation of APG workers based on commuting patterns

<i>Commuting minutes</i>	<i>Commuting band share</i>	<i>County share</i>	<i>Locations within counties</i>
Under 20	30.0%	30.0%	Harford County along I-95 and northeastern section
20-30	25.0%	10.0%	Harford County--Bel Air
		10.0%	Baltimore County--White Marsh, Rosedale, Essex
		5.0%	Cecil County--Perryville and North East (toll pushes Perryville into this tier)
31-45	30.0%	6.5%	Harford County—Jarrettsville
		7.5%	Cecil County—Elkton
		10.0%	Baltimore County--Lutherville, Towson
		3.5%	Baltimore City--Fells Point, Roland Park
		1.5%	York County--southeastern portion
		1.0%	Lancaster County--southern portion
45-59	10.5%	2.5%	New Castle County--Newark (toll pushes Newark into this tier) ¹³ and remainder
		2.5%	York County--Fawn Grove and southern part of county
		5.5%	Baltimore County--Cockeysville and north
Over 60	4.5%	1.5%	York County--along I-83
		1.5%	Anne Arundel County, Chester County, Howard County—all
		1.5%	Lancaster County—Lancaster
Total	100.0%	100.0%	

Exhibit II-14 summarizes the predicted allocation of commuters working at APG. This analysis assumes that roughly half of the workers at APG would commute from and reside in Harford County. Another quarter of the workers would live in Baltimore County. One worker in eight would live and Cecil County, while the rest would be distributed in other jurisdictions. An estimated 1.5 percent would live outside of the region of interest.

¹³ It is possible that certain New Castle County residents could avoid the worst toll congestion by strategic use of various roadways including Elkton Road, which originates in Newark. However, average travel time would still approach roughly 45 minutes.

Exhibit II-14: Summary allocation of APG commuters by county

<i>County</i>	<i>Share of total</i>
Harford County	46.5%
Baltimore County	25.5%
Cecil County	12.5%
Lancaster County	2.5%
New Castle County	2.5%
Baltimore City	3.5%
York County	5.5%
Anne Arundel County, Howard County, Chester County, other	1.5%
Total	100.0%

Commuting patterns and distribution of contractor-tail workers

The commuting behavior described above applies to APG workers who are either employees of the Department of Defense or are embedded contractors. The commuting behavior of contractor-tail workers is assumed to be similar. Where these workers will locate, however, is subject to uncertainty and this of course will impact from where commutes will begin and end.

Logically, it would be expected that APG contractors would locate near APG. This notion is supported by the behavior of federal contractors that moved from Arlington County to Washington, DC, to be near their DOD client. Moreover, an office complex has been planned for APG that could potentially accommodate up to 3 million square feet of office space and which would be available to the contractor tail.¹⁴ This complex, Opus G.A.T.E., could supply virtually all the office space demand created by the mid-case scenario, including demand created by indirect and induced employment. Recently, another developer announced plans for an 800,000-square-foot office complex at the Route 22 entrance to APG.¹⁵ In combination these two developments could provide 3.8 million square feet of office space on or immediately outside of APG. Existing Class A office space is also available in Belcamp and Havre de Grace.

The availability of this office space, however, is not guaranteed. Aberdeen is currently at or near its water and wastewater treatment capacity limits. While there will be substantial increases in Aberdeen’s water and wastewater treatment capacity over the next 10 years, there may be difficulties in creating this capacity in time for office space to be developed and available when contractors who may want to locate adjacent to APG need to make lease decisions. As this capacity for Aberdeen will be derived from facilities built on APG itself, there may also be uncertainty about the timely availability of office space on base (e.g., the Opus G.A.T.E. project).

¹⁴ “The G.A.T.E. at Aberdeen Proving Ground,” www.opuscorp.com/projectdetail

¹⁵ Daniel J. Sernovitz, “COPT plans Harford Co. office park,” *Baltimore Business Journal*, July 20, 2007.

One alternative to office development in Aberdeen is new office space in the area of Abingdon. This area is served by the Harford County water and wastewater treatment systems which currently have excess capacity of 3 million gallons per day (MGD), much more than any office space would need. In addition, the Abingdon water treatment plant is scheduled to expand by 10 MGD by the end of 2010.¹⁶ Moreover, the Abingdon area has been considered, at least preliminarily, by developers for office space development.

Despite reasons for locating in Harford or the uncertainties of new office space development, it is presumed that some portion of the APG contractors may decide to locate elsewhere. Contractors may be doing business at APG and at Fort Meade and desire to locate in Baltimore City or Baltimore County. The availability of desired skills in the labor force may dictate site selections further from APG for some contractors. Baltimore County has the capacity to build 5 million to 7 million square feet of office space between White Marsh and Cross Roads at I-95 in eastern Baltimore County. Other contractors may find Cecil County attractive and easily accessible to APG along I-95 as well as to markets in Wilmington and suburban Philadelphia. Both Cecil and New Castle counties also enjoy relative proximity to Fort Monmouth, and many contractors may seek to straddle the area between APG and an installation with which they have had a relationship.

Notwithstanding the complexity of site selection decisions for individual companies, it is assumed that proximity to APG will trump other factors for most BRAC-related contractors. The uncertainties surrounding the supply of new office space in Harford County, the complexity of individual decisions concerning office locations, and the range of employment that may constitute the contractor tail, suggest that an estimated 90 percent of the low end office space demand by contractors may be met by Harford County. At the other end of the range, Harford County may be able to meet only 65 percent of the maximum demand for office space by these contractors. In either case, the analysis assumes the most likely alternative to Harford County is Baltimore County, given its proximity to APG, the availability of relatively more ample office space, and easier access to a larger labor pool. Baltimore City will also have competitive advantages for firms that may be doing business at Fort Meade or the Washington area as well as at APG. As noted above, Cecil County will have advantages over other firms although it is assumed to be less competitive than Baltimore County or Baltimore City.

This analysis, therefore, assumes the distribution of contractor-tail employment shown in Exhibit II-15. The principal determinant of distribution is the share of contractor-tail employment captured by Harford County. Employment not locating in Harford County is allocated as follows: Baltimore County (75 percent of non-Harford County employment), Baltimore City (20 percent of non-Harford County employment), and Cecil County (5 percent of non-Harford County employment).

This assumption could break down for a number of reasons. First, Cecil County's share of the defense contractor tail is low not because of its lack of geographic appeal, but

¹⁶ Personal communication, Jacqueline Ludwig, Harford County Department of Public Works, August 21, 2007.

because of its lack of available office space. Many of the decisions regarding office space will be made in 2008-2011 and presently Cecil County is not well-positioned to compete particularly with Harford and Baltimore counties. Those two jurisdictions have office space available and Harford County is known to have several projects under development suitable for defense contractors. However, should Cecil County be able to site more office space between now and 2010, it is likely that its share of the defense contractor tail will be larger than that presumed here, probably by orders of magnitude.

Second, our knowledge of the defense contractor tail is far from perfect. Under one theory some will choose to straddle Fort Monmouth and Aberdeen by locating in New Castle County, DE, thereby better preserving revenue generating relationships with customers in New Jersey. Moreover, location in New Castle County would provide contractors with access to the broader Philadelphia area labor force. The study team's model places relatively low probability on this given the demonstrated preference for proximity among BRAC/defense contractors. However, the study team acknowledges the very real possibility that the extent to which the defense contractor tail will locate in New Castle County has been underestimated by this analysis.

Exhibit II-15: Distribution of contractor-tail employment

<i>Jurisdiction</i>	<i>Share of employment</i>		
	Mid-case	Low case	High case
Harford County	77.5%	90.0%	65.0%
Baltimore County	16.9%	7.5%	26.3%
Cecil County	1.1%	0.5%	1.8%
Baltimore City	4.5%	2.5%	7.0%
Note: According to the study team's model, the lower the BRAC impacts, the greater the proportion absorbed in Harford County.			

The commuting patterns of these contractor-tail workers will mimic those of the workers at APG. The practical effect of the broader distribution of the contractor tail, however, is to diffuse the residential locations of workers more broadly throughout the region of interest, particularly in Baltimore and Cecil counties and Baltimore City.

The residential locations of indirect and induced workers' households are assumed to reflect the residential locations of APG workers and the contractor tail. When the locations of these indirect and induced workers are combined with the estimated location of residences of APG workers and contractor-tail workers, the basic allocation of all households related to BRAC changes at APG can be compiled. Population estimates can be found in Exhibit II-18, II-19 and II-20.

Allocation of BRAC impacts

The estimates provided above create the foundation for the estimates to follow. Exhibit II-16 presents the allocation of all BRAC-related employment for the mid-case scenario by type of job and jurisdiction. Included in the exhibit is the handful of jobs that are estimated to be located in Anne Arundel, Chester, and Howard counties. This level of detail is provided to give the reader a better understanding of how each type of job is

distributed within the study area. Generally the more outlying jurisdictions, such as Lancaster and New Castle counties, are expected to see increases in indirect and induced employment related to APG but not direct or contractor-tail employment. Allocations of all BRAC-related employment for the low case and high case differ in magnitude, but are very similar in their patterns of distribution.

Exhibit II-16: Mid-case allocation of all BRAC-related employment

<i>Jurisdiction</i>	<i>Type of job</i>				
	Direct	Contractor-tail	Indirect	Induced	Total
Harford County	8,677	5,604	1,436	3,520	19,237
Baltimore County		1,221	1,051	2,577	4,849
Cecil County		81	404	975	1,460
Lancaster County			77	189	266
New Castle County			77	204	281
Baltimore City		325	179	437	941
York County			170	416	586
Anne Arundel, Chester, Howard counties			46	114	160
Total	8,677	7,231	3,440	8,432	27,780

Note: Totals may not add due to rounding.

Exhibit II-17 presents the allocation of all BRAC-related employment for the three cases. As expected, Harford County receives the bulk of employment in all cases with Baltimore and Cecil counties also receiving significant increases in employment. Estimates of employment located in Anne Arundel, Chester, and Howard counties are not included in this or the following exhibits.

Exhibit II-17: Allocation of BRAC-related employment: three cases

<i>Jurisdiction</i>	<i>Mid-case</i>	<i>Low case</i>	<i>High case</i>
Harford County	19,237	16,253	21,232
Baltimore County	4,849	2,859	7,660
Cecil County	1,460	1,151	1,765
Lancaster County	266	225	294
New Castle County	281	238	311
Baltimore City	941	465	1,654
York County	586	495	647
Total	27,620	21,686	33,563

Note: Totals may not add due to rounding.

The households associated with BRAC-related employment will be more broadly distributed in the region than is employment because of the commuting patterns described above. Exhibit II-18 summarizes the distribution of households by jurisdiction for the three cases. Harford County is expected to absorb the largest share of these households, followed by Baltimore County, and then Cecil County. In part because of the assumption that some contractor-tail employment would be located in Baltimore City, the city will receive a meaningful share of these households.

Exhibit II-18: Allocation of BRAC-related households: three cases

<i>Jurisdiction</i>	<i>Mid-case</i>	<i>Low case</i>	<i>High case</i>
Harford County	7,059	5,964	7,791
Baltimore County	5,168	3,613	7,109
Cecil County	1,984	1,626	2,283
Lancaster County	379	321	419
New Castle County	380	321	419
Baltimore City	877	540	1,343
York County	835	705	922
Total	16,682	13,090	20,286

Exhibit II-19 presents the allocation of population associated with the allocation of households. Population estimates are based on the assumption of 2.7 persons per household.

Exhibit II-19: Allocation of BRAC-related population: three cases

<i>Jurisdiction</i>	<i>Mid-case</i>	<i>Low case</i>	<i>High case</i>
Harford County	19,059	16,103	21,036
Baltimore County	13,954	9,755	19,195
Cecil County	5,357	4,390	6,165
Lancaster County	1,025	866	1,131
New Castle County	1,025	866	1,131
Baltimore City	2,368	1,459	3,626
York County	2,254	1,905	2,488
Total	45,042	35,343	54,772

Exhibit II-20 lists the estimated public school population for the three cases by jurisdiction. As discussed earlier, these estimated public school populations are based on two assumptions, first, that on average 77 percent of school-age children (i.e. children from 5 through 17 years of age) would attend public schools. Remaining school-age children would attend parochial or private schools or perhaps would be schooled at home. Second, the average number of public-school children per household ranges from 0.52 to 0.79, with a mid-case value of 0.66.

Exhibit II-20: Allocation of BRAC-related public school population: three cases

<i>Jurisdiction</i>	<i>Mid-case</i>	<i>Low case</i>	<i>High case</i>
Harford County	4,624	3,101	6,155
Baltimore County	3,385	1,879	5,616
Cecil County	1,300	846	1,804
Lancaster County	247	166	331
New Castle County	249	167	331
Baltimore City	575	281	1,061
York County	547	367	728
Total	10,927	6,807	16,026

Estimated total demand for office space by jurisdiction is summarized in Exhibit II-21. Total demand comprises demand created by contractor-tail, indirect, and induced employment. As discussed above, substantial office space may and likely will be developed at APG itself or in nearby Harford County. If all contractor-tail employment were located in this Harford County office space, there would be a shift in demand from the allocation presented in the exhibit. This shift would increase the demand for office space in Harford County and reduce demand in Baltimore and Cecil counties and Baltimore City.

Exhibit II-21: Allocation of BRAC-related office space demand: three cases (square feet)

<i>Jurisdiction</i>	<i>Mid-case</i>	<i>Low case</i>	<i>High case</i>
Harford County	2,081,869	1,559,138	2,395,067
Baltimore County	861,210	479,975	1,412,411
Cecil County	241,588	187,607	297,437
Lancaster County	42,633	36,020	47,055
New Castle County	42,633	36,020	47,055
Baltimore City	173,381	80,446	314,531
York County	93,792	79,245	103,520
Total	3,537,107	2,458,452	4,617,076

Exhibit II-22 presents the estimated allocation of demand for retail space in shopping centers by jurisdiction. This demand is based on the distribution of population presented in Exhibit II-19 and the estimated requirement of 25 square feet of retail space per person. A slight adjustment has been made for Cecil and New Castle counties because of Delaware's tax-free shopping. The presumption is that a somewhat higher proportion of Cecil County retail demand (10 percent) will be satisfied in New Castle County relative to broader study area norms.

Exhibit II-22: Allocation of BRAC-related retail space: three cases (square feet)

<i>Jurisdiction</i>	<i>Mid-case</i>	<i>Low case</i>	<i>High case</i>
Harford County	474,312	400,745	523,506
Baltimore County	347,261	242,774	477,693
Cecil County	119,983	98,335	138,090
Lancaster County	25,501	21,545	28,145
New Castle County	38,831	32,472	43,490
Baltimore City	58,942	36,300	90,233
York County	56,101	47,400	61,920
Total	1,120,931	879,571	1,363,077

This analysis concentrates single-mindedly on the impacts of APG BRAC-related changes. There will be other BRAC impacts, however. The estimates shown in Exhibit II-23 provide estimates of households and population that are taken from an earlier RESI report. The calculation of public-school population is made on the basis of the mid-case scenario assumptions used in this analysis. For much of the study area, the magnitude of these impacts is modest to minimal in comparison to the impacts that are generated by APG. This statement is less true, however, for Baltimore City and Baltimore County.

The discussion in the remainder of this report does not take into consideration the impacts shown in Exhibit II-23, which implies that at the margin, projected shortfalls of service capacity may be greater than the estimates presented in the balance of this report suggest.

Exhibit II-23: RESI impacts from Fort Meade and Andrews AFB

<i>Jurisdiction</i>	<i>Households</i>	<i>Population</i>	<i>Public school population</i>
Harford County	225	608	147
Baltimore County	759	2,049	497
Cecil County	34	92	22
Lancaster County	N.A.	N.A.	N.A.
New Castle County	N.A.	N.A.	N.A.
Baltimore City	1,044	2,819	684
York County	N.A.	N.A.	N.A.
Sources: RESI, Sage			

III. Baseline Conditions and Projections

BRAC is expected to bring dramatic demographic and economic changes to the seven-jurisdiction study area. Even prior to BRAC, however, much of the region was projected to undergo dynamic change over the next decade. Many of the jurisdictions in this region are on the outer fringe of the Baltimore metropolitan area or the Philadelphia–Wilmington metropolitan area. Cecil County is strategically situated in or between both. In recent years, these more distant suburban areas have typically experienced the highest growth rates and the greatest economic/demographic change.

The following discussion estimates demographic and economic conditions in the region of interest over the next 10 years assuming that BRAC did not occur. This analysis assumes that the effects of BRAC discussed in the previous section would be in addition to the changes discussed below. Of course, as time passes and more data are acquired regarding the transformative impacts of BRAC, baseline dynamics in the study area are likely to change, which in turn will modify collective understanding of BRAC demographic and economic effects.

Population and households

As shown in Exhibit III–1, the population in the seven jurisdictions in the region of interest is currently estimated at 3.2 million people. In the absence of BRAC, this population would be projected to grow to 3.4 million in the year 2012 and to 3.5 million by 2017.

Exhibit III-1: Population estimates: baseline

<i>Jurisdiction</i>	<i>Population estimate, 2007</i>	<i>Population estimate, 2012</i>	<i>Population estimate, 2017</i>
Harford County (1)	242,700	260,100	271,520
Cecil County	102,000	114,000	126,800
Baltimore County (1)	802,300	824,980	836,500
Baltimore City (1)	651,080	658,420	658,400
New Castle County	520,000	540,000	560,000
Lancaster County (2)	497,875	517,691	537,375
York County	423,816	463,357	503,607
Total	3,239,771	3,378,548	3,494,202

Notes. (1) Data are from Baltimore Metropolitan Council Round 6B for 2005, 2010, 2015, and 2020, and are interpolated for 2007, 2012, and 2017.

(2) County provided data for 2005, 2010, 2015, and 2020; estimates for 2007, 2012, and 2017 are interpolations.

