Demographic School Analysis: Population Projections for the Quaker Valley School District

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This analysis will consist of three parts:

I. An overview describing the following:

a rather in-depth analysis that focuses on significant demographic and economic processes occurring in the last decade or longer within the school district. Particularly important are seven findings, some of which are unexpected surprises:

(1) A change in the number of births from a continuing decrease per multi-year period from 1990-94 to1995-99 to 2000-04 to a rather stable level of births just above 100/year in 2005-09 and 2010-13. In short, the birth trajectory has is now flat;
(2) A fairly large change in the proportion of births that enroll in Kindergarten from an average of 96% to 113%; on a base of 100 births/year, for instance, this change indicates an increase of 17 more students enrolling at the entry level in Elementary School per year;
(3) There is an increased in-flow of families with pre-school children; in 2000, the increase in the number of preschool children living in the school district, above the number born to Quaker Valley School District (SD) residents over the prior 5-year period, averaged 9/year; in 2010 the comparable number was 22/year;
(4) While most school districts in Western Pennsylvania have experienced steady declines in births over the last 20 years, related to macro population age structure shifts involving the Baby Boom and the baby bust, and in the Quaker Valley SD this has been the case; now the impacts of the Echo Boom or Millennial age cohorts are occurring and will continue for another 10 years—underlying a possible shift in the birth trajectory—to one of increases in births in the near term future;
(5) Between 2000 and 2010, total student enrollment in the Quaker Valley SD increased by 142 students, an average of 14/year; in contrast, in the last 4 years the school district has experienced a modest decrease of 61 students or an average of 15 fewer students/year, with modest decreases at the elementary and high school levels and a modest increase at the middle school;

(6) Enrollment changes lie largely in two processes—what we term the Exit-Entry Exchange (E3) and the net-migration (NM) of students; the joint operation of these 2 processes will be important to understanding or interpreting important changes in the projections of student enrollment, as they provide insight into the enrollment outcomes; for example, E3 & NM are either observed or projected as follows:

5-Year Period	E3	NM	Enrollment Change (EM + NM)
2005-2009	-144	+219	+75
2010-2014	-232	+157	-75
2015-2019	-208	+149	-59
2020-2024	-172	+143	-29

with the following observations and projections at the Elementary level:

5-Year Period	E3	NM	Enrollment Change (EM + NM)
2005-2009	-149	+198	+49
2010-2014	-195	+138	-57
2015-2019	+192	+148	-44
2020-2024	-121	+143	+22

The importance of the sign and the magnitude, especially of E3, is key in determining the shifts in enrollment; and

(7) There is an increasing discrepancy in student enrollments in the Edgeworth and Osborne Elementary Schools resulting from differential birth and net migration rates in the allocated municipality; what was 31 to 35 more elementary students enrolled in Edgeworth Elementary in 2009 and 2010, has in the last 3 years increased to 100 to 118 more students; in the 2014-15 school year the difference was 100.

II. Development and analysis of grade specific school district projections for the ten-year period, 2015-2024.

The four sets of projections in this part of the analysis use four-year retention ratios and consider alternative fertility levels. Retention ratios in all of these scenarios have a baseline level of "growth" embedded in them.

III. Development and analysis of grade specific projections for the two elementary schools for the ten-year period, 2015-20024. A brief analysis of two alternatives for addressing the discrepancy in the elementary enrollments in Edgeworth and Osborne will also be conducted.

I. Overview

Fertility

Stability in the Average Number of Births per Year

The births from 1990-2013 and by five-year period are shown in Table 1. It is on the summary information by five-year period, in terms of average births per year, in Table 1 (page 2, bottom quadrant), that we will concentrate. From 1990 to 1994, the average number of births was 148 per year and from 1995 to 1999, it decreased to 130 (-18) per year. Then, from 2000-2004, the number of births decreased only slightly, to an average of 125 per year. In 2005-2009, a rather large decrease occurred again, with an average number of 105 births per year (-20). Then in the most current four-year period, 2010-2013, the average number of births per year was 102—only 3 births different than the average for 2005-09. Thus, from 2005 to 2013, births have averaged 102-105 per year and appear to have generally stabilized in this range. A 2nd point regarding these data is that the current level of 100-105 births per year is around 45 fewer births than in 1990-94 and 25 less than in 1995-99. The importance of the 1995-99 years is that they comprise the period in which the high school seniors of 2014 were born, as well as the births of the rest of the high school students. These cohorts average about 25 more births per year than the cohorts in the 2005-2013 time frames—the current and relatively recent elementary entry cohorts.

