Demographic School Analysis: Population Projections for the Blackhawk School District

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The present analysis will consist of five parts: (1) an initial analysis of demographic and economic processes impacting student enrollments, (2) the ten-year projections of students by grade and level, (3) the ten-year projections of students by grade in each of the 2 primary schools, and a summary of (1) and (2).

To arrive at these projections, we take an in-depth look at shifts in births, levels of migration and rate of new housing construction. We examine the changes that have occurred, including whether there have been shifts in the last decade or longer, and for births, in particular, we probe into the processes and structures underlying these shifts, also revealing likely directions in the future. Migration is shown to be quite important. We examine net-migration of *i)* families with preschool children, *ii)* students at each educational level and *iii)* the reproductive age female population by age-cohort. We also look at the rate of new housing construction and the level expected in the next 10 years, particularly in Chippewa Township. And, finally, we look at the enrollment in alternative schooling. A brief overview of the initial analysis is given below.

I. An initial analysis with four overall themes—

(1) Births

(i) We find that births dropped sharply from 1990-94 to 1995-99 (907→786), a decrease of 121 births or an average of -24/year and then dropped significantly less from 1995-99 to 2000-04 (786→762), a decrease of 24 or an average of 5/year. Remarkably, since 2000-04, births have been essentially stable, averaging 149/yr. to 152/yr. for almost 2 decades, as follows: 2000-04 (762, 152/yr. ave.), 2005-09 (747, 149/yr. ave.), 2010-14 (757, 151/yr. ave.) and, 2015-17 (747, 149/yr. ave.—the latter a 5-year equivalent). Underneath this stability, there is considerable oscillation centered on population waves with particular impacts from the 30-34 age cohorts. A key question is the following: "Should we expect the number of births to remain at the current level, as has been the case for 18 years or to begin to increase? We expect births to continue at the current level, or higher but consider alternatives—both up and down, tied to (1) the replacement of the baby bust cohorts by the Echo Boom cohorts and (2) the net in-migration of Echo Boom cohorts in their thirties.

(ii) A primary reason for the earlier 2 downward shifts in the number of births was the fundamental large shifts in the key reproductive age-cohorts—20-24, 25-29,

30-34 and 35-39. These shifts are occurring in the United States, in Pennsylvania, in Beaver County and, indeed, in the Blackhawk School District—which we will show. We label these shifts or ***population waves*** as the Baby Boom, the baby bust and the Echo Boom (Millennials). These population waves are especially important given the relative constant fertility rates over the last 45 years for white non-Hispanic women in the United States, which we will also show. Not to be confused with this stability, however, is the timing of births over the life cycle—particularly a delay in childbearing, for which we also find evidence. The percent of births in the district before/after age 30 has shifted from 59%/41% in 1990-94 to 45%/55% in 2015-17 or -14% for births to mothers less than age 30 and +14% to mothers age 30 and above.

(2) Net Migration

A 2nd fundamental population process is also in play—net migration into and out of the school district. These processes can be observed at multiple levels: preschool children, students in K to Grade 12 and in the reproductive age female adult residents as follows:

(i) In the 1st two of three 5-year periods for which data is available, 1995-99 and 2005-09, there has been a net inflow of preschoolers and their families moving into the district. The average net in-migration for ages 0-4 was rather stable at 14-15 preschool children per year. In the 3rd period, 2010-14, net-migration of preschoolers was, in effect, zero.

(ii) In terms of the net migration of Blackhawk School District students, we have developed a method to deduce such flows from time-series enrollment data. Initially assuming no migration, we calculate the difference between the exiting senior class in high school in the spring and the subsequent entering Kindergarten class in the fall—which we call the exit-entry exchange (E3). Then, algebraically, when we subtract E3 from the actual student enrollment change, we obtain the net migration (NM). Phrased differently, the 2 processes—E3 and NM, when added together equal the enrollment change per year. For instance, without migration, in the last 10 years the total district enrollment would have decreased by just over 350 students (-353). However, the net in-migration of 70 students reduced the actual total enrollment loss to just over 280 students (-283), a change of approximately 20%.

(iii) We can also deduce the net migration of 5-year age-cohorts in the overall population of school district female residents. This is important in muting or reinforcing the effects of the population waves. Generally, we observe ***very*** large net out-migration for both age cohorts in their 20s (20-24 and 25-29) and ***very*** large net in-migration for the age cohorts in their 30s (30-34 and 35-39). This is certainly the case for the Blackhawk School District, with all 4 cohorts key to the number of births.

(3) Housing

Construction of new housing has averaged 24/yr. over the last 7 years, with the following number of new homes: Chippewa Township—107, Darlington

Township—15, Patterson Township—14 and South Beaver Township—29; in total, this is 165 new homes. In Chippewa Township construction of new homes was higher (33/yr.) in the brief 4-year period, 2010-2013, as a large PRD (Shenango Woods) was being built, along with several other generally smaller PRDs. Given the on-going construction of new homes in Chippewa Township and the onset of 2 new major PRDs with at least 338 new homes, we expect additional direct impacts from new housing, beyond the effects already built into the retention ratios—which have embedded effects from both new and existing homes. Additionally, the more long-term effects of the cracker plant in nearby Potter Township will, no doubt add to such housing development, with the timing dependent on the rate of complementary development as well as downstream development from the cracker. Currently, attempting to specify the more detailed development does not seem productive. However, we will construct two scenarios with new SFDs and multi-unit housing (eg. duplexes, quads, townhomes) to take into account the known jump in housing development about to begin.

(4) Alternate Schooling

Lastly, we will examine students residing in the school district who are "home schooled" or are enrolled in charter, cyber/charter or private/parochial schools. Somewhat unexpected is the growth of students who are home schooled—an average of 37 students per year in 2010-2013 and 54 students per year in 2014-17. In contrast, the charter student enrollment has increased from an average of 27 students per year (2007-2011) to 37 students per year (2012-2014) and then declined to 31 students per year (2015-2017). The cyber charter school enrollment experienced an even sharper decrease—from 56/yr. in 2007-2012 to 36/yr. in 2013-2016, In 2017, it was 30. The data for private/parochial student enrollment also has a surprise. From 2009-2014, enrollment averaged 127/yr. and increased to 147/yr, in 2015-2017. In 2017, private/parochial enrollment accounted for 57% of the students enrolled in alternative schooling. Overall, we find the number of home schooled has increased substantially, the charter enrollment increased and then decreased; the cyber/charter enrollment has decreased and the private/parochial enrollment has increased by 16%. Also, we note that in 2017, alternative schooling had 263 students and the Blackhawk School District had an enrollment of 2,355 for a total of 2,618 students; hence the proportions are 10% and 90%, respectively.

II. Development and analysis of grade specific school district projections for the ten-year period, 2019-2028 (5 Scenarios).

All of the projection scenarios use the most current four-year retention ratios and the most current 4-year Birth to Kindergarten ratio. Two scenarios have increases in births, ranging from a slight to a moderate increase. A 3rd projection has births returning to their prior level before the most recent increase in the last 4 years. Two final scenarios add direct impacts from new housing construction.

III. **Development and analysis of grade specific school district projections of the 2 Primary Schools for the ten-year period, 2019-2028.**

This analysis requires assigning births within municipalities to the subsequent primary school that they will attend. For the direct housing impacts, it also requires allocating the new students to their respective primary school.

IV. Summaries

We will provide summaries of the basic findings and of the most likely student projection scenarios.

I. Initial Analysis

The analysis to follow, preceding the student population projections, is important both in terms of determining the nature of the demographic modeling to use and in the selection of parameters for such models. The analysis is also important in the interpretation of the underlying processes involved in the derived projected enrollment. We begin by taking an in-depth look at the demographic side of the process—fertility and migration.

Fertility

A Continuation of the Current Number of Births, Which Has Been Stable for Almost 2 Decades or a Shift to Increased Births?

Table 1 provides the number of births by year, per municipality and the total births over the last twenty-eight years. Table 2 provides a summary form by collapsing the individual years into 5-year periods. As shown in the Table 2, the initial level of births in 1990-94 was 907, followed in 1995-99 by 786, a sharp drop of 121 births or an average yearly decrease of 24 births per year. Births continued to decrease in the next 5 years, 2000-04, but the decrease was much smaller, -24, to 762 births; in this case the decrease was only a drop of 5 fewer births per year. From 2000-04 onward, births basically stabilized for more than a decade at the 2000-04 level. The sequential order was 152, 149, 151, and 149 for the 2000-04, 2005-09, 2010-14 and 2015-17 five-year equivalent[1]. ***That births remained stable, effectively, for 18 years or almost 2 decades is quite remarkable***, especially, with the following processes at work—1) the movement of distinct population waves through the age structure, 2) the continuation of delays in childbearing into the 30s and even the 40s and 3) the very large net migration streams—out of the district in the 20s (20-24 and 25-29) and into the district during the 30s (30-34 and 35-39). But stable it is—in the narrow range of 149/yr. to 152/yr.

There is possibly a hint of a change in the birth trajectory if we take the last 4 years, where the number of births is just over the 18-year range of 149-152, averaging 154/yr. Given the entry of the Echo Boom age cohorts to all the key age cohorts—20-24, 25-29. 30-34 and 35-39—by 2020, it seems likely that births will increase. To more fully understand this conclusion, we will take into account the **major shifts in the population age structure or population waves,** as well as **delayed child bearing**—with an increasing proportion of births in the 30's. *The population waves that are moving through the age structure are quite pronounced* and are fundamental to a more thorough understanding of why births dropped in 1995-99 and then continued to drop for another 5 years before they stabilized. One of the factors operating in the last 20 years has been the replacement of Baby Boom age-cohorts by smaller "baby bust" age-cohorts in their twenties and subsequently in their thirties—both being

[1] The 2015-17 3-year period was turned into a 5-year equivalent by multiplying the 3-yr. number of births by 5/3. or 448 x (5/3) = 747 or an average of 149/year.

key reproductive age-cohorts responsible for most of the births in the United States. Presently, we are seeing a different replacement—where the larger Echo Boom age cohorts replace the baby bust cohorts. Thus, we will now look more closely at the shifts in the number of births and the processes underlying these shifts.

<u>Relative Impact of the Different Age-cohorts: Delayed Childbearing</u>

Table 3 provides the births by age-cohort of mother over the last 28 years for the entire school district and reveals part of the nature of the shift in births—delayed childbearing. Note that the "Total Birth" column (Σ) is the same as in Table 2. Table 3 now provides the ***number of births per age-cohort*** for 28 years. Here our initial concern is to address the relative impact of the different age-cohorts. At the top of Table 3, in the early 1990s, one can see the relative dominance, In terms of the number of births, of two age-cohorts, 25-29 and 30-34 (See the % of ∑ row.) The remaining ordering is then as follows: the 20-24 age cohort, the 35-39 age-cohort, then the 15-19 age-cohort and the 40-44 age-cohort. By 1995-99, the shift to births in the early 30s was clear. The overall shift in births to mothers less than age 30 versus age 30 or above is shown in the last row of Table 3. The drop in relative share (%) for all cohorts less than age 30 was as follows: age 25-29 -4% (35%→31%), age 20-24 -6% (17%→11%) and 15-19 -3% (6%→3%). In contrast, the 30+ age cohorts all increased their relative share: age 30-34 +10% (30%→40%), age 35-39 +3% (10%→13%), and age 40-44 +1% (1%→2%). Overall, the before/after age 30 changed from 59%/41% in 1990-94 to 45%/55% in 2015-17. These shifts clearly depict a process of delayed childbearing, from 59% to 45% for births to mothers <30 and from 41% to 55% for mothers age 30 or above. Does a delay in childbearing also mean that there will be a decrease in the number of children per woman? We will address this question below, as well as shed insight into the sequential number of births in the Blackhawk School District for over 2 decades.

Total Fertility Rate[1]

We will briefly take a look at the Total Fertility Rate (TFR) in the United States. We do so for two reasons. First, the shifts in these TFRs have been largely responsible for the oscillations in the population age structure or population waves that we noted above. Second, for white and, more recently for white, non-Hispanic women, the TFRs have been remarkably stable for the past 45 years. Such stability then enables one to focus on the shifts in the number of reproductive women by age to better understand the shifts in the number of births, and to potentially better incorporate such insights into forecasts of future births—at a minimum, in terms of direction, if not magnitude. The Total Fertility Rate for the United States from 1917 to 2016 is given in Table 4. The dark shaded years denote the Baby Boom (1946-1965) and the lighter shaded years denote the baby bust (1971 to 1980). In Table 4, we may observe that the peak of the Baby Boom occurred in 1957 with a TFR of 3.77 and that the trough of the baby bust occurred in 1976 with a TFR of 1.74. We may also note from Table 4 that the TFR of 1.74 is the lowest TFR between 1917 and 2016, including the

[1] The Total Fertility Rate (TFR) is the average expected total number of children that a woman will have under the current age-specific fertility rates.

TFRs of the Great Depression. Similarly, the highest TFR between 1917 and 2016 is the TFR of 3.77. Hence, these fertility measures denote the two most distinct fertility points of the past century. Additionally, they are embedded in the most distinct streams of fertility surrounding them, with an entire set of years of relative high fertility and relative low fertility. It is these pivotal streams that are impacting school enrollments nationally, as well as in Pennsylvania, and certainly Beaver County today, half a century away. As noted above, they will continue to do so into the future.

In 2010, the population of the Blackhawk SD had the following racial distribution: White—97%, Black—1%, Asian—1% and 2+races—1%.[1] The respective TFRs in 2010 were 1.9, 2.0, and 1.7 for white, black and Asian women in the US. If, however, we remove the Hispanic part of the white 1.9 TFR, it is 1.8. Table 5 provides the TFRs for white and white, non-Hispanic females from 1970 to 2016. One of the most striking aspects of these data is the range of the TFRs from 1972 to 2016 for the white, and where it is possible to discern, the white, non-Hispanic females***. For 45 years these TFRs have been in the 1.7 to 1.9 range, meaning that they are, in fact, very stable. In effect, we can treat them as constant.*** *Thus, we can now answer the question posed earlier as to delayed childbearing and the number of children per woman. More specifically, even with* ***delayed childbearing****, the total number of children that a white non-Hispanic woman is expected to have is the same—only the age has shifted.* Thus, the two main drivers for the number of births, given the stability in the total

[1] The percentage of Hispanic residents in the district was 1%, and the US Hispanic TFR in 2010 was 3.0.

fertility rates, will be delayed childbearing and the number of reproductive age women. The latter can change in two ways—(1) from large scale shifts in the reproductive population, as, for example, the Baby Boom and baby bust and (2) from net migration—in this case largely from new jobs, new housing or the relative attractiveness of the area, including the quality of the school district--in the case of in-migration, and the lack of jobs and/or quality of the schools, in the case of out- migration. Both in-migration and out-migration are also greatly affected by age, particularly in the key child bearing ages between 20 and 40, which we will demonstrate later in this analysis. It should be noted before continuing, that given the stability in the total fertility rate for whites, we may expect in both the short-term and the more long-term, future echo booms and echo busts, as the oscillation in the relative size of the birth cohorts already born dampens down. Certainly one of the mechanisms for change noted above is occurring in the Blackhawk School District—shifts in the number of reproductive age females. Thus, we will now look more directly at the population waves, resulting from the TFRs shown in Table 4.

Relative Size of the Different Age-Cohorts/Population Waves: Baby Boom, Baby Bust and the Echo Boom

A second story emerges beyond that of delayed childbearing if we take a closer look into the nature of the shifts in the number of births by age in Table 3. More specifically, can we identify the structures or processes underlying the shifts in the number of births in Table 3? To begin to do so, we need to take into account the number of reproductive age women in different age-cohorts, since the Baby Boom and baby bust periods have resulted in considerable oscillations in the number of women in the prime childbearing years. To reiterate, at the peak of the Baby Boom (1957) the Total Fertility Rate was 3.8, while at the trough of the baby bust (1976) it was 1.7, less than 1⁄2 that of the Baby Boom peak. Thus, the number of reproductive age females is much larger if they were born in the Baby Boom years and reciprocally, much smaller if they were born in the baby bust years. If fertility rates of these cohorts of women were the same over time, then the number of expected births would vary considerably, with more births to Baby Boom mothers and fewer births to baby bust mothers. This is at least part of explanation for the shifts in births over time, in terms of where in the age distribution to expect increases or decreases in births. It is also pertinent for expectations regarding future levels of births since we are currently beginning to see Echo Boom cohorts, which are larger than the baby bust cohorts, take center stage in the key reproductive ages. We will subsequently explore these points in more depth below.