Sources: Unless otherwise noted, data were provided by local jurisdictions.

Projected population change over the next decade varies dramatically from jurisdiction to jurisdiction. Population growth is expected to be strongest in Cecil County and York County. Previously anticipated baseline population growth in Harford County is also very strong in the period 2007 to 2012, but was projected to taper off from 2012 to 2017. Projected population growth is slowest in Baltimore City, which was projected to grow

just over 1 percent from 2007 to 2012 and was actually expected to decline marginally from 2012 to 2017. Projected growth in Baltimore County is also relatively slow compared to the region as a whole. Projected growth in New Castle and Lancaster counties was anticipated to be close to the region-wide averages of 4.3 percent from 2007 to 2012 and 3.4 percent from 2012 to 2017. See Exhibit III–2 for details.

Exhibit III-2: Population change: baseline

<i>Jurisdiction</i>	<i>Population change: 2007-2012</i>		<i>Population change: 2012-2017</i>	
	Number	Change	Number	Change
Harford County	17,400	7.2%	11,420	4.4%
Cecil County	12,000	11.8%	12,800	11.2%
Baltimore County	22,680	2.8%	11,520	1.4%
Baltimore City	7,340	1.1%	(20)	0.0%
New Castle County	20,000	3.8%	20,000	3.7%
Lancaster County	19,815	4.0%	19,684	3.8%
York County	39,541	9.3%	40,250	8.7%
Total	138,776	4.3%	115,654	3.4%

Source: Sage

Projected growth in households for the baseline is summarized in Exhibit III–3. For 2007, there are an estimated 1.3 million households in the region. Total households were expected to grow to 1.4 million by the year 2017.

Exhibit III-3: Household estimates: baseline

<i>Jurisdiction</i>	<i>Household estimate, 2007</i>	<i>Household estimate, 2012</i>	<i>Household estimate, 2017</i>
Harford County (1)	90,940	98,940	105,600
Cecil County	37,240	42,385	47,745
Baltimore County (1)	322,180	332,860	338,520
Baltimore City (1)	260,520	268,560	271,880
New Castle County	200,000	205,000	210,000
Lancaster County (2)	186,605	193,870	203,374
York County	164,270	179,596	195,197
Total	1,261,755	1,321,211	1,372,316

Notes. (1) Data are from Baltimore Metropolitan Council Round 6B for 2005, 2010, 2015, and 2020, interpolated for 2007, 2012, and 2017.
(2) County provided data only for 2005, 2010, 2015, and 2020.
Sources: Unless otherwise noted, data were provided by local jurisdictions.

The rate of change in household growth across the region mirrors the rate of change in population. Projected increases in the number of households were highest in Cecil and York counties, and were also high in Harford County. Increases in households were projected to be smallest in Baltimore City and Baltimore County. New Castle and Lancaster counties again tended to reflect anticipated region-wide average increases. These rates of change are slightly higher than the rates of population change, a reflection of the trend towards smaller household sizes over time. These data are presented in Exhibit III–4.

Exhibit III-4: Household change: baseline

<i>Jurisdiction</i>	<i>Household change: 2007-2012</i>		<i>Household change: 2012-2017</i>	
	Number	Change	Number	Change
Harford County	8,000	8.8%	6,660	6.7%
Cecil County	5,145	13.8%	5,360	12.6%
Baltimore County	10,680	3.3%	5,660	1.7%
Baltimore City	8,040	3.1%	3,320	1.2%
New Castle County	5,000	2.5%	5,000	2.4%
Lancaster County	7,265	3.9%	9,504	4.9%
York County	15,326	9.3%	15,601	8.7%
Total	59,456	4.7%	51,105	3.9%

Source: Sage

Public schools

Public schools constitute one of the key services provided by local governments to their residents, arguably the most important and also the most expensive. In Maryland, school capacity is determined first by state government and is defined by specific pupil per classroom ratios; 20 students per pre-kindergarten class, 22 students per kindergarten class, and 25 students per class in primary grades.

Exhibit III-5 presents data on state-rated school capacities in Maryland jurisdictions for 2007 and 2012. These data need to be understood with several caveats. No data are available for the year 2017. This is not surprising as changes in school capacity are a function of capital budgets, which typically are not projected for 10-year periods. No data are available for jurisdictions outside of Maryland. While this is an apparent data gap, BRAC-related increases in public school populations are smallest in these outlying jurisdictions. Finally, capacity estimates for 2012 should be considered conservative because the capital budget cycle would allow for capacity additions that are not reflected in these numbers. Indeed, there are current plans for adding to schools in Cecil County, which if approved would increase capacity. These potential increases in Cecil County public school capacity are not reflected in the exhibit. Despite these analytical issues, the capacity estimates are valuable because they allow for the quantification of the ability of public systems to absorb increased student populations given current plans for enhanced capacity.

Exhibit III-5: Public school capacity estimates: baseline

<i>Jurisdiction</i>	<i>Public school capacity estimate, 2007</i>	<i>Public school capacity estimate, 2012</i>	<i>Public school capacity estimate, 2017</i>
Harford County	41,664	44,971	N.A.
Cecil County	16,748	16,748	N.A.
Baltimore County	111,518	112,268	N.A.
Baltimore City (1)	126,000	126,000	N.A.
New Castle County	N.A.	N.A.	N.A.
Lancaster County	N.A.	N.A.	N.A.
York County	N.A.	N.A.	N.A.

Note. (1) Baltimore City capacity from minutes of Maryland State Board of Education, February 22-23, 2005 and refer to the 2004-2005 public school year.
Sources: Unless otherwise noted, data were provided by local jurisdictions.

Known changes in public school capacity are listed in Exhibit III–6. Given the incompleteness of these data, these increases in school capacity should be considered preliminary and conservative. As shown, Harford County is expected to increase school capacity by 3,307 spaces or almost 8 percent by 2012. In fact these additions to capacity are expected to be available by 2010 at the latest. Baltimore County is expected to have a much more modest increase in capacity over the next 5 years. The exhibit indicates no change in Cecil County capacity, although, as noted above, these data do not reflect several projects under consideration that would add classroom space. Baltimore City is shown as having no increase in capacity. Recently, the city has actually reduced capacity, but retains substantial excess capacity.

Exhibit III-6: Public school capacity change: baseline

<i>Jurisdiction</i>	<i>Public school capacity change: 2007-2012</i>		<i>Public school capacity change: 2012-2017</i>	
	Number	Change	Number	Change
Harford County	3,307	7.9%	N.A.	N.A.
Cecil County	-	0.0%	N.A.	N.A.
Baltimore County	750	0.7%	N.A.	N.A.
Baltimore City	N.A.	N.A.	N.A.	N.A.
New Castle County	N.A.	N.A.	N.A.	N.A.
Lancaster County	N.A.	N.A.	N.A.	N.A.
York County	N.A.	N.A.	N.A.	N.A.

Source: Sage

Projected public school enrollments are presented in Exhibit III–7. Maryland local educational agencies are required to project enrollments in public schools for a period of 10 years. Available projections for Maryland schools extend either to school years beginning 2015 or 2016, and are therefore just short of the 10 year time frame for this analysis. Projections for 2012 and 2017 are not available for New Castle County.

Exhibit III-7: Public school enrollment estimates: baseline

<i>Jurisdiction</i>	<i>Public school enrollment estimate, 2007</i>	<i>Public school enrollment estimate, 2012</i>	<i>Public school enrollment estimate, 2017</i>
Harford County (1)	39,582	39,775	40,360
Cecil County	16,622	16,793	18,179
Baltimore County (1,2)	105,330	106,769	109,916
Baltimore City (3)	78,530	71,290	72,020
New Castle County	66,806	N.A.	N.A.
Lancaster County	70,123	69,318	70,766
York County	68,908	70,876	74,022

Notes. (1) Data listed as enrollments for 2017 are projected enrollments for 2015 made by Maryland Department of Planning.
 (2) Baltimore County data are actual enrollments, not FTE enrollments, as projected by Baltimore County Public Schools, which differ significantly from data published by Maryland Department of Planning.
 (3) All Baltimore City data are from Maryland Department of Planning. Data listed at enrollments for 2017 are projected enrollments for the 2016-2017 school year.
 Sources: Unless otherwise noted, data were provided by local jurisdictions.

Projected public-school enrollment increases or decreases in the absence of BRAC are presented in Exhibit III-8. Public-school enrollment was expected to increase modestly in Harford, Cecil, and Baltimore counties between 2007 and 2012. York County was expected to see a more significant increase in public-school enrollment in that period, while Lancaster County and Baltimore City were projected to sustain decreases in public school enrollment. For 2012 to 2017, Cecil and York counties were expected to have sharp increases in public school enrollment, while Harford, Baltimore, and Lancaster counties and Baltimore City were projected to experience more moderate increases.

Exhibit III-8: Public school enrollment change: baseline

<i>Jurisdiction</i>	<i>Public school enrollment change: 2007-2012</i>		<i>Public school enrollment change: 2012-2017</i>	
	Number	Change	Number	Change
Harford County	193	0.5%	585	1.5%
Cecil County	171	1.0%	1,386	8.3%
Baltimore County	1,439	1.4%	3,147	2.9%
Baltimore City	(7,240)	-9.2%	730	1.0%
New Castle County	N.A.	N.A.	N.A.	N.A.
Lancaster County	(806)	-1.1%	1,448	2.1%
York County	1,968	2.9%	3,146	4.4%

Source: Sage

Water and wastewater

Increases in population lead directly to increases in demands for drinking water and wastewater treatment services. Typically, these services are provided by public systems. In more rural areas of many of these jurisdictions, however, water is provided by wells and wastewater treatment is provided by septic systems owned and maintained by

individual property owners. When services are provided by private wells and septic systems, increases in population will not place new demands on publicly-owned water and wastewater treatment services.

The capacity of public water supply systems in the seven jurisdictions is presented in Exhibit III-9. The complexity of local drinking water supplies can be seen in the notes to the exhibit. For Harford County, supply is based on County and municipal systems as well as some capacity developed on base at APG. Baltimore City provides service to itself as well as to Baltimore County. In fact major water supplies for Baltimore City come from reservoirs located in Baltimore County (e.g., Loch Raven). Public water supply in Cecil County is a municipal function that does not extend into the unincorporated county. Water supply is also not necessarily fixed. In York County capacity can be measured either in terms of maximum pumping capacity or maximum safe yield from a variety of public water sources. As explained in the notes to the exhibit, the total capacity for York County reflects the more restrictive of these capacities for each source. Capacity data are not available for Lancaster County.

Exhibit III-9: Water supply capacity estimate (million gallons per day or MGD)

<i>Jurisdiction</i>	<i>Water supply capacity estimate, 2007</i>	<i>Water supply capacity estimate, 2012</i>	<i>Water supply capacity estimate, 2017</i>
Harford County (1)	26	38 ^(2,3)	47.5 ^(4,5)
Cecil County	7.6	11	14
Baltimore County	360	360	480
Baltimore City (6)	265	265	265
New Castle County (7)	116.4	115.8	116.4
Lancaster County	N.A.	N.A.	N.A.
York County (8)	59	65	70

Notes. (1) Municipal and Harford County reliable maximum daily capacity (Army supplies not included).
(2) Includes 10 MGD first expansion of Abingdon WTP.
(3) Includes Aberdeen City share (2 MGD) of proposed new 4 MGD WTP on base at APG.
(4) Includes planned 10 MGD second expansion of the Abingdon WTP
(5) Includes Aberdeen City share (1 MGD) of planned 2 MGD expansion of APG WTP.
(6) Capacity for Baltimore City also includes service to Baltimore County
(7) Available capacity (part of total capacity) equals 21.5 MGD in 2007, 18.7 MGD in 2012, and 16.48 MGD in 2017.
(8) York County's water supply capacity estimate for 2007 was obtained by comparing the pumping capacity of each York County public water supplier to the safe yield capacity (where available) of each supplier. The more restrictive of the pumping capacity or the safe yield capacity was used in the capacity summation for all of York County's public water suppliers. These data were obtained from Pennsylvania's DEP website. As a general check, review of the 1998 York County Water Supply Plan provided treatment capacities and safe yield capacities. Again, summation of the more restrictive of these two capacities for each supplier provided a total County capacity which was very near the total capacity achieved from DEP's website.
Sources: Data were provided by local jurisdictions.

Changes in the baseline water supply capacity are presented in Exhibit III-10. In the period from 2007 to 2012, Harford and Cecil counties are expected to increase public

water supplies substantially and York County is expected to have a significant increase in water supply capacity. In the other jurisdictions little or no change in capacity is expected during the next five years. From 2012 to 2017, Harford and Cecil counties are expected again to increase public water supplies substantially as will Baltimore County. York County again will have a significant increase in water supply.

Exhibit III-10: Water supply capacity change: baseline

<i>Jurisdiction</i>	<i>Water supply capacity change: 2007-2012</i>		<i>Water supply capacity change: 2012-2017</i>	
	MGD	Change	MGD	Change
Harford County	12	46.2%	10	25.0%
Cecil County	3	44.7%	3	27.3%
Baltimore County	-	0.0%	120	33.3%
Baltimore City	-	0.0%	-	0.0%
New Castle County	(1)	-0.5%	1	0.5%
Lancaster County	N.A.	N.A.	N.A.	N.A.
York County	6	10.2%	5	7.7%

Source: Sage

Wastewater treatment capacity projections for the baseline are listed in Exhibit III–11. As with public water supply, wastewater treatment capacity can be complex and represent a mixture of county and municipal systems. Baltimore City provides all wastewater treatment services for Baltimore County. It should be emphasized that the data for New Castle County are for available capacity, that is, unused capacity as opposed to total capacity.

Exhibit III-11: Wastewater treatment capacity estimate (MGD)

<i>Jurisdiction</i>	<i>Wastewater treatment capacity estimate, 2007</i>	<i>Wastewater treatment capacity estimate, 2012</i>	<i>Wastewater treatment capacity estimate, 2017</i>
Harford County (1)	27.2	28.3 ⁽²⁾	28.3
Cecil County	8.1	11	14
Baltimore County	N.A.	N.A.	N.A.
Baltimore City (3)	250.0	250.0	261.0
New Castle County (4)	2.6	2.6	2.6
Lancaster County	N.A.	N.A.	N.A.
York County (5)	74.0	81.0	88.0

Notes. (1) Municipal and Harford County annual average capacity (Army treatment capacity not included).
 (2) Includes 1.025 expansion of Havre de Grace WWTP; construction to be completed before 2010.
 (3) Baltimore City serves both Baltimore City and Baltimore County. Capacity in 2017 based on the city's Comprehensive Water and Wastewater Plan of August 2006.
 (4) Data refers to available capacity. Overall sewer capacity north of the canal is ultimately restricted by the flow limit established for New Castle County through the City of Wilmington/New Castle County sewer agreement. Current flow limit is 10.589 MGD.
 (5) York County wastewater treatment capacity for 2007 was obtained through analysis of data retrieved from the Community Facilities Report of the York County Comprehensive Plan. In the year 2006, roughly 30 percent of York County residents/businesses were serviced by onlot well water and onlot septic systems. Future capacities for water and sewage were obtained by assuming that 30 percent of the population would continue to be serviced by onlot systems. A ratio was then used to determine future capacities based upon the known present capacity and the future population projections.
 Sources: Individual jurisdictions; City of Baltimore, "Comprehensive water and wastewater plan," August 2006.

Expected changes in publicly owned wastewater treatment capacity are presented in Exhibit III-12. Over the next 5 years, Cecil County is expected to experience a substantial relative increase in wastewater treatment capacity. In that same period Harford and York counties will generate more modest capacity increases. From 2012 to 2017, Cecil County is again expected to significantly increase wastewater treatment capacity. Baltimore City and York County are also expected to see significant increases in capacity between 2012 and 2017.

Exhibit III-12: Wastewater treatment capacity change: baseline (MGD)

<i>Jurisdiction</i>	<i>Wastewater treatment capacity change: 2007-2012</i>		<i>Wastewater treatment capacity change: 2012-2017</i>	
	<i>MGD</i>	<i>Change</i>	<i>MGD</i>	<i>Change</i>
Harford County	1	4.0%	-	0.0%
Cecil County	3	36.0%	3	27.3%
Baltimore County	N.A.	N.A.	N.A.	N.A.
Baltimore City	-	0.0%	11	4.4%
New Castle County	-	0.0%	-	0.0%
Lancaster County	N.A.	N.A.	N.A.	N.A.
York County	7	9.5%	7	8.6%

Source: Sage

The projected changes in wastewater treatment capacity are for a publicly owned systems and do not include capacity that would be available through septic systems. Although in the State of Maryland there is a preference for growth to occur in areas served by public water and public wastewater treatment systems, a significant share of all growth tends to occur in areas where new housing is reliant on individual wells and septic systems. This trend is expected to continue into the future.

Housing

The availability of housing is one key to absorbing and managing growth. The future supply of housing is subject to many factors and substantial uncertainty.

The estimate of housing supply and inventory used to support this analysis begins with the U.S. Census estimate of 2005 housing inventory. The U.S. Census estimate is not the only source of data for the housing inventory. The Maryland Department of Planning maintains a database that also estimates housing inventory. Maryland Department of Planning estimates of the housing inventory in the four Maryland jurisdictions, however, appear to be substantially below U.S. Census estimates and, for Harford County, are below the county’s Round 6B estimate of housing units. This analysis assumes that the U.S. Census data are more reliable. These data are presented in Exhibit III–13.