Relative Impact of the Different Age Cohorts: Waves in the Age Structure and Delayed Childbearing

Table 2 reveals part of the nature of the shift in births—yet further delayed childbearing. Delayed child childbearing was clear in the earliest years here—1990 to 1994—as the age cohort with the most births (35%) was the 30-34 age cohort, indicative of the delay into the 30's. Another indicator was that an additional 18% of the births were by females age 35-39. Thus, 53 % of the total number of births was to mothers in their 30's with another 3% of the births by females over 40, for a cumulative 56% over 30. By 2010-13, the percentages were 38%, 21% and 6% for the 30-34, 35-39 and 40+ age cohorts, and a cumulative 65% of births. As may be seen on page 2 of Table 3, all percentage increases were to women age 30 and above and all percentage decreases were to women less than age 30. The increments were 3%, 3%, 2% and 1% for the 30-34, 35-39, 40-44 and 45+ age cohorts, respectively. The decrements were 6%, 1% and 2% to the 25-29, 20-24 and 15-29 age cohorts respectively, with the largest change for any age cohort, being the 25-29 age-cohort's 6% decrease. As women delay childbearing in pursuit of more education and careers, the window for births narrows somewhat and this might account for decreased births if the number of women per age group stayed the same. However, due to prior very large swings in birth rates in the past, the number of women in the key reproductive ages is quite volatile, yielding large swings in the size of these key age cohorts. The Baby Boom is commonly recognized, the baby bust less so, and the Millennials (or Echo Boom), are becoming fairly well known. These waves in the population age structure are quite important in understanding shifts in births over time and, particularly so in affecting the ever changing shifts in school enrollments. The story is far more complicated than simply delayed childbearing. In fact, for white non-Hispanic women, delayed childbearing appears to only have affected the timing in the life cycle of births and not the number of children.

Table 3 provides a look at the fertility rates in the United States over the last century. The dark shaded years indicate the Baby Boom, while the lighter shaded years pertain to the baby bust. 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. The Baby Boom was basically a 20-year period, 1946-1965, in which the TFR was near or over 3.0 or 3 children per woman. It peaked in 1957 at 3.77 or nearly 4 children per woman. The baby bust is a 10-year period in which the TFR sank quite rapidly, to below 2.5 and generally remained less than 1.8, less than 2 children per woman. The trough of the baby bust was in 1976 with a TFR of 1.74, less than ½ of that of the peak in the Baby Boom in 1957 of 3.77. In fact, these two TFR's, 3.77 and 1.74 are the highest and lowest TFR's over the entire century, including the Great Depression and The Great Recession. In addition to their being the most distinct fertility points of the past century, 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 Allegheny

County today, half a century away. They will continue to do so, as well, into the future, including the Quaker Valley School District (SD). We expect these waves in the population age structure to exist in the Quaker Valley SD resident population and to help inform our expectations regarding shifts in the birth trajectory in the near-term future.

Table 4 provides the TFRs for the White and, where possible, the White non-Hispanic population in the United States from 1970 to 2013 (the latest data available). The most striking aspect of these data is the range of the TFRs from 1972 to 2010 for the white, and where it is possible to discern, the white, non-Hispanic females. For over 40 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, even with delayed childbearing, the total number of children that a woman is expected to have is the same—only the age has shifted. The delayed childbearing effect is a one- or two-wave impact and will not recur unless there is a return to higher fertility rates at lower ages. Thus, once the delayed childbearing effect is complete, the main driver for the number of births, given the stability in the total fertility rates, will be the number of reproductive age women. This 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 lack of jobs in the case of out- migration. 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 Quaker Valley SD—shifts in the number of reproductive age females, as will be shown below.