Table 6 provides data for the United States, Pennsylvania and Allegheny County for 5-year cohorts from ages 0 to 44 and depicting the population waves. In the top panel of Table 6, t**he numbers in bold type indicate the Baby Boom** and the shaded numbers indicate the baby bust. We refer to a medium sized cohort born between the Baby Boom and the baby bust as the Transition cohort (1966—1970) and, in effect the leading edge of the baby bust. The Echo Boom cohorts immediately trail the baby bust cohorts and cover at least 2 decades, as did the Baby Boom. The data for Table 6 extend from 1990 to 2010. At all three levels—in the United States, Pennsylvania and Allegheny County, there are decreases in the 20-24, 25-29 and 30-34 female age-cohorts between 1990 and

2000 AND decreases in the 30-34, 35-39 and 40-44 age-cohorts between 2000 and 2010. (See the shaded age-cohorts in the Change by Age-cohort Across Time, the second panel—lower quadrant of Table 6). One has to think in terms of generational change, where the births of daughters in one generation become the mothers of the next generation—here daughters born in the Baby Boom now having children and similarly, daughters born in the baby bust are now having children. Thus, the shifts in the 20-24, 25-29 and 30-34 age-cohorts of females in 1990-2000 represent a more tidal shift from the Baby Boom to the baby bust due to changes in fertility levels as noted earlier--from total fertility rates, where on average, their mothers had 3.8 children in 1957 to 1.7 children in 1976. The low fertility rates in the 1970s are referred to as the baby bust. To illustrate, there were 21.3 million children born between 1956 and 1960, at the height of the Baby Boom and 16.3 million births between 1971 and 1975 the onset of the baby bust, a decrease of 5.0 million births and a drop of 23%. Also, these same cohorts-–aged 10 years by 2010—and now 30-34, 35-39 and 40-44 are again experiencing decreases in the number of women. Equally important, <u>in 1990</u>, the four five-year Baby Boom cohorts (born in 1946-1965) occupied three of the key reproductive age-cohorts (25-29, 30-34 and 35-39, as well as the oldest reproductive cohort 40-44). In contrast, <u>by 2000</u>, the Baby Boom daughters occupied only the two older reproductive cohorts and the two five-year baby bust cohorts (born in 1971-1980) were beginning to take center stage, occupying both key twenty-year-old cohorts. (See the shaded age-cohorts in the upper panel of Table 6 to view their aging from the teens to the 20's to the 30's.) A third key reproductive cohort, age 30-34 in 2000, was held by the Transition cohort, which we have described as the leading edge of the baby bust or the 1st baby bust cohort. In 2000, three of the key reproductive age-cohorts (20-24, 25-29 and 30-34) were smaller than their predecessors in 1990, as clearly shown in the upper panel of Table 6. (Look to the left in the same row.) Look also in the lower panel where the size of the change across the decades is given, as well as the percentage change. From 1990 to 2000, the largest decrease was in the 25-29 age-cohort and between 2000 and 2010, the largest decrease was in the 35-39 age-cohort. In both cases, this is the 2nd baby bust cohort. By examining the shaded age-cohorts in the lower panel of Table 6, one can see that they travel in tandem and are decreasing in both decades at all levels—national, state and county. These cohorts are the two baby bust cohorts and the Transition cohort, the latter of which led the declines once the Baby Boom was over. If one looks at the size of the Echo Boom cohorts which follow the baby bust cohorts, they reverse the age-cohort declines and are increasing in both the United States and Pennsylvania in both decades for at least the 1st three Echo Boom cohorts. At the national level the increases range from 14% to 20% in 1990 to 2000 and from 9% to 14% in the 2nd decade, 2000 to 2010. The increases are generally more modest in Pennsylvania—from 4% to 14% in 1990-2000 and 6% to 16% in 2000-2010. In Allegheny County, the story is more mixed with increases in only the 2nd Echo Boom cohort between 1990 and 2000 and for the 1st and 2nd Echo Boom cohorts in 2000 to 2010.[1]

The data for Beaver County is given in Table 7 and, for 2000, for example,

[1] The smaller that the geographical unit being examined is, the greater is the potential impact of migration.

the baby bust cohorts in 2000 (TC2, bb1 & bb2; all shaded) are clearly much smaller than the Baby Boom cohorts (BB1-BB4); the 2000 1st 3 Echo Boom cohorts are also much larger than the baby bust cohorts. Additionally, in 2010 the Baby Boom cohorts readily outnumber all 3 baby bust cohorts and Echo 3 & 4 outnumber 2 of the 3 baby bust cohorts. In short, the population waves are readily observable in all of the data examined—county, state and national levels. Table 8 shows the Beaver county population by age for 1990, 2000, 2010 and 2015. The relative size of the Baby Boom age cohorts in comparison to the baby bust age cohorts is quite clear for all years across 3 ½ decades. The relative size of the Echo Boom cohorts to those of the baby bust, however, appear to be dependent on the net migration into or out of the county—and is more contingent, to which we will return later in the analysis. We will look at the population wave data for the school district shortly, as well as interpret the associated sequential decline in births as an outcome of cohort replacement.

Since the age-cohorts that we have been discussing have a very clear time of birth identification, we can specify their location across time in 5-year sequences—including the future. We do this in Table 9, mapping the shifting of the key Baby Boom, baby bust and Echo Boom cohorts for 5-year periods, from 1990 to 2020. The distinct cohorts include the 4 Baby Boom cohorts, the Transition cohort, the 2 baby bust cohorts and the 1st three Echo boom cohorts. In 1990, the Baby Boom cohorts occupied all age bands 25 and older, including 3 key reproductive age-cohorts—25-29, 30-34 and 35-39. By 2000, we can see that the baby bust cohorts are in their 20's and occupy the 20-24 and 25-29 age bands. The Transition cohort also occupies the 30-34 age band. So, it follows that the baby bust cohorts will also occupy the 30-34 and 35-39 age bands in 2010, while the 1st two Echo Boom cohorts take over the two twenty age-cohorts. In 2015 and currently in 2019, Echo Boom cohorts occupy 3 key age bands—20-24, 25-29 and 30-34 and soon (2020) will occupy the 25-29, 30-34 and 35-39 age bands. Even in 2025, the Echo Boom cohorts will still occupy the 30's and the early 40 age-band (40-44). In short, the two most important features in Table 9, regarding the future, pertain to the replacement of the baby bust cohorts by the Echo Boom cohorts in 3 of the 4 key reproductive cohorts by 2015 and the continuation of the Echo Boom cohorts in the key reproductive ages beyond 2020 as well. With multiple Echo Boom cohorts moving into all key reproductive ages, the bottom line is that births should increase. This would involve Echo Boomers both moving up (in age) and moving in (the 2000→2010 analog). These Echo Boomers will be replacing the baby bust cohorts as this oscillatory process continues well into the 21st century. And, these shifts in demographic age structure are part of a national, as well as a regional and local, set of shifts tied to at least one familiar term—Baby Boom—and now, by two less familiar terms—baby bust and Echo Boom (Millennials). All municipalities and schools in the United States are embedded in these demographic processes. The distinctions revolve around the extent to which migration modifies these basic population distributions at the particular geographical level.

Table 10 provides the data for the female population in Blackhawk SD, by age-cohort, for ages 15 to 44. The years pertain to 1990, 2000, 2010 and 2015. In 1990 the US Census does not have 5-year cohort data for municipalities whose population was below 2,500 (5 of the 8 municipalities in the Blackhawk

SD—Darlington, Enon Valley, Patterson Heights and West Mayfield Boroughs and Darlington Township). In the 3 municipalities with a total population of at least 2,500 (Chippewa, Patterson and South Beaver Townships), the population waves are quite apparent. In 1990 and 2000, the Baby Boom cohorts, depicted in bold print in the top quadrant of the table (numbering in the 400s and 500s, are much larger than the baby bust cohorts (shaded), numbering in the 300s. In 2000, the 1st Echo 1 cohort, age 15-19, is also larger than the baby bust cohort that it is replacing (407 vs. 381). In 1990 and 2000, all 3 of the strikingly distinct population distributions stemming from the oscillations in fertility rates are quite clear. In 2010, the 1st two Echo cohorts EB1 and EB2, are larger than their baby bust counterparts (296 to 265 & 266 to 210, while the 3rd Echo cohort is about the same size as its replacement (407 to 403).

Three of the four Echo cohort replacements for 2015, Echo 2, 3 and 4 are not larger than the cohorts that they are replacing; all are less than age 30. Examining the numbers and percentage changes in brackets, indicating net-migration, we can observe that there is substantial *net out-migration for the cohorts in their* <u>*20s*</u>, *-28% and -41%, significantly depleting Echo cohorts 2 and 3. In contrast, the 1st Echo cohort,* <u>*ages 30-34*</u>*, increases by 30% via net in-migration (+32%). Also*, counter to larger geographical areas which are less affected by migration, *the 3rd baby bust cohort has an even larger inflow of 51%, increasing it by 32% over the cohort that it is replacing and reversing the expected shift in the number of births*. *Given the expected delay in childbearing, as well as the narrowing of the window for most births—before age 40, these 2 age cohorts in their 30s—the one an Echo cohort and the other an enhanced* *baby bust cohort--may very well be the key to the expected increase in births in the near term.*[1]

. To develop insight into the school district's sequential shifts in births over 2 decades, as shown in Table 3, we will use the knowledge gained about population waves from Tables 4 to 11 to determine or infer whether births should go up or down across 5-yr. periods, starting at 1990-94 to 1995-99—that is based on the age cohorts and their position in the population waves during the change in 5-year periods. Stated differently, by comparing the new age cohort's expected size relative to that of the prior age cohort that is being replaced at a given age, we can then infer the expected direction—up or down—in expected births—for each cohort, compared to the observed shift in the number of births in Table 3. It is important to acknowledge that neither 1995 nor 2005 are observable—thus once again we will be relying on the lessons from the above tables to make the inferences.

In sum, we expect that the Baby Boom cohorts entrance to an age cohort to yield increased births, for baby bust cohorts to show decreases in births and for Echo Boom cohorts to once again have increases in births. For instance, from Tables 1 and 2, we saw births drop sharply from 1990-94 to 1995-99. We can now address why. Table 12 adds shading for the baby bust cohorts and also includes the increase or decrease per cell for Table 3. Therefore, we will use this more complete version of births by age of mother. From Table 12, we can see

[1] Table 11 provides comparable data for all 8 municipalities from 2000 to 2015, with the overall results basically the same.

that the decline in births from 1990-94 to 1995-99, for the 2 baby bust cohorts in their 20s, is -149 (with a decrease of 10 births in the 15-19 age cohort). The sharpest decline in births, -116, was in the age cohort 25-29, the leading edge of the baby bust. Overall, from 1990-94 to 1995-99, there was a decrease of 121 births or 24/yr. If it not been for the modest increase in births (+21) by the last Baby Boom cohort in their 30s, the drop would have been even steeper. No doubt, the 1st major decline in births is due to the entrance of baby bust age females into their 20s—20-24 and 25-29.

By 2000-04, the baby bust cohorts now occupy not only the 2 cohorts in their 20s, but also the 30-34 age cohort and from 2000 to 2015, most of the central shifts occur in this age band. The decline in births from 1995-99 to 2000-04 is now quite modest, a drop of 24 births or 5/year. The leading edge of the baby bust, the Transition cohort, is now 30-34 and as it occupies this age band, there is a drop of 48 births. This decrease is muted by increased births, once again, in the last Baby Boom cohort and also unexpectedly by the 1st baby bust cohort (25-29). We infer from the increase in births in this baby bust cohort that there was either net in-migration, increasing the number of women 25-29 years of age or a delay in childbearing from the 15-19 and/or 20-24 age-cohort to the 25-29 age cohort, since it need not always involve a shift above the 30+ bar.

The 2000-04 to 2005-09 shifts in births are once again centered on the 30-34 age cohort—with a decrease of 60 births in the 1st baby bust cohort. This decrease was moderated by increases in the 1st two Echo Boom cohorts (15-19 and 20-24: +36), with a slight increase by the 2nd baby bust cohort (+9) in the 25-29 age-band. The overall change in births was -15 or -3/yr. Stability in births has begun. The case for 2005-09 to 2010-14 is one of an increase of 10 births or +2/yr. Again, unexpectedly, the 2nd baby bust cohort has an increase of 53 births, which is moderated primarily by expected decreases in the 2 other baby bust cohorts (-38).

Finally, we have the shifts from 2010-14 to 2015-17. For the 3-year period, 2015-17, we 1st convert the 3 years of births to a 5-yr. equivalent by multiplying by 5/3. Again, the change is centered in the age-cohort 30-34 where the 1st Echo Boom cohort has an increase of 64 births; this potential gain is quickly erased by a decrease of 84 births in all 3 of the following Echo cohorts—Echo 2, 3 and 4. The 3rd baby bust cohort had an increase of 12 births and the 3 baby bust cohorts had an net increase of 10 births, bringing the total births to 747 or -2/yr. Looking back at the female population age structure for ages 15-44, recall that we found net in-migration for both the 2nd baby bust age cohort and the 1st Echo Boom cohort with inflows sufficient to yield positive cohort replacements, as well as negative results for Echos 2,3 an3—entirely consistent with the 2015-17 findings.

As for a possible turnaround to increased births, if we take the last 4 years, then there is a very slight increase from the 149-152 range over the last 18 years to 154 births/yr. This, in effect would be the 1st increase in 2 decades. This increase comes about as the baby bust is aging out of the childbearing ages and the Echo Boom cohorts occupy the 2 dominant cohorts for births—25-39 and 30-34. But in 2015-17, only the 30-34 age-cohort, Echo 1, yielded an increase in births. All 3 subsequent Echos had decreases, combining to yield an overall decrease in births. The direction in the future is now a matter of how the Echo

Boom cohorts age and how net migration modifies them.

We have data in 2 tables to further inform our expectations. Table 9 indicates that by 2015, 3 of the 4 key cohorts (29-24, 25-29 and 30-34) are occupied by Echo Boom cohorts. Daughters born in the baby bust occupied only 1 key cohort (35-39). Also, as shown in Table 9, by 2020, the Echo Boom cohorts will still occupy 3 of 4 key cohorts (25-29, 30-34 and 35-39) and the baby bust will occupy only the cohort ages 40-44. A 2nd table, Table 12 (bottom quadrant, right side) shows the relative size of the cohort replacements for 2015 in the Blackhawk School District---ie observable data for the Table 9 age cohorts in 2015. The 1st Echo cohort (30-34) had a substantial gain of 22% and the last of the baby bust, ages 35-39 had an increase of 25%. Echos 2,3 and 4 had decreases due to high net out-migration, especially for the age 20-24 women. The set of Echo Boom cohorts thus provides a mixed set of signals, somewhat dampening the expectations of birth increases, but not eliminating them. To date, we only have the last 4 years of births increases, but the location of Echo Boom cohorts in key childbearing cohorts now and post-2020 suggest considerable possibilities for maintaining the current level of births or increasing them yet further. Much depends on net migration and delayed childbearing, particularly the former. We now turn to net migration to shed further insight.

Migration

Net Migration of Preschoolers

The 1st distinct view into net-migration provides additional insight into what to expect in Kindergarten enrollment in the next five years and possibly longer. By comparing the census count for children less than five years of age in year x to the births to school district residents in the prior five years (x-5 to x), we can ascertain the net-migration of families with preschoolers. Three sets of such data are shown in panels A, B and C of Table 13.

In panel A of Table 13, we contrast the census count of children under age 5 in **2000** (column A) to the number of births for years 1995-99 (column B). The difference indicates the net-migration (column C) and column D gives the average number of new children per year of age (0-4). In 1995-99, there was a net in-migration of 69 preschoolers for an average of 14 new preschool children per year. In panel B, comparing births for 2005-09, and children under 5 in the census in **2010,** the net in-migration increases a bit to 76 preschool children moving in, an average of 15 new additional preschool children per year. Then in the most recent period of 2010-14, the number of births was 757and the ACS census 5-yr, estimate for children 0-4 in **2015** was 750, a loss of 7 preschoolers or 1 per year. Taking, the 2015 estimate at face value, the net in-migration of preschoolers came to an end, in contrast to the 2 earlier findings where net migration was positive, at 14-15 preschoolers per year. Given the standard error or scatter in the ACS estimates, the conclusion regarding net in-migration coming to an end is less robust than that from the 2 prior decennial census findings of an inflow of about 14-15 new preschoolers per year.

Just how important are such migration impacts? The average number of births per year has basically remained stable at about 150 births per year for the last 18 years. Thus, if 15 additional preschoolers moved in, that would indicate an increase of about 10%. From a longer time frame, incorporating these inflows averaging 14-15 preschoolers per year, the impact is stable and already taken into account in terms of Kindergarten entrants.

Net-Migration (NM) of Students

The Exit-Entry Exchange (E3) and Net-Migration (NM)

For a 2nd look at net-migration and more specifically the net migration (NM) of students from Kindergarten through Grade 12, we bring such migration into play alongside what we refer to as the Exit-Entry Exchange (E3). The two processes jointly determine the student enrollment changes. We use an accounting system based on a hypothetical or counterfactual case. What we refer to here as “net migration” pertains to all entries and exits. Thus, we are using the term “migration” in a very restricted sense—migration into or out of the Blackhawk School District student population. Actual migrants into the school from outside the school district—whether from other parts of Beaver County or other parts of Pennsylvania, or other states, or even from overseas, are in the count, but not distinguished from one another. From the numerical enrollment data alone, we have no information on source of origin of the mover. The same holds for actual migration out of the school district—we do not know the destination. Additionally, we do not know the type of move if it is a local one. For example, a dropout at the high school level is certainly an exit and a second grader who did not attend the first grade in the Blackhawk School District is an entrant. Both are counted as “migrating” out of or into the school. In short, “net migration,” as used here refers to the difference of all exits and all entrants to the Blackhawk School District. This “net migration” can be obtained using only enrollment data. Below, we will briefly describe the method.

Initially, we momentarily assume the counterfactual case of “What if no one migrated?” Then, the change in the student population (C) would be totally determined by the difference in the sizes of the Grade 12 graduates exiting at the end of year t-1 and the size of the entering Kindergarten class in year t. That is, C= [K_t - $G12_{t-1}$]. Second, we compute the actual change in overall enrollment, denoted by E, where E=(Total Enrollment in t) - (Total Enrollment in t-1). Now, denote “net migration” as F. Then, E=C+F or F=E-C. Table 14 provides these data and outcomes for the most recent decade in the Blackhawk School District from 2009-2018. We will illustrate the process by describing a single year and then we will discuss the overall results. For 2017-18, 218 seniors from the 2017-18 school year exited (eg, graduated in the spring), while 178 new students entered Kindergarten the following fall (column A), a difference of 40 students. (Table 14, columns A and B and row t=2018-19; see footnote to the table.) Thus, with no migration, the student population would decrease by 40 students. ($\otimes_1$, column C). The actual enrollment change was a decrease of 25 students (Column E: the $\otimes_2$ column is shown as the difference in the population at t minus the population at t-1). Therefore, “net-migration” here is positive (more entrants than exits), and is +15 (the Net Migration Column F, which is (E-C) or [-25 - (-40)] = +15. That is, 15 more students entered the school district, further increasing student enrollment from -40 without migration, to the actual decrease of 25 students.

A summary of the net migration is given at the bottom of Table 14, with the 5-year changes in parentheses in the 10-year coverage. In the last 5 years, without migration, enrollment would have decreased by 142 students (last row, column C, -142); the actual decrease was close, -147 (last row, column E) due to the net out-migration of 5 students (last row, column F). Migration was much more important in the prior five-year period, 2009-2013 (See the next to last row, columns C, E and F and the numbers in parentheses.). In this 5-year period, enrollment would have decreased by over 200 (-211) without the net in-migration of 75 students. Hence, enrollment actually decreased by 136 students. Over the last 10 years (2009-2018), without migration, enrollment would have decreased by 353 students (-14%); but with the net in-migration of 70 students, the actual enrollment decrease was 283 students (-11%), from a total student enrollment of 2,613 in 2008 to one of 2,330 in 2018. The bottom line is that E3 is the main driver of enrollment decline in the Blackhawk School District and that NM is positive, but not very large.