Exhibit III-13: Housing inventory, 2005

<i>Jurisdiction</i>	<i>Housing units, total, 2005</i>	<i>Housing units, occupied, 2005</i>	<i>Housing units, owner occupied, 2005</i>	<i>Housing units, renter occupied, 2005</i>	<i>Housing units, vacant, 2005</i>
Harford County	92,122	87,079	67,988	19,091	5,043
Cecil County	39,048	35,088	25,971	9,117	3,960
Baltimore County	324,596	308,949	210,992	97,956	15,647
Baltimore City	294,262	242,978	123,562	119,446	51,284
New Castle County	209,592	193,255	135,270	57,985	16,337
Lancaster County	190,744	184,296	128,220	56,076	6,448
York County	168,875	159,432	122,288	37,144	9,443
Source. US Census, American FactFinder					

In projecting housing inventory for Maryland jurisdictions, this analysis primarily relied on estimates of new housing construction from 2005 through 2015 that are included in the Maryland Department of Planning BRAC report. Annual estimates of new housing construction were added to the estimated housing inventory in 2005 to produce the estimated housing inventory for the years 2007 and 2012. The estimate for 2017 assumes that housing production levels in 2015 will continue through 2017.¹⁷ The exception to this method is the projection for Harford County which is based on data provided by the county’s planning office. Because no data similar to the Maryland Department of Planning projections are available on current or future housing construction for the jurisdictions outside of Maryland, the housing inventory for 2005 and the rate of increase

¹⁷ See Appendix A for additional information on estimated housing supply.

from 2000 to 2005 are used to project housing inventory for 2007, 2012, and 2017. The projected housing inventory for each jurisdiction in the region of interest is presented in Exhibit III-14.

Exhibit III-14: Housing inventory projections

<i>Jurisdiction</i>	<i>Housing inventory estimate, 2007</i>	<i>Housing inventory estimate, 2012</i>	<i>Housing inventory estimate, 2017</i>
Harford County (1)	93,946	104,145	111,145
Cecil County	41,036	46,304	51,773
Baltimore County	329,753	339,234	346,441
Baltimore City	296,377	302,970	310,434
New Castle County	213,620	223,691	233,762
Lancaster County	195,046	205,800	216,554
York County	173,737	185,892	198,047

Note. (1) Data from Harford County Department of Planning and Zoning.
Sources. Harford County, US Census, Maryland Department of Planning “BRAC report,” Sage

Projected changes in housing inventory, shown in Exhibit III-15, are most dramatic in Harford and Cecil counties. In Baltimore County and Baltimore City growth in housing inventory is anticipated to be far more modest. Growth in New Castle, Lancaster, and York counties, based on recent experience, is projected to be significant.

These projected changes in housing supply are based either the Maryland Department of Planning’s estimates of new housing construction or recent changes in the housing inventory of New Castle, Lancaster, and York counties. The number of new housing units in each of these jurisdictions is ultimately in the hands of developers who react to perceived market conditions tempered by the regulatory process that governs development, particularly the zoning of land and the establishment of permissible densities.

Exhibit III-15: Changes in housing inventory

<i>Jurisdiction</i>	<i>Housing inventory change: 2007-2012</i>		<i>Housing inventory change: 2012-2017</i>	
	Number	Change	Number	Change
Harford County	10,199	10.9%	7,000	6.7%
Cecil County	5,269	12.8%	5,469	11.8%
Baltimore County	9,481	2.9%	7,207	2.1%
Baltimore City	6,593	2.2%	7,464	2.5%
New Castle County	10,071	4.7%	10,071	4.5%
Lancaster County	10,754	5.5%	10,754	5.2%
York County	12,155	7.0%	12,155	6.5%

Source. Sage

It should be noted that the ongoing cyclical weakness in much of the study area’s housing market could result in less housing inventory change than projected, particularly for the

2007–2012 period. Homebuilders are in the midst of a housing downturn of historic proportions, and it is anticipated that median home price declines will begin late in 2007 and last through 2009 in much of the study area. Though Maryland, Delaware and Pennsylvania will likely not suffer the 16 percent decline in median home values expected in California during this period, builders face a mix of stubbornly high land prices (which refuse to fall in part because of anticipated BRAC impacts), high construction materials prices (elevated global demand remains in place), a rising active inventory of unsold existing homes, a disengaged buyer and tighter mortgage credit. Together, these factors will conspire to keep homebuilding activity suppressed relative to historic norms through 2009. Homebuilders have already been in deceleration mode since 2005.

Despite the recent reduction in homebuilding activity, the active inventory of unsold homes has been rising throughout the study area. In Harford County, for instance, the active inventory is now 1,994 homes, compared to 853 two years ago. In Baltimore County, the active inventory has risen from 1,632 to 4,388 over that period, while the corresponding figures in Cecil County and Baltimore City are 476 to 1,007 and 2,050 to 5,700 according to the Maryland Association of Realtors.

It is likely that substantial BRAC impacts will begin to take place in the midst of ongoing cyclical weakness in the local housing market. Over the period 2009–2012, housing sales are likely to be brisk as elevated supply meets elevated demand. Population expansion will likely be most rapid during this period, with the active inventory trimmed substantially by 2011. Builders will take this as their cue to reaccelerate activities, with building reaching a peak in 2011–2013, with 2009–2010 being a period heavy with land transfer/purchase and permitting activities. Building activity would be expected to decelerate toward historic norms between the period 2014 through 2017, though of course then existing cyclical factors, including interest rates, will make their impacts felt. Moreover, building activity may remain elevated during this latter period if BRAC has the types of dynamic effects on business formation and innovation hinted at in other parts of this report.

It is important to note that the projections in Exhibit III-14 do not reflect the current or future capacity of land that is or may become available for residential development. For example, Harford County has an inventory of land that is zoned for over 30,000 residential units, well above the total of approximately 17,000 new housing units projected to be built by 2017. Thus, if there is market interest and supportive public policy, the projections listed above may be exceeded.

Office space

Within the region of interest, the current supply of office space is concentrated in Baltimore City and Baltimore County, which combined have almost 58 million square feet of office space. The supply of office space reported in Exhibit III–16 for Harford County is not the existing supply. Rather, the reported supply in 2007 includes 80,000 square feet of space being developed at APG for one of the contractors moving because

of BRAC and over 800,000 square feet of office space that has been approved by the county planning office, but that has not yet been built. Other existing office space in Harford County is not included in the number below. Therefore, the baseline of office space supply has been established as a dynamic baseline that takes into consideration all available information regarding the future size of relevant office markets. No data are available for office space in Lancaster and York counties.

Exhibit III-16: Office space supply (millions of square feet)

<i>Jurisdiction</i>	<i>Office space supply estimate, 2007</i>	<i>Office space supply estimate, 2012</i>	<i>Office space supply estimate, 2017</i>
Harford County (1)	0.9	2.8	N.A.
Cecil County	0.2	0.5	0.9
Baltimore County (2,3)	26.6	N.A.	N.A.
Baltimore City (3)	31.3	N.A.	N.A.
New Castle County	2.0	N.A.	N.A.
Lancaster County	N.A.	N.A.	N.A.
York County	N.A.	N.A.	N.A.

Notes. (1) Harford County data for approved or proposed construction in 2007 plus 80,000 square feet at Opus G.A.T.E. Existing office space other than Opus G.A.T.E. is not reported. Estimate for 2012 assumes that 2 million square feet of space are developed at the Opus G.A.T.E. project. Potential office space based on zoning capacity exceeds 12 million square feet.
(2) Eastern section of Baltimore County has 1.9 million square feet of existing office space.
(3) Baltimore County and Baltimore City office space data from "Transwestern outlook Baltimore area at Q107," Delta Associates, March 2007.
Sources: Unless otherwise noted, data were provided by local jurisdictions.

A few comments on future office space supply in Harford, Cecil, and Baltimore counties are warranted. Given the Opus G.A.T.E. project at APG and the recent announcement of plans for an office park just outside APG, these figures for Harford County may turn out to be conservative. These prospective office projects are located, however, in Aberdeen which currently has very little excess water capacity. While Aberdeen is expected to expand its water treatment capacity dramatically over the next 5 years and 10 years, there is some uncertainty whether this capacity will enable office space development to proceed in a timely manner. Development may not be ready in time for contractors that would want to commit to office space in 2009 or 2010. Cecil County may also be faced with questions about the timely availability of water and wastewater service for new office development. In the case that Harford County cannot develop as much office space as the market would demand, the most likely alternative location for contractor firms would be northeastern Baltimore County. The data above for Baltimore County do not include the potential to develop 5 million to 7 million square feet of office space in a strategically situated portion of eastern Baltimore County along I-95. This potential development is not constrained by available water and wastewater treatment capacities and would provide reasonably quick access to APG.

Few data are available for office space in 2012 and 2017. This is not surprising as new office space can and will be built in response to market conditions, often of a short-term nature.

IV. Impacts and Constraints

BRAC impacts will create additional demand for both privately and publicly supplied amenities ranging from office space to wastewater treatment. As in much of life, timing is everything or at least critically important when BRAC impacts and the demands they create are considered.

In theory, whenever the demands created by BRAC exceed the estimated capacity for delivering goods or services, this impact will constitute a constraint on the ability of a jurisdiction to absorb the growth BRAC is anticipated to generate. In practice, constraints might be better defined as “red flags” for jurisdictions that identify issues or problems in responding to growth. The capacity projections are not set in stone, but rather are subject to change and redefinition. Government, particularly local government, has a substantial role in defining future capacity of key goods (e.g., housing) and services (e.g., public education).

In addition, there are ways of absorbing or managing growth when capacity is constrained. Housing vacancy rates can fall, classrooms can exceed state or locally defined capacity, and traffic can become more congested. Optimistically, these conditions would be temporary as market conditions and/or public policies/investments respond to and resolve these types of issues.

Estimated phasing of BRAC impacts related to APG

The most specific available data on the timing of BRAC or related impacts at APG is in the SAIC report. That report indicates that less than 5 percent of the on-base jobs are expected to be in place by 2007. Most of the remaining on-base jobs are expected to arrive in 2009 or 2010 and can safely be assumed to be firmly in place by 2012. This analysis assumes that there is a likelihood of some delay in the arrival of contractor-tail jobs and that the final 10 percent of those jobs will arrive after 2012. Even more delay is assumed in the creation of indirect and induced jobs (created in response to the direct jobs and contractor-tail jobs) with one-third of those jobs not being created until after 2012. Exhibit IV-1 summarizes the phasing of all BRAC-related employment for the high case.¹⁸ This phasing is used for all three analytical scenarios.

¹⁸ The analysis of phasing is based on the high case because detailed information on the timing of direct jobs is available in the SAIC report and the SAIC estimate of 9,154 direct jobs is the basis for the high case. SAIC is the only known source of data on the timing of BRAC impacts.

Exhibit IV-1: Phasing of BRAC-related employment

<i>Type of job</i>	<i>2007</i>	<i>2012</i>	<i>2017</i>
Direct jobs (1)	434	8,677	8,677
Contractor-tail jobs (2)	362	6,508	7,231
Indirect jobs (3)	117	2,294	3,440
Induced jobs (3)	287	5,624	8,432
Total	1,200	23,103	27,780
Share	4.3%	83.2%	100.0%

Notes. (1) Phasing of direct jobs based on SAIC report.
(2) Assumes 10 percent of contractor-tail jobs arrive after 2012, remaining jobs follow pattern of direct jobs.
(3) Assumes one-third of indirect and induced jobs arrive after 2012, remaining jobs follow pattern of direct jobs.
Sources: SAIC, Sage

Using the phasing estimates described above, the phasing of all BRAC-related employment for all three scenarios can be estimated. See Exhibit IV-2.

Exhibit IV-2: Phasing of BRAC-related employment: three scenarios

<i>Scenario</i>	<i>2007</i>	<i>2012</i>	<i>2017</i>
Mid-case	1,200	23,103	27,780
Low case	938	18,155	21,821
High case	1,451	28,070	33,739

Source: Sage

Impacts and constraints: population and housing

The impacts of BRAC on population in the seven jurisdictions are summarized in Exhibit IV-3. For each jurisdiction, the following are presented:

- baseline population in the years 2007, 2012, and 2017 and the absolute and percentage change in population from 2007 to 2017;
- mid-case population, including the baseline population, for 2007, 2012, and 2017 and the absolute and percentage change in population from 2007 to 2017;
- similar data for the low case; and
- similar data for the high case.

It is important to stress that the figures for the three scenarios in Exhibit IV-3 include baseline conditions. For 2012, the baseline population for Harford County is projected to be 260,100. For the mid-case scenario, the county's population in 2012 is projected to be 275,870, in other words, BRAC is expected to increase Harford County's population in 2012 by 15,770 people over what the population would have been in the absence of BRAC. As noted earlier, baseline population projections for Maryland jurisdictions were taken from Round 6B of the Baltimore Metropolitan County's forecasts and are assumed to exclude any anticipated BRAC effects.

Exhibit IV-3: Phasing of BRAC-related population: baseline and three BRAC scenarios

<i>Jurisdiction</i>	<i>Scenario</i>	<i>Population</i>			<i>Change 2007-2017</i>	
		2007	2012	2017	Number	Percent
Harford County	Baseline	242,700	260,100	271,520	28,820	11.9%
	Mid-case	243,510	275,870	290,579	47,069	19.3%
	Low case	243,384	273,424	287,623	44,239	18.2%
	High case	243,594	277,505	292,556	48,962	20.1%
Cecil County	Baseline	102,000	114,000	126,800	24,800	24.3%
	Mid-case	102,228	118,432	132,157	29,929	29.3%
	Low case	102,187	117,633	131,190	29,004	28.4%
	High case	102,262	119,101	132,965	30,703	30.0%
Baltimore County	Baseline	802,300	824,980	836,500	34,200	4.3%
	Mid-case	802,893	836,526	850,454	47,561	5.9%
	Low case	802,714	833,052	846,255	43,541	5.4%
	High case	803,115	840,862	855,695	52,579	6.5%
Baltimore City	Baseline	651,080	658,420	658,400	7,320	1.1%
	Mid-case	651,181	660,380	660,768	9,588	1.5%
	Low case	651,142	659,627	659,859	8,717	1.3%
	High case	651,234	661,420	662,026	10,792	1.7%
New Castle County	Baseline	520,000	540,000	560,000	40,000	7.7%
	Mid-case	520,044	540,848	561,025	40,981	7.9%
	Low case	520,037	540,716	560,866	40,829	7.9%
	High case	520,048	540,936	561,131	41,083	7.9%
Lancaster County	Baseline	497,875	517,691	537,375	39,499	7.9%
	Mid-case	497,919	518,539	538,399	40,481	8.1%
	Low case	497,912	518,407	538,241	40,328	8.1%
	High case	497,923	518,627	538,506	40,582	8.2%
York County	Baseline	423,816	463,357	503,607	79,791	18.8%
	Mid-case	423,912	465,222	505,861	81,950	19.3%
	Low case	423,897	464,933	505,512	81,615	19.3%
	High case	423,922	465,416	506,095	82,173	19.4%
Total	Baseline	3,239,771	3,378,548	3,494,202	254,430	7.9%
	Mid-case	3,241,685	3,415,816	3,539,244	297,559	9.2%
	Low case	3,241,273	3,407,791	3,529,545	288,272	8.9%
	High case	3,242,098	3,423,867	3,548,974	306,876	9.5%

Harford and Cecil counties will experience the most dramatic population increases. Both counties were expected to expand rapidly even in the absence of BRAC. As the most mature jurisdictions, Baltimore County and City are expected to experience the smallest relative population increases. For both jurisdictions, BRAC-related population growth is projected to add one-third to baseline population estimates over the next 10 years. While York County is expected to grow dramatically, the county is projected to see only moderate population impact from BRAC. Growth rates for Lancaster and New Castle counties tend to reflect seven-jurisdiction averages. Like York County, Lancaster and New Castle counties are estimated to experience moderate total population effects.

Increases in households will parallel increases in population and will form the basis of enhanced future housing demand. Exhibit IV-4 compares future households with the estimated future housing inventory to estimate the capacity of projected housing supply to meet demand. Housing inventory is defined as projected housing units and should not be confused with active inventory. Though the active inventory of unsold homes has risen sharply over the past two years, the underlying number of units (inventory) does not change much from year to year. Moreover, the recent rise in active inventory over the past two years follows a period of brisk housing activity, which drove the active inventories to abnormally low levels. As a result, as of July 2007, active inventory remains well below 5 percent in much of the study area.

Exhibit IV-4: Phasing of BRAC-related housing demand: baseline and three BRAC scenarios

<i>Jurisdiction</i>	<i>Scenario</i>	<i>Projected housing demand</i>		<i>Projected demand versus projected inventory (I)</i>	
		2012	2017	2012	2017
Harford County	Baseline	98,940	105,600	100.0%	100.0%
	Mid-case	104,781	112,659	105.9%	106.7%
	Low case	103,875	111,564	105.0%	105.7%
	High case	105,386	113,391	106.5%	107.4%
Cecil County	Baseline	42,385	47,745	96.4%	97.1%
	Mid-case	44,027	49,729	100.1%	101.1%
	Low case	43,730	49,371	99.4%	100.4%
	High case	44,274	50,028	100.6%	101.7%
Baltimore County	Baseline	332,860	338,520	103.3%	102.9%
	Mid-case	337,136	343,688	104.6%	104.4%
	Low case	335,849	342,133	104.2%	104.0%
	High case	338,742	345,629	105.1%	105.0%
Baltimore City	Baseline	268,560	271,880	93.3%	92.2%
	Mid-case	269,286	272,757	93.6%	92.5%
	Low case	269,007	272,420	93.5%	92.4%
	High case	269,671	273,223	93.7%	92.6%
New Castle County	Baseline	205,000	210,000	96.5%	94.6%
	Mid-case	205,314	210,380	96.6%	94.7%
	Low case	205,265	210,321	96.6%	94.7%
	High case	205,347	210,419	96.6%	94.8%
Lancaster County	Baseline	193,870	203,374	99.2%	98.9%
	Mid-case	194,184	203,753	99.3%	99.0%
	Low case	194,136	203,695	99.3%	99.0%
	High case	194,217	203,793	99.3%	99.1%
York County	Baseline	179,596	195,197	101.7%	103.7%
	Mid-case	180,287	196,032	102.1%	104.2%
	Low case	180,180	195,902	102.0%	104.1%
	High case	180,358	196,119	102.1%	104.2%

Exhibit IV-4 is based on the projected supply or inventory of housing units, which is subject to market conditions and regulation. A measure of potential housing supply is land zoned for residential development. This tends to be greater than the projected supply of housing units. For example, new construction in Harford County is projected to add over 17,000 housing units to the housing inventory over the next 10 years, however, current zoning would allow over 30,000 new units. If demand for housing is expected to exceed the projected supply of housing, the most likely response is that developers would build new housing at faster rates than is currently projected assuming such development was approved by local authorities.