The Baby Boom and Baby Bust : United States, Pennsylvania, Allegheny County and the Quaker Valley SD Area

Before continuing, we will offer somewhat more context for the changes in the number of reproductive women. Are the oscillations in the population of the key reproductive age-cohorts only occurring at the national level or are they also occurring in Western Pennsylvania and in Pennsylvania in general? Table 5 provides data for the United States, Pennsylvania and Allegheny County, the most populous county in Western Pennsylvania, for five-year age cohorts from ages 0 to 44 between 1990 and 2010, using US Census Bureau data. At the national level, there were drops in the 20-24, 25-29 and 30-34 female age-cohorts from 1990 to 2000. (See Change by Age Cohort Across Time panel.) This represents a shift from the baby boom to the baby bust as fertility levels changed--from total fertility rates, where, as discussed above, on average, mothers had 3.8 children in 1957 to 1.7 children in 1976. To illustrate, there were 21.1 million children born between 1955 and 1959, at the height of the baby boom and 16.5 million births between 1975 and 1979 the trough of the baby bust, a decrease of 4.6 million births. In 1990 the peak of the baby boom was 30-34 (in bold type in the top panel: **10986**); in 2000 the trough of the baby bust was 20-24 (in highlight in the top panel: 9276). Similar results hold for Pennsylvania and

Allegheny County—though the percentage decreases are higher, the smaller the geographic area. Now, what about the Quaker Valley SD?

Tables 6 and 7 provide the data for all residents of the school district—male and female and for all ages from birth to 85+, by 5-year age group. From 1990 to 2000, as shown in Table 6, there are major decreases for both cohorts in their 20's, as the first baby bust cohort replaced a Baby Boom cohort (See last column, bb→BB.) and as the 2nd baby bust cohort replaced the Transition Cohort between the Baby Boom and the baby bust (See last column, bb →TC). The drop in the numbers of people in the two cohorts was 34% for the 20-24 cohort and 41% for the age-cohort 25--29. (See last column in bold print.). Table 7 presents the data for the 2000 to 2010 change and for our purpose, the focus is on the age cohorts in their 30's. We see major decreases in the resident population of 26% and 32%, for ages 30-34 and 35-39, respectively.. Thus, what is being observed in the Quaker Valley School District between 1990 and 2010—decreases in the number of residents in the 20-24, 25-29 and 30-34 age cohorts (1990→2000), followed by decreases in the number of residents in the 30-34, 35-39 and 40-44 age-cohorts (2000→2010)--is a national, state and Western Pennsylvania process as well. The baby bust children have matured to key reproductive ages and they have far fewer numbers than the prior baby boom cohorts or even the Transition Cohort wedged between the Baby Boom and baby bust cohorts. Specific numbers for females only in the Quaker Valley SD are shown in Table 8. The lower quarter panel on the left indicated the percentage changes as the smaller birth cohorts replace the larger ones—the baby bust cohorts first affect the 20's from 1990→2000 , with decreases of almost 40%, and then subsequently affect the 30' from 2000→2010, with decreases of 27% to 33%. These percentage decreases represent very large drops in the key reproductive age women in the school district (Table 8), in Allegheny County, Pennsylvania and the United States (Table 5). With the TFR relatively constant for white non-Hispanic women (Table 4), there are clear reasons for the drops in births in the district between 1990 and 2010. Table 9 more directly addresses this point, comparing shifts in the number of reproductive age females (NRAF) by 5-year age cohort with the shifts in the number of births. Areas highlighted indicate where the shifts in NRAF are rather clear. For instance, in the top panel for the age-cohort 20-24, there is a 40% drop in NRAF and a 33% drop in births. Similarly, for the 25-29 age cohort there is a 39% drop in NRAF and a 46% drop in births. In other cases, there is a change in fertility behavior, generally with younger age cohorts decreasing their fertility and older age cohorts increasing their fertility behavior beyond that of the NRAF.