Tables 14A-14D provide comparable results at these processes at each educational level, but we will focus on the summary table—Table 15. A summary by educational level and time period by E3 and NM, as well as their combined effects is provided in Table 15. Perhaps the main takeaways from Table 15 are the following; 1) E3 is negative in all cells at all levels; 2) NM at the High School level is negative and roughly even in both time periods (-31 & -32); 3) NM at the Intermediate School is positive and equal in both time periods (+36 & +36); 4) E3 is relatively large at 3 levels—Intermediate, Middle and High Schools, -146, -93 and -81, respectively; 5) NM is relatively large at 2 levels—Intermediate and High Schools; 6) enrollment losses are approximately equal in both time periods (-147 & -136) with a total decrease in the last 10 years of 283 students.

Retention Ratios and the Birth-to-Kindergarten Ratio

A 3rd look at net migration, as well as the process of grade progression, involves retention ratios. In this analysis, we will use retention ratios as a baseline for projecting the changes in student population. The annual "retention ratios" shown in Table 16 are averaged over four years to increase the reliability of the estimates. "Retention ratios" also have an element of growth embedded in them since they may be above one (1.0). Thus, for instance in Table 16, eight of the twelve retention ratios are greater than or equal to 1.0, though only one of these is over 1.02 in the most current estimates, 2014-17. Retention ratios over 1.0 capture part of the growth stemming from housing construction, as well as net in-migration into the district, but they do so indirectly. That is, these ratios are not true "retention/survival rates" of the students in the origin grade or they would necessarily be less than or equal to 1.0. Rather these ratios capture retention of current students, replacements for any students who leave (if ≥1.0) and in-migration of students whose families move into the district, whether into new or existing housing. While they do not directly relate the specific underlying processes affecting the students, they reflect such processes indirectly. Hence, we refer to those retention ratios as entailing "embedded growth."

One of the most important ratios is the Birth-to-Kindergarten (B→K) ratio, shown in the last row of Table 16. In 2006-09, this ratio is 1.200, in 2010-13 it is 1.116 and in 2014-17 the ratio is 1.135. A ratio of 1.135 means that per 100 births, 5-6 years later K enrollment is expected to be 114. This is the B→K ratio that will be used in the student projections in Section II***. The B→K ratio of 1.135***

is a 4-year average. Over the last 12 years, this ratio has been relatively stable, with a slight dip in the middle 4 years and then a slight uptick in the last 4 years.

Obviously, any retention ratio or B→K ratio greater than 1.0 indicates the occurrence of net in-migration and specifies its magnitude. For instance, the G2→G3 and G3→G4 ratios of 1.018 and 1.034 indicate that net in-migration adds 2% and 3% to the G3 and G4 enrollments, respectively. Also, net in-migration of preschoolers adds to the K enrollment—underscoring that it is not only births that is an important factor in future student enrollments, but it is net-migration of preschoolers and students elsewhere as well. Both the accounting framework (E3 & NM) and the parametric framework of retention and Birth→K ratios underscore the importance of net in-migration at the Primary School. .

What is not so readily grasped is that the B→K ratio and the subsequent retention ratios act, in effect, like compound interest, ratcheting up the effect at each grade or as each marker is reached. How does one compare 2 ***sets*** of retention ratios or B→K ***and*** the subsequent retention ratios? For instance, how does one compare the relatively large B→K ratio of 1.200 in 2006-09 along with the subsequent retention ratios, to that of the (B→K) ratio in 2014-17 of 1.135, followed by its successive retention ratios? We 1st look at the **cumulative** retention ratios per se, shown in Table 17. We will then add the B→K ratios. We will refer to each set of ratios in Table 17 as Set #1 to Set #3, corresponding to columns 2-4 in Table 16. The cumulative retention ratio values are obtained by multiplying the ratios in sequential order starting at K. For example, the cumulative retention ratio in set #3, 2014-2017, is obtained by multiplying the K→G1 times the ratio for G1→G2, .969 x 1.012 = .981 = .98 (See row 2, column 3 of Table 17.); then multiply the result, .981 times the next ratio for G2→G3, that is, .981 x 1.018 = .998 =1.00; then multiplying .998 times the next ratio, 1.034 (G3→G4), we have 1.032. We can interpret the outcomes in terms of additional expected students per grade compared to the number of students in K. For both the retention ratios in 2006-09 and 2010-13, the peak is at G9 and is 1.15, indicating that enrollment at G9 is expected to be 115 per 100 K students.

In answer to the dilemma of how to compare 2 or more sets of retention ratios, taking the cumulative outcomes enables a rather quick comparison. For Table 17, Set #2 is greater than Set # 1 or # 3 at any grade. Set #3 is never greater than Set #1 or #2 due primarily to the K→G1 value being.969 or less than 1.00.[1] This starting value's impact continued until Grade 3, when the cumulative value was essentially 1.0. For the Blackhawk SD perhaps a more insightful comparison would be the cumulative B→K and retention ratios, shown in Table 18. Set #1, with a B→K ratio of 1.2, consistently has higher values, with the expected 9th grade class having 138 students per 100 births. Set #2's peak was also at G9, with an expected G9 class of 128 students per 100 births. The most current set, Set #3, in comparison has 116 G9 students per 100 births. With the most current number of births in the last 4 years (154), the expected G9 class

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[1] At 1st I thought that the K→G1 < 1.0 estimate was a mistake, but after checking the yearly the K→G1 moves, all 4 years from 2014-2017 have fewer G1 students than the origin number of K students. For example, the 2014 K class of 176 students had 173 students in G1 the following year, 2015 and this was also the case for 2015, 2016 and 2017. In both of the prior 4 year estimates of K→G1, the values were above 1.0, specifically 1.027 and 1.029.

size would be as follows: Set #1--213[2] students, Set #2—197 students and Set #3—179 students. These cumulative ratios imply that net in-migration is lower now than before—in either of the prior 4-year periods. Additionally, in terms of net-migration, the B→K ratio is quite strong at 1.135, implying considerable net in-migration of preschoolers—which is consistent with 2 of the earlier preschool findings and negating the ACS data on preschoolers for 2015.

Net migration of Adults by Age-Cohort in Conjunction with Cohort Replacement

The key idea in the deduction of the cohort replacement and net-migration streams, from a comparison of two population distributions over time, is the following: *I)* to make row comparisons for the cohort replacement outcomes (simply comparing the two distributions for each age-cohort at two points in time) and *ii)* to view the rows diagonally holding constant the birth year for net migration. In the ***ages 0 to 50***, the changes in *ii)* are due almost entirely to net-migration, versus death. That is, for the initial (eg 2000) cohort ages x to x+5, ten years later it will be ages x+10 to x+15. If no one migrated or died, then the population would have the same number of people as in x to x+5—aging in place; if the numbers differ, then this is due to net-migration, with either additional gains or losses.[1]

In a prior section examining births, we looked in some depth at the cohort replacement process and particularly focused on the replacement of Baby Boom

[2] eg.154 x 1.38 = 213
[1] This example is for comparing decennial census data 10 yrs. apart. For the comparison to follow using the decennial census and the ACS data 5 years apart (2010 and 2015), then a 5-year cohort age x to x+5 in 2010, will be x+5 to x+10 in 2015, etc.

cohorts by baby bust cohorts and also the initial replacement of baby bust cohorts by Echo Boom cohorts—the latter already occurring for the 20s and about to take place for the 30s. We found that the 1st set of replacements (baby bust for Baby Boom cohorts) resulted in major declines in births for a decade. Currently, the 2nd type of replacement (Echo Boom for baby bust cohorts) is expected to mainly add births or maintain the current level of births due to larger Echo Boom cohorts of women now replacing the baby bust cohorts; ***but net out-migration could reverse such outcomes by depleting the relative size of the Echo Boom cohorts.***

For the Blackhawk School District residents, we have restricted the data to female age-cohorts between 15-19 and 40-44, the childbearing years. The data are provided in Tables 10 and 11, with the focus now on net-migration. To illustrate the logic, let's take the 1990 20-24 age- cohort as an example (top quadrant, 1st column, 2nd row). This cohort numbered 310 residents in 1990, but by 2000, the cohort had aged to 30-34 (2nd column, 4th row) and now numbered 378, indicating a net in-migration of 68 women; that is, 378 - 310 = +68. Also, the 30-34 cohort in 1990, numbering 504 women, was ***replaced*** in 2000 by the new 30-34 age cohort, numbering 378, thereby declining by 126 women, a process that we have called ***cohort replacement***: {378 – 504 = -126); note that ***the NM outcome is already embedded in the cohort replacement outcome***. What is important here is the relative size of this NM component, with particular attention to the cohorts in the 20-39 age band—20-24, 25-29, 30-34 and 35-39.

Here we briefly want to concentrate on this complementary process to cohort replacement—net migration (NM). To expedite the review, we return to

Tables 10 and 11. Net migration is given by values within the brackets on the right side of each cell in the 2nd and 3rd quadrants of the tables. If we focus only on the NM aspect of Tables 10 and 11, then ***we observe a striking outcome based on age—all but 2 cells (13 of 15) in the 2 bottom quadrants of each table indicate net out-migration for all cohorts below age 30 and <u>all</u> cells in the 2 bottom quadrants of each table indicate net in-migration for all cohorts age 30 or older. A 2nd striking aspect of these data is the relative magnitude of the net migration,*** as shown in the bottom quadrant of each table. ***Net out-migration for 20-24 and 25-29 age cohorts generally range from 27% to 48% of the starting cohort, while net in-migration for the 30-34 and 35-39 age cohorts is also very large—from 21% to 51% of the starting cohort.***

Enrollment in the Blackhawk School District and in Alternative Schooling

We now turn to enrollment in alternative schooling by children of residents in the Blackhawk SD. But 1st we take a brief look at the student enrollment in the Blackhawk SD over the last decade and one-half. This data is given in Table 19, by educational level and overall. One may think of this table as consisting of 2 halves--upper and lower. The former takes point values at the onset, 2008, after 5 years, 2013 and after 10 years, 2018. Bold print in the yearly cells indicates growth in enrollment, which occurs in 21 of the total 75 cells, including the total enrollment. But the main story is one of fairly steady decreases in enrollment at all levels. These declines seem to be dampening at the Intermediate and Middle Schools, but not at the High School, where the decreases are accelerating somewhat, -55, -67 and -77 over the last three 5-year periods. The Primary School enrollment increased briefly in 2012, 2013 and 2014, but is now at its level in 2008. It had the smallest amount of decrease over the 15-year period, (-40) as may be seen in the 1st row of Table 19 with Δ ‘s; another take on this is that the Primary enrollment is currently 40 students below the enrollment 15 years ago in 2004.

The bottom half of Table 18 provides information regarding average number of students per educational level per year and average grade size, both providing a different take on the enrollment decreases over the last decade. In terms of average grade size, both the Primary and intermediate enrollment is stable while the Middle and High School enrollment is still decreasing, but at a bit slower rate. The average number of students per year has also remained the same for the Primary and Intermediate School enrollment over the last decade. Both the average number of students and the average grade size have continued to decrease at the Middle and High Schools but the rates have dampened in the last 5 years.

Table 20 provides the data for enrollment in alternative schools, with 3 surprises. The 1st surprise is the jump in enrollment in the home schooled. The average number of home-schooled students was 37 students per year from 2010 to 2013, but then it increased to an average of 54 students per year during the next 4 years, 2014-2017. A 2nd surprise is the enrollment shifts for the cyber charter schools—starting from an average of 56/year, in 2007-2012; it then decreased to a 36/year average in 2013-2016; in 2017, it was 30. Charter School enrollment averaged 27 students per year in 2007-2011, increased to 37/yr. in

2012-2014, before decreasing to 31/yr. in 2015-17. A 3rd surprise is the near term increase in private/parochial enrollment. We have only one year of enrollment above 160 students—2007. Thereafter it averaged 127 students per year from 2009 to 2014 and then increased to 147/yr. in 2015-17. Finally, if we take the total enrollment in 2017 in both alternative schooling and the Blackhawk School District, we have 263 students in the alternative schooling and 2,330 public school students for a total of 2,593 students and a distribution of 10% in alternative schools and 90% of the students enrolled in the public school.

Housing Development

Lastly, we will now take a look at housing development over the last 12 years (2008-2018), where the data was available. The importance of this segment of the analysis is that, should we find sufficient housing development, then we can go beyond the indirect effects of retention ratios and also take into account the direct effects of housing. Table 21 provides the new housing data and Table 21A shows the main PRDs under construction over this time frame.

The housing data for 12 years (2008-2018) is complete for only one municipality—Chippewa Township, but is essentially available for all municipalities with new homes for the last 7 years (2012-2018). Over this 7 year period, the following new homes were built: Chippewa Township—107, Darlington Township—15, Patterson Township—14 and South Beaver Township—29; in total, this is 165 new homes, averaging 24/yr. In Chippewa Township construction of new homes was higher (33/yr.) in the brief 4-year period, 2010-2013, as a large PRD (Shenango Woods) was being built, along with several other generally smaller PRDs. Given the on-going construction of new homes in Chippewa Township and the onset of 2 new major PRDs with at least 338 new homes, we expect additional direct impacts from new housing, beyond the effects already built into the retention ratios—which have embedded effects from both new and existing homes. Additionally, the more long-term effects of the cracker plant in nearby Potter Township will, no doubt add to such housing development, with the timing dependent on the rate of complementary development as well as downstream development from the cracker. Currently, attempting to specify the more detailed development does not seem productive due to the many alternative forms that it might take. However, we will construct two scenarios with new SFDs and multi-unit housing (eg. duplexes, quads, townhomes) to take into account the known jump in housing development about to begin.

Summary

In summary, we have examined several major demographic and economic effects to take into consideration when making our projections. We now re-iterate ten of the main findings. ***Finding #1: From 1990-94 to the present, 2014-17, Births declined for a decade, but then stabilized at 149-152 births per year for the last decade and ½ , with a signal of a potential turnaround and increase in the last 4 years.*** The first finding is that, in contrast to many school districts in Pennsylvania, where births dropped steadily for 20 years, in the Blackhawk School District the drop was for 10 years but then essentially stabilized in the 149-152 per year range, with no more decreases. In fact, in the last 4 years, there has been a slight uptick in births to 154/yr.

Finding #2*: *Delayed Childbearing is continuing, with 14% more births to mothers age 30 or higher. Births have continued to shift to women over age 30, with the greatest decrease in births by the 20-24 age-cohort (-6%) and the greatest increase by the 30-34 age-cohort (+10%). In 1990-94, 59% of births were to women less than age 30. Currently, this share is 45% and now over ½ of births are to women age 30 and above (55%). Delayed childbearing does not, however, mean fewer children per woman. Rather the number of children is the same; only the timing has changed. ***Finding #3*: *The distinct Total Fertility Rates in the United States for essentially the 2nd half of the 20th century, 1945-2000, produced Population Waves in the age structure, including in Blackhawk, and these Population Waves are largely responsible for the changes in births.*** The initial decade decrease in births in the Blackhawk SD was largely due to the replacement of Baby Boom cohorts of women by baby bust cohorts. It began when the baby bust women occupied both age cohorts in their 20s. It then continued as the baby bust cohorts aged and occupied the 1st cohort in their 30s. Additional decreases did not occur for 3 reasons—1) Baby Boom and Echo Boom cohorts muted the expected decreases from the baby bust cohorts; 2) the 2nd baby bust cohort, when it reached ages 30-34, had a sharp increase in births; and 3) the Echo Boom cohorts expected increase in births was reversed due to depletions by net out-migration. ***Finding #4*: *Total Fertility Rates in the United States for white non-Hispanic women has remained stable for the past 45 years.*** The TFR for white, non-Hispanic women ranged from 1.7 to 1.9 from 1972 to 2017—45 years. This small variation means that we can basically treat the TFR as constant. Consequently, the number of births will vary with the number of women per age cohort—which then has major implications for the relative number of expected births. ***Finding #5***: ***Net in-migration of Preschoolers has remained stable for the last decade and 1/2.*** Net-migration of preschoolers has remained about 14-15/yr. based on the preschooler data in the 1st decade and the B→K ratio of 1.135 in the most recent time span. ***Finding #6: Using E3 and NM as distinct factors of enrollment change, we find that NM has muted the decreases somewhat, but that the main factor producing the decline in enrollment has been a relatively large E3.*** The negative E3 has occurred primarily due to the decline in births, with its magnitude increasing somewhat due to the cumulative compounding of the retention ratios. ***Finding #7: The retention and B→K ratios have substantial growth embedded in them, with 8 of the 12 retention ratios equal or greater than 1.00.*** The increases over 1.0 act like compound interest when multiplied sequentially. The retention ratios parameterize the process where any ratio greater than 1.0 indicates the occurrence of net in-migration and specifies its magnitude. ***Finding #8***: ***NET OUT-MIGRATION of WOMEN in THEIR 20s, both the 20-24 and 25-29 age cohorts IS VERY HIGH, and NET IN-MIGRATION by WOMEN in THEIR 30s, both the 30-34 and 35-39 age cohorts IS ALSO VERY HIGH.*** The net out-migration rates of women in their 20s ranged from 27% to 48% (with one exception,14%) and the net in-migration rates of women in their 30s ranged from 21% to 51%, with no exceptions. The significance of these high migration rates is that they may potentially affect the population waves; for example, enhancing a baby bust cohort or depleting an Echo Boom cohort. ***Finding #9***: ***Enrollment in the Blackhawk School District has generally decreased steadily over the last decade and a half, while enrollment in alternative schooling has increased somewhat—though not evenly; we find decreases at the cybers, an increase, followed by a decrease at the charters, increases in the home schooled and a modest increase at the private/parochial schools.*** The decreases in the district's student enrollment have not been uniform across educational levels, nor across time, but they have been fairly steady. Perhaps a signal that the end of the declines is about to occur at the Primary and Intermediate Schools is evidenced by no change in the average number of students and in the average grade size. The same cannot be said for the Middle and High Schools. Presently alternative school enrollment is 10% of total enrollment. ***Finding #10***: ***Major housing development is about to begin in Chippewa Township with implications for increased students, particularly from construction of single family dwellings (SFDs).*** A reasonable estimate of the number of new homes built per year for the last 7 years is 165 houses, an average of 24/yr. In the last 7 years. The following new homes were built: Chippewa Township—107, Darlington Township—15, Patterson Township—14 and South Beaver Township—29; in total, this is 165 new homes. In Chippewa Township construction of new homes was higher (33/yr.) in the brief 4-year period, 2010-2013, as a large PRD (Shenango Woods) was being built, along with several other generally smaller PRDs. Given the on-going construction of new homes in Chippewa Township and the onset of 2 new major PRDs with at least 338 new homes, we expect additional direct impacts from new housing, beyond the effects already built into the retention ratios—which have embedded effects from both new and existing homes. We will construct two scenarios with direct impacts from new housing—each to add new housing impacts to the increased births. These scenarios, dealing with both single and multi-unit housing (eg. duplexes, quads, townhomes) will take into account the known jump in housing development about to begin.