In assessing potential constraints imposed by housing supply, the analysis assumes that any demand for housing includes a 5 percent vacancy rate. This vacancy rate allows for turnover and is lower than the recent vacancy rates in all but one of the jurisdictions (see Appendix A). In other words, at 100 percent capacity, a jurisdiction is assumed to have vacant units equal to 5 percent of total housing units. If housing demand is at 105 percent of capacity, this analysis estimates that all available housing is occupied.

The impacts of BRAC on housing supplies in Harford and Cecil counties are clearly significant. Even baseline conditions in Harford County are reaching or exceeding the expected supply of housing units. The addition of BRAC demand means that total demand exceeds projected supply in 2007, 2012, and 2017 under all three scenarios. In the mid-case demand exceeds projected supply over the next decade by 6 percent to 7 percent.

The implication is that for Harford County, housing inventory is a potential constraint on the absorption of BRAC-related growth. This does not mean that housing will be unavailable for those who are projected to live in Harford County. It does, however, mean that if these households locate in Harford County, then new housing construction will need to increase faster than it is projected to do so by the Maryland Department of Planning. It may also mean that vacancy rates in the county will drop below the benchmark of 5 percent and/or that the high demand for housing will tend to increase housing prices.

Given the estimated commuting patterns from APG, the majority (over 60 percent) of the BRAC-related housing demand for the county is projected to be along I-95 within 20 minutes of APG. Another major demand (over 20 percent) would be centered in and near Bel Air. Remaining demand is expected to be more broadly distributed in northern sections of the county more than 30 minutes from APG. See Appendix B for an estimated allocation of housing demand in Harford County communities.

The impacts of BRAC on Cecil County housing appear not to be as severe as in Harford County. Much of the explanation is that Cecil County had a housing vacancy rate above 11 percent in 2005 compared to a vacancy rate in Harford County of just under 6 percent in that year (see Appendix A for vacancy rates in 2005). Thus, the analysis assumes that BRAC demand is substantially absorbed by existing and presently available housing. This might not be a reasonable assumption if vacant housing is not suited to the tastes and

preferences of those being attracted to the region by BRAC. If vacant housing in Cecil County is not generally suited to BRAC households, then the analysis has underestimated the extent to which housing availability may be a constraint in Cecil County.

Commuting patterns indicate that roughly half of the Cecil County housing demand would focus on Perryville and North East within a half-hour commute. The remaining half of demand would extend to Elkton and other areas more distant from APG.

In Baltimore County, BRAC demands do not make as dramatic a difference from baseline conditions as is true in Harford and Cecil counties. Baltimore County, however, is projected to have a tight housing market even under baseline conditions. The baseline condition for Baltimore County over the next decade indicates that demand will exceed supply by approximately 3 percent and that BRAC will add 1 or 2 percentage points to overall demand.

The locations within Baltimore County most forcefully implicated by BRAC extend from eastern neighborhoods to central and northern parts of the county. Over a third of the households expected to settle in the county are projected to be along I-95, including in White Marsh, Rosedale, and Essex, areas within no more than an estimated 30 minute commute to APG. Almost half of the households would settle in areas stretching from Perry Hall to Towson; areas estimated to be more than 30 minutes but no more than 45 minutes from APG. The remaining households are projected to settle in more distant communities, including Pikesville and Cockeysville.

In Baltimore City under baseline conditions, housing supply will comfortably exceed housing demand and BRAC will have little overall effect. The city's ability to meet BRAC-related demand, however, may present a case similar to that of Cecil County. The city vacancy rate in 2005 was over 21 percent and presumably included abandoned housing of little interest to BRAC households.

Yet, the relatively modest demands for city housing stemming from BRAC appear unlikely to be constrained by the city's housing supply. Areas assumed to be of interest to BRAC-related households include downtown neighborhoods such as Harbor East and neighborhoods in the northern and northeastern sections of the city. Fells Point and Roland Park are not quite 45 minutes from APG, but it is assumed that these neighborhoods will attract relatively few households. Of course, Fells Point and adjacent neighborhoods hold a special appeal that is not mimicked by suburban communities, and it may be that this analysis underestimates the impact BRAC will have on these areas.

The analysis of housing constraints for jurisdictions outside of Maryland is subject to more uncertainty. Data on future new housing construction outside of Maryland were not available. As a result, all calculations for New Castle, Lancaster, and York counties are based on the 2005 housing inventory and changes in that inventory between 2000 and 2005. It appears that housing inventories are relatively tight. Baseline housing demand is estimated to be at or above 95 percent of capacity now and is projected to remain near these levels over the next 10 years. Nevertheless, the impacts of BRAC will be minimal

compared to baseline conditions as a result. BRAC is projected to add no more than three-tenths of a percentage point to baseline demand in New Castle, Lancaster, and York counties.

Characteristics of housing demand

The nature of housing demand that will be created by BRAC is determined in large measure by the incomes of households that will benefit from BRAC. Exhibit IV-5 lists potential housing purchasing power of BRAC households. Household income is based on the assumption that total household income is 130 percent of the income of the BRAC worker. In other words, most households will have a second source of income that will supplement income derived from BRAC. Direct (i.e. on-base) workers are projected to have the highest income, followed by contractor-tail workers, indirect workers, and induced workers. Home value is estimated on the assumption of a 10 percent down payment and a 30-year fixed mortgage at 6.5 percent with the mortgage payment equal to 25 percent of income. Rent per month is estimated at 25 percent of income.

Exhibit IV-5: Purchasing power of BRAC households

<i>Category of worker</i>	<i>Direct</i>	<i>Contractor-tail</i>	<i>Indirect</i>	<i>Induced</i>
Household income, 2007	\$152,351	\$124,780	\$81,740	\$62,893
House value	\$552,639	\$452,630	\$296,504	\$228,139
Rent/month	\$3,174	\$2,600	\$1,703	\$1,310
Source: Sage				

Calculations in Exhibit IV-5 are based on average income per category of BRAC worker. Individual households in each category will earn varying incomes that may diverge significantly from these averages. Nevertheless, the averages help to illustrate the broad ranges of housing values that BRAC households will seek.

The Maryland Department of Planning in its report on BRAC addressed the questions of the cost of housing that households might occupy and whether this housing would be owned or rented. The results of this assessment tend to reinforce the impression of demand for higher priced housing implied by Exhibit IV-5. In addition, given the many high income households associated with BRAC, the vast majority of demand will be associated with owner-occupied housing as opposed to rentals.

Exhibit IV-6 is derived from the Maryland Department of Planning BRAC report and summarizes total demand for housing by its status as owner-occupied or renter-occupied and by its cost category. Cost categories are broadly defined within the local housing markets over the span of time of BRAC changes in these jurisdictions. As indicated, it is expected that six of seven households will purchase rather than rent.

Exhibit IV-6: Housing ownership versus rental by housing cost category

<i>Housing occupancy and cost</i>	<i>Owner-occupied</i>				<i>Renter-occupied</i>			
	Low	Middle	High	Subtotal	Low	Middle	High	Subtotal
Harford County	10.1%	22.8%	53.2%	86.0%	1.7%	3.8%	8.5%	14.0%
Cecil County	19.8%	23.6%	42.1%	85.5%	3.5%	4.5%	6.6%	14.5%
Baltimore County	15.7%	22.6%	48.4%	86.7%	2.7%	3.9%	6.7%	13.3%
Baltimore City	16.6%	19.7%	50.7%	87.0%	2.9%	3.4%	6.6%	13.0%

Sources: Maryland Department of Planning "BRAC Report," Sage

Most of the housing is characterized as high cost and quality. Between 25 percent and 30 percent of owner-occupied and renter-occupied housing demand is expected to be of middle range cost while the remaining share (from 12 percent to 23 percent, depending on jurisdiction) will be low cost. The variations in housing occupancy and cost across jurisdictions are expected to be modest.

As the Maryland Department of Planning report notes, housing prices are volatile and can change quite rapidly. The same is true of the mix of housing for sale versus housing for rent. Given the capacity of the housing market to respond to changes in demand, the estimates of demand summarized in Exhibit IV-6 should be considered as guidelines to future demand that will be tempered and refined as population increases in the jurisdictions and the particular qualities of future housing demand become more apparent.

Data characterizing the nature of future housing demand in New Castle, Lancaster, and York counties were not available. Given the relatively modest demands BRAC changes at APG will place on these housing markets, it is assumed that suitable housing choices will be available for BRAC households who will select these counties for their residence.

Impacts and constraints: public schools

Assuming that housing demands in Exhibit IV-4 are met, these new households will generate associated and increased demands for public school services. The phasing of these public school demands are summarized for the baseline and three cases in Exhibit IV-7.

Exhibit IV-7: Phasing of public school demand: baseline and three BRAC scenarios

Jurisdiction	Scenario	Public school demand			Demand versus capacity (1)		
		2007	2012	2017	2007	2012	2017
Harford County	Baseline	39,582	39,775	40,360	95.0%	88.4%	89.7%
	Mid-case	39,778	43,601	44,984	95.5%	97.0%	100.0%
	Low case	39,714	42,341	43,461	95.3%	94.2%	96.6%
	High case	39,843	44,868	46,515	95.6%	99.8%	103.4%
Cecil County	Baseline	16,622	16,793	18,179	99.2%	100.3%	108.5%
	Mid-case	16,677	17,868	19,479	99.6%	106.7%	116.3%
	Low case	16,658	17,493	19,025	99.5%	104.4%	113.6%
	High case	16,699	18,286	19,983	99.7%	109.2%	119.3%
Baltimore County	Baseline	105,330	106,769	109,916	94.5%	95.1%	97.9%
	Mid-case	105,474	109,570	113,301	94.6%	97.6%	100.9%
	Low case	105,410	108,324	111,795	94.5%	96.5%	99.6%
	High case	105,569	111,416	115,532	94.7%	99.2%	102.9%
Baltimore City	Baseline	78,530	71,290	72,020	61.4%	55.7%	56.3%
	Mid-case	78,554	71,765	72,595	61.4%	56.1%	56.7%
	Low case	78,542	71,522	72,301	61.4%	55.9%	56.5%
	High case	78,575	72,168	73,081	61.4%	56.4%	57.1%
New Castle County	Baseline	66,806	N.A.	N.A.	N.A.	N.A.	N.A.
	Mid-case	66,817	N.A.	N.A.	N.A.	N.A.	N.A.
	Low case	66,813	N.A.	N.A.	N.A.	N.A.	N.A.
	High case	66,820	N.A.	N.A.	N.A.	N.A.	N.A.
Lancaster County	Baseline	70,123	69,318	70,766	N.A.	N.A.	N.A.
	Mid-case	70,134	69,523	71,014	N.A.	N.A.	N.A.
	Low case	70,130	69,456	70,933	N.A.	N.A.	N.A.
	High case	70,137	69,591	71,097	N.A.	N.A.	N.A.
York County	Baseline	68,908	70,876	74,022	N.A.	N.A.	N.A.
	Mid-case	68,931	71,328	74,569	N.A.	N.A.	N.A.
	Low case	68,924	71,180	74,389	N.A.	N.A.	N.A.
	High case	68,939	71,478	74,750	N.A.	N.A.	N.A.

Note. (1) For Maryland jurisdictions capacity is based on state standards for pupils per classroom. No similar data are available for New Castle, Lancaster, and York counties. See Exhibit III-5.

Source: Sage.

Baseline demands are based on official forecasts of enrollments published by local or state agencies. In Maryland, these projections may extend only to 2016 rather than the 2017 benchmark used in this analysis. BRAC-related demand is based on estimates of the tendency of new households to increase demand for public school spaces.

The analysis of capacity is based on data provided by the jurisdictions and the current estimate of school construction activities in Maryland. Construction activities have been planned out as far as 2010, well before the benchmark years of 2012 and 2017 used in this analysis. Many school projects in Maryland are in planning stages, but have not yet

been approved.¹⁹ Some of these projects will likely increase current and projected capacities. Given the timeframes used in this analysis and the cycle for capital projects, school districts should have time to respond to any predicted shortfalls in public school capacity, though certainly not ample time.

Harford and Cecil counties will exhibit the most striking impacts from BRAC on school capacity. Harford County, which is estimated to be currently at 95 percent of capacity, is estimated to have even more excess capacity under baseline conditions in 2012 and 2017. This increased school capacity is partly the result of several school construction projects scheduled over the next several years that will add over 3,300 spaces in the county's public schools (see Exhibit IV-7). BRAC demands are expected to absorb most of this new capacity by 2012 and are expected to fill or exceed it by 2017 in the mid case and high case. As noted above in the distribution of household population, the demand for public schools is projected to be concentrated along I-95, then in the area in and around Bel Air with the remaining demand spread across the county's northern sections.

According to Sage estimates, Cecil County will experience significantly greater constraints. Currently the county's schools are essentially at full capacity and, under baseline conditions, are expected to stay at full capacity in 2012, but then substantially outgrow that capacity by 2017. The effects of BRAC will accelerate the demand for school capacity by about 5 years (i.e. BRAC-related excess demand in 2012 is projected roughly to equal baseline excess demand in 2017). By 2017 BRAC would result in demand for school capacity that is approximately 14 percent to 19 percent greater than current capacity. Given the projected distribution of BRAC-related households this demand is expected to be distributed across the county.

In Baltimore County, the baseline conditions are for schools to have roughly 5 percent excess capacity over the next 5 years and then to have a significant reduction in excess capacity by 2017 as enrollments increase. BRAC will increase demand for public schools significantly by 2012 and projected enrollment will essentially absorb or exceed all county capacity by 2017. Given the expected location of BRAC-related households this demand for public school space is projected to affect schools from central to eastern Baltimore County. It is important to note that being over 100 percent capacity is not synonymous with overcrowding. As an example, in both Baltimore and Howard counties, the trigger for overcrowding status is 115 percent of capacity.²⁰

BRAC effects on Baltimore City schools will be minimal in terms of school capacities. The city has abundant excess capacity in its schools. This coupled with relatively modest estimates of increased enrollments in city schools from BRAC means that city school capacity will not be a constraint on BRAC absorption. School quality is a separate issue.

¹⁹ A list of school projects is included as "Appendix G. BRAC Counties Construction Improvement Program" in Maryland Department of Planning, *BRAC Report*.

²⁰ Home Builders Association of Maryland (2005). *Adequate Public Facilities Ordinance in Maryland: An Analysis of their Implementation and Effects on Residential Development in the Baltimore Metropolitan Area*.

That said, the study team expects that there will be considerable overcrowding at certain schools by 2012 and beyond. Redistricting is seldom perfect and political constraints regarding the movement of students are very real. Efficient utilization of school capacity will be at a premium in Baltimore, Harford and Cecil counties in the years ahead. It is even possible that certain City schools will find their capacity strained.

School capacity data are not available for jurisdictions outside of Maryland. Because BRAC-related increases in public schools in these counties are expected to be minimal to modest, the likelihood that school capacity would be a constraint for BRAC households is remote.

Impacts and constraints: public water and wastewater treatment services

Increased demand for housing will inevitably increase demands for public water and wastewater treatment services. In most jurisdictions, however, some share of new housing will rely on private wells and septic systems. Baltimore City is the only jurisdiction where all housing is connected to public water and sewer systems.

The extent to which new housing is likely to be served by public water and sewer systems varies. The Maryland Department of Planning estimated that the following shares of new housing would be served by public systems:

- Harford County – 77.0 percent
- Cecil County – 64.5 percent
- Baltimore County – 80.8 percent
- Baltimore City – 100.0 percent

In estimating the baseline and BRAC-related demands for public water, several data sources and factors were utilized. Projected connections to public systems were combined with estimated per capita demand to estimate BRAC-related demand. This method was also used for Cecil County baseline demand. In Harford and Baltimore counties and Baltimore City, master plans for water and sewer services were also consulted to determine baseline demands. New Castle County provided data on current and projected baseline demands. In Lancaster and York counties, public water service is provided by sub-county jurisdictions and a significant share of housing uses private wells and septic systems. Current and projected baseline demands were not available.

Exhibit IV-8 summarizes projected demand for water supplied by public systems for the baseline and the three scenarios. This future demand is also compared to total projected capacity, which was presented in Exhibit III-9. For Maryland jurisdictions and New Castle County, future demand comprises all demands for water from public systems. For Lancaster and York counties, because data on baseline demands for public water are not available, future demand is only estimated for BRAC-related households. Projections for Cecil County are based on estimated demands by households and exclude any demands to emerge from non-residential sources.