How will the population waves in the age structure affect the future? Can we utilize what we already know about these waves to get an edge on the likelihood of the direction of change in the future for the Quaker Valley SD? While the discussion above has not focused on the Echo Boom or Millennials who trail the baby bust, here we turn briefly to such cohorts. The first 3 cohorts trailing the highlighted baby boom cohorts in Table 7 are generally larger than the baby boom cohorts at all levels—national, state and county. These increases are not as large as the decreases found for the baby bust, but they definitely indicate a reversal in direction—from decreases to increases in the NRAF. Similarly, in Table 7, for the Quaker Valley SD, the Echo Boom cohorts occupying the 15-19 to 25-29 ages are 3% to 18% larger than their predecessors. In Table 9, which is restricted to females only, the same does not hold for the key age-cohort 25-29 , but does apply to the 15-19 and 20-24 age-cohorts. Table 10 records where each type of cohort—Baby boom, baby bust or Echo Boom (Millennials)—will be in the age distribution over time, from 1990 to 2020. It is the 2015 and 2020 years that are most important for the near-term future. In 2015, the Millennials occupy the 20-24, 25-29 and 30-34 age bands, with the baby bust still holding the 35-39 age band. However, by 2020, the Millennials hold all 3 key age groupings—25-29, 30-34 and 35-39, with subsequent Millennial or Echo Boom cohorts still coming. Thus, we expect, at the least, a modest increase in births, if not in 2015, then between 2015 and 2020.

Net-Migration

Net-Migration of Families with Preschool Children

Table 11 provides data on the net-migration of families with preschool children—by municipality and for the overall school district. The upper panel of Table 11 shows the net-migration from 1995 to 2000. We contrast (1) the number of births to residents living in the district between 1995 and 2000 and (2) the number of children below age 5 in the 2000 Census. The Census data indicate that net-migration of 47 preschool children moved into the district or 9.4

per year, an increase of the preschool population of 7%. Of the municipalities, Edgeworth Borough stands out with a net–migration of +44 preschoolers in this time period. More recently, between 2005 and 2010, the net-migration of families with preschoolers increased substantially to 110 or 22/year, equivalent to an increase of 21% in births. Municipalities with net-migration of over 10 preschool children include Alleppo Township (+13), Edgeworth Borough (+25), Leet Township (+17), and Sewickley Borough (+37). Should all 22 children enter Kindergarten at age 5, then Births and these "equivalent births" would virtually equal the births in 2000-04, negating the drop in births of 20 per year between 2000-04 and 2005-09 and underscoring the importance of net-migration.

Retention Ratios as Indicators of Net-Migration

The shifts in 4-year retention ratios and Birth-to-Kindergarten ratios from 1990-93 to 2010-13 are shown in Table 12. The most surprising parameter in Table 12 is the most recent Birth-to-Kindergarten (B→K) ratio—1.126. Currently, for every 100 births, 5-6 years later 113 Kindergarten students would be expected to enroll. The previous highest B→K ratio was .959, making the increase .167 or 17%. Combing the B→K ratio with the K→G1 retention ratio yields a cumulative 1.263, indicating a Grade 1 class of 126 per 100 births 6-7 years ago. The 1.26 also indicates that the 21% of the First Grade is expected to consist of in-migrants, further underscoring the rather high rates of geographical mobility in the US and the importance of net-migration in the Quaker Valley SD. The remaining retention ratios form Grade 1 to Grade 8 are also above 1.0, indicating yet additional net in-migration at each grade. We note here that the retention ratios for most grades from K to Grade 8 are a bit lower than previously. Of particular importance is the G8→G9 case where parochial students normally enter. This ratio has been steadily declining since the 1998-2001 period—from 1.078→1.048→1.041→1.008 currently.

In this analysis we will use retention ratios as a baseline for projecting the changes in student population. These parameter estimates are averaged over four years to increase reliability of the estimates. “Retention ratios” have an element of growth embedded in them since they may be above one (1). Thus, for instance in Table 12, for the most recent period, 2010-2013, eight of the twelve retention ratios are greater than 1.0. At Kindergarten to Grade 1 the ratio is 1.122 and five of the remaining seven retention ratios over 1.0 are in the 1.02 to 1.03 range. Retention ratios over 1.0 also capture part of the growth stemming from housing construction (near term or longer term), 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. Thus, 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.” Presently, we will denote such growth largely as a result net in-migration, whether to newly built homes or to existing housing stock.