II. Development and Analysis of Grade-Specific School District Projections for the Ten-Year Period 2019-2028

Scenario I: Projections with Fertility at Current Levels, Aging and Embedded Growth

The Scenario I projections use the following:

1. 2018 observed student populations per grade;
2. 2014-2017 four-year retention ratios (Table 16) based on school enrollment for 2014-2018; for the $B_{t-5} \rightarrow K_t$ ratio, the K refers to K in 2015-2018 and births in 2009-2013;
3. For 2019-2022 projections, the observed births (2013-2017) in the Blackhawk SD were used; and
4. For 2023-2028 projections, the expected number of births is based on the most current 4-year average for 2014-2017, 154/yr. (See Table 1 for individual years.)

This scenario assumes that births will remain at the current level—154 per year for 2018 to 2023. As discussed in the analysis, births have increased slightly to the present level in the last 4 years and here we assume that births will continue at this level. This scenario takes into account the following: 1) the most recent birth data, 2) the most recent retention ratios, which have embedded growth or net-migration, and 3) the most recent 4-yr. Birth-to-Kindergarten enrollment ratio (1.135).

The results for this scenario are given in Table 22. In the first 5 years, there is very little change in enrollment at the Primary School, a difference of only one student, whereas the Intermediate School has an increase of 15 students. In contrast,, the Middle School's enrollment is expected to drop sharply, with a decrease of 54 students (-7%). The High School, like the Intermediate School, is expected to have an increase of 21 students (+3%).

In the 2nd five years of this scenario, all 3 lower educational levels—Primary, Intermediate and Middle School—have increases of +4, +4 and +17 students, respectively. The High School is now expected to decrease by 35 students (-5%)

Overall, by 2028, these projections indicate essentially no change at the Primary level (+5, +1%), a modest gain at the Intermediate School (+19, +6%), a substantial decrease at the Middle School (-37, -5%) and a modest decrease at the High School (-14, -2%).

The number of students at the beginning of the projection in 2018, after 5 years, (2023) and after 10 years (2028) in this scenario is as follows:

Educational Level	2018	2023	2028
Primary School	512	513	517
Intermediate School	337	352	356
Middle School	752	698	715
High School	729	750	715
Total	2,330	2,313	2,303

This Scenario is viewed as quite likely if there were no direct impacts from the 2 new large scale housing developments about to begin in Chippewa Township.

Scenario II: Projections with a Modest Increase in Fertility

In Section I, we found that births were basically stable for the last decade and ½ but had a very slight increase in the last 4 years from 149-152 per year to 154 /yr. These births will start to enter Kindergarten in 2019 and will continue to do so for the subsequent 3 years 2020, 2021 and 2023. The projections from 2019 to 2022 will rely on known births for 2013 to 2017. It is the next 6 years of births in 2018-2023 that we are now attempting to specify. In Scenario I above, we assumed that for these 6 years births would be stable at the last 4-year average—154/yr. Here, we are assuming that births will continue to increase moderately, adding 10 births/yr. and thus we raise the births to 164/yr.

The increase in births in 2014-17 stemmed from a modest contribution by the 3rd baby bust cohort (ages 35-39, +12), but mostly from the 1st Echo Boom cohort (age 30-34, +64), as shown in Table 12. The other 3 Echo Boom cohorts in 2015-19 occupy all of the younger cohorts ages 15-19, 20-24 and 25-29 and all had decreases in births, indicating net out-migration, particularly for both cohorts in their 20s. (See Table 12 for the location in the age structure of the Echo Boom cohorts, all 4 of which follow the baby bust cohorts (shaded). We now expect that these Echo cohorts will increase as they enter their 30s, which should portend increased births as they sequentially do so. These points are made to underscore the basis for expecting more sustained increases in births in the district.

The results for this scenario (Scenario II) are given in Table 23. Since none of the increased births reach beyond Grade 5 in the 10-year projection period, we shade the cells where there is a difference from Scenario I. We will not elaborate on the projections where there are no differences, that is, for the High School. In the 1st 5 years, the Primary School now has a gain in enrollment of 12 students and in the 2nd 5 years, it adds an additional 24 students, an increase above that in Scenario I of 20 students. At the Intermediate School, there is an increase of 15 students, +4%, in the 1st 5 years, as in Scenario I, but in the 2nd 5 years the increase is, once again, 24 additional students--20 above that in Scenario I (now +24 vs. +4). At the end of 10 years, enrollment in both the Primary and Intermediate Schools is expected to increase by over 35 students each--+36 for the Primary School and +39 for the Intermediate School. In the 1st 5 years, the Middle School is expected to drop sharply (-54, -7%), as in Scenario I, but in the 2nd 5 years there is now a gain of 27 students (+4%) versus a gain of 17 students in Scenario I; hence, the decrease in enrollment after 10 years is now 27 students (-5%) vs. 37 students, as in Scenario I. There is no difference from Scenario I at the High School (-14, -2%). Overall, there is a rather small decrease in total student enrollment in the 1st 5 years (-6, 0%) and a gain in the 2nd 5 years of 40 students (+2%). The total enrollment now has a small increase of 34 students (+1%) versus a loss of 27 students in Scenario I.

This Scenario is viewed as the 2nd most likely scenario for the Blackhawk School District if there were no major housing developments on the horizon.

Scenario III: Projections with Lower Fertility

In this scenario we assume births from 2018 to 2023 return to their prior level the last decade and ½, that is 149/yr.—the lower end of the 149-152 range. This assumes that the slight increase in Scenario I was just a one-time blip on an otherwise stable trajectory and that the Echo Boom cohorts will continue to be depleted by net out-migration. This is a possibility, but one that also seems unlikely unless the net in-migration of women in their 30s, seen without fail over the last 2 ½ decades doesn't "show up". In this respect, **we view this scenario as a lower bound on enrollment**.

The results are shown in Table 24. Since the new births will not impact the enrollment beyond Grade 5, as was the case with Scenario II, the results for the High School will remain the same and we will focus on the 3 lower educational levels. In both the 1^{s} and 2nd 5 years, the Primary School is now expected to have a small decrease of enrollment, initially of 5 students, followed in the 2nd 5 years by another small decrease of 8 students. After 10 years, the Primary School enrollment is expected to decrease by 13 students (-3%). In this scenario, the Intermediate School has a gain of 15 students (+4%) in the 1st 5 years, as seen in all scenarios, now followed by a small decrease of 8 students (-2%); after 10 years, the Intermediate enrollment is expected to increase by 7 students (+2%). A sharp decrease at the Middle School is expected in the 1st 5-year period, as in Scenarios I and II, followed in the 2nd 5 years by a modest increase of 11 students; after 10 years. Middle School enrollment in this scenario is expected to drop by 43 students or -6%.

The expected enrollment at the High School is the same as in all prior scenarios—an increase of 21 students in the 1st 5 years (+3%) and a decrease in the 2nd 5 years (-35, -5%), resulting in a small decrease of 14 students after 10 years (-2%). Overall, the drop in expected enrollment in this scenario is 23 students in the 1st 5 years and 40 students in the 2nd 5 years; after 10 years, the expected decrease is -63 students (-3%).

This Scenario (III) is NOT viewed as a likely outcome, but is provided should a stability in births hold, which might be the case if the Echo boom cohorts either "move out" or do not "move in", depleting their relative larger size in the district AND were no major housing developments on the horizon.

Scenario IV: Projections with Fertility at Current Levels, Aging and Embedded Growth with Direct Impacts from New Housing

In this scenario, we assume that births will remain at the level of the last 4 years (154/yr.) and that new housing construction increases substantially via 2 new large-scale PRDS involving 150 Single Family Dwellings (SFDs) and 188 multi-dwelling units (MDUs). The expected build-out is 9 years. In this modeling, direct impacts from new housing construction only apply to the increment in construction beyond the normal baseline or beyond the average rate of construction before the additional PRDs start. Here we are assuming that all of the construction within the 2 new PRDs involves an increment or jump above the baseline and that the prior rate of construction outside of the PRDs will continue. We estimated the baseline rate of new home construction using the most recent 7 years at 24 new homes per year. We also estimate a student/housing ratio per housing type. The student/housing ratios come from separately aggregating the SFDs and MDUs that have been built within the on-going PRDs in the school district over the last decade and then taking a count of Blackhawk students in those homes. This estimate was 1.08, for SFDs and .13 for MDUs. The expectation of 150 new SFDs is likely on the high side, and we will simplify and assume a student/housing ratio of 1.00 for SFDs and edge the estimate for MDUs up a bit to .17, since it may be on the low side. We also obtained data from the student counts for the student/housing ratio regarding the distribution of the new students by educational level--.21, .18, .40 and .21 for the primary, intermediate, middle and high school levels, respectively. Again, we will simplify and use the following distribution: .20, .20, .40 and .20. Currently, neither of the 2 new PRDs. has broken ground and thus we expect that it will be 2020 before new homes are actually built

We allocate new students per grade within the specified level as evenly as possible, as shown in Table 25A for SFDs and Table 25B for MDUs. We then sum the cells in Tables 25A and 25B for the total allocation that will be used in this scenario, forming Table 25C. We also incorporate the additional students sequentially, starting in grade K and as a 1st step, they enter and then we apply the appropriate retention ratio per year to all students in K. We then apply this procedure iteratively for each grade, each year. In short, once a new student enters, they become a part of the student population per grade and the retention ratios then apply to them as well.

The results for Scenario IV are given in Table 25 and the outcomes may seem somewhat surprising. At the Primary School, in the 1st 5 years there is basically no change (+8 students). Then, in the 2nd 5 years there is an even smaller increment, +3 students. Consequently, there is virtually no expected difference from the starting enrollment in 2018. The entry of 36 additional primary students over the 10 years resulted in a net change from Scenario I of 6 more students at the primary level (+11 here in Scenario IV vs. +5 in Scenario I). At the Intermediate School, in the 1st 5 years, we expect an additional 32 students (+10%), followed in the 2nd 5 years by loss of 1 student (0%). The expected change after 10 years is an increase of 31 students (+9%). This compares with an expectation of 19 additional students in Scenario I. At the Intermediate School, new housing added 12 additional students above the 19 additional students expected in Scenario I. In this case, once again, 36 additional students are expected to enroll in the district due to new housing. At the Middle School, we have a loss of 16 students in the 1st 5 years, then a gain of 25 students in the 2nd 5 years for, once again, virtually no change after 10 years (+9 students, +2% Δ). But now there is a substantial difference from Scenario I, where the 10-year result was a loss of 37 students. Note that it took 73 additional students entering the district's enrollment to obtain this result at the end of 10 years (See Table 25C.). The High School case resembles that at the Intermediate School—with a large gain in the 1st 5 years students here +44 students and a change of only 1 student in the 2nd 5 years. At the end of 10 years the High School is expected to increase by 45 students (+6%).

. Overall, in terms of total enrollment change, we have the following:

	Scenario IV	Scenario I	Additional Students
1st 5 years	+68	-17	+85
2nd 5 years	+28	-10	+38
10 yr. total	+96	-27	+123

In total, the 150 new SFDs and 188 MDUs would be expected to generate an ***additional*** 123 students in 2028—6 additional students at the Primary School level, 12 additional students at the Intermediate School, 46 more students at the Middle School (though still a decrease of 3 students) and 59 additional students at the High School, for a total difference of 123 additional students (+5%). In this scenario, the new students entered in all 10 years with 36 new entrants at the Primary, Intermediate and High Schools and 73 additional new students entering at the Middle School.

We make two additional observations. First, direct impacts from new housing are distributed across all educational at the same time (year), whereas shifts in births have all new entrants at the Kindergarten level and take time thereafter to affect enrollments at all levels. . Second, the effect of net migration (NM) via the retention ratios, as discussed in Section I, acts as compound interest and is exponential or multiplicative. But the most current retention ratios in the Blackhawk School District, shown in Table 16, do not have nearly as much of a cumulative effect as in the prior 4 and 8 year retention ratios, where, for instance, in the prior 4 years by grade 9 the class was expected to be 15% larger than the initial K class. The modeling of new housing in this study affects enrollment arithmetically or in an additive way. The cumulative nature of new housing impacts rides with that of the retention ratios, but increases cumulatively according to the number of grades traversed as the students progress upward in grades, adding students at each grade as specified by the weighted allocations at that grade. Third, the distribution of new students per educational level used here is weighted more heavily at the Middle School level than is usually found and that of the lower educational levels is lower than is usually found. Should this change for the new housing developments, then the projections for the Primary and Intermediate Schools would be expected to be higher than found here. Presently, these distributional estimates were based on the known houses built in the PRDs in Table 21A.

Scenario IV is the most likely scenario for the Blackhawk School District.

<u>Scenario V: Projections with Higher Fertility, Aging and Embedded Growth with Direct Impacts from New Housing</u>

Though Scenario IV may be the most likely scenario, it seems prudent to also consider the case where births do increase modestly above that of the last 4 years, as well as the expected jump in new housing. One of the primary reasons is the positioning of the Echo boom cohorts in the key reproductive ages going forward. In fact, should young families move into the new housing, an additional housing impact may be an increase in births. Thus, we now add the direct housing impacts to Scenario II, just as Scenario IV added the housing impacts to Scenario I. We will not repeat the logic to the modeling discussed in Scenario IV. It is the same here. What are distinct are the joint impacts of a higher level of births and substantial new housing.

The results for this scenario are given in Table 26.The allocation of new students due to new housing is the same as in Scenario IV; nevertheless, we repeat them here in Tables 26 A, B and C, with Table 26C being a summation of Tables 26 A and B. As before, we shade the cells where there is a difference in the results from Scenario IV. At the Primary School level there is now a small increase of 19 students in the 1st 5 years, then 23 more students in the 2nd 5 years. After 10 years, the increase is expected to be 42 additional students (vs. 36 in Scenario II and 11 students in Scenario IV). At the Intermediate School, the growth is now expected to be notable in both 5 year periods--+32 in the 1st 5 years and +29 in the 2nd 5 years, totaling an additional 61 students in 2028 compared to 39 additional students in Scenario II and 31 in Scenario IV. The Middle School has the same result as Scenario IV in the 1st 5 years and 10 more students in the 2nd 5 years (+ 35 s. +25); after 10 years the enrollment change is now positive for both Scenarios IV (+9) and V +19) unlike that in Scenario I (-37) or Scenario II (-27). At the High School, the results in both 5 year periods is the same as in Scenario IV, a growth of 44 students in the 1st 5 years and 1 additional student in the 2nd 5 years. In the 1st 5 years, this is 23 more students than in Scenario II; it is also 36 more students in the 2nd 5 years and 59 more students after 10 years.

Overall, in terms of total enrollment change, we have the following:

	Scenario V	Scenario II	Additional Students
1st 5 years	+79	-6	+85
2nd 5 years	+88	+40	+48
10 yr. total	+167	+34	+133

Scenario V is viewed as the 2nd most likely scenario for the Blackhawk School District.

Summary

This demographic study has considered a range of possibilities for projecting the expected student enrollment changes in the future—with explicit linkages to the rather in-depth analysis in Section I. These alternative futures or Scenarios (S's) include the following, in order of likelihood:

S IV: level of births in last 4 yrs., 154/yr. and direct impacts from new housing
S V: modest increase in births, 164/yr. and direct impacts from new housing

Likelihood with no direct impact from new housing:

S I: level of births in last 4 yrs., 154/yr.
S II: modest increase in births: 164/yr.
S III: return to prior level of births; B= 145/yr.

Scenarios I, II and III are all unlikely given the onset of 2 major housing plans totaling 338 new homes—150 SFDs and 188 MDUs. While Scenario IV is viewed as the most likely, Scenario V is also viewed as plausible, should the Echo Boom cohorts "show up" in their 30s.

The current enrollment, as well as the 5-year and 10-year projected enrollments for Scenarios IV and V, are given below.