Exhibit IV-8: Phasing of public water demand: baseline and three BRAC scenarios (MGD)

Jurisdiction	Scenario	Public water demand			Demand versus capacity		
		2007	2012	2017	2007	2012	2017
Harford County	Baseline	19.3	21.9	24.5	74%	58%	52%
	Mid-case	19.4	23.3	26.2	75%	61%	55%
	Low case	19.4	23.1	26.0	75%	61%	55%
	High case	19.4	23.4	26.4	75%	62%	56%
Cecil County	Baseline	6.9	8.1	9.4	91%	74%	67%
	Mid-case	6.9	8.4	9.8	91%	76%	70%
	Low case	6.9	8.3	9.7	91%	76%	70%
	High case	6.9	8.5	9.9	91%	77%	70%
Baltimore County (1)	Baseline	103.8	106.0	108.4	N.A.	N.A.	N.A.
	Mid-case	103.9	107.1	109.7	N.A.	N.A.	N.A.
	Low case	103.8	106.8	109.3	N.A.	N.A.	N.A.
	High case	103.9	107.5	110.1	N.A.	N.A.	N.A.
Baltimore City	Baseline	116.2	115.3	115.6	83%	84%	85%
	Mid-case	116.2	115.5	115.9	83%	84%	85%
	Low case	116.2	115.4	115.8	83%	84%	85%
	High case	116.2	115.6	116.0	83%	84%	85%
New Castle County	Baseline	94.9	97.1	99.9	82%	84%	86%
	Mid-case	94.9	97.2	100.0	82%	84%	86%
	Low case	94.9	97.2	100.0	82%	84%	86%
	High case	94.9	97.2	100.0	82%	84%	86%
Lancaster County	Baseline	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.
	Mid-case	0.0	0.1	0.1	N.A.	N.A.	N.A.
	Low case	0.0	0.1	0.1	N.A.	N.A.	N.A.
	High case	0.0	0.1	0.1	N.A.	N.A.	N.A.
York County	Baseline	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.
	Mid-case	0.0	0.1	0.2	N.A.	N.A.	N.A.
	Low case	0.0	0.1	0.2	N.A.	N.A.	N.A.
	High case	0.0	0.2	0.2	N.A.	N.A.	N.A.

Note. (1) Baltimore County's public water supply is provided by Baltimore City.
Source: Harford County Sage.

As shown in Exhibit IV-8 the capacity of public water systems in the Maryland jurisdictions and in New Castle County appears to be ample relative to projected demands.²¹ For Harford and Cecil counties, the explanation is found in Exhibit III-10, which shows substantial expansions of public water supply capacity over the next decade. By 2017 water supply capacity in Harford and Cecil counties is expected to increase by over 80 percent. For Baltimore County and Baltimore City, the demands created by BRAC are small relative to overall system capacity. Moreover, baseline projections indicate little overall growth in demand in these jurisdictions. Indeed, the baseline

²¹ As discussed earlier in the report, the timing of the availability water and wastewater treatment services may have a significant influence of the timely availability of office space at or adjacent to APG. This in turn could limit the amount of office-based BRAC employment located in Harford County.

projection for the city indicates declining future demand.²² BRAC-related demand in New Castle, Lancaster, and York Counties is very small relative to the baseline projections and for New Castle County is well within projected capacity. Whether BRAC-related demands will present capacity issues in Lancaster and York counties is not known, but it is highly unlikely given the relatively small, incremental demands that BRAC will create for those jurisdictions.

The BRAC-related demands for public wastewater treatment and that demand in comparison to projected capacity are presented in Exhibit IV-9. The issues raised in the projection of public water demand also apply to the projections of public wastewater treatment. Baseline demands for Harford and Baltimore counties and Baltimore City are taken from master plans for those jurisdictions. Baseline demands for Cecil County represent Sage estimates based on per capita demands and future populations. Baseline demands for New Castle County are based on data supplied by the County. No such data were available for Lancaster and York counties. For all jurisdictions, BRAC-related demand is estimated on the basis of projected BRAC-related populations, per capita demand, and the probability that households will be connected to public sewage systems.

Water and wastewater treatment capacity as a source of significant estimation error

In April 2003, Maryland, Virginia, Pennsylvania, New York, West Virginia, Delaware, and the District of Columbia agreed to cut current nutrient loads to the Chesapeake Bay in half to meet the Chesapeake 2000 agreement water quality goals. This agreement requires reducing annual nitrogen and phosphorus baywide by 110 million pounds and 6.3 million pounds, respectively, from 2000 levels.

These nutrient reduction goals are also necessary to address *Federal Clean Water Act* requirements.²³ In September 2005, the EPA published revised State water quality standards that both Maryland and Virginia adopted. These standards establish a regulatory framework for Bay restoration efforts through the development of a Total Maximum Daily Load (TMDL) allocation. TMDLs prescribe the pollutant reduction levels necessary to meet revised water quality standards. Similar to the Bay nutrient reduction objectives, a TMDL sets a limit, or cap, on pollutants that impair water quality. The TMDL for the Bay has yet to be established, however, if water quality standards are not met by 2010, a TMDL will be developed and will set pollutant loading limits for all sources within the watershed. These sources include discharges from sewage treatment plants and suburban stormwater systems.²⁴

²² The Baltimore City water system also serves portions of Anne Arundel, Harford, and Howard counties. Demands from these counties are not reflected in Exhibit IV-6, but absorb much of the remaining system capacity.

²³ Maryland's Tributary Strategy Statewide Implementation Plan, pg. 4.

²⁴ Ibid.

Exhibit IV-9: Phasing of public wastewater treatment demand: baseline and three BRAC scenarios

<i>Jurisdiction</i>	<i>Scenario</i>	<i>Public wastewater treatment demand (MGD)</i>			<i>Demand versus capacity</i>		
		2007	2012	2017	2007	2012	2017
Harford County	Baseline	17.6	19.6	21.6	65%	69%	76%
	Mid-case	17.6	20.9	23.3	65%	74%	82%
	Low case	17.6	20.7	23.0	65%	73%	81%
	High case	17.6	21.0	23.4	65%	74%	83%
Cecil County	Baseline	6.9	8.1	9.4	85%	74%	67%
	Mid-case	6.9	8.4	9.8	86%	76%	70%
	Low case	6.9	8.3	9.7	86%	76%	70%
	High case	6.9	8.5	9.9	86%	77%	70%
Baltimore County	Baseline	103.8	106.0	108.4	N.A.	N.A.	N.A.
	Mid-case	103.9	107.1	109.7	N.A.	N.A.	N.A.
	Low case	103.8	106.8	109.3	N.A.	N.A.	N.A.
	High case	103.9	107.5	110.1	N.A.	N.A.	N.A.
Baltimore City	Baseline	116.2	115.3	115.6	88%	89%	86%
	Mid-case	116.2	115.5	115.9	88%	89%	86%
	Low case	116.2	115.4	115.8	88%	89%	86%
	High case	116.2	115.6	116.0	88%	89%	87%
New Castle County	Baseline	94.9	97.1	99.9	N.A.	85%	194%
	Mid-case	94.9	97.2	100.0	N.A.	88%	198%
	Low case	94.9	97.2	100.0	N.A.	87%	197%
	High case	94.9	97.2	100.0	N.A.	88%	198%
Lancaster County	Baseline	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.
	Mid-case	0.0	0.1	0.1	N.A.	N.A.	N.A.
	Low case	0.0	0.1	0.1	N.A.	N.A.	N.A.
	High case	0.0	0.1	0.1	N.A.	N.A.	N.A.
York County	Baseline	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.
	Mid-case	0.0	0.1	0.2	N.A.	N.A.	N.A.
	Low case	0.0	0.1	0.2	N.A.	N.A.	N.A.
	High case	0.0	0.2	0.2	N.A.	N.A.	N.A.

Source: Sage.

TMDLs along with normal political/administrative factors could slow the formation of needed BRAC infrastructure in both Harford and Cecil counties. To the extent that this occurs, BRAC impacts could be deflected away to jurisdictions like Baltimore County, New Castle County, and others. Because the TMDL is yet to be set, the study team has no basis on which to alter its baseline impact scenario. But stakeholders should be aware of the possibility that economic/population impacts could be considerably more dispersed than the study team’s estimations suggest.

System-wide capacity projections are available for Maryland jurisdictions, but not for the three jurisdictions in the study area outside Maryland. New Castle County, however, provided projections for estimated unused, available capacity.

As was true for public water, wastewater treatment capacity is not projected to be a constraint for Maryland jurisdictions. For Harford County, this can be attributed to excess capacity particularly in the Harford County system and the smaller Aberdeen system. The system in Havre de Grace is expected to be closer to capacity in the next few years despite a 1 MGD expansion to the Havre de Grace wastewater treatment plant to be completed by 2010. For the county's smallest systems—Joppatowne and Spring Meadows—capacity has now been reached or is expected to be reached soon.²⁵ In Cecil County the projected expansions of public wastewater treatment capacity allow for a relatively easy absorption of projected demand. As noted in Exhibits III-11 and III-12, Cecil County expects to increase wastewater treatment capacity by 73 percent over the next decade. The Baltimore City treatment capacity which serves both the city and Baltimore County is projected to increase by 2017. Coupled with modest increases in both baseline and BRAC-related demand, this capacity can readily accommodate conditions projected through 2017.

For New Castle County, data on unused capacity (rather than total) capacity are available. Assuming that this unused capacity exceeds current (i.e. 2007) demand, the assessment of demand versus capacity is based on incremental increases in demand from current levels. As shown in Exhibit III-11, unused capacity is estimated at 2.6 MGD in 2007 and is not projected to change through 2017. Because the baseline increase in demand from 2007 to 2012 is estimated to be 2.2 MGD, this increase in demand will require 85 percent of projected unused capacity in 2012. BRAC-related demand in 2012 will increase requirements of projected unused capacity to at least 87 percent and as much as 89 percent, depending on the scenario. By 2017, increases in baseline demand are expected to exceed unused capacity by a substantial margin. BRAC-related demand will add to this excess demand by 3 to 4 percentage points. Clearly projected demands for public wastewater treatment services will overwhelm available capacity in the longer term. While this excess future demand is substantial as a share of current unused capacity, in absolute terms, an increase of 2.6 MGD in wastewater treatment capacity would meet this demand. According to the Director of Redevelopment for New Castle County government, New Castle County is undertaking a major new sewer infrastructure program south of the C&D Canal in the Middletown area. This will contribute to sewer capacity over the next two years, but will influence an area that is too distant from APG to significantly alter predicted development patterns.

The lack of data regarding baseline demand and available capacity limits the assessment of public wastewater treatment as a constraint on BRAC-related growth in Lancaster and York counties. The demand figures presented in Exhibit IV-7 for these counties represent only the incremental demand for public wastewater treatment demand created by BRAC-related households. These demands are modest, however, and are estimated at no more than 0.1 MGD for all scenarios, except the high case for York County in 2017 when demand related to BRAC is projected to be 0.2 MGD. Given these modest demands, it is not expected that wastewater treatment capacity will be a serious constraint on these counties' ability to absorb BRAC-related growth.

²⁵ Capacities for individual systems in Harford County from Table 4-1, Harford County Waster & Sewer Master Plan Spring 2007.

The analysis of demand for public water and wastewater treatment capacity discussed above does not take into consideration the projected demand created by office and retail space. These demands are minimal and are estimated to generate marginal demands well within the capacities of jurisdictional systems. See Appendix A for a discussion of this demand and other aspects of the water and wastewater treatment capacity analysis.

Impacts and constraints: commercial real estate

New population either from baseline conditions or from BRAC will create a demand for retail space. Exhibit IV-10 shows the increase in demand for shopping center retail space from 2007 for the baseline and the three cases and also compares the increase in the three cases relative to the baseline. In all cases, the new demand is estimated on the basis of 25 square feet of retail space for each new resident of the jurisdiction.

For Harford County, the baseline estimate is a demand for 721,000 square feet of new retail space in shopping centers between 2007 and 2017. The impacts of BRAC would increase this overall demand to 1.1 million to 1.2 million square feet. The addition of BRAC-related demand increases the baseline demand for this retail space by 56 percent to 73 percent.

BRAC-related retail space demands in Cecil County are also substantial. Baseline demand for new retail space over the next decade is estimated at 620,000 square feet. Depending on the scenario, BRAC would increase the total demand to 718,000 to 758,000 square feet, an increase of between 16 to 22 percent over baseline demand.

In Baltimore County and Baltimore City, BRAC will have roughly similar relative impacts on baseline demand for retail space, increasing baseline demand by 20 percent to over 50 percent depending on the scenario. The county, however, is expected to have a much larger increase in demand from the baseline—855,000 square feet—than is the city, which will have a baseline increase in demand of 183,000 square feet.

Growing baseline demand for retail space in shopping centers in New Castle, Lancaster, and York counties will be substantial, ranging from roughly 1 million to 2 million square feet over the next decade. BRAC, however, will have only a minimal impact on this demand, increasing baseline demand by no more than 2 to 4 percent.

Exhibit IV-10: Phasing of shopping center retail space demand: baseline and three BRAC scenarios (thousands of square feet)

<i>Jurisdiction</i>	<i>Scenario</i>	<i>Shopping center demand</i>			<i>Increase relative to baseline</i>	
		2007	2012	2017	Number	Percent
Harford County	Baseline	-	435	721		
	Mid-case	20	829	1,197	476	66%
	Low case	17	768	1,123	403	56%
	High case	22	870	1,246	526	73%
Cecil County	Baseline	-	300	620		
	Mid-case	6	404	740	120	19%
	Low case	5	385	718	98	16%
	High case	7	420	758	138	22%
Baltimore County	Baseline	-	567	855		
	Mid-case	15	856	1,204	349	41%
	Low case	10	769	1,099	244	29%
	High case	20	964	1,335	480	56%
Baltimore City	Baseline	-	184	183		
	Mid-case	3	232	242	59	32%
	Low case	2	214	219	36	20%
	High case	4	259	274	91	50%
New Castle County	Baseline	-	500	1,000		
	Mid-case	1	528	1,039	39	4%
	Low case	1	524	1,032	32	3%
	High case	1	531	1,043	43	4%
Lancaster County	Baseline	-	495	987		
	Mid-case	1	517	1,013	26	3%
	Low case	1	513	1,009	22	2%
	High case	1	519	1,016	28	3%
York County	Baseline	-	989	1,995		
	Mid-case	2	1,035	2,051	56	3%
	Low case	2	1,028	2,042	48	2%
	High case	3	1,040	2,057	62	3%

Source: Sage.

BRAC will also bring substantial demand for office space, both from the office-based contractors that will follow the direct jobs at APG as well as from the indirect and induced employment generated by the on-base and contractor-tail employment. Office space for indirect and induced employment varies widely from new space for real estate offices to information technology services companies.

Exhibit IV-11 summarizes the estimated demand for office space resulting from BRAC. Excluded from these figures is the office space for the on-base workers at APG. For each jurisdiction demand under each of the three scenarios is presented. Because the analysis assumes that most of the space required by the contractor tail would be located in Harford County, the majority of the total demand is projected to be in Harford County.

Exhibit IV-11: Phasing of office space demand: baseline and three BRAC scenarios (thousands of square feet)

<i>Jurisdiction</i>	<i>Scenario</i>	<i>2007</i>	<i>2012</i>	<i>2017</i>
Harford County	Mid-case	87	1,689	2,082
	Low case	64	1,247	1,559
	High case	100	1,951	2,395
Cecil County	Mid-case	8	165	242
	Low case	6	126	188
	High case	11	208	297
Baltimore County	Mid-case	33	640	861
	Low case	17	337	480
	High case	56	1,085	1,412
Baltimore City	Mid-case	7	133	173
	Low case	3	58	80
	High case	13	248	315
New Castle County	Mid-case	1	28	43
	Low case	1	24	36
	High case	2	31	47
Lancaster County	Mid-case	1	28	43
	Low case	1	24	36
	High case	2	31	47
York County	Mid-case	3	63	94
	Low case	3	53	79
	High case	4	69	104
Total	Mid-case	141	2,746	3,537
	Low case	96	1,869	2,458
	High case	186	3,624	4,617

Significant demand for space is also projected for Baltimore County, largely because the analysis assumes that most of the contractor-tail office space that is not located in Harford County will be in Baltimore County. Baltimore City and Cecil County are also projected to see significant new demand for office space.

Impacts and constraints: traffic

All of these new on-base workers will add substantially to the traffic coming to and leaving APG on a daily basis. Exhibit IV-12 examines the potential for this daily commuting to add traffic to I-95 in the vicinity of APG. Assuming that almost all workers commute alone by private vehicle and that almost all of these commuters use Exit 85 on I-95 to access APG, the BRAC-related traffic will significantly increase I-95's traffic load. For the mid-case this commuter traffic would increase traffic 20 percent in the section of I-95 between Exits 80 and 85 (to the south and west of Exit 85) and 9 percent between Exits 85 and 89 (to the north and east of Exit 85). Clearly there would also be a substantial increase in traffic on local roadways between Exit 85 and APG.

It is possible that MARC service will significantly reduce these predicted traffic counts. MARC service is strategically available between Perryville and Aberdeen. MARC service also links Baltimore City and Baltimore County to Aberdeen, which also may serve as another reason for households to live in these jurisdictions. By implication, any related opportunities to engage in transit-oriented development should be exploited to the extent possible.

Exhibit IV-12: Estimated traffic generation by all on-base direct and contractor-tail jobs

<i>Type of on-base job</i>	<i>Mid-case</i>	<i>Low case</i>	<i>High case</i>
Direct jobs	8,677	8,200	9,154
Contractor tail (1)	5,604	3,866	6,608
Total	14,281	12,066	15,762
Vehicle trips per day (2)	1.8	1.8	1.8
Total trips per day	25,706	21,719	28,372
Trips using I-95 (3)	23,135	19,547	25,535
Commuters from south/west (4)	16,657	14,074	18,385
Commuters from north/east (5)	6,478	5,473	7,150
AADT south/west of Exit 85 (6)	85,450	85,450	85,450
AADT north/east of Exit 85	72,950	72,950	72,950
APG commuters as share of AADT south/west of Exit 85	19.5%	16.5%	21.5%
APG commuters as share of AADT north/east of Exit 85	8.9%	7.5%	9.8%

Notes. (1) Assumes 77.5 percent of the contractor tail works at or very near APG.
(2) Assumes 0.9 trips each way per worker.
(3) Assumes 90 percent of trips use I-95 via Exit 85.
(4) Assumes 72 percent of traffic originates from south or west of Exit 85.
(5) Assumes 28 percent of traffic originates from north or east of Exit 85.
(6) AADT stands for annual average daily traffic.
Source: Sage

Of course, I-95 will not be the only affected roadway. MD-715 is the fundamental access route for visitors and truck drivers and undoubtedly will become more crowded in the years ahead. Route 22 serves as the access point for all federal employees and also will be used by many commuters from Bel Air who will be working proximate to APG, including for civilian defense contractors. MD-543 also feeds into the MD-715 gate. US-40 will be impacted both from the north and the south of APG as workers from White Marsh and other portions of Baltimore County use that roadway as an alternative to I-95. From the north, workers from Cecil County will undoubtedly utilize Route 40 as a primary means to access the base and other heavily BRAC-impacted areas.