Net-Migration of Students

For the net migration of students from Kindergarten through Grade 12, 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, here we are using the term “migration” in a very restricted sense—migration into or out of the Quaker Valley School District student population. Actual migrants into the school from outside the eleven municipalities—whether from other parts of Allegheny 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 first grader who did not attend kindergarten in the public school 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 Quaker Valley School District. This “net migration” can be obtained using only enrollment data. Below, we will briefly describe the method.

Initially, we will illustrate the method with the total Quaker Valley School District. Then, we will also apply the method at each level—elementary, intermediate, middle and high school. First, 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 Kindergarten class entering in year t. That is $C=K_t-G12_{t-1}$. We then 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 13 provides these data and outcomes for the Quaker Valley School District from 1994-2014, the last 20 years. We will first illustrate the process by describing a single year and then we will discuss the overall result. For 2013-14, (row t=2014-15; see footnote to table), the most current year for migration, 117 seniors from the 2013-14 year exited (Column B, Table 13), while 96 new students entered Kindergarten in 2014-15(Column A). Thus, with no migration the student population would decrease by 81 students (Column C = Column A - Column B or 96–177 = -81). The actual change was -24 (Column E, which is shown as the difference in Column D of the population at t minus the population at t-1). Therefore, "net-migration" here is positive (more exits than entries), and is +57 (Column F, which is (E-C) or [-24 – (-81)= +57]. That is, not only was there a difference in K-G12 of 81 fewer students due to the replacement of G12 by K, but total enrollment decreased by only 24, indicating that 57 additional students entered, yielding a net in-migration of 57 students. This is also the case all of the 20 years. as shown in Table 13, Column F, where there were also more entries than exits or a net in-migration. Over the last five years the net in-migration was 157 students. Without migration, the school district would have decreased by 232 students or 12% and have a student population of 1,763. Instead, with the net in-migration, the actual or observed decrease was 75 or -4% and the 2014 student population was 1,920. Hence, we have a net migration of +157 or +8% of the original 2009 enrollment. Over the last 10 years, the in-migration has been +376 and the K-G12 replacement loss has been -376. Thus, net in-migration has exactly countered the exit-entry process and the student enrollment in 2014 returned to its level a decade ago, in 2004. We will refer to this tandem process or combination as E3/NM providing a summary measure of the enrollment outcome, broken down by the Exit-Entry Exchange (E3) and net migration (NM).

The overall E3/NM outcome includes a much more dynamic process at each educational level, which we will now examine. We can also deduce the net migration at each educational level using similar logic. The results are shown in Tables 13A-13D for the elementary through the high school levels, respectively. As shown in Table 13A net in-migration at the elementary level over the last decade, was +336 or +41%. With no migration, the elementary enrollment would have decreased by 344 or 42%, whereas the actual enrollment decreased by 8 students or +1%. Migration is quite significant at the elementary level, and in the last five years it has muted the potential decrease in elementary school student enrollment by 71%--from -195 to -57. At the middle school level, migration is much less important, as shown in Table 13B. Without migration, over the last decade, the middle school enrollment would have decreased by 31 students or -6%. Actual enrollment over the last 5 years increased by 6 students or +1%. Thus, net in-migration was +37 students, equivalent to 8% of the 2009 student population of 478 students. In the last ten years, at the middle school, enrollment increased by 34 students or 8%, with net in-migration accounting for 100% of the gain--+63, with the E3 "replacement" accounting for a potential loss of 29 students (-6%) and +63 -29 = +34, the observed gain in enrollment. Finally, at the high school, we get a different result. See Table 13C. Replacement of graduating seniors by freshmen students would have yielded a loss of 6 students in the last five years. However, enrollment decreased 24 students and, hence there were 18 students who left without being replaced or a net out- migration of -18. Over the last ten years, the process was similar with "replacement" or internal moves yielding a net loss of 3 students, while net-migration was -23 students. Thus, the enrollment change was a decrease of 26 students. In the prior 10 years, from 1994 to 2004, E3 was positive, +83 students and net migration was also positive, but less (+27). The joint E3/NM process therefore yielded an increase of 110 high school students. If we add the results at all 3 levels, the outcome is Table 13—the total enrollment change over time, a result of the E3/NM processes. A summary is provided below.