	Current Enrollment	5 Yr. Outcome	10 Yr. Outcome
Most likely: Scenario IV	Pr S 512	520 (+8)	523 (+11)
B= 154 + new housing	In S 337	369 (+32)	368 (+31)
	MS 752	736 (-16)	761 (+9)
	HS 729	773 (+44)	774 (+45)
	Total 2,330	2,398 (+68)	2,426 (+96)
2nd most likely: Scenario V	Pr S 512	531 (+19)	554 (+42)
B= 164 + new housing	In S 337	369 (+32)	398 (+61)
	MS 752	736 (-16)	771 (+19)
	HS 729	773 (+44)	774 (+45)
	Total 2,330	2,409 (+79)	2,497 (+167)

III. Development and Analysis of Grade-Specific School District Projections for the Two Primary Schools: 2019-2028

We will 1st consider the case with no direct impacts from new housing and births at the level of the last 4 years (154/yr), consistent with Scenario I. This assumes that future allocations of the new students in the 2 major housing developments are not “set in stone”, so-to-speak. Given current attendance boundaries, all would attend Northwestern Primary School. We must now allocate the births per municipality to one or the other of the 2 Primary Schools. We do so by taking the proportions in K and reasoning that the proportionate births map 1-to-1 to subsequent K enrollments. In 2016-2018, six of the municipalities sent all their K children to one Primary School[1]. The two municipalities with a split distribution were Patterson Heights Borough and Chippewa Township—the former with 95% to Patterson Primary and 5% to Northwestern Primary. The 2nd municipality, Chippewa, varied somewhat by year, from 45% in 2016, to 51% in 2017, to 65% in 2018 to Northwestern Primary and 55% in 2016, 49% in 2017 and 35% in 2018 to Patterson Primary. The 3-year average was 46% to Patterson and 56% to Northwestern. If we take all 3 grades in the primary schools, then the 3-year average was 49% to Patterson and 51% to Northwestern. While it appears that the more recent births in Chippewa Township are tilting toward Northwestern, based on the 65% to 35% K distribution in 2018, it is certainly possible that that split could shift back to Patterson, as was the case in 2016 with 55% to Patterson. The 3-year average for all 3 grades in the primary schools seems a good basis for allocating the births in Chippewa Township—with a 51% to 49% distribution. Given the shifts from one primary to the other, in the K proportion over the last 3 years, we have chosen to take a middle-of-the-road outcome and split the births 50% to 50%, evenly to each primary school. Patterson Height’s births per year are basically

[1] Patterson Township → Patterson Primary; Darlington and South Beaver Townships and Darlington, Enon Valley and West Mayfield Boroughs → Northwestern Primary.

too small to take the 3-year average 95% and 5% split, so we will allocate 100% of the births to the Patterson Primary. We use the same B→K ratio and retention ratios that were used in Section II; (See Table 16.)

The results are given in Tables 27A and 27B for Patterson Primary and Northwestern Primary, respectively. We will first look at Table 27A. In the 1st 5 years enrollment in Patterson Primary is expected to increase by 14 students and then decline by 5 students in the 2nd 5 years. After 10 years, enrollment is expected to have increased by 9 students—to 222 students. The peak enrollment is expected in 2023 at 227 students. Table 27B gives the results for Northwestern Primary. In the 1st 5 years, Northwestern Primary's enrollment is expected to decrease by 9 students, then regain 8 of those students in the 2nd 5 years. By 2028, enrollment is essentially the same as in 2018, less 1 student.

Given the location of the 2 new housing developments and the current attendance boundaries for the primary students, without a change in those boundaries, all of the students living in the new developments would attend Northwestern Primary. This scenario is provided in Table 27C. The allocation of new students is shown in the upper quadrant of Table 26C, pertaining to the primary grades. In the 1st 5 years enrollment decreases by 3 students, from 299 to 296 students. In the 2nd 5 years the enrollment increases by 8 students; thus, by 2018 five additional students are expected, with an enrollment of 304 students. The peak enrollment in this scenario is 18 additional students and enrollment at 317 students.

As a check on the consistency between the projections in Scenario IV at the aggregate educational level and Scenario VI for the 2 individual primary schools, we can compare the K-G2 results on Table 25 with the combined results for the 2 primary schools in Tables 27A and 27C. Across the 10 years, the differences generally are 3 students (7 yrs.), but 1 yr. each of differences of 1 student, 5 students and 6 students. The differences then vary from 1 to 6 students, which is at most a difference of from .2% to 1.2%--which we view as extremely consistent.

Table 1

Annual Number of Births to BSD Residents by Municipality and Year: 1990-2017

Year	Chippewa Twp	Darlington Twp	Patterson Twp	So Beaver Twp	Darlington Boro	Patterson Hts Boro	W Mayfield Boro	Enon Valley Boro	Total[1]
1990	70	22	35	26	5	7	14	5	184
1991	68	22	39	28	6	4	11	2	180
1992	64	16	39	33	7	7	11	4	181
1993	70	20	39	32	5	9	12	4	191
1994	55	26	31	22	7	11	12	7	171
1995	49	21	37	30	4	6	13	8	168
1996	82	12	34	18	5	8	`0	7	176
1997	55	17	27	23	4	5	1	7	139
1998	59	20	28	16	12	5	11	9	160
1999	54	22	24	15	8	5	13	2	143
2000	75	15	27	18	12	7	7	5	166
2001	67	12	16	9	10	3	10	15	142
2002	69	13	22	24	10	6	10	4	158
2003	67	21	29	19	3	1	12	4	156
2004	64	11	15	27	10	0	9	4	140
2005	45	15	24	16	14	0	9	4	127
2006	58	8	35	26	2	0	13	3	145
2007	60	19	31	19	5	1	13	6	154
2008[+]	58	17	41	23	2	1	11	7	160
2009	67	14	32	18	8	4	11	7	161
2010	61	18	23	18	6	1	9	3	139
2011	85	15	27	16	6	4	11	6	170
2012	63	17	29	20	4	2	7	4	146
2013	63	11	23	18	2	5	10	3	135
2014	75	18	27	19	4	3	17	4	167
2015	61	10	25	24	3	2	12	3	140
2016	71	15	35	19	0	3	10	3	156
2017	70	17	27	22	3	1	10	2	152

[1] Source: Pennsylvania Department of Health

Table 2

Annual Number of Births to Blackhawk School District Residents by Municipality and 5-Year Period: 1990-2017

5-Year Period	Chippewa Twp	Darlington Twp	Patterson Twp	So Beaver Twp	Darlington Boro	Patterson Hts Boro	West Mayfield Boro	Enon Valley Boro	Total[1]
∑ 1990-1994	327	106	183	141	30	38	60	22	907
∑ 1995-1999	299	92	150	102	33	29	48	33	786
∑ 2000-2004	342	72	109	97	45	17	48	32	762
∑ 2005-2009	288	73	163	102	31	6	57	27	747
∑ 2010-2014	347	79	129	91	22	15	54	20	757
∑ 2015-2017	202/"337"	42/"70"	87/"145"	65/"108"	6/"10"	6/"10"	32/"53"	8/"13"	448/"747"
Average/Year									
1990-1994	65.4	21.2	36.6	28.2	6.0	7.6	12.0	4.4	181.4
1995-1999	59.8	18.4	30.0	20.4	6.6	5.8	9.6	6.6	157.2
2000-2004	68.4	14.4	21.8	19.4	9.0	3.4	9.6	6.4	152.4
2005-2009	57.6	14.6	32.6	20.4	6.2	1.2	11.4	5.4	149.4
2010-2014	69.4	15.8	25.8	18.2	4.4	3.0	10.8	4.0	151.4
2015-2017	67.3	14.0	29.0	21.6	2.0	2.0	10.7	2.6	149.4
2014-2017[2]	277	60	114	84	10	9	49	12	615
Ave. Last 4 Yrs.	69.3	15.0	28.5	21.0	2.5	2.3	12.3	3.o	***153.8 = 154***

[1] Source: Pennsylvania Department of Health; see Table 1 for individual years. For 2015-2017, the numbers in quotes are the 5-year equivalent, obtained by multiplying the 3-yeqr observed number by 5/3's or 1.67.

[2] *Last 4 years*

Table 3

Number of Births by Age of Mother and Year for Blackhawk School District Residents[1]

	15-19	20-24	25-29	30-34	35-39	40-44	45+	∑
				1990-1994				
∑	58	156	320	270	91	11	1	907
% of ∑	.064	.172	***.353***	***.298***	.100	.012	.001	
Avg/Yr	11.6	31.2	64.0	54.0	18.2	2.2	0.2	181.4
				1995-1999				
∑	48	123	204 (-116)	291	103	17	0	786
% of ∑	.061	.156	***.260***	***.370***	.131	.022	0	
Avg/Yr	9.6	24.6	40.8	58.2	20.6	3.4	0	157.2
				2000-2004				
∑	39	119	223	243 (-48)	120	16	2	762
% of ∑	.051	.156	***.293***	***.319***	.157	.021	.003	
Avg/Yr	7.8	23.8	44.6	48.6	24.0	3.2	0.4	152.4
				2005-2009				
∑	52	142	232	183 (-60)	108	30	0	747
% of ∑	.070	.190	***.311***	***.245***	.145	.040	0	
Avg/Yr	10.4	28.4	46.4	36.6	21.6	6.0	0	149.4
				2010-2014				
∑	37	133	251	236 (+53)	83	17	0	757
% of∑	.049	.176	***.332***	***.312***	.110	.022	0	
Avg/Yr	7.4	26.6	50.2	47.2	16.6	3.4	0	151.4
				2015-2017				
∑	13/"22"	51/"85"	138/"230"	180/"300"	57/"95"	8/"13"	1/"2"	448/"747"
% of ∑	.029	.114	***.308***	***.402***	.127	.018	.002	
Avg/Yr	"4.4"	"17.0"	"46.0"	"60.0"	"19.0"	"2.6"	"0.2"	"149.4"
%Δ[2]	-.035	-.058	-.045	+.104	+.027	+.006	+.001	
	-.14			+.14				

[1] * Source: Pennsylvania Department of Health

[2] %Δ from 1990-94 to 2015-17

Table 4

Total Fertility Rate for the United States: 1917-2016[Φ]

1917	3.33	1942	2.63	1967	2.56	1992	2.05
1918	3.31	1943	2.72	1968	2.46	1993	2.02
1919	3.07	1944	2.57	1969	2.46	1994	2.00
1920	3.26	1945	2.49	1970	2.48	1995	1.98
1921	3.33	1946	2.94	1971	2.27	1996	1.98
1922	3.11	1947	3.27	1972	2.01	1997	1.97
1923	3.10	1948	3.11	1973	1.88	1998	2.00
1924	3.12	1949	3.11	1974	1.84	1999	2.01
1925	3.01	1950	3.09	1975	1.77	2000	2.06
1926	2.90	1951	3.27	1976	1.74	2001	2.03
1927	2.82	1952	3.36	1977	1.79	2002	2.01
1928	2.66	1953	3.42	1978	1.76	2003	2.04
1929	2.53	1954	3.54	1979	1.81	2004	2.05
1930	2.53	1955	3.58	1980	1.84	2005	2.05
1931	2.40	1956	3.69	1981	1.81	2006	2.10
1932	2.32	1957	3.77	1982	1.83	2007	2.12
1933	2.17	1958	3.70	1983	1.80	2008	2.07
1934	2.23	1959	3.71	1984	1.81	2009	2.00
1935	2.19	1960	3.65	1985	1.84	2010	1.93
1936	2.15	1961	3.62	1986	1.84	2011	1.89
1937	2.17	1962	3.46	1987	1.87	2012	1,88
1938	2.22	1963	3.32	1988	1.93	2013	1.86
1939	2.17	1964	3.19	1989	2.01	2014	1.86
1940	2.30	1965	2.91	1990	2.08	2015	1.84
1941	2.40	1966	2.72	1991	2.06	2016	1.82

[Φ] Data Sources:
(1) 1917-39 "Trends in Fertility in the United States," U.S. Dept. of Health, Education and Welfare, 1977, Table 13, DHEW Pub #78-1906;
(2) 1940-1980 Vital Statistics of the United States, Vol. 1, Natality, 2003. Table 1-7.
(3) 1980-2007 "Births: Final Data for 2007" National Vital Statistics Reports, Vol. 58, No. 24, August 2010, Table 4 (Department of Health and Human Services).
(4) 2008-2010 National Vital Statistics Reports, Vol. 61, No.1, August 2012.
(5) 2011-2016 National Vital Statistical Reports, Vol. 67, No.1, January 2018.

Table 5

Total Fertility Rate* for the United States—White and White (non-Hispanic): 1970-2016

	ALL	White (including Hispanic)	White (non-Hispanic)	Hispanic		ALL	White (including Hispanic)	White (non-Hispanic)	Hispanic
1970	2.5	2.4			1990	2.1	2.0	1.9	3.0
1971	2.3	2.2			1991	2.1	2.0	1.8	3.0
1972	2.0	1.9			1992	2.1	2.0	1.8	3.0
1973	1.9	1.8			1993	2.0	2.0	1.8	2.9
1974	1.8	1.7			1994	2.0	2.0	1.8	2.8
1975	1.7	1.7			1995	2.0	2.0	1.8	2.8
1976	1.7	1.7			1996	2.0	2.0	1.8	2.8
1977	1.8	1.7			1997	2.0	2.0	1.8	2.7
1978	1.7	1.7			1998	2.1	2.0	1.8	2.7
1979	1.8	1.7			1999	2.1	2.1	1.8	2.6
1980	1.8	1.8			2000	2.1	2.1	1.9	2.7
1981	1.8	1.7			2001	2.0	2.0	1.8	2.7
1982	1.8	1.8			2002	2.0	2.0	1.8	2.7
1983	1.8	1.7			2003	2.0	2.1	1.9	2.7
1984	1.8	1.7			2004	2.0	2.1	1.8	2.8
1985	1.8	1.8			2005	2.1	2.1	1.8	2.8
1986	1.8	1.8			2006	2.1	2.1	1.9	2.9
1987	1.9	1.9			2007	2.1	2.1	1.9	2.9
1988	1.9	1.9			2008	2.1	2.1	1.9	2.7
1989	2.0	1.9			2009	2.0	2.0	1.8	2.5
					2010	1.9	2.0	1.8	2.4
					2011	1.9	1.9	1.8	2.2
					2012	1.9	1.9	1.8	2.2
					2013	1.9	1.9	1.8	2.2
					2014	1.9	1.9	1.8	2.1
					2015	1.8	1.9	1.7	2.1
					2016	1.8	NA	1.7	2.1

* The Total Fertility Rate is the average expected total number of children that a woman will have under the current age-specific fertility rates.

Table 6

SHIFTS IN AGE COHORTS OF FEMALES IN THE UNITED STATES IN PENNSYLVANIA AND ALLEGHENY COUNTY: 1990-2010

	United States			Pennsylvania			Allegheny County		
	1990[2]	**2000**	**2010**	**1990**	**2000**	**2010**	**1990**	**2000**	**2010**
0-4	8962	9365	9882	387926	355356	356322	41156	34721	31110
5-9	8837	10026	9959	383947	403701	369276	39193	38610	31588
10-14	*8347*	10008	10097	*368709*	420247	385924	*36073*	40548	33460
15-19	*8651*	9829	10736	*402320*	417294	442601	*40160*	39916	39221
20-24	9345	*9276*	10572	432692	*373203*	432260	47352	*37861*	45020
25-29	**10617**	*9583*	10466	**503220**	*366399*	388958	**53801**	*38593*	42309
30-34	**10986**	10189	*9966*	**466320**	417281	*364911*	**59283**	43097	*36047*
35-39	**10061**	**11388**	*10138*	**418201**	**482595**	*384115*	**54269**	**49714**	*34921*
40-44	**8924**	**11313**	10497	**337594**	**504367**	429693	**47016**	**54439**	39203

CHANGE BY AGE COHORT ACROSS TIME[3]

	United States		Pennsylvania		Allegheny County	
	x(2000)-x(1990)	x(2010)-x(2000)	x(2000)-x(1990)	x(2010)-x(2000)	x(2000)-x(1990)	x(2010)-x(2000)
0-4	+403k (+4.5%)	+517k (+5.5%)	-32570 (-8.4%)	+966 (+0.3%)	-6435(-15.6%)	-3611 (-10.4%)
5-9	+1189k(+13.5%)	-67k (-0.7%)	+19754 (+5.1%)	-34425 (-8.5%)	-583(-1.5%)	-7022 (-18.2%)
10-14	+1661k(+19.9%)	+89k (+0.9%)	+51538(+14.0%)	-34323 (-8.2%)	+4475(+12.4%)	-7088 (-17.5%)
15-19	+1178k +13.6%)	+907k (+9.3%)	+14974 (+3.7%)	+25307 (+6.1%)	-244(-0.6%)	-695 (-1.7%)
20-24	*-69k (-0.7%)*	+1296k(+14.0%)	*-59489 (-13.7%)*	+59057 (+15.8%)	-9491(-20.0%)	+7159 (+18.9%)
25-29	*-1034k (-9.7%)*	+883k (+9.2%)	*-136821 (-27.2%)*	+22559 (+6.2%)	-15208(-28.3%)	+3716 (+9.6%)
30-34	-797k (-7.3%)	*-223k (-2.3%)*	-49039 (-10.5%)	*-52370 (-12.6%)*	-16186(-27.3%)	*-7050 (-16.4%)*
35-39	+1327k(+13.2%)	*-1250k (-11.0%)*	+64394 (+15.4%)	*-98480 (-20.4%)*	-4555(-8.4%)	*-14793 (-29.8%)*
40-44	+2389k(+26.8%)	-816k (-7.2%)	+166773 (+49.4%)	-74674 (-14.8%)	+7423(+15.8%)	-15236 (-28.0%)

[2] In thousands e.g., 8,962 is 8,962,000 or 8.962 million

[3] Cross-Sectionally by Period; in other words, change (∆) in age group x in 1990 vs. 2000 for the same age group

Table 7

Population Age Distribution for Beaver County[1]: 2000 and 2010

Age Cohort	2000	Birth Years		2010	Birth Years		Δ Net Migration & Aging		Δ Cohort Replacement
<5	9,860	1996-2000	EB4[2]	8,966	2006-10				-894 (-9%)
5-9	11,596	1991-95	EB3	9,284	2001-05				-2.312 (-20%)
10-14	12,311	1986-90	EB2	9,902	1996-2000	EB4	+42 (0%)	EB→EB	-2,409 (-20%)
15-19	11,888	1981-85	EB1	11,007	1991-95	EB3	-589 (-5%)	EB→EB	-881 (-7%)
20-24	8,921	1976-80	bb2	9,043	1986-90	EB2	***-3,268 (-27%)***	***EB→bb***	+122 (+1%)
25-29	9,121	**1971-75**	bb1	9,288	1981-85	EB1	***-2,600 (-22%)***	***EB→bb***	***+167 (+2%)***
30-34	10,977	1966-70	TC2	8,935	1976-80	bb2	+14 (0%)	*bb →TC2*	-2,042 (-19%)
35-39	13,919	1961-65	BB4	9,401	**1971-75**	bb1	+280 (+3%)	*bb→BB*	-4,518 (-32%)
40-44	**15,500**	**1956-60**	BB3	10,862	1966-70	TC2	-115 (-1%)	*TC2→BB*	-4,638 (-30%)
45-49	13,784	1951-55	BB2	13,467	1961-65	BB4	-452(-3%)	BB→BB	-317 (-2%)
50-54	12,121	1946-50	BB1	**14,741**	**1956-60**	BB3	-759 (-5%)	***BB→BB***	***+2,620 (+22%)***
55-59	9,481	1941-45	TC1	13,076	1951-55	BB2	-708 (-5%)	***BB→*** TC1	***+3,595 (+38%)***
60-64	8,509	1936-40	De2	10,907	1946-50	BB1	-1,214 (-10%)	***BB→De***	***+2,398 (+28%)***
65-69	8,410	1931-35	De1	8,154	1941-45		-1,327 (-14%)		-256 (-3%)
70-74	9,012	1926-30		6,999	1936-40		-1,510 (-18%)		-2,013 (-22%)
75-79	7,540	1921-25		6,146	1931-35	De1	-2,264 (-27%)		-1,394 (-18%)
80-84	4,963	1916-20		5,536	1926-30		-3,476 (-39%)		***+563 (+12%)***
85-89	2,456	1911-15		3,242	1921-25		-4,298 (-57%)		***+786 (+32%)***
90+	1,043	Pre 1911		1,583	Pre-1921				***+540 (+52%)***
Total	181,412			170,539					-10,873 (-6%)