MD-7, the former alignment of US-40 from Baltimore to the Delaware line, will also be affected from both the north and south of Aberdeen. MD-7 will help transport workers from White Marsh and Abingdon to the south and workers from North East to the north to APG and other areas. MD-24 and MD-755 will also be significantly impacted due to a combination of commuting toward APG and overall population growth within Harford County.

The study team anticipates that these roadways will be the most BRAC impacted and that these impacts will of course be felt most profoundly during morning commutes. As with I-95, MARC rail service has the potential to significantly alleviate impending bottlenecks. However, given the demographics of BRAC contractors and other technical personnel and the desire to be mobile during the day to attend meetings and conferences, it is still likely that congestion awaits the region around APG.

V. Fiscal Impacts

The estimation of fiscal impacts is driven primarily by household income and enhanced property values. Increased property values are dominated by housing, both owner-occupied and rental, new office and retail space.

Exhibit V-1 provides estimates of household income and housing values for BRAC-related population under the three scenarios. These values apply only to BRAC-related households, not households associated with the pre-existing baseline. Housing values are estimated on the assumption that housing purchasers will make down payments worth 10 percent of housing prices and will devote 25 percent of income to 30-year, mortgages at 6.5 percent. The value of rental housing is estimated in the same manner. As a result, whether buying or renting, BRAC households are assumed to occupy housing commensurate with their income.

Exhibit V-1: BRAC-related income and housing values: three scenarios (millions of dollars)

<i>Jurisdiction</i>	<i>Scenario</i>	<i>Total annual household income</i>			<i>Total Housing value</i>		
		<i>2007</i>	<i>2012</i>	<i>2017</i>	<i>2007</i>	<i>2012</i>	<i>2017</i>
Harford County	Mid-case	\$35.4	\$689.8	\$778.3	\$128.5	\$2,502.1	\$2,823.2
	Low case	\$30.4	\$592.6	\$664.4	\$110.4	\$2,149.7	\$2,409.9
	High case	\$38.8	\$756.5	\$855.7	\$140.9	\$2,744.2	\$3,104.1
Cecil County	Mid-case	\$9.9	\$192.7	\$217.9	\$35.9	\$698.9	\$790.5
	Low case	\$8.3	\$161.2	\$180.9	\$30.0	\$584.8	\$656.2
	High case	\$11.3	\$219.2	\$249.1	\$40.8	\$795.2	\$903.5
Baltimore County	Mid-case	\$25.0	\$486.9	\$557.4	\$90.7	\$1,766.3	\$2,021.9
	Low case	\$18.2	\$353.7	\$398.8	\$65.9	\$1,283.0	\$1,446.6
	High case	\$33.5	\$652.5	\$754.8	\$121.5	\$2,367.0	\$2,738.1
Baltimore City	Mid-case	\$1.9	\$37.1	\$41.8	\$15.1	\$293.4	\$338.8
	Low case	\$1.6	\$31.9	\$35.7	\$9.7	\$189.6	\$214.7
	High case	\$2.1	\$40.7	\$46.0	\$22.4	\$436.5	\$509.9
New Castle County	Mid-case	\$1.9	\$37.1	\$41.8	\$6.9	\$134.5	\$151.8
	Low case	\$1.6	\$31.9	\$35.7	\$5.9	\$115.6	\$129.6
	High case	\$2.1	\$40.7	\$46.0	\$7.6	\$147.5	\$166.9
Lancaster County	Mid-case	\$4.2	\$80.9	\$93.4	\$6.9	\$134.5	\$151.8
	Low case	\$2.7	\$52.3	\$59.2	\$5.9	\$115.6	\$129.6
	High case	\$6.2	\$120.3	\$140.6	\$7.6	\$147.5	\$166.9
York County	Mid-case	\$4.2	\$81.6	\$92.1	\$15.2	\$295.9	\$333.9
	Low case	\$3.6	\$70.1	\$78.6	\$13.1	\$254.3	\$285.0
	High case	\$4.6	\$89.5	\$101.2	\$16.7	\$324.6	\$367.1
Maryland	Mid-case	\$72.2	\$1,406.5	\$1,595.5	\$270.1	\$5,260.7	\$5,974.4
	Low case	\$58.5	\$1,139.4	\$1,279.8	\$216.0	\$4,207.1	\$4,727.5
	High case	\$85.7	\$1,668.9	\$1,905.6	\$325.7	\$6,342.8	\$7,255.5

For both income and housing values, figures are cumulative over time. That is, the BRAC-related increases for income and housing values shown for 2017 embody the increases for 2007 and 2012.

The exhibit also includes increases in income and housing values in Maryland. Given that Maryland will absorb the bulk of BRAC-related growth, it will also experience substantial fiscal impacts related to BRAC.

Exhibit V-2 presents expected increases in the value of retail and office space. As with Exhibit V-1, these values are cumulative over time; values listed for 2017 include increases for 2007 and 2012. Because the State of Maryland will receive property tax revenue, the total increases for all retail and office space are shown.

Exhibit V-2: BRAC-related retail and office space values: three scenarios (millions of dollars)

<i>Jurisdiction</i>	<i>Scenario</i>	<i>Retail space value (1)</i>			<i>Office space value (2)</i>		
		<i>2007</i>	<i>2012</i>	<i>2017</i>	<i>2007</i>	<i>2012</i>	<i>2017</i>
Harford County	Mid-case	\$2.5	\$49.3	\$59.6	\$17.3	\$337.7	\$416.4
	Low case	\$2.1	\$41.6	\$50.3	\$12.8	\$249.4	\$311.8
	High case	\$2.8	\$54.4	\$65.7	\$20.0	\$390.3	\$479.0
Cecil County	Mid-case	\$0.7	\$12.5	\$15.0	\$1.7	\$33.1	\$48.3
	Low case	\$0.6	\$10.3	\$12.3	\$1.3	\$25.2	\$37.5
	High case	\$0.8	\$14.3	\$17.4	\$2.1	\$41.6	\$59.5
Baltimore County	Mid-case	\$1.9	\$36.1	\$43.6	\$6.6	\$127.9	\$172.2
	Low case	\$1.3	\$25.2	\$30.5	\$3.5	\$67.5	\$96.0
	High case	\$2.5	\$49.6	\$60.0	\$11.1	\$217.0	\$282.5
Baltimore City	Mid-case	\$0.3	\$6.1	\$7.4	\$1.4	\$26.6	\$34.7
	Low case	\$0.2	\$3.8	\$4.6	\$0.6	\$11.6	\$16.1
	High case	\$0.5	\$9.4	\$11.3	\$2.5	\$49.6	\$62.9
New Castle County	Mid-case	\$0.1	\$4.0	\$4.9	\$0.3	\$5.7	\$8.5
	Low case	\$0.1	\$3.3	\$4.1	\$0.2	\$4.8	\$7.2
	High case	\$0.2	\$4.5	\$5.4	\$0.3	\$6.3	\$9.4
Lancaster County	Mid-case	\$0.1	\$2.6	\$3.2	\$0.3	\$5.7	\$8.5
	Low case	\$0.1	\$2.2	\$2.7	\$0.2	\$4.8	\$7.2
	High case	\$0.2	\$2.9	\$3.5	\$0.3	\$6.3	\$9.4
York County	Mid-case	\$0.3	\$5.8	\$7.0	\$0.6	\$12.5	\$18.8
	Low case	\$0.3	\$4.9	\$6.0	\$0.5	\$10.6	\$15.8
	High case	\$0.3	\$6.4	\$7.8	\$0.7	\$13.8	\$20.7
State of Maryland	Mid-case	\$5.4	\$105.3	\$127.3	\$27.0	\$525.4	\$671.6
	Low case	\$4.2	\$82.0	\$99.1	\$18.2	\$353.7	\$461.4
	High case	\$6.6	\$129.3	\$156.3	\$35.9	\$698.4	\$883.9

Notes. (1) Retail space value based on construction cost of \$125 per square foot of space.

(2) Office space value based on construction cost of \$200 per square foot of space.

Source: Sage

Income tax and property tax

The property and income tax revenue that would be received by county governments and Baltimore City are listed in Exhibit V-3. As with the previous exhibits, these figures apply only to tax revenues generated as the result of APG's realignment. These figures are also cumulative. Data for the increase in 2017 when all BRAC effects are assumed to occur include the earlier increases in 2007 and 2012.

Exhibit V-3: BRAC-related property tax and income tax revenue: three scenarios (annual, ongoing impacts in millions of dollars)

<i>Jurisdiction</i>	<i>Scenario</i>	<i>Property tax revenue</i>			<i>Income tax revenue</i>		
		<i>2007</i>	<i>2012</i>	<i>2017</i>	<i>2007</i>	<i>2012</i>	<i>2017</i>
Harford County	Mid-case	\$1.6	\$31.3	\$35.7	\$0.8	\$15.2	\$17.1
	Low case	\$1.4	\$26.4	\$30.0	\$0.7	\$13.0	\$14.6
	High case	\$1.8	\$34.5	\$39.5	\$0.9	\$16.6	\$18.8
Cecil County	Mid-case	\$0.4	\$7.1	\$8.0	\$0.2	\$3.8	\$4.3
	Low case	\$0.3	\$5.9	\$6.6	\$0.2	\$3.2	\$3.5
	High case	\$0.4	\$8.1	\$9.2	\$0.2	\$4.3	\$4.9
Baltimore County	Mid-case	\$1.1	\$21.4	\$24.8	\$0.5	\$10.1	\$11.5
	Low case	\$0.8	\$15.3	\$17.5	\$0.4	\$7.3	\$8.3
	High case	\$1.5	\$29.2	\$34.2	\$0.7	\$13.5	\$15.6
Baltimore City	Mid-case	\$0.4	\$7.4	\$8.6	\$0.1	\$1.6	\$1.9
	Low case	\$0.2	\$4.6	\$5.3	\$0.1	\$1.0	\$1.2
	High case	\$0.6	\$11.2	\$13.2	\$0.1	\$2.4	\$2.8
New Castle County	Mid-case	\$0.0	\$0.8	\$0.9	\$0.0	\$0.0	\$0.0
	Low case	\$0.0	\$0.7	\$0.8	\$0.0	\$0.0	\$0.0
	High case	\$0.0	\$0.8	\$1.0	\$0.0	\$0.0	\$0.0
Lancaster County	Mid-case	\$0.0	\$0.4	\$0.5	\$0.0	\$0.2	\$0.2
	Low case	\$0.0	\$0.4	\$0.4	\$0.0	\$0.2	\$0.2
	High case	\$0.0	\$0.5	\$0.5	\$0.0	\$0.2	\$0.2
York County	Mid-case	\$0.1	\$1.4	\$1.6	\$0.0	\$0.4	\$0.5
	Low case	\$0.1	\$1.2	\$1.4	\$0.0	\$0.4	\$0.4
	High case	\$0.1	\$1.6	\$1.8	\$0.0	\$0.4	\$0.5
Maryland	Mid-case	\$0.3	\$6.6	\$7.6	\$2.6	\$51.3	\$58.2
	Low case	\$0.3	\$5.2	\$5.9	\$2.1	\$41.3	\$46.4
	High case	\$0.4	\$8.0	\$9.3	\$4.2	\$81.6	\$98.7

Property taxes are a mainstay of local government revenue. In Maryland, county property taxes tend to cover a broad range of services provided by the county (as opposed to municipalities) including education. Thus, in Maryland, although municipalities may levy separate property taxes that are in addition to countywide property taxes, county property taxes tend to predominate. In Delaware and Pennsylvania, county property tax rates are substantially lower than they are in Maryland. Other sub-county taxing districts, however, are important in the levying of property taxes. This is particularly true of school districts.

Because this analysis focuses on impacts at the county level, the property tax figures in Exhibit V-3 are only for property taxes levied by counties. Rates used in these estimates are as follows.

- Harford County – 1.082 percent
- Baltimore County – 1.110 percent
- Cecil County – 0.960 percent
- Lancaster County – 0.296 percent
- New Castle County – 0.455 percent
- Baltimore City – 2.268 percent
- York County – 0.451 percent
- Maryland – 0.112 percent

Actual property taxes paid by households would be higher in many cases, depending on the specific location of households and whether they were subject to additional municipal or school district property tax levies.

Maryland is one of only a handful of states that allows counties to levy income taxes. Delaware has no local income tax and in Pennsylvania the average local tax rate is minimal (0.5 percent).²⁶ Income tax revenues presented for individual jurisdictions are separate from state income tax revenue.

Sales tax

Consumer spending in Maryland will increase substantially as a result of BRAC. Exhibit V-4 provides estimates of the cumulative annual sales tax receipts for the State of Maryland under the three scenarios.

Exhibit V-4: BRAC-related sales tax in Maryland: three scenarios (annual, ongoing impacts in millions of dollars)

<i>Jurisdiction</i>	<i>Scenario</i>	<i>2007</i>	<i>2012</i>	<i>2017</i>
Maryland	Mid-case	\$2.1	\$41.5	\$47.1
	Low case	\$1.7	\$33.4	\$37.5
	High case	\$3.1	\$60.1	\$71.4

²⁶ Pennsylvania local income tax rates from Tax Foundation as cited in Andrew A. Green, “State leader look at MD income taxes,” *Baltimore Sun*, July 19, 2007.

Summary of fiscal impacts

Exhibit V-5 summarizes the annual tax receipts for the seven jurisdictions and the State of Maryland from income, property, and sales tax revenue that would be generated as a result of the BRAC changes at APG. Receipts are provided for all three scenarios and are cumulative over time.

Exhibit V-5: Summary of BRAC-related tax revenue: three scenarios (annual, ongoing impacts in millions of dollars)

<i>Jurisdiction</i>	<i>Scenario</i>	<i>2007</i>	<i>2012</i>	<i>2017</i>
Harford County	Mid-case	\$2.4	\$46.4	\$52.8
	Low case	\$2.0	\$39.4	\$44.6
	High case	\$2.6	\$51.1	\$58.3
Cecil County	Mid-case	\$0.6	\$10.8	\$12.3
	Low case	\$0.5	\$9.0	\$10.1
	High case	\$0.6	\$12.4	\$14.1
Baltimore County	Mid-case	\$1.6	\$31.5	\$36.4
	Low case	\$1.2	\$22.6	\$25.7
	High case	\$2.2	\$42.7	\$49.8
Baltimore City	Mid-case	\$0.5	\$9.0	\$10.5
	Low case	\$0.3	\$5.7	\$6.5
	High case	\$0.7	\$13.6	\$16.1
New Castle County	Mid-case	\$0.0	\$0.8	\$0.9
	Low case	\$0.0	\$0.7	\$0.8
	High case	\$0.0	\$0.8	\$1.0
Lancaster County	Mid-case	\$0.0	\$0.6	\$0.7
	Low case	\$0.0	\$0.5	\$0.6
	High case	\$0.0	\$0.7	\$0.8
York County	Mid-case	\$0.1	\$1.8	\$2.1
	Low case	\$0.1	\$1.6	\$1.8
	High case	\$0.1	\$2.0	\$2.3
Maryland	Mid-case	\$5.1	\$99.4	\$112.9
	Low case	\$4.1	\$79.9	\$89.8
	High case	\$7.7	\$149.7	\$179.3

Maryland jurisdictions will experience significant increases in annual tax receipts as a result of APG BRAC. In the mid-case scenario, Harford County would annually collect an added \$53 million; Baltimore County’s collections would rise by over \$36 million per year; Cecil County’s annual receipts would increase by over \$12 million while Baltimore City would collect an additional \$11 million each year. Counties outside of Maryland would see much smaller increases in annual tax receipts in the mid-case, under \$1 million for New Castle and Lancaster counties and \$2.1 million for York County. The State of Maryland is also a major beneficiary, with augmented annual tax receipts estimated at \$113 million under the mid-case scenario.

Cost of services

Of course the augmented revenues described above are counterbalanced by an expansion in the need for local and state government services. The analysis below utilizes FY2007 budget data and 2006 estimates of jurisdictional population and employment. Sage begins this part of the analysis by determining the share of local government expenditures traceable to the residential base vis-à-vis the commercial base. The study team does this by assuming that government service provision is in part a function of the amount of time spent within the county. Residents are assumed to spend more time in the county than employees, though of course a single person may spend each day fulfilling both roles. The analysis accounts for this. Commuting data are utilized to segregate people into various categories. People who both live and work in a jurisdiction are assumed to utilize government services most intensely. People who live in a jurisdiction but work elsewhere use government services somewhat less intensely. Those who merely work in a particular jurisdiction but live elsewhere are presumed to use government services even less intensely, particularly because they are presumed to utilize none of that community's educational services. The analysis assigns no cost of government service to those individuals that neither live nor work in a particular jurisdiction.

The cost of services analysis also assumes that certain types of services are exclusively residential and others exclusively non-residential. Expenditures on pre-K through grade 12 education are assigned to a jurisdiction's residential base. Economic development expenditures are assigned to the commercial base. The share of local government expenditures assigned to respective residential bases is presented in Exhibit V-6.