Time Frame	Elementary	Middle	High School	Total Enrollment
1995-99	-173/+128→(-44)	-15/+65→+50	+73/-7→+66	-114/+186→+72
2000-04	-124/+185→+61	-76/+77→+1	+10/+34→+44	-190/+296→+106
2005-09	-149/+198→+49	+2/+26→+28	+3/-5→ -2	-144/+219→ +75
2010-14	-195/+138→-57	-31/+37→+6	-6/-18→-24	-232/+157→ -75

Enrollment from 1990 to 2014 is provided by educational level and overall in Table 14. The outcomes above from the E3/NM process, by 5-year period, are also shown in the bottom quadrant of Table 14.

New Housing Development

We will now briefly look at new housing development in the Quaker Valley SD. Tables 15A,15B and 15C provide the data by municipality and overall for 1990-99, 2000-09 and 2010-2015, respectively, covering the past 25 years. In the 1990's (Table 15A), the primary new housing developments were in Aleppo Township and Bell Acres Borough, with about 40 total new homes built in each. Sewickley Hills, Sewickley Heights and Edgeworth Boroughs combined, also had over 40 new homes. A total of 143 total new homes were built during this decade. Since some data are not available, we estimate that between 14 and 17 new homes were built on average during the 1990's.

In the 1st decade of the 21st century, new housing construction in the Quaker Valley SD increased by more than 20%, with over 176 new homes being built. Bell Acres, by far, had the most new housing construction—55 new homes, primarily in 3 new housing developments—Charleston Square, Summerlawn and Skymark. Leet Township, with The Woods at Quaker Valley housing plan, followed , with 40 new homes and Aleppo Township was nor far behind, with 34 new homes. Sewickley Borough and Sewickley Heights also added 20 and 12 new homes, respectively. We estimate that for the 2000-2009 decade, an average of between 18 and 21 new homes were built per year.

The data for the last 5 and ½ years is shown in Table 15C. Here, Bell Acres and Aleppo Township have relatively few new homes—10 and 9, respectively. Most of the new homes in the last 5 and ½ years have been built in Sewickley Hills and Sewickley Borough—37 and 31, for a total of 68 new homes.

The majority of the 37 new homes in Sewickley Hills, in The Woods of Sewickley Hills, were built in the 1st 4 years—2010 to 2013, (cf. Table 15C). The 31 new homes in Sewickley Borough are a mixture of Townhomes (19 units) and Single Family Dwellings (12). The townhouse counts in Sewickley Borough include 11 townhouse units in 2012 and 8 townhouse units in 2015. The 9 Single Family Dwellings (SFDs) are distributed over several years and range from 1 to 3 new homes per year.

Overall, new housing is being built rather steadily—with different housing plans taking the lead over time. There are clearly no major increments, as the numbers estimated per year in Tables 15A (14-17), 15B (18-21) and 15C (17-18) are all within a relatively narrow band, with a slight downturn in the most current period. Therefore, we do not expect a direct impact from housing beyond that which is embedded in the Birth-to-Kindergarten ratio and the retention ratios.

II. Development and Analysis of Grade-Specific School District Projections for the Ten-Year Period 2015- 2024

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Scenario I: Projections with Fertility, Aging and Embedded Growth (Current Fertility Level)

The Scenario I projections use the following:

1. 2014 observed student populations per grade;

2. 2010-2013 four-year retention ratios (Table12) based on beginning of year school enrollment for 2009-2013;

3. Expected Kindergarten enrollment mapped to t-5 and t-6 births (See notes to Table 12.) using a four-year Birth-to-Kindergarten enrollment ratio of 1.126

(Table 12);