[1] Sources: U.S. Census Bureau, Decennial Censuses

[2] EB: Echo Boom Cohort; BB: Baby Boom Cohort; bb: Baby Bust Cohort; De: Great Depression Cohort; TC: Transition Cohort , TC1--Transition between Great Depression and Baby Boom; TC2—Transition Cohort between Baby Boom & baby bust

Table 8

Population Age Distribution for Beaver County[1]: 1990, 2000, 2010 and 2015

Age Cohort	1990[2]	2000	2010	2015[2]
<5	11,720	9,860	8,966	8,659
5-9	12,467	11,596	9,284	9,507
10-14	12,179	12,311	9,902	9,338
15-19	12,122	11,888	11,007	9,848
20-24	10,785	8,921	9,043	9,678
25-29	**12,868**	9,121	9,288	9,507
30-34	**15,219**	10,977	8,935	9,848
35-39	**13,989**	**13,919**	9,401	9,507
40-44	12,457	**15,500**	10,862	9,507
45-49	10,109	**13,784**	**13,467**	11,715
50-54	9,419	12,121	**14,741**	**13,922**
55-59	9,805	9,481	**13,076**	**14,092**
60-64	11,426	8,509	10,907	**11,885**
65-69	10,778	8,410	8,154	9,507
70-74	8,835	9,012	6,999	7,131
75-79	6,058	7,540	6,146	5,773
80-84	3,483	4,963	5,536	5,263
85-89	2,366	2,456	3,242	5,263
90+		1,043	1,583	
Total	186,093	181,412	170,539	169,785

[1] Sources: U.S. Census Bureau, Decennial Censuses and ACS (2015)
[2] Data for 85-89 includes all 85+

Table 9

Age Structural Change Process Across Time by Major Type of Population Cohort and Five-Year Increments in Time – 1990-2020

Type of Cohort[+]	1990	1995	2000	2005	2010	2015	2020
EB_3	<10	<10	<10	10-14	15-19	20-24	25-29
EB_2	<10	<10	10-14	15-19	20-24	25-29	30-34
EB_1	<10	10-14	15-19	20-24	25-29	30-34	35-39
bb_2	10-14	15-19	20-24	25-29	30-34	35-39	40-44
bb_1	15-19	20-24	25-29	30-34	35-39	40-44	45+
TC	20-24	25-29	30-34	35-39	40-44	45+	45+
BB_4	25-29	30-34	35-39	40-44	45+	45+	45+
BB_3	30-34	35-39	40-44	45+	45+	45+	45+
BB_2	35-39	40-44	45+	45+	45+	45+	45+
BB_1	40-44	45+	45+	45+	45+	45+	45+

[+] EB: Echol Boom, bb: baby bust, TC: Transition cohort between the baby boom and baby bust cohorts; BB: Baby Boom. Also note that $BB_4 > TC > bb_1 > bb_2$.

Table 10

Population Distribution and Change via Cohort Replacement for the Reproductive Female Population in the Blackhawk SD: 1990-2015[1]

Age Cohort	Female Population			
	1990	2000	2010	2015
15-19	381	407	403	354
20-24	310	210	266	238
25-29	**425**	265	296	192
30-34	**504**	378	300	391
35-39	**517**	**534**	342	452
40-44	**491**	**574**	438	367

Age Cohort	1990→2000	2000→2010	2010→2015
	POPULATION DISTRIBUTION CHANGE VIA "REPLACEMENT" BY YOUNGER COHORTS	POPULATION DISTRIBUTION CHANGE VIA "REPLACEMENT" BY YOUNGER COHORTS	POPULATION DISTRIBUTION CHANGE VIA "REPLACEMENT" BY YOUNGER COHORTS
15-19	+26 [-31]	-+4 [+2]	-49 [-31]
20-24	-100 [-197]	+56 [-185]	-28 [-165]
25-29	-160 [-116]	+31 [-111]	-104 [-74]
30-34	-126 [+68]	-78 [+90]	+91 [+95]
35-39	+17 [+109]	-192 [+77]	+110 [+152]
40-44	+83 [+70]	-136 [+60]	-71 [+25]

Age Cohort	1990→2000	2000→2010	2010→2015
	PERCENTAGE CHANGE IN POPULATION DISTRIBUTION VIA "REPLACEMENT" BY YOUNGER COHORTS	PERCENTAGE CHANGE IN POPULATION DISTRIBUTION VIA "REPLACEMENT" BY YOUNGER COHORTS	PERCENTAGE CHANGE IN POPULATION DISTRIBUTION VIA "REPLACEMENT" BY YOUNGER COHORTS
15-19	+7% [-7%]	-1% [0%]	-12% [-8%]
20-24	-32% [-48%]	+27% [-41%]	-11% [-41%]
25-29	-38% [-30%]	+12% [-27%]	-35% [-28%]
30-34	-25% [+22%]	-21% [+43%]	+30% [+32%]
35-39	+3% [+26%]	-36% [+29%]	+32% [+51%]
40-44	+17% [+14%]	-24% [+16%]	-16% [+7%]

[1] Data by 5-year cohort was **not** available in 1990 for municipalities with less than 2,500 residents; thus, the data in this table pertain to the 3 townships for which such data were available in 1990—Chippewa, Patterson and South Beaver. Table 11 has the data for all municipalities for 2000-2015.

Table 11

Population Distribution and Change via Cohort Replacement for the Reproductive Female Population in the Blackhawk School District: 2000-2015[1]

Age Cohort	Female Population		
	2000	2010	2015
15-19	580	546	464
20-24	298	389	382
25-29	381	415	336
30-34	519	413	504
35-39	**748**	469	591
40-44	**763**	586	470

Age Cohort	2000→2010	2010→2015
	Population Distribution Change via "Replacement" by Younger Cohorts	Population Distribution Change via "Replacement" by Younger Cohorts
15-19	-34 [+6]	-82 [-71]
20-24	+91 [-221]	-7 [-164]
25-29	+34 [-165]	-79 [-53]
30-34	-106 [+115]	+91 [+89]
35-39	-279 [+88]	+122 [+178]
40-44	-177 [+67]	-116 [+1]

Age Cohort	2000→2010	2010→2015
	Percentage Change in Population Distribution via "Replacement" by Younger Cohorts	Percentage Change in Population Distribution via "Replacement" by Younger Cohorts
15-19	-6% [+1%]	-15% [-13%]
20-24	+31% [-36%]	-2% [-30%]
25-29	+9% [-28%]	-19% [-14%]
30-34	-20% [+39%]	+22% [+21%]
35-39	-37**%** [+23%]	+26% [+43%]
40-44	-23% [+13%]	-20% [0%]

[1] Data are from US decennial censuses in 2000 and 2010; and from the yearly ACS census for 2015—the 5-yr. estimate; shaded cells indicate baby bust age cohorts—Transition cohort, baby bust cohort #1 and baby bust cohort #2, respectively.

Table 12

Number of Births by Age of Mother and Year for Blackhawk School District Residents[1]

	15-19	20-24	25-29	30-34	35-39	40-44	45+	∑
				1990-1994				
∑	58	156	320	270	91	11	1	907
% of ∑	.064	.172	***.353***	***.298***	.100	.012	.001	
Avg/Yr	11.6	31.2	64.0	54.0	18.2	2.2	0.2	181.4
				1995-1999				
∑	48 (-10)	123 (-33)	204 (-116)	291 (+21)	103 (+12)	17 (+6)	0 (-1)	786
% of ∑	.061	.156	***.260***	***.370***	.131	.022	0	
Avg/Yr	9.6	24.6	40.8	58.2	20.6	3.4	0	157.2
				2000-2004				
∑	39 (-9)	119 (-4)	223 (+19)	243 (-48)	120 (+17)	16 (-1)	2 (+2)	762
% of ∑	.051	.156	***.293***	***.319***	.157	.021	.003	
Avg/Yr	7.8	23.8	44.6	48.6	24.0	3.2	0.4	152.4
				2005-2009				
∑	52 (+13)	142 (+23)	232 (+9)	183 (-60)	108 (-12)	30 (+14)	0 (-2)	747
% of ∑	.070	.190	***.311***	***.245***	.145	.040	0	
Avg/Yr	10.4	28.4	46.4	36.6	21.6	6.0	0	149.4
				2010-2014				
∑	37 (-15)	133 (-9)	251 (+19)	236 (+53)	83 (-25)	17 (-13)	0	757
% of∑	.049	.176	***.332***	***.312***	.110	.022	0	
Avg/Yr	7.4	26.6	50.2	47.2	16.6	3.4	0	151.4
				2015-2017				
∑	13	51	138	180	57	8	1	448
∑ x (5/3)	22 (-15)	85 (-48)	230 (-21)	300 (+64)	95 (+12)	13 (-4)	2 (+2)	747
% of ∑	.030	.114	***.308***	***.402***	.127	.017	.003	
Avg/Yr	4.4	17.0	46.0	60.0	19.0	2.6	0.4	149.4
%Δ[2]	-.034	-.058	-.045	+.104	+.027	+.005	+.002	
		-.14			+.14			

[1] * Source: Pennsylvania Department of Health

[2] %Δ from 1990-94 to 2015-17

Table 13
Evidence of Net In-Migration of Families with Preschool Children by Municipality and Overall School District: 1995-99, 2005-09 and 2010-14

Panel A 1995-99

Municipalities	Column A 2000 Census Children < 5 Yrs. Of Age	Column B Births 1995-99	Column C Net In-Migration (Preschoolers) ∆ (A-B)	Column D Avg. No. of New Children per Year of Age (0-4)
Chippewa Twp	340	299	+41	+8.2
Darlington Twp	88	92	-4	-0.8
Patterson Twp	157	150	+7	+1.4
So Beaver Twp	106	102	+4	+0.8
Darlington Boro	23	33	-10	-2.0
Patterson Hts Boro	44	29	+15	+3.0
W. Mayfield Boro	77	48	+29	+5.8
Enon Valley Boro	20	33	-13	-2.6
TOTAL	***855***	***786***	***+69***	***+13.8***

Panel B 2005-09

Municipalities	Column A 2010 Census Children < 5 Yrs. Of Age	Column B Births 2005-09	Column C Net In-Migration (Preschoolers) ∆ (A-B)	Column D Avg. No. of New Children per Year of Age (0-4)
Chippewa Twp	326	288	+38	+7.6
Darlington Twp	87	73	+14	+2.8
Patterson Twp	169	163	+6	+1.2
So Beaver Twp	100	102	-2	-0.4
Darlington Boro	21	31	-10	-2.0
Patterson Hts Boro	18	6	+12	+2.4
W. Mayfield Boro	79	57	+22	+4.4
Enon Valley Boro	23	27	-4	-0.9
TOTAL	***823***	***747***	***+76***	***+15.2***

Panel C 2010-14

Municipalities	Column A 2015 Census Children < 5 Yrs. Of Age	Column B Births 2010-14	Column C Net In-Migration (Preschoolers) ∆ (A-B)	Column D Avg. No. of New Children per Year of Age (0-4)
Chippewa Twp	279	347	-68	-13.6
Darlington Twp	59	79	-20	-4.0
Patterson Twp	163	129	+54	+10.8
So Beaver Twp	105	91	+14	+2.8
Darlington Boro	23	22	+1	+0.2
Patterson Hts Boro	24	15	+9	+1.8
W. Mayfield Boro	57	54	+3	+0.6
Enon Valley Boro	20	20	0	0
TOTAL	***750***	***757***	***-7***	***-1.4***

Table 14

Overall Net Migration for the Blackhawk School District Using Baseline "Replacement" of Grade 12 Students in Year t-1 by Kindergarten Students in Year t: 2009-2018

	A	B	C	D	E	F
	K_t	$G12_{t-1}$	Δ_1 without migration[ς]	Total Student Population$_t$	Δ_2[ξ]	Net Migration[λ`]
t= 2009-10	165	231	-66	2,557	-56	+10
2010-11	171	211	-40	2,515	-42	--2
2011-12	148	192	-44	2,459	-56	-12
2012-13	176	206	-30	2,465	+6	=36
2013-14	184	215	-31	2,477	+12	+43
2014-15	176	222	-46	2,427	-50	-4
2015-16	157	167	-10	2,410	-17	-7
2016-17	176	203	-27	2,395	-15	+12
2017-18	168	187	-19	2,355	-40	-21
2018-19	178	218	-40	2,330	-25	+15
Last 10 years: ∑ 2009-2018			-353 (-211)		-283 (-136)	+70 (+75)
Last 5 years: ∑ 2014-2018			-142		-147	-5

[ς] $\Delta_1 = K_t - G12_{t-1}$, i.e., assuming the counterfactual case of "what if" no one migrated; rather there was only G12 students exiting via graduation and K students entering. Thus the "net migration" pertains to year t-1.

[ξ] Δ_2=Student Population$_t$ – Student Population$_{t-1}$; in 2008 the total student population was 2,613.

[λ] Net migration is (Δ_2-Δ_1) where Δ_2 is the change in actual or observed total students and Δ_1 is the counterfactual "what if" case depicting would happen to the total student population with no migration—in or out. Thus, the difference (Δ_2 - Δ_1) is net migration.

Table 14A

Net Migration at the Primary Level: 2009-2018

		K_t	$G2_{t-1}$	Δ_1 without migration[ς]	Total Student $Population_t$	Δ_2[ξ]	Net Migration[λ]
t=	2009-10	165	150	+15	531	+20	+5
	2010-11	171	189	-18	527	-4	+14
	2011-12	148	183	-35	482	-45	-10
	2012-13	176	164	+12	504	+22	+10
	2013-14	184	176	+8	535	+31	+23
	2014-15	176	161	+15	555	+20	+5
	2015-16	157	192	-35	518	-37	-2
	2016-17	176	188	-12	505	-13	-1
	2017-18	168	176	-8	485	-20	-12
	2018-19	178	153	+25	512	+27	+2
Last 10 years: ∑ 2009-2018				-33 (-18)	+1 (+24)		+34 (+42)
Last 5 years: ∑ 2014-2018				-15	-23		-8

[ς] $\Delta_1 = K_1 – G2_{t-1}$

[ξ] Δ_2= Primary Student $Population_t$ – Primary Student $Population_{t-1}$; in 2008 the total Primary (K-G2) student population was 511.

[λ] The basic equation for net migration is (Δ_2-Δ_1); that is, the actual change in primary student population minus what it would have been without migration, i.e., replacing the G2 population at t-1 who move up to the intermediate school by t with the new entrants at K in t and with all other grades having all students staying and moving up one grade. The difference (Δ_2 - Δ_1) is the net migration that occurred.

Table 14B

Net Migration at the Intermediate Level: 2009-2018

		$G2_{t-1}$	$G4_{t-1}$	Δ_1 without migration[ς]	Total Student $Population_t$	Δ_2[ξ]	Net Migration[λ]
t=	2009-10	150	190	-40	376	-35	+5
	2010-11	189	220	-31	343	-33	-2
	2011-12	183	154	+29	379	+36	+7
	2012-13	164	192	-28	368	-11	+17
	2013-14	176	193	-17	360	-8	+9
	2014-15	161	177	-16	342	-18	-2
	2015-16	192	182	+10	371	+29	+19
	2016-17	188	173	+13	396	+25	+12
	2017-18	176	205	-29	370	-26	+3
	2018-19	153	190	-37	337	-33	+4
Last 10 years: ∑ 2009-2018				-146 (-87)	-74 (-51)		+72 (+36)
Last 5 years: ∑ 2014-2018				-59	-23		+36

ς $\Delta_1 = G2_{t-1} – G6_{t-1}$

ξ Δ_2=Elementary Student $Population_t$ – Elementary Student $Population_{t-1}$; in 2008 the total Intermediate (G3-G4) student population was 411.

λ The basic equation for net migration is (Δ_2-Δ_1); that is, the actual change in intermediate student population minus what it would have been without migration, i.e., replacing the G4 population at t-1 who move up to the middle school by t with the new entrants at G3 in t-1 and with all other grades having all students staying and moving up one grade. The difference (Δ_2 - Δ_1) is the net migration that occurred.

Table 14C

Net Migration at the Middle School Level: 2009-2018

		$G4_{t-1}$	$G8_{t-1}$	Δ_1 without migration$^{\varsigma}$	Total Student $Population_t$	Δ_2^{ξ}	Net Migration$^{\lambda}$
t=	2009-10	190	225	-35	794	-24	+11
	2010-11	220	217	+3	808	+14	+11
	2011-12	154	180	-26	781	-27	-1
	2012-13	192	215	-23	753	-28	-5
	2013-14	193	183	+10	776	+23	+13
	2014-15	177	218	-41	734	-42	-1
	2015-16	182	164	+18	747	+13	-5
	2016-17	173	191	-16	725	-22	-6
	2017-18	205	197	+8	743	+18	+10
	2018-19	190	181	+9	752	+9	0
Last 10 years: ∑ 2009-2018				-66 (-71)	+48 (-42)		+27 (+29)
Last 5 years: ∑ 2014-2018				-22	-24		-2

$^{\varsigma}$ $\Delta_1 = G4_{t-1} - G8_{t-1}$

$^{\xi}$ Δ_2= Middle Student $Population_t$ – Middle School Student $Population_{t-1}$; in 2008 the total Middle School (G5-G8) student population was 818.