Exhibit V-6: Share of local government expenditures assigned to the residential base by jurisdiction

<i>Jurisdiction</i>	<i>Share of expenditures attributed to the residential base</i>
Harford County	87.8%
Baltimore County	84.5%
Cecil County	89.2%
Lancaster County	84.0%
New Castle County	82.3%
Baltimore City	83.3%
York County	84.9%

Exhibit V-7 indicates that by 2017, BRAC will increase the demand for government services by \$36.6 million per annum in Harford County, \$25.9 million per annum in Baltimore County, \$8.2 million per year in Cecil County and \$6.7 million in Baltimore City.

Exhibit V-7: Estimated cost of services by 2017 (millions), BRAC-related households and businesses

<i>Jurisdiction</i>	<i>BRAC residential cost of services</i>	<i>BRAC commercial cost of services</i>	<i>Total cost of services related to BRAC</i>
Harford County	\$30.2	\$6.4	\$36.6
Baltimore County	\$24.2	\$1.7	\$25.9
Cecil County	\$7.8	\$0.4	\$8.2
Lancaster County	\$0.3	\$0.0	\$0.3
New Castle County	\$0.4	\$0.0	\$0.4
Baltimore City	\$5.7	\$1.0	\$6.7
York County	\$0.7	\$0.0	\$0.7
Total	\$69.3	\$9.5	\$78.8

Though these are not inconsequential totals, these figures are far less than the countervailing revenues that BRAC will generate. The net fiscal surplus that BRAC will generate at the end of the forecast horizon (2017) is presented below in Exhibit V-8. The net fiscal impact in Harford County, for instance, will be \$16 million per year. Of course, these future revenues will need to be leveraged to support short-term capital projects that will allow Harford and other jurisdictions to support BRAC accommodation.

Exhibit V-8: Estimated BRAC-related cost of services compared to mid-case fiscal impacts (millions)

<i>Jurisdiction</i>	<i>Total cost of services related to BRAC</i>	<i>Fiscal impacts related to BRAC</i>	<i>Net fiscal impact of BRAC</i>
Harford County	\$36.6	\$52.8	\$16.2
Baltimore County	\$25.9	\$36.4	\$10.5
Cecil County	\$8.2	\$12.3	\$4.1
Lancaster County	\$0.3	\$0.7	\$0.4
New Castle County	\$0.4	\$0.9	\$0.5
Baltimore City	\$6.7	\$10.5	\$3.8
York County	\$0.7	\$2.1	\$1.4
Total	\$78.8	\$115.7	\$36.9

Conclusion

Based on this analysis, the long-discussed BRAC impacts are real and large. The economic activities that BRAC will unleash in the seven-jurisdiction study area will be of a type that should permit ascendant quality of life, including through support for public investment, availability of jobs, and support for higher quality retail and entertainment amenities.

All told, APG BRAC will create nearly 28,000 jobs, attract nearly 17,000 households and boost population by roughly 45,000 between now and 2017 in the seven-jurisdiction

study area. Associated with this will be demand for 3.6 million square feet of additional office space and 1.1 million square feet of retail space.

There is considerable preparatory work to be done in the short-term. The analysis identifies existing shortfalls of housing, water/sewer capacity, wastewater capacity, and classroom capacity in a number of jurisdictions. Many of these shortfalls will evaporate if planned investments move forward. To the extent that they do not, BRAC impacts will be accommodated differently than has been predicted in this analysis.

Finally, this report has not endeavored to calculate the dynamic/transformational effects of BRAC. BRAC will bring to Central Maryland and to a lesser extent to Delaware and Pennsylvania large numbers of scientific and technical personnel. This population will join an already formidable scientific/technical community; one that is increasingly innovative and global in scope. This now larger innovative community may be capable of generating an array and level of economic impacts that are presently unfathomable.

Appendix A- Assumptions

Any economic analysis is based on at least a few assumptions. BRAC analysis is no different. Some of the assumptions the study team has made are explained in the main body of the report to promote comprehension. The following discussion explains the rationales supporting other assumptions and various sources of data that have been used to minimize the need for simplifying assumptions.

Jobs per household. The estimated number of jobs per household is used to translate expected increases in employment into a concomitant number of new households. These households, in turn, form the basis for estimating population, demand for public services, and other regional impacts. The estimate is based on employment in Maryland and the number of households assumed to be participating in the labor force.

The number of households assumed to be participating in the labor force is defined as all households headed by persons under the age of 65. The number of households headed by persons 65 years or older is estimated on the basis of the known population 65 years or older, and the known number of householders living alone who are 65 years or older. The remaining population 65 years or older is assumed to live in households of two persons. As a result, the estimated number of households headed by persons 65 years or older is shown in Exhibit A-1. Given that not all older Marylanders are likely to be living independently, this estimate may overstate the number of households headed by persons 65 years or older.

Exhibit A-1: Households headed by persons 65 years or older

Population 65 years and over	609,450
Householder 65 years or older living alone	171,337
Households if 2 people per household	219,057
Estimated households for persons 65 years or older	390,394
Source: U.S. Census, 2005	

Exhibit A-2 presents the estimated employment per household for households headed by persons under 65 years of age. This estimate is calculated by comparing civilian and armed forces employment to the number of households headed by persons under 65 years of age. As noted above, the estimated number of households headed by persons under 65 years may be too high. On the other hand, some proportion of households headed by younger persons does not participate in the labor force. These include those who retire before age 65 as well as those not participating in the labor force for other reasons. In estimating 1.64 jobs per household, there are potential errors in both directions due to uncertainties associated with the number of households that participate in the labor force. If in fact more households participate in the labor force, then the number of jobs per household will be lower. If fewer households participate in the labor force, the number of jobs per household will be greater. These changes in the ratio would in turn affect the number of households associated with BRAC-related jobs, the resulting population, and its demands for public services, housing, and other goods and services.

Exhibit A-2: Employment per household

Employed, civilian and armed forces	2,785,036
Total households	2,085,647
Estimated households for persons 65 years or older	390,394
Estimated households for persons under 65 years	1,695,254
Employed/household with persons under 65 years	1.64
Source: U.S. Census, 2005	

Estimates of indirect and induced jobs. The methodology for estimating indirect and induced jobs associated with the jobs that BRAC will bring to APG is based on a model of the Maryland economy created with IMPLAN, a widely accepted standard for estimating these types of economic effects. One of the critical relationships estimated by IMPLAN is the number of indirect and induced jobs relative to direct jobs. This so-called multiplier effect allows for estimates of employment that is likely to be created by the net new jobs that will be located at APG and contractor-tail jobs.

IMPLAN estimates these multiplier effects for over 500 economic sectors. In addition, individual economic sectors can be combined to create custom sectors. By using the mix of jobs likely to relocate to APG (see Exhibit A-3), the contribution of individual economic sectors to the total mix can be quantified.

Exhibit A-3: Mix of jobs expected to relocate to APG

<i>Job types/economic sectors</i>	<i>Total</i>	<i>Share of total</i>
Transportation and warehousing	1350	14.7%
Professional services, R&D	4430	48.4%
Management of companies	1841	20.1%
Administrative & support, waste management	860	9.4%
Other services	676	7.4%
Total	9157	100.0%
Source: RESI		

Most of these job types can be matched to one or more IMPLAN economic sectors. Exhibit A-4 lists the relevant IMPLAN sectors. Almost half of the new jobs at APG fall under a general heading of professional services and research and development. According to the SAIC report, most of this work appears to be related to information technology services such as computer programming and scientific and technical research, development, and demonstration. IMPLAN does not have a single economic sector that corresponds to this range of activities. To approximate these activities, a custom IMPLAN sector for information technology services was created from a cluster of sectors that are believed to be related to the new activities at APG. These sectors are identified below by IMPLAN sector number. A description of each sector is also provided.

- 441 Custom computer programming services
- 442 Computer systems design services
- 443 Other computer related services
- 444 Management consulting services

- 445 Environmental and other technical consulting
- 446 Scientific research and development services

Exhibit A-4: Correspondence of jobs expected to relocate to APG and IMPLAN sectors

<i>Job types/economic sectors</i>	<i>IMPLAN sector</i>	
	Number	Description
Transportation and warehousing	394	Truck transportation
	400	Warehousing and storage
Professional services, R&D	Custom	Based on sectors 441-446
Management of companies	451	Management of companies and enterprises
Administrative & support, waste management	452	Office administrative services
	460	Waste management and remediation services
Other services	455	Business support services
Source: Sage		

Exhibit A-5 presents the data used to estimate the relationship between direct BRAC jobs and indirect and induced jobs. The bulk of the exhibit presents a listing of the relationship between direct, indirect, and induced jobs for the types of jobs that are expected at APG. The numbers in the columns labeled direct jobs, indirect jobs, and induced jobs are IMPLAN estimates of the jobs created by \$1 million of demand for these services. For example, IMPLAN estimates that for each \$1 million of demand for truck transportation services, 8.10 direct jobs are created, 3.80 indirect jobs are created, and 3.86 induced jobs are created. By using the share of the total mix for each type of job a weighted average for all jobs expected to relocate to APG can be calculated. That weighted average estimates that for each \$1 million of demand for the types of services that will be relocating to APG, 10.98 direct jobs will be created along with 2.37 indirect jobs and 5.82 induced jobs. Alternatively, for each direct job created at APG, there will be 0.22 indirect jobs and 0.53 induced jobs generated.

Exhibit A-5: Ratio of indirect and induced jobs to direct jobs

<i>IMPLAN</i> sector		<i>Share of total</i>	<i>Jobs per \$1 million of demand</i>		
			<i>Direct jobs</i>	<i>Indirect jobs</i>	<i>Induced jobs</i>
Number	Description				
394	Truck transportation	7.4%	8.10	3.80	3.86
400	Warehousing and storage	7.4%	12.25	1.72	5.55
Custom	Professional services, R&D	48.4%	11.08	1.93	6.51
451	Management of companies and enterprises	20.1%	10.74	2.45	6.11
452	Office administrative services	4.7%	6.08	4.97	4.35
460	Waste management and remediation services	4.7%	8.06	3.48	4.05
455	Business support services	7.4%	17.52	1.97	4.77
Weighted average		100.0%	10.98	2.37	5.82
Ratio of indirect and induced jobs to direct jobs				0.22	0.53
Sources: RESI, IMPLAN, Sage					

It should be noted that the relationships quantified in Exhibit A-5 are based on the economy of Maryland. One criticism of IMPLAN is that as a static model it fails to respond to the types of fundamental economic change that BRAC may bring to the seven-jurisdiction study area. Because BRAC represents a substantial increase in the economic base of this area, it is reasonable to assume that the jurisdictions will, in response, develop a more complex set of economic relationships that are better able to serve the future needs of the county's economy. For example, in the future, Harford and Cecil counties may offer a more robust array of economic support for information technology than is true today. From an economic perspective, this would translate into a greater economic impact in these jurisdictions as local businesses are able to provide more goods and services to APG than is possible today.

This shortcoming of IMPLAN is mitigated to some extent by basing the relationships in Exhibit A-5 on the statewide economy. While BRAC will likely bring fundamental economic change to the state as a whole, Maryland is much better equipped to respond to the economic opportunities of BRAC than is any individual jurisdiction in the state. As a result, it is assumed that the statewide relationships between new BRAC-related direct jobs and indirect and induced jobs are less likely to change in the longer run than is true for more local areas like Harford, Cecil or Baltimore counties.

Estimates of households, population, and school-age population. The number of jobs created at APG as a result of BRAC is used to estimate the number of households that will move to Harford County and the surrounding region. Based on the calculations presented in Exhibits A-1 and A-2, new jobs are converted to new households using a ratio of 1.64 jobs per household. The total population associated with these households is based on an average household size of 2.7 persons per household. According to the SAIC report, this is the average household size in Monmouth County, New Jersey as

reported by the US Census Bureau in 2005. Based on a survey conducted of Fort Monmouth employees likely to relocate or considering relocating to APG, 29 percent of employees moving to APG are estimated to be single persons. Assuming the remaining 71 percent of employees are family members, then the average household size for families likely to relocate to APG is 3.39 persons. The analysis assumes that all of these families include two parents and as a result have 1.39 children under the age of 18 years. Based again on the BRAC survey, it is assumed that 74 percent of these children are of school age. This amounts to 1.03 school-age children per household. Finally, based on the BRAC survey it is assumed that 77 percent of the school-age children will attend public schools, that is, 0.79 school age children per household, who are likely to attend public school. Exhibit A-6 summarizes these assumptions, provides their values, and lists sources for the data.

Exhibit A-6: Assumptions built into population and school age population increases related to BRAC

<i>Nature of assumption</i>	<i>Value</i>	<i>Source</i>
Average household size	2.70	SAIC, RESI, US Census
Share of households which are single persons	29%	October 2006 BRAC survey results and analysis
Average household size for families	3.39	Sage calculation
If families have 2 parents, then children per household	1.39	Sage calculation
Share of all children who are of school age (5 – 17 years)	74%	October 2006 BRAC survey results and analysis
Number of children of school age (5 – 17 years) per household	1.03	Sage calculation
Share of school age children in public schools	77%	October 2006 BRAC survey results and analysis
Number of school age children in public schools per household	0.79	Sage calculation

The estimate for public school students per household, just discussed, is higher than the value used in Harford County to project school enrollments. As a result, the analysis uses the figure of 0.79 public school students per household as the high end of a range. For the low end, the 0.43 public-school students per household factor used by Harford County was adjusted. The 0.43 figure includes all households in the county including senior households who are unlikely to be in the workforce or to have children in public schools. By adjusting for senior households, the Harford County figure can be made comparable to the 0.79 figure derived from survey data for households considering relocating to APG. According to the 2000 Census, 17.4 percent of county households were headed by someone aged 65 or above. The analysis presumes that there are no pupils in those households although that is probably a slight overstatement. Based on this, the balance of Harford County households produces 0.52 public school pupils per household.

This figure of 0.52 public school students per household is then used as the low end of the range. The midpoint between 0.52 and 0.79 is used as the mid-case variable for public school students per household. That value is 0.66 public school students per household.

In all cases, it is assumed that 77 percent of school age children attend public schools. The remaining children are at parochial or independent schools or are home schooled.

Office and retail space. The BRAC jobs that will be relocating to APG are clearly a part of the knowledge economy. As a result, many of the jobs that will be created in response to these BRAC jobs will be office-based. To provide readers with some context about the extent to which BRAC job composition is different from the current composition of jobs in the study area, the study team generated Exhibits A-7 and A-8. Exhibit A-7 provides data from published government sources regarding the absolute number of jobs in each jurisdiction by industry in 2006. Exhibit A-8 provides data regarding job shares in each jurisdiction.

Exhibit A-7: 2006 breakdown of employment by industry by jurisdiction

<i>Industry</i>	<i>Balt. City</i>	<i>Balt. County</i>	<i>Cecil</i>	<i>Harford</i>	<i>Lancaster</i>	<i>New Castle</i>	<i>York</i>
Construction and Mining	11,200	27,732	2,144	7,370	19,542	18,665	12,397
Manufacturing	17,034	25,700	4,564	4,543	43,601		37,599
Trade, Transp. and Utilities	42,998	71,446	6,250	18,594	51,647	50,645	37,538
Information	6,115	6,384	252	648	3,675	5,492	1,983
Financial Services	22,594	30,778	823	3,489	9,430	36,144	5,804
Prof. and Business	46,741	51,270	1,782	10,969	19,712	52,165	16,172
Education and Health	90,055	60,145	2,874	8,436	33,478	36,309	21,845
Leisure and Hospitality	25,983	31,212	3,146	8,321	20,884	24,028	14,840
Other Services	11,111	11,869	1,042	2,878	6,403	9,085	6,170
Government	75,315	58,832	7,156	16,698	19,497	32,662	19,728
Total Employment	349,146	375,368	30,033	81,946	227,872	282,874	174,077

Source: Maryland Department of Labor, Licensing and Regulation; Bureau of Labor Statistics

Exhibit A-8: 2006 employment shares by industry by jurisdiction

<i>Industry</i>	<i>Balt. City</i>	<i>Balt. County</i>	<i>Cecil</i>	<i>Harford</i>	<i>Lancaster</i>	<i>New Castle</i>	<i>York</i>
Construction and Mining	3.2%	7.4%	7.1%	9.0%	8.6%	6.6%	7.1%
Manufacturing	4.9%	6.8%	15.2%	5.5%	19.1%	6.2%	21.6%
Trade, Transp. and Utilities	12.3%	19.0%	20.8%	22.7%	22.7%	17.9%	21.6%
Information	1.8%	1.7%	0.8%	0.8%	1.6%	1.9%	1.1%
Financial Services	6.5%	8.2%	2.7%	4.3%	4.1%	12.8%	3.3%
Prof. and Business	13.4%	13.7%	5.9%	13.4%	8.7%	18.4%	9.3%
Education and Health	25.8%	16.0%	9.6%	10.3%	14.7%	12.8%	12.5%
Leisure and Hospitality	7.4%	8.3%	10.5%	10.2%	9.2%	8.5%	8.5%
Other Services	3.2%	3.2%	3.5%	3.5%	2.8%	3.2%	3.5%
Government	21.6%	15.7%	23.8%	20.4%	8.6%	11.5%	11.3%

Source: Maryland Department of Labor, Licensing and Regulation; Bureau of Labor Statistics

The RESI report provided data on the likely mix of jobs in the BRAC contractor tail and for indirect and induced employment. Some types of jobs are clearly office-based while others are not. The demand for office space per worker varies substantially across the country and even within regions. Space per worker is also influenced by the availability of space, the amount of speculative office space built, and other factors. A recent analysis of the Washington, DC metropolitan area office market estimated office space per worker for office-based workers in 2004 at 276 square feet and projected that figure to increase to 292 square feet by 2030.²⁷ On the assumptions that these figures for space per worker include many private-sector workers in metropolitan Washington, DC, and that these workers would have more space per worker than is likely for workers in Harford County and the surrounding region, this analysis assumes 250 square feet of office space per office-based worker.