4. For years 2015-2018, the observed births in the Quaker Valley SD were used (See Table 1); and

5. For 2019-2024 the average number of births for 2010 -2013 was used (102).

This scenario takes into account the following: (1) the most recent birth data; (2) the most current retention ratios, which have embedded growth or net migration; and (3) the most recent Birth to Kindergarten enrollment ratio. Table 16 presents the results for this scenario. In the first five years, the elementary level decreases by 44 students and the middle school is basically stable (+2). A decrease of 17 students is also expected at the High School. In the 2nd 5 years the elementary level is expected to increase by 22 students, regaining half of the loss in the 1st 5 years. The middle school, is expected to decline by 48 students, while the High School enrollment is stable (-3). After 10 years, there are decreases at all levels, -22. -46 and -20 for the elementary, middle and high school levels, respectively.

Scenario II: Projections with Higher Fertility, Aging and Embedded Growth

In this scenario we increase the births for the 2019-2024 projections to the 2000-2004 level—125 births per year. The changes in results are shaded and only reach the 5th grade since births pertaining to the 1st 5 years are already known. Table 17 presents the results. The loss of 18 students at the elementary level is only slightly less than in Scenario I, but a major change is expected in the 2nd 5 years, where a substantial gain in enrollment occurs—an increase of 169 students. After 10 years, there is an expected increase of 151 students at the elementary level. The expected enrollments at the middle and high schools is the same as in Scenario I—stability in the 1st 5 years at the middle school (+2) and at the high school in the 2nd 5 years (-3), but with decreases in enrollment of 17 students in the 1st 5 years and even more decreases (-48) at the middle school in the 2nd 5 years. The 10-year results include overall are an increase of 85 students, almost an equal reversal to that in Scenario I, which had a decrease of 88 students. This is a substantial difference.

Scenario III: Projections with Moderately Higher Fertility, Aging and Embedded Growth

In this scenario, we assume that there is an increase in births from 2019 to 2024, but that the increase is more moderate than in Scenario II. We now assume that births increase to115 births per year. This is an increase of 13 per year above the current number of births used in Scenario I and is 10 fewer births per year than assumed in Scenario II. Since the change in births does not start until 2019, the effects will not reach the middle and high schools by 2024, as was the case in Scenario II. Any changes in the results from those of Scenario I are indicated by a shading of the outcomes. The results are shown in Table 17. In the 1st 5 years a decrease of 30 students is expected at the elementary level, but in the 2nd 5 years, there is an increase of over 100 elementary students (+104). After 10 years, the elementary enrollment is expected to increase by 74 students, while the middle and high schools experience losses totaling 66 students. Hence, total enrollment is stable, with only an increase of 8 students.

Scenario IV: Projections with Higher Fertility for All Years, Aging and Embedded Growth

In this scenario, births, or their equivalence via net in-migration of preschoolers, are assumed to reach 125 from 2015 onward for all years. This is a very strong assumption and sets an upper bound on the projections. The results are shown in Table 19. In the 1st 5 years, there is an expected increase of 97 elementary students, with no change for the middle and high schools. In the 2nd 5 years, there are changes at all levels—increases of 54, 48 and 25 students at the elementary, middle and high school levels. After 10 years, there are also expected gains at all levels, with the largest at the elementary level (+151), the next largest at the middle school and basically no change at the high school (+8). This scenario is not likely, but either a continued gradual increase in the B→K ratio or a comparable spike in the B→K ratio would have a similar effect. Thus, while it is not likely, neither is it out of the realm of possibility.