$^{\lambda}$ The basic equation for net migration is (Δ_2-Δ_1); that is, the actual change in middle school student population minus what it would have been without migration, i.e., replacing the G8 population at t-1 who move up to the high school by t with the new entrants from G4 in t-1 and with all other grades having all students staying and moving up one grade. The difference (Δ_2 - Δ_1) is the net migration that occurred.

Table 14D

“Net Migration at the High School Level: 2009-2018

	$G8_{t-1}$	$G12_{t-1}$	Δ_1 without migration$^{\varsigma}$	Total Student $Population_t$	Δ_2^{ξ}	Net $Migration^{\lambda}$
t= 2009-10	225	231	-6	856	-17	-11
2010-11	217	211	+6	837	-19	-25
2011-12	180	192	-12	817	-20	-8
2012-13	215	206	+9	840	+23	+14
2013-14	183	215	-32	806	-34	-2
2014-15	218	222	-4	785	-21	-17
2015-16	164	167	-3	774	-11	-8
2016-17	191	203	-12	769	-5	+7
2017-18	197	187	+10	757	-12	-22
2018-19	181	218	-37	729	-28	+9
Last 10 years: ∑ 2009-2018			+-81 (-35)	-144 (-67)		-63 (-32)
(-42)Last 5 years: ∑ 2014-2018			-46	-77		-31

$^{\varsigma}$ $\Delta_1 = G8_{t-1} - G12_{t-1}$

$^{\xi}$ Δ_2= High School Student $Population_t$ – High School Student $Population_{t-1}$; in 2008 the total High School (G9-G12) student population was 873.

$^{\lambda}$ The basic equation for net migration is (Δ_2-Δ_1); that is, the actual change in high school student population minus what it would have been without migration, i.e., replacing the G12 population at t-1 who graduate by t with the new entrants at G9 in t)from G8 in t-1) and with all other grades having all students staying and moving up one grade. The difference (Δ_2 - Δ_1) is the net migration that occurred.

Table 15

Summary of E3 and NM by Educational Level and Overall—Last 5 Years, Prior 5 Years and Decade Overall: 2009-2018

	NM			**E3**			**Enrollment ∆**		
Educational Level	**Last 5 Yrs**	**Prior 5 Yrs**	**10 Years**	**Last 5 Yrs**	**Prior 5 Yrs**	**10 Years**	**Last 5 Yrs**	**Prior 5 Yrs**	**10 Years**
Primary	-8	+42	+34	-15	-18	-33	-23	+24	**+1**
Intermediate	+36	+36	+72	-59	-87	-146	-23	-51	-74
Middle School	-2	+29	+27	-22	-71	-93	-24	-42	-66
High School	-31	-32	-63	-46	-35	-81	-77	-67	-144
Total	**-5**	**+75**	**+70**	**-142**	**-211**	**-353**	**-147**	**-136**	**-283**

Table 16

Blackhawk School District Retention Ratios 2006-2017§ (Four-Year Averages)

	2006-2009	2010-2013	2014-2017
K→G1	1.027	1.029	.969
G1→G2	1.026	1.012	1.012
G2→G3	1.007	1.031	1.018
G3→G4	1.005	1.014	1.034
G4→G5	.986	1.007	1.004
G5→G6	1.014	1.017	1.003
G6→G7	1.017	.997	.980
G7→G8	1.004	.987	1.012
G8→G9	1.054	1.046	.988
G9→G10	.943	.982	1.017
G10→G11	.954	.949	.976
G11→G12	.975	1.010	1.001
B_{t-5}→K_t*	***1.200***	***1.116***	***1.135***

§ Data for the retention ratios for 2014-2017 included student populations for 2014-2018—the beginning school year enrollment; similarly data for the years 2010-2013 included student populations for 2010-2014 while that for 2006-2009 used the beginning of school year enrollment in 2006-2010. For the Birth to Kindergarten ratio, we use four year averages for (.75 x Birth at t-5) + (.25 x Birth at t-6 and Kindergarten enrollment at t; eg., the 2010-2013 header for B→K here refers to the K enrollments in 2011-2014 and births from 2005-2009, while the header for 2014-2017 refers to the most recent K enrollments in 2015-2018 and births from 2009-2013.

Table 17

Blackhawk School District Cumulative Retention Ratios 2006-2017[§]
(Four-Year Averages)

	2006-2009	2010-2013	2014-2017
K→G1	1.027	1.029	.969
G1→G2	1.054	1.041	.981
G2→G3	1.061	1.074	.998
G3→G4	1.066	1.089	1.032
G4→G5	1.051	1.096	1.036
G5→G6	1.066	1.115	***1.039***
G6→G7	1.084	1.112	1.019
G7→G8	1.089	1.097	1.031
G8→G9	***1.147***	***1.148***	1.019
G9→G10	1.082	1.127	1.036
G10→G11	1.032	1.069	1.011
G11→G12	1.006	1.080	1.012
B_{t-5}→K_t*	***1.200***	***1.116***	***1.135***

[§] Data for the retention ratios for 2014-2017 included student populations for 2014-2018—the beginning school year enrollment; similarly data for the years 2010-2013 included student populations for 2010-2014 while that for 2006-2009 used the beginning of school year enrollment in 2006-2010. For the Birth to Kindergarten ratio, we use four year averages for (.75 x Birth at t-5) + (.25 x Birth at t-6 and Kindergarten enrollment at t; eg., the 2010-2013 header for B→K here refers to the K enrollments in 2011-2014 and births from 2005-2009, while the header for 2014-2017 refers to the most recent K enrollments in 2015-2018 and births from 2009-2013.

Table 18

Blackhawk School District Cumulative B→K and Retention Ratios: 2006-2017[§] [Based on Four-Year Averages]

	2006-2009	2010-2013	2014-2017
K→G1	1.23	1.15	1.10
G1→G2	1.26	1.16	1.11
G2→G3	1.27	1.20	1.13
G3→G4	1.28	1.21	1.17
G4→G5	1.26	1.22	***1.18***
G5→G6	1.28	1.24	1.18
G6→G7	1.30	1.24	1.16
G7→G8	1.31	1.22	1.17
G8→G9	***1.38***	***1.28***	1.16
G9→G10	1.30	1.26	1.18
G10→G11	1.24	1.19	1.15
G11→G12	1.21	1.21	1.15
B_{t-5}→K_t*	***1.200***	***1.116***	***1.135***

[§] Data for the retention ratios for 2014-2017 included student populations for 2014-2018—the beginning school year enrollment; similarly data for the years 2010-2013 included student populations for 2010-2014 while that for 2006-2009 used the beginning of school year enrollment in 2006-2010. For the Birth to Kindergarten ratio, we use four year averages for (.75 x Birth at t-5) + (.25 x Birth at t-6 and Kindergarten enrollment at t; eg., the 2010-2013 header for B→K here refers to the K enrollments in 2011-2014 and births from 2005-2009, while the header for 2014-2017 refers to the most recent K enrollments in 2015-2018 and births from 2009-2013.

Table 19

Total Student Enrollment in the Blackhawk School District by Year and Level: 2004-2018

School Yr.	Primary	Intermediate	Middle	High School	Total
2004	552	420	897	928	2797
2005	***586***	379	845	***958***	2768
2006	550	***386***	841	930	2707
2007	544	***398***	829	917	2688
2008	511	***411***	818	873	2613
2009	***531***	376	794	856	2557
2010	527	343	***808***	837	2515
2011	482	***379***	781	817	2459
2012	***504***	368	753	***840***	***2465***
2013	***535***	360	***776***	806	***2477***
2014	***555***	342	734	785	2427
2015	518	***371***	***747***	774	2410
2016	505	***396***	725	769	2395
2017	485	370	***743***	757	2355
2018	***512***	337	***752***	729	2330
∆ 2018 - 2004	-40	-83	-145	-199	-467
∆ 2018 - 2008[1]	***+1 (+24)***	***-74 (-51)***	***-66 (-42)***	***-144 (-67)***	***-283 (-136)***
∆ 2018 - 2013[2]	***-23***	***-23***	***-24***	***-77***	***-147***
Ave. Number of Students/Year					
2004-2008	549	399	846	921	2715
2009-2013	516	365	782	831	2495
2014-2018	515	363	740	763	2383
Ave. Grade Size/Year					
2004-2008	183	200	212	230	209
2009-2013	172	183	196	208	192
2014-2018	172	182	185	191	183

[1] *Last 10 years, numbers in parentheses are 1st 5 years of the decade*
[2] *Last 5 years*

Table 20

Overall Alternative Schooling by Type of Alternative

Yr.	Home Schooled	Charter	Cyber Charter	Private/Parochial	$\sum$
2007	NA	28	66	190	284
2008	NA	35	55	141	231
2009	NA	25	57	131	213
2010	38	23	54	127	244 (206)[1]
2011	33	23	57	125	238 (205)
2012	37	36	47	122	242 (205)
2013	41	38	35	125	239 (198)
2014	57	37	37	130	241 (204)
2015	54	31	37	147	269 (215)
2016	54	31	36	145	270 (213)
2017	51	32	30	150	263 (212)

[1] Numbers in parentheses equal Σ minus "home schooled" for comparison with 2007-2009 where "home schooled" was not available

Table 21

New Housing in Blackhawk School District by Municipality[1]

	Municipality				
Year	Chippewa Township	Darlington Township	Patterson Township	S. Beaver Township	Σ
2007	23[2]				23
2008	8				8
2009	12				12
2010	42[3]	6			48
2011	26	0			24
2012	32	2	10	5	49
2013	31	0	0	5	36
2014	10	8	0	6	24
2015	5	1	1	4	11
2016	9	2	3	0	14
2017	12	0	0	5	17
2018	8	2	0	4	14
Σ last 7 yrs.	107	15	14	29	165[4]
Ave. last 7 years	15.3	2.1	2.0	4.1	23.7 = 24

[1] Four boroughs had no new homes built in the last 5 years, excluding 1 replacement—Darlington. Patterson Heights, West Mayfield and Enon Valley
[2] 158 with apartments
[3] The 2010-2013 Total in Chippewa Township: 131, or 32.7/yr. ave. or 33/yr.
[4] Total known new homes 2007-2018: 280

Table 21A

Housing Developments for Blackhawk student counts by grade or educational level (Primary, Intermediate, Middle School & High School) and by Development & type of housing unit—Blackhawk School District

I. Chippewa Township

1. Chippewa Heights
   SFDs, Townhomes, Quads/Duplexes

2. Hickory Woods (all SFDs)

3. Shenango Woods (all SFDs)

4. Spring Blossom
   Duplexes, Townhomes, 3-story Multi-Unit

5. Timberwood (all Townhomes)

6. Waterside Estates (all SFDs)

II. Patterson Township

7. Darlington Court (all Duplexes)

III. South Beaver Township

8. Blackhawk Hill Condos (all Condo THs)

Table 22

Blackhawk School District Forecasts per Grade: 2019-2028 Fertility/Aging/Embedded Growth Scenario with Current Retention and Birth to Kindergarten Ratios and Current Fertility Levels (Scenario I)*

	K	G1	G2	Total K→G2	G3	G4	Total G3→G4	G5	G6	G7	G8	Total G5→G8	G9	G10	G11	G12	Total G9 → G12	Total K → G12
2018	178	166	168	512	155	182	337	188	210	178	176	752	189	192	189	159	729	2,330
2019	180	172	168	520	171	160	331	183	189	206	180	758	174	192	187	189	742	2351
2020	167	174	174	515	171	177	348	161	184	185	208	738	178	177	187	187	729	2,330
2021	173	162	176	511	177	177	354	178	161	180	187	706	206	181	173	187	747	2,318
2022	174	167	164	505	179	183	362	178	179	158	182	697	185	210	177	173	745	2,309
2023	175	169	169	513	167	185	352	184	179	175	160	698	180	188	205	177	750	2,313
2024	175	170	171	516	172	173	345	186	185	175	177	723	158	183	183	205	729	2,313
2025	175	170	172	517	174	179	353	174	187	181	177	719	175	161	179	183	698	2,287
2026	175	170	172	517	175	180	355	180	175	183	183	721	175	178	157	179	689	2,282
2027	175	170	172	517	175	181	356	181	181	172	185	719	181	178	174	157	690	2,282
2028	175	170	172	517	175	181	356	182	182	177	174	715	183	184	174	174	715	2,303

	2018	2023	2028	∆2023-2018	∆2028-2023	∆2028-2018
K→G2	512	513	517	+1 (0%)	+4 (+1%)	+5 (+1%)
G3→G4	337	352	356	+15 (+4%)	+4 (+1%)	+19 (+6%)
G5→G8	752	698	715	-54 (-7%)	+17 (+1%)	-37 (-5%)
G9→G12	729	750	715	+21 (+3%)	-35 (-5%)	-14 (-2%)
Total	2,330	2,313	2,303	-17 (-1%)	-10 (0%)	-27 (-1%)

* This scenario uses the following parameters: (1) Baseline four-year retention ratios (2014-2017), as shown in Table 16; (2) Birth at t-5 to K enrollment ratio of 1.135; this is derived as follows: (a) a baseline .75 (t-5 Births) + .25 (t-6 Births) for births in years 2009-2013and 2015-2018 K enrollments. For years 2019-2022, observed births in 2013-2017 in the Blackhawk School District were used. For years 2023-2028, the average number of births for the most recent 4 years was used (154); see Table 2.

Table 23

Blackhawk School District Forecasts per Grade: 2019-2028 Fertility/Aging/Embedded Growth Scenario with Current Retention and Birth to Kindergarten Ratios and Higher Fertility Levels (Scenario II)*

	K	G1	G2	Total K→G2	G3	G4	Total G3→G4	G5	G6	G7	G8	Total G5→G8	G9	G10	G11	G12	Total G9 → G12	Total K → G12
2018	178	166	168	512	155	182	337	188	210	178	176	752	189	192	189	159	729	2,330
2019	180	172	168	520	171	160	331	183	189	206	180	758	174	192	187	189	742	2351
2020	167	174	174	515	171	177	348	161	184	185	208	738	178	177	187	187	729	2,330
2021	173	162	176	511	177	177	354	178	161	180	187	706	206	181	173	187	747	2,318
2022	174	167	164	505	179	183	362	178	179	158	182	697	185	210	177	173	745	2,309
2023	186	169	169	524	167	185	352	184	179	175	160	698	180	188	205	177	750	2,324
2024	186	180	171	537	172	173	345	186	185	175	177	723	158	183	183	205	729	2,334
2025	186	180	182	548	174	179	353	174	187	181	177	719	175	161	179	183	698	2,318
2026	186	180	182	548	185	180	365	180	175	183	183	721	175	178	157	179	689	2,323
2027	186	180	182	548	185	191	376	181	181	172	185	719	181	178	174	157	690	2,333
2028	186	180	182	548	185	191	376	192	182	177	174	725	183	184	174	174	715	2,364

	2018	2023	2028	Δ2023-2018	Δ2028-2023	Δ2028-2018
K→G2	512	524	548	+12 (+2%)	+24 (+5%)	+36 (+7%)
G3→G4	337	352	376	+15 (+4%)	+24 (+7%)	+39 (+12%)
G5→G8	752	698	725	-54 (-7%)	+27 (+4%)	-27 (-4%)
G9→G12	729	750	715	+21 (+3%)	-35 (-5%)	-14 (-2%)
Total	2,330	2,324	2,364	-6 (0%)	+40 (+2%)	+34 (+1%)

* This scenario uses the following parameters: (1) Baseline four-year retention ratios (2014-2017), as shown in Table 16; (2) Birth at t-5 to K enrollment ratio of 1.135; this is derived as follows: (a) a baseline .75 (t-5 Births) + .25 (t-6 Births) for births in years 2009-2013and 2015-2018 K enrollments. For years 2019-2022, observed births in 2013-2017 in the Blackhawk School District were used. For years 2023-2028, the average number of births is assumed to be above the current level in the last 4 years (154), increasing by 10/yr to 164/yr.

Table 24

Blackhawk School District Forecasts per Grade: 2019-2028 Fertility/Aging/Embedded Growth Scenario with Current Retention and Birth to Kindergarten Ratios and Lower Fertility Levels (Scenario III)*

	K	G1	G2	Total K→G2	G3	G4	Total G3→G4	G5	G6	G7	G8	Total G5→G8	G9	G10	G11	G12	Total G9 → G12	Total K → G12
2018	178	166	168	512	155	182	337	188	210	178	176	752	189	192	189	159	729	2,330
2019	180	172	168	520	171	160	331	183	189	206	180	758	174	192	187	189	742	2351
2020	167	174	174	515	171	177	348	161	184	185	208	738	178	177	187	187	729	2,330
2021	173	162	176	511	177	177	354	178	161	180	187	706	206	181	173	187	747	2,318
2022	174	167	164	505	179	183	362	178	179	158	182	697	185	210	177	173	745	2,309
2023	169	169	169	507	167	185	352	184	179	175	160	698	180	188	205	177	750	2,307
2024	169	164	171	504	172	173	345	186	185	175	177	723	158	183	183	205	729	2,301
2025	169	164	166	499	174	179	353	174	187	181	177	719	175	161	179	183	698	2,269
2026	169	164	166	499	169	180	349	180	175	183	183	721	175	178	157	179	689	2,258
2027	169	164	166	499	169	175	344	181	181	172	185	719	181	178	174	157	690	2,252
2028	169	164	166	499	169	175	344	176	182	177	174	709	183	184	174	174	715	2,267

	2018	2023	2028	∆2023-2018	∆2028-2023	∆2028-2018
K→G2	512	507	499	-5 (-1%)	-8 (-2%)	-13 (-3%)
G3→G4	337	352	344	+15 (+4%)	-8 (-2%)	+7 (+2%)
G5→G8	752	698	709	-54 (-7%)	+11 (+2%)	-43 (-6%)
G9→G12	729	750	715	+21 (+3%)	-35 (-5%)	-14 (-2%)
Total	2,330	2,307	2,267	-23 (-1%)	-40 (-2%)	-63 (-3%)

* This scenario uses the following parameters: (1) Baseline four-year retention ratios (2014-2017), as shown in Table 14; (2) Birth at t-5 to K enrollment ratio of .939; this is derived as follows: (a) a baseline .75 (t-5 Births) + .25 (t-6 Births) for births in years 2009-2013and 2015-2018 K enrollments. For years 2019-2022, observed births in 2013-2017 in the Blackhawk School District were used. For years 2023-2028, births were assumed to return to their prior level in 2005-09 and for the last 3 years—149 births per year. See Table 2.