Based on the expected breakdown of BRAC-related jobs reflected in Exhibit A-9, one can determine the demand for various types of employment-generating space that will be required jurisdiction by jurisdiction. As the exhibit below indicates, a large share of contractor-tail and indirect jobs will be in office space-using industries like professional services and information. By contrast, the induced jobs, which are generated through household spending, will be largely concentrated in retail and services.

²⁷ “Downtown Washington office market study,” Delta Associates, September 19, 2005.

Exhibit A-9: Projected breakdown of BRAC-related jobs

<i>Economic sector</i>	<i>Contractor-tail jobs</i>	<i>Indirect jobs</i>	<i>Induced jobs</i>
Agriculture	0.0%	0.1%	0.5%
Mining	0.0%	0.0%	0.0%
Utilities	0.0%	0.1%	0.3%
Construction	0.0%	1.4%	1.2%
Manufacturing	0.0%	2.3%	2.4%
Wholesale trade	0.0%	1.1%	2.7%
Transportation, warehousing	7.4%	7.2%	2.8%
Retail trade	0.0%	1.2%	18.3%
Information	25.0%	16.8%	1.2%
Finance and insurance	0.0%	1.8%	4.4%
Real estate	0.0%	4.1%	3.2%
Professional, scientific, technical services	49.2%	33.9%	4.7%
Management of companies	10.1%	3.9%	0.3%
Administrative, support, waste management, remediation services	7.3%	17.9%	4.5%
Educational services	0.0%	0.2%	3.7%
Health care, social services	0.0%	0.0%	19.9%
Arts, entertain- ment, recreation	0.0%	1.9%	3.2%
Accommodation, food services	0.0%	3.0%	12.0%
Other services	1.0%	2.7%	8.3%
Government	0.0%	0.4%	6.4%
Total	100.0%	100.0%	100.0%

The International Council of Shopping Centers conducts an annual census of shopping centers. The most recent census for 2005 found almost 136 million square feet of retail space in shopping centers in Maryland. As shown in Exhibit A-10, this was the equivalent of 25 square feet of space per Maryland resident.

Exhibit A-10: Retail space demand

<i>Factor</i>	<i>Value</i>
Shopping center gross leasable area, Maryland, 2005	135,912,603
Maryland population, 2005	5,461,318
Retail space per capita	25
Sources: International Council of Shopping Centers, US Census, Sage	

Contractor tail

Contractor tail is a term of art for those private companies and their employees who work under contract for the Department of Defense agencies that are relocating to Maryland. Among the issues associated with the changes that BRAC will bring to the state, the size of the contractor tail may be the most uncertain.

As noted in the text, estimates of the number of contractor-tail jobs to each direct job (i.e. Department of Defense employees and embedded contractors) have run as high as six

jobs. Local Maryland economic development agencies have used an estimate of two jobs per each direct job at Fort Meade. The difficulty with these estimates is the lack of documentation to support these ratios.

In gathering data for this analysis, two estimates of this ratio appeared to be benefit from better documentation, or at least slightly better documentation. The RESI analysis indicates that 8,000 contractor-tail jobs would be part of the BRAC effects statewide in Maryland. These would be in addition to the 15,272 direct jobs statewide estimated by RESI. How RESI derived the estimate of 8,000 contractor-tail jobs is unclear. The second estimate is based on the experience of Arlington County, Virginia which lost 1 million square feet of contractor office space when the Naval Sea Systems Command vacated 1.2 million square feet of office space in the county and moved to Washington, D.C. These represented the most specific data we were able to identify.

This experience seems to demonstrate not only a ratio of direct employment to contractor-tail employment, but also the keen interest on the part of contractors to locate virtually next door to their clients. Given that Arlington County and Washington, D.C. are separated only by the Potomac River and are connected by good roads and an excellent subway, it seems clear that even a separation of 20 to 30 minutes of travel time is too much for many contractors.

Housing supply

The future inventory of housing for Maryland jurisdictions can be estimated as the sum of U.S. Census estimates of the 2005 housing inventory and annual estimates of new housing construction.²⁸ For Maryland jurisdictions, new housing construction from 2005 through 2015 was estimated in the Maryland Department of Planning “BRAC report.”

Future construction activity as estimated by the Maryland Department of Planning is summarized in Exhibit A-11. Total construction activity was converted to annual activity to allow for estimates of housing inventory in 2007, 2012, and 2017.

Exhibit A-11: New housing construction 2005-2015

<i>Jurisdiction</i>	<i>New construction total 2005-2008</i>	<i>New construction per year 2005-2008</i>	<i>New construction total 2009-2015</i>	<i>New construction per year 2009-2015</i>
Harford County	6,891	1,723	11,973	1,710
Cecil County	3,975	994	7,656	1,094
Baltimore County	10,314	2,579	10,090	1,441
Baltimore City	4,229	1,057	10,450	1,493

Source: Maryland Department of Planning “BRAC report,” Sage

²⁸ U.S. Census data on housing from the American FactFinder series is based on relatively small samples and therefore has some margin of error. For a small county like Cecil County, the margin of error was plus or minus 2.5 percent. For Baltimore County, a much larger jurisdiction, the margin of error was plus or minus 0.8 percent.

Projected new housing construction is not necessarily the upper bound for new housing supply. Another is the inventory of land zoned for residential use. For example, according to the Harford County Department of Planning and Zoning, current zoning would allow for the development of roughly 30,000 housing units in the county. At projected rates of new construction estimated by the Maryland Department of Planning, this land inventory would accommodate projected new housing construction for over 17 years. If market conditions warranted, this land inventory could be used at a much faster rate than the rates shown in Exhibit A-9 assuming developers were interested and the county supported and approved proposed developments.

The estimated and projected housing inventory using the U.S. Census estimate for 2005 and Maryland Department of Planning estimates of new housing construction is shown in Exhibit A-12. Because Harford County provided its own estimate and projection of the county’s housing inventory, those data were used in the analysis rather than the estimates in Exhibit A-12.

Exhibit A-12: Estimated and projected housing inventory 2005, 2007, 2012, and 2017 based on 2005 U.S. Census data

<i>Jurisdiction</i>	<i>Housing inventory estimate, 2005</i>	<i>Housing inventory estimate, 2007</i>	<i>Housing inventory estimate, 2012</i>	<i>Housing inventory estimate, 2017</i>
Harford County	92,122	95,568	104,144	112,696
Cecil County	39,048	41,036	46,304	51,773
Baltimore County	324,596	329,753	339,234	346,441
Baltimore City	294,262	296,377	302,970	310,434
Source: U.S. Census, Maryland Department of Planning “BRAC report,” Sage				

The differences between the Harford County estimates of housing inventory and those in Exhibit A-12 are modest. The differences were roughly 1,600 fewer units in the County estimate for 2007, one more housing unit in the county estimate for 2012, and 1,600 fewer units in the county estimate for 2017 compared to the estimates in the exhibit above. These differences are all within less than 2 percent.

Vacancy rates are an important factor in real estate, reflecting in part the turnover in housing units as well as new construction and facilitating the purchase of housing by households. Exhibit A-13 lists vacancy rates for each jurisdiction as of 2005.

Exhibit A-13: Housing inventory and vacancy rates, 2005

<i>Jurisdiction</i>	<i>Housing units, total</i>	<i>Housing units, vacant</i>	<i>Vacancy rate</i>
Harford County	92,122	5,043	5.8%
Cecil County	39,048	3,960	11.3%
Baltimore County	324,596	15,647	5.1%
Baltimore City	294,262	51,284	21.1%
New Castle County	209,592	16,337	8.5%
Lancaster County	190,744	6,448	3.5%
York County	168,875	9,443	5.9%

Source. US Census, American FactFinder

Public water and wastewater treatment

Future demand for public water and wastewater treatment services created by BRAC-related increases in population are estimated on the basis of the average daily demand per capita and the likelihood that new residents will use public water and wastewater treatment services. Baseline demand was available from master plans for Harford and Baltimore counties and Baltimore City and from the responses to data requests made for this analysis.

The Harford County master plan for water and wastewater treatment includes projected daily per capita demand for several systems that operate in the county. The highest future demands were for the Harford County system and these estimates, listed below, were used to project BRAC-related demand for all jurisdictions.

- Daily per capita demand, 2007 105 gallons
- Daily per capita demand, 2012 110 gallons
- Daily per capita demand, 2017 115 gallons

As discussed in the main body of this report, all jurisdictions except Baltimore City have a significant share of households that use private wells and septic systems. Based on the Maryland Department of Planning BRAC report and the responses to data requests made for this analysis, the following percentages of residents were assumed to use public water and wastewater treatment:

- Harford County 77.0%
- Cecil County 64.5%
- Baltimore County 80.8%
- Baltimore City 100.0%
- New Castle County 80.0%
- Lancaster County 70.0%
- York County 70.0%

Residential demand is the key to understanding the impacts BRAC will place on public water and wastewater treatment capacities. In addition, BRAC will generate commercial real estate development that will also create demands. Commercial demands, however,

are relatively insignificant relative to residential demand. The following table estimates the demand for water and wastewater treatment created by new office and retail space. New office space demand is restricted to that created as a result of BRAC and does not include a projected baseline. Nevertheless, as Exhibit A-14 demonstrates, BRAC-related demand and baseline projected demand for retail space is less than 0.1 MGD in most cases for most jurisdictions.²⁹ The exceptions are Harford County where these demands might reach 0.3 MGD by 2017 under the high-case scenario and Baltimore County where demands might be 0.1 MGD by 2017 under the mid-case and high-case scenarios. These demands would be easily accommodated by the projected capacities of the public water and wastewater treatment systems in both counties (see Exhibits IV-8 and IV-9).

²⁹ Estimated water and sewer demand taken from Tim Miller Associates, Inc., “Supplemental Final Environmental Impact Statement, Riverwalk Village (and Saw Mill Lofts Alternatives),” Village of Hastings-on-Hudson Planning Board, June 2005.

Exhibit A-14: Water and wastewater treatment demand from office and retail space

<i>Jurisdiction</i>	<i>Scenario</i>	<i>Million gallons per day</i>		
		2007	2012	2017
Harford County	Baseline	0.0	0.0	0.0
	Mid-case	0.0	0.2	0.2
	Low case	0.0	0.1	0.2
	High case	0.0	0.2	0.3
Cecil County	Baseline	0.0	0.0	0.0
	Mid-case	0.0	0.0	0.0
	Low case	0.0	0.0	0.0
	High case	0.0	0.0	0.0
Baltimore County	Baseline	0.0	0.0	0.0
	Mid-case	0.0	0.0	0.1
	Low case	0.0	0.0	0.0
	High case	0.0	0.1	0.1
Baltimore City	Baseline	0.0	0.0	0.0
	Mid-case	0.0	0.0	0.0
	Low case	0.0	0.0	0.0
	High case	0.0	0.0	0.0
New Castle County	Baseline	0.0	0.0	0.0
	Mid-case	0.0	0.0	0.0
	Low case	0.0	0.0	0.0
	High case	0.0	0.0	0.0
Lancaster County	Baseline	0.0	0.0	0.0
	Mid-case	0.0	0.0	0.0
	Low case	0.0	0.0	0.0
	High case	0.0	0.0	0.0
York County	Baseline	0.0	0.0	0.0
	Mid-case	0.0	0.0	0.0
	Low case	0.0	0.0	0.0
	High case	0.0	0.0	0.0
Source: Sage				

Appendix B – Allocating Projected Housing Demand for Harford County Municipalities and Select Communities

Harford County is expected to absorb much of the impacts from the BRAC changes at APG. Where within the county those impacts will occur is a matter of great interest. The most obvious way in which impacts will be located is the location of housing for new households that will live in the county over the next 10 years.

Exhibit B-1 reflects the increase in BRAC-related demand for housing in Harford County. Exhibit B-2 shows the total increase in housing demand given underlying expected increases in baseline demand and the incremental impacts of APG BRAC.

Exhibit B-1: Baseline and BRAC-related incremental demand for housing in Harford County

<i>Scenario</i>	<i>2007</i>	<i>2012</i>	<i>2017</i>
Baseline	-	8,000	14,660
Mid-case	300	5,841	7,059
Low case	253	4,935	5,964
High case	331	6,446	7,791

Exhibit B-2: Total baseline and BRAC-related incremental demand for housing in Harford County

<i>Scenario: Baseline plus</i>	<i>2007</i>	<i>2012</i>	<i>2017</i>
Mid-case	300	13,841	21,719
Low case	253	12,935	20,624
High case	331	14,446	22,451

To estimate where these new households will be located in Harford County, the analysis relies on the zoned capacity of residential land for individual communities in the county. The data presented in Exhibit B-3 show total capacity, including zoned, but undeveloped land for seven distinct communities/areas in the county's building envelope. This envelope represents the area served by public water and wastewater treatment services and generally lies along the I-95 corridor or along the Route 24 corridor from I-95 to Bel Air.

As shown there are almost 20,000 housing units of residential capacity in the building envelope. Most of this capacity is in close proximity to APG, either in the Aberdeen/Havre de Grace area or in the Abingdon/Emmorton area. In addition to the almost 20,000 housing unit capacity within the building envelope, the county has zoned land outside the envelope that could be used to develop an additional 11,000 housing units. Public policy considerations would dictate that a disproportionate share of new residential construction will take place within the building envelope and that development outside of this envelope will not be encouraged.

Exhibit B-3: Zoned capacity of residential land in building envelope

<i>Community</i>	<i>Total housing unit capacity</i>	<i>Share of total</i>
Fallston	500	2.5%
Forest Hill/Bel Air	2,183	11.0%
Churchville/Creswell	240	1.2%
Aberdeen/Havre de Grace	7,691	38.6%
Abingdon/Emmorton	6,319	31.7%
Joppa/Joppatowne	1,598	8.0%
Edgewood	1,384	6.9%
Total	19,915	100.0%

Sources: HarfordEnvelopeCapacity1206.xls, Harford County Department of Planning and Zoning; Sage

The Maryland Department of Planning BRAC report estimated that 77 percent of the housing demand in Harford County would be met by development in the building envelope. If this share of the demand for housing shown in Exhibit B-2 is evenly distributed among the communities within the building envelope, approximately 84 percent of the land zoned for residential development in the envelope would be used by 2017 to meet baseline and BRAC mid-case demand. In addition about 45 percent of net planned units outside the building envelope would be used.

By 2017, as shown in Exhibit B-4, the remaining capacity of residential land would comprise just over 9,000 housing units. Most of the housing demand would be met by the Aberdeen/Havre de Grace and the Abingdon/Emmorton areas.

Exhibit B-4: Allocation of baseline plus BRAC mid-case housing demand

<i>Community</i>	2007	2012	2017	<i>Remaining capacity, 2017</i>	
				Units	Share of total
Fallston	6	268	420	80	16%
Forest Hill/Bel Air	25	1,168	1,833	350	16%
Churchville/Creswell	3	128	202	38	16%
Aberdeen/Havre de Grace	89	4,116	6,458	1,233	16%
Abingdon/Emmorton	73	3,382	5,306	1,013	16%
Joppa/Joppatowne	19	855	1,342	256	16%
Edgewood	16	741	1,162	222	16%
Outside building envelope	69	3,183	4,995	6,005	55%
Total	300	13,841	21,719	9,196	30%

Exhibit B-5 shows the allocation of housing demand for the baseline plus the BRAC low case. Again, demand is distributed evenly across the communities in the building envelope. That is, Fallston is allocated 2.5 percent of demand, Forest Hill/Bel Air is allocated 11 percent of demand and so on. Although the low case creates a somewhat lower demand for housing, this scenario still absorbs about two-thirds of the land now zoned for residential development in Harford County. By 2017, just over 10,000 units of capacity would remain from the current supply of residentially zoned land, the majority of this remaining capacity would be beyond the county's building envelope.

Exhibit B-5: Allocation of baseline plus BRAC low case housing demand

<i>Community</i>	2007	2012	2017	<i>Remaining capacity, 2017</i>	
				Units	Share of total
Fallston	5	250	399	101	20%
Forest Hill/Bel Air	21	1,092	1,741	442	20%
Churchville/Creswell	2	120	191	49	20%
Aberdeen/Havre de Grace	75	3,846	6,133	1,558	20%
Abingdon/Emmorton	62	3,160	5,039	1,280	20%
Joppa/Joppatowne	16	799	1,274	324	20%
Edgewood	14	692	1,104	280	20%
Outside building envelope	58	2,975	4,744	6,256	57%
Total	253	12,935	20,624	10,291	33%

Finally, the allocation of the baseline plus the BRAC high case is shown in Exhibit B-6. As this scenario has the greatest demand, it absorbs the largest share of land currently zoned for residential use—87 percent of that land in the building envelope and 46 percent of that land outside the building envelope. Roughly three-quarters of the land currently zoned for residential development would be used by 2017 under this scenario.

Exhibit B-6: Allocation of baseline plus BRAC high case housing demand

<i>Community</i>	2007	2012	2017	<i>Remaining capacity, 2017</i>	
				Units	Share of total
Fallston	6	279	434	66	13%
Forest Hill/Bel Air	28	1,219	1,895	288	13%
Churchville/Creswell	3	134	208	32	13%
Aberdeen/Havre de Grace	98	4,296	6,676	1,015	13%
Abingdon/Emmorton	81	3,530	5,485	834	13%
Joppa/Joppatowne	20	893	1,387	211	13%
Edgewood	18	773	1,201	183	13%
Outside building envelope	76	3,323	5,164	5,836	53%
Total	331	14,446	22,451	8,464	27%

References

Sage collected the bulk of the data used for this analysis directly from the seven jurisdictions in response to a series of data requests. In addition, the following materials were referenced during the analysis:

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