Table 25

Blackhawk School District Forecasts per Grade: 2019-2028 Fertility/Aging/Embedded Growth Scenario with Current Retention and Birth to Kindergarten Ratios, Current Fertility Levels and Direct Impacts from Single Family and Multi-Family Housing (Scenario IV)*

	K	G1	G2	Total K→G2	G3	G4	Total G3→G4	G5	G6	G7	G8	Total G5→G8	G9	G10	G11	G12	Total G9 → G12	Total K → G12
2018	178	166	168	512	155	182	337	188	210	178	176	752	189	192	189	159	729	2,330
2019	180	172	168	520	171	160	331	183	189	206	180	758	174	192	187	189	742	2,351
2020	170	175	175	520	174	179	353	165	186	187	210	748	180	178	188	188	734	2,355
2021	174	168	178	520	180	183	363	182	169	184	191	726	208	185	175	189	757	2,366
2022	175	170	173	518	184	188	372	186	185	170	188	729	190	213	183	176	762	2,381
2023	176	171	173	520	178	191	369	191	188	183	174	736	187	194	209	183	773	2,398
2024	177	172	174	523	178	187	365	195	194	186	187	62	173	191	190	207	761	2,411
2025	176	174	175	525	180	186	366	190	199	192	190	771	187	177	187	191	742	2,404
2026	176	172	178	526	179	189	368	188	193	197	196	774	189	193	174	188	744	2,412
2027	176	172	175	523	182	186	368	191	190	190	202	773	195	192	189	175	751	2,415
2028	176	172	175	523	179	189	368	188	193	187	193	761	200	198	187	189	774	2,426

	2018	2023	2028	∆2023-2018	∆2028-2023	∆2028-2018
K→G2	512	520	523	+8 (+2%)	+3 (0%)	+11 (+2%)
G3→G4	337	369	368	+32 (+10%)	-1 (0%)	+31 (+9%)
G5→G8	752	736	761	-16 (-2%)	+25 (+3%)	+9 (+2%)
G9→G12	729	773	774	+44 (+6%)	+1 (0%)	+45 (+6%)
Total	2,330	2,398	2,426	+68 (+3%)	+28(+1%)	+96 (+4%)

* This scenario uses the following parameters: (1) Baseline four-year retention ratios (2014-2017), as shown in Table 16; (2) Birth at t-5 to K enrollment ratio of 1.135; this is derived as follows: (a) a baseline .75 (t-5 Births) + .25 (t-6 Births) for births in years 2009-2013and 2015-2018 K enrollments. For years 2019-2022, observed births in 2013-2017 in the Blackhawk School District were used. For years 2023-2028, the average number of births for the most recent 4 years was used (154); see Table 2. Additionally, we have incorporated the direct impacts from new housing construction—of both SFDs and multi-unit homes.

Table 25A

Table of Distribution for the Additional Expected Students per Grade per Year Stemming from the Growth in Single Family Housing in the Blackhawk School District (Scenario IV)*

	2019	2020	2021	2022	2023	∑	2024	2025	2026	2027	2028	∑
K	0	2	1	1	1	5	1	1	1	1	1	10
G1	0	1	2	1	1	5	1	1	1	1	1	10
G2	0	1	1	2	1	5	1	1	1	1	1	10
∑	0	4	4	4	3	15	3	3	3	3	3	30
G3	0	2	2	2	2	8	2	2	1	1	1	15
G4	0	2	2	2	1	7	2	2	2	1	1	15
∑	0	4	4	4	3	15	4	4	3	2	2	30
G5	0	2	2	2	2	8	2	2	1	1	1	15
G6	0	2	2	2	1	7	2	2	2	1	1	15
G7	0	2	2	2	2	8	2	2	1	1	1	15
G8	0	2	2	2	1	7	2	2	2	1	1	15
∑	0	8	8	8	6	30	8	8	6	4	4	60
G9	0	1	1	1	1	4	1	1	1	1	0	8
G10	0	1	1	1	1	4	1	1	1	0	0	7
G11	0	1	1	1	1	4	1	1	1	1	0	8
G12	0	1	1	1	0	3	1	1	1	1	0	7
∑	0	4	4	4	3	15	4	4	4	3	0	30

* Student/housing unit ratios: 1.00 for SFDs with a distribution by level of .20, .20, .40 and .20 for the primary, intermediate, middle and high school levels, respectively.

Table 25B

Table of Distribution for the Additional Expected Students per Grade per Year Stemming from the Growth in Multi-Family Housing in the Blackhawk School District (Scenario IV)*

	2019	2020	2021	2022	2023	∑	2024	2025	2026	2027	2028	∑
K	0	1	0	0	0	1	1	0	0	0	0	2
G1	0	0	1	0	0	1	0	1	0	0	0	2
G2	0	0	0	1	0	1	0	0	1	0	0	2
∑	0	1	1	1	0	3	1	1	1	0	0	6
G3	0	1	0	1	0	2	0	1	0	0	0	3
G4	0	0	1	0	0	1	1	0	1	0	0	3
∑	0	1	1	1	0	3	1	1	1	0	0	6
G5	0	2	0	0	0	2	1	0	0	0	0	3
G6	0	0	2	0	0	2	0	1	0	0	0	3
G7	0	0	0	2	0	2	0	0	2	0	0	4
G8	0	0	0	0	1	1	0	0	0	2	0	3
∑	0	2	2	2	1	7	1	1	2	2	0	13
G9	0	1	0	0	0	1	0	1	0	0	0	2
G10	0	0	1	0	0	1	0	0	1	0	0	2
G11	0	0	0	1	0	1	0	0	0	0	0	1
G12	0	0	0	0	0	0	1	0	0	0	0	1
∑	0	1	1	1	0	3	1	1	1	0	0	6

* Student/housing unit ratios: .17 for multi-family housing units with a distribution by level of .20, .20, .40 and .20 for the primary, intermediate, middle and high school levels, respectively. 7

Table 25C

Table of Distribution for the Additional Expected Students per Grade per Year Stemming from the Growth in Single Family and Multi-Family Housing in the Blackhawk School District (Scenario IV)*

	2019	2020	2021	2022	2023	∑	2024	2025	2026	2027	2028	∑
K	0	3	1	1	1	6	2	1	1	1	1	12
G1	0	1	3	1	1	6	1	2	1	1	1	12
G2	0	1	1	3	1	6	1	1	2	1	1	12
∑	0	5	5	5	3	18	4	4	4	3	3	36
G3	0	3	2	3	2	10	2	3	1	1	1	18
G4	0	2	3	2	1	8	3	2	3	1	1	18
∑	0	5	5	5	3	18	5	5	4	2	2	36
G5	0	4	2	2	2	10	3	2	1	1	1	18
G6	0	2	4	2	1	9	2	3	2	1	1	18
G7	0	2	2	4	2	10	2	2	3	1	1	19
G8	0	2	2	2	2	8	2	2	2	3	1	18
∑	0	10	10	10	7	37	9	9	8	6	4	73
G9	0	2	1	1	1	5	1	2	1	1	0	10
G10	0	1	2	1	1	5	1	1	2	0	0	9
G11	0	1	1	2	1	5	1	1	1	1	0	9
G12	0	1	1	1	0	3	2	1	1	1	0	8
∑	0	5	5	5	3	18	5	5	5	3	0	36

* Student/housing unit ratios: 1.00 for SFDs and .17 for multi-family units, with a distribution by level of .20, .20, .40 and .20 for the primary, intermediate, middle and high school levels, respectively.

Table 26

Blackhawk School District Forecasts per Grade: 2019-2028 Fertility/Aging/Embedded Growth Scenario with Current Retention and Birth to Kindergarten Ratios, Higher Fertility Levels and Direct Impacts from Single Family and Multi-Family Housing (Scenario V)*

	K	G1	G2	Total K→G2	G3	G4	Total G3→G4	G5	G6	G7	G8	Total G5→G8	G9	G10	G11	G12	Total G9 → G12	Total K → G12
2018	178	166	168	512	155	182	337	188	210	178	176	752	189	192	189	159	729	2,330
2019	180	172	168	520	171	160	331	183	189	206	180	758	174	192	187	189	742	2,351
2020	170	175	175	520	174	179	353	165	186	187	210	748	180	178	188	188	734	2,355
2021	174	168	178	520	180	183	363	182	169	184	191	726	208	185	175	189	757	2,366
2022	175	170	173	518	184	188	372	186	185	170	188	729	190	213	183	176	762	2,381
2023	187	171	173	531	178	191	369	191	188	183	174	736	187	194	209	183	773	2,409
2024	188	182	174	544	178	187	365	195	194	186	187	762	173	191	190	207	761	2,432
2025	187	184	185	556	180	186	366	190	199	192	190	771	187	177	187	191	742	2,435
2026	187	182	188	557	189	189	378	188	193	197	196	774	189	193	174	188	744	2,453
2027	187	182	185	554	192	196	388	191	190	190	202	773	195	192	189	175	751	2,466
2028	187	182	185	554	198	200	398	198	193	187	193	771	200	198	187	189	774	2,497

	2018	2023	2028	Δ2023-2018	Δ2028-2023	Δ2028-2018
K→G2	512	531	554	+19 (+4%)	+23 (+7%)	+42 (+8%)
G3→G4	337	369	398	+32 (+10%)	+29 (+8%)	+61 (+18%)
G5→G8	752	736	771	-16 (-2%)	+35 (+5%)	+19 (+3%)
G9→G12	729	773	774	+44 (+6%)	+1 (0%)	+45 (+6%)
Total	2,330	2,409	2,497	+79 (+3%)	+88 (+4%)	+167 (+7%)

* This scenario uses the following parameters: (1) Baseline four-year retention ratios (2014-2017), as shown in Table 16; (2) Birth at t-5 to K enrollment ratio of 1.135; this is derived as follows: (a) a baseline .75 (t-5 Births) + .25 (t-6 Births) for births in years 2009-2013and 2015-2018 K enrollments. For years 2019-2022, observed births in 2013-2017 in the Blackhawk School District were used. For years 2023-2028, the average number of births for the most recent 4 years was used (164); see Table 2. Additionally, we have incorporated the direct impacts from new housing construction—of both SFDs and multi-unit homes.

Table 26A

Table of Distribution for the Additional Expected Students per Grade per Year Stemming from the Growth in Single Family Housing in the Blackhawk School District (Scenario V)*

	2019	2020	2021	2022	2023	∑	2024	2025	2026	2027	2028	∑
K	0	2	1	1	1	5	1	1	1	1	1	10
G1	0	1	2	1	1	5	1	1	1	1	1	10
G2	0	1	1	2	1	5	1	1	1	1	1	10
∑	0	4	4	4	3	15	3	3	3	3	3	30
G3	0	2	2	2	2	8	2	2	1	1	1	15
G4	0	2	2	2	1	7	2	2	2	1	1	15
∑	0	4	4	4	3	15	4	4	3	2	2	30
G5	0	2	2	2	2	8	2	2	1	1	1	15
G6	0	2	2	2	1	7	2	2	2	1	1	15
G7	0	2	2	2	2	8	2	2	1	1	1	15
G8	0	2	2	2	1	7	2	2	2	1	1	15
∑	0	8	8	8	6	30	8	8	6	4	4	60
G9	0	1	1	1	1	4	1	1	1	1	0	8
G10	0	1	1	1	1	4	1	1	1	0	0	7
G11	0	1	1	1	1	4	1	1	1	1	0	8
G12	0	1	1	1	0	3	1	1	1	1	0	7
∑	0	4	4	4	3	15	4	4	4	3	0	30

* Student/housing unit ratios: 1.00 for SFDs with a distribution by level of .20, .20, .40 and .20 for the primary, intermediate, middle and high school levels, respectively.

Table 26B

Table of Distribution for the Additional Expected Students per Grade per Year Stemming from the Growth in Multi-Family Housing in the Blackhawk School District (Scenario V)*

	2019	2020	2021	2022	2023	∑	2024	2025	2026	2027	2028	∑
K	0	1	0	0	0	1	1	0	0	0	0	2
G1	0	0	1	0	0	1	0	1	0	0	0	2
G2	0	0	0	1	0	1	0	0	1	0	0	2
∑	0	1	1	1	0	3	1	1	1	0	0	6
G3	0	1	0	1	0	2	0	1	0	0	0	3
G4	0	0	1	0	0	1	1	0	1	0	0	3
∑	0	1	1	1	0	3	1	1	1	0	0	6
G5	0	2	0	0	0	2	1	0	0	0	0	3
G6	0	0	2	0	0	2	0	1	0	0	0	3
G7	0	0	0	2	0	2	0	0	2	0	0	4
G8	0	0	0	0	1	1	0	0	0	2	0	3
∑	0	2	2	2	1	7	1	1	2	2	0	13
G9	0	1	0	0	0	1	0	1	0	0	0	2
G10	0	0	1	0	0	1	0	0	1	0	0	2
G11	0	0	0	1	0	1	0	0	0	0	0	1
G12	0	0	0	0	0	0	1	0	0	0	0	1
∑	0	1	1	1	0	3	1	1	1	0	0	6

* Student/housing unit ratios: .17 for multi-family housing units with a distribution by level of .20, .20, .40 and .20 for the primary, intermediate, middle and high school levels, respectively.

Table 26C

Table of Distribution for the Additional Expected Students per Grade per Year Stemming from the Growth in Single Family and Multi-Family Housing in the Blackhawk School District (Scenario V)*

	2019	2020	2021	2022	2023	∑	2024	2025	2026	2027	2028	∑
K	0	3	1	1	1	6	2	1	1	1	1	12
G1	0	1	3	1	1	6	1	2	1	1	1	12
G2	0	1	1	3	1	6	1	1	2	1	1	12
∑	0	5	5	5	3	18	4	4	4	3	3	36
G3	0	3	2	3	2	10	2	3	1	1	1	18
G4	0	2	3	2	1	8	3	2	3	1	1	18
∑	0	5	5	5	3	18	5	5	4	2	2	36
G5	0	4	2	2	2	10	3	2	1	1	1	18
G6	0	2	4	2	1	9	2	3	2	1	1	18
G7	0	2	2	4	2	10	2	2	3	1	1	19
G8	0	2	2	2	2	8	2	2	2	3	1	18
∑	0	10	10	10	7	37	9	9	8	6	4	73
G9	0	2	1	1	1	5	1	2	1	1	0	10
G10	0	1	2	1	1	5	1	1	2	0	0	95
G11	0	1	1	2	1	5	1	1	1	1	0	9
G12	0	1	1	1	0	3	2	1	1	1	0	8
∑	0	5	5	5	3	18	5	5	5	3	0	36

* Student/housing unit ratios: 1.00 for SFDs and .17 for multi-family units, with a distribution by level of .20, .20, .40 and .20 for the primary, intermediate, middle and high school levels, respectively.

Table 27A

Patterson Primary School Forecasts per Grade: 2019-2028 Fertility/Aging/Embedded Growth Scenario with Current Fertility (last 4 Years) (Scenario Via)[*]

	K	G1	G2	Total K→G2
2018	67	80	66	213
2019	75	65	81	221
2020	69	73	66	208
2021	81	67	74	222
2022	75	78	68	221
2023	75	73	79	227
2024	75	73	74	222
2025	75	73	74	222
2026	75	73	74	222
2027	75	73	74	222
2028	75	73	74	222

	∆2023-2018	∆2028-2032	∆2028-2018	∆Peak	Peak Size
Overall	+14	-5	+9	+14	227

[*] This scenario uses the following parameters: (1) Baseline four-year retention ratios (2014-2017), as shown in Table 16; (2) Birth at t-5 to K enrollment ratio of 1.135. For years 2018-2022, the observed births from 2013-2017 in were used. For years 2023-2028, 154 births/yr was assumed. See text for more details as to the breakdowns per primary school.

Table 27B

Northwestern Primary School Forecasts per Grade: 2019-2028
Fertility/Aging/Embedded Growth Scenario with Current Fertility (Last 4 Years)
(Scenario VIb)*

	K	G1	G2	Total K→G2
2018	111	86	102	299
2019	107	108	87	302
2020	99	104	109	312
2021	94	96	105	295
2022	100	91	97	288
2023	101	97	92	290
2024	101	98	98	297
2025	101	98	99	298
2026	101	98	99	298
2027	101	98	99	298
2028	101	98	99	298

	∆2023-2018	∆2028-2032	∆2028-2018	∆Peak	Peak Size
Overall	-9	+8	-1	+13	312

* This scenario uses the following parameters: (1) Baseline four-year retention ratios (2014-2017), as shown in Table 16; (2) Birth at t-5 to K enrollment ratio of 1.135. For years 2018-2022, the observed births from 2013-2017 in were used. For years 2023-2028, 154 births/yr was assumed. See text for more details as to the breakdowns per primary school.

Table 27C

Northwestern Primary School Forecasts per Grade: 2019-2028 Fertility/Aging/Embedded Growth Scenario with Current Fertility and Direct Impacts from Housing (Scenario Vic)*

	K	G1	G2	Total K→G2
2018	111	86	102	299
2019	107	108	87	302
2020	102	105	110	317
2021	95	102	107	304
2022	101	93	104	298
2023	102	99	95	296
2024	103	100	101	304
2025	102	102	102	306
2026	102	100	105	307
2027	102	100	102	304
2028	102	100	102	304

	∆2023-2018	∆2028-2032	∆2028-2018	∆Peak	Peak Size
Overall	-3	+8	+5	+18	317

* This scenario uses the following parameters: (1) Baseline four-year retention ratios (2014-2017), as shown in Table 16; (2) Birth at t-5 to K enrollment ratio of 1.135. For years 2018-2022, the observed births from 2013-2017 in were used. For years 2023-2028, 154 births/yr was assumed. See text for more details as to the breakdowns per elementary school. Additionally, we add the direct impacts from new housing, using the pertinent cells from Table 26C.