III. Development and Analysis of Areal Specific District Projections for the Two Elementary Schools by Grade: 2015- 2024

In these projections, we must allocate the births to the elementary school of attendance. All municipalities but one have 100% attendance at one of the elementary schools. That municipality, Sewickley Borough, has students attending both schools. Enrollment from Sewickley Borough over the last 5 years has had an almost 50/50 split between the 2 elementary schools—with the dividing boundary at Broad Street. In the last 5 years, with a cumulative enrollment from Sewickley Borough at K to G5 of 1,257 students, the breakdown is 635 attending Edgeworth and 622 attending Osborne, yielding a percentage outcome of .505/.495—a 1 % difference. Rounding to 1.0 essentially means using 2 decimal places at .50/.50 or .51/.49. In general, it makes little difference—at most, 1 student per year for the K entry class and generally, it ends up as if it were .50/,50; here we have taken the larger of the two for the initial rounding and chosen .51/.49 to Edgeworth/Osborne. But, as noted, at most it resulted in a difference of only 1 student in 2 of the 4 years where births are known, for K enrollment in years 2015-2018. Of course, there are fluctuations around averages and in any specific year the distribution may be different than the average. A more important factor was the split for K enrollment from 2019-2024. In this case, we use the 4-year average for 2010-2013 births by municipality, while maintaining the.51/.49 allocation for Sewickley Borough. This results in the following distribution by year for years 2010-2013:

Year	Edgeworth Elementary	Osborne Elementary	Total Births
2010	51	54	105
2011	57	41	98
2012	55	45	100
2013	63	43	106
∑	226 (55%)	183 (45%)	409

Thus, for the assumed births for K enrollment in years 2019 to 2024, we will utilize the .55/.45 split. As assumed in Scenario III, there are 115 births per year for the Kindergarten enrollment from 2019-2024. Using the B→K ratio of 1.126, this allocates K enrollment as 59 in Osborne and 71 in Edgeworth from 2019 onward. For years prior to 2019, actual births per municipality were used, with the municipal-elementary linkage as follows for the 100% municipalities:

Edgeworth Elementary School—Bell Acres Borough, Edgeworth Borough, Leetsdale Borough, Sewickley Heights Borough and Sewickley Hills Borough; and Osborne Elementary School—Aleppo Township, Glenfield Borough, Hayesville Borough, Osborne Borough and Leet Township. The results are shown in Tables 20 and 21.

The Edgeworth Elementary School projections are provided In Table 20. In the 1st 5 years enrollment is expected to decrease by 22 students, followed by an increase of 53 students in the 2nd 5 years. By 2024, student enrollment is expected to increase by 31, with an enrollment of 491 students in 2024. The results for the Osborne Elementary School are given in Table 21. In the 1st 5 years, there is a modest decrease of 6 students, followed in the 2nd 5 years by an increase comparable to that in Edgeworth, but a bit higher—55 additional students. By 2024, the enrollment gain in the Osborne Elementary School is expected to be 49 additional students (18 more than in the Edgeworth Elementary), with a total enrollment of 409 students. The projected differences in enrollment, for the most part, do not decline much, but at one point (2017) there are only 72 more students in Edgeworth than in Osborne. Moreover, the average projected difference in enrollment is 89 more students in the Edgeworth Elementary. For each year, the projected differences are as follows: 2014-- +100, 2015-- +95, 2016-- +108, 2017-- +72, 2018-- +86, 2019-- +84, 2020-- +79, 2021-- +93, 2022-- +93, 2023-- +93, 2024--+82. If these differences are deemed to be too large, then there are, at a minimum 2 basic alternatives—(1) redistricting with the goal of maintaining relatively equal enrollments, with the movement of about 45 students from the Edgeworth Elementary attendance area to the Osborne Elementary attendance area or (2) redrawing the elementary configuration with the K-G2 students in one building and the G3-G5 students in the other. The first alternative involves the shifting of attendance boundaries—either splitting other municipalities, as is currently the case with Sewickley Borough (.505/,495), or shifting the boundary in Sewickley Borough itself. The 2nd alternative, would initially involve moving about ½ of the elementary students. Is such a change realistic from a building capacity viewpoint? Rearranging the results from Scenario III with K-G2 in Building A and the G3-G5 students in Building B, we would have the following:

Year	Building A (K-G2)	Building B (G3-G5)	Total Students
2014 (current)	381	439	820
2015	375	428	803
2016	356	455	811
2017	376	422	798
2018	376	418	794
2019	392	398	790
2020	410	420	830
2021	423	419	842
2022	423	437	860
2023	423	457	880
2024	423	471	894

These numbers seem well within the current building capacities, but, of course considerable thinking also seems prudent regarding actual use of classrooms, and much more. The present suggestions regarding the disparate enrollments in the 2 elementary schools and possible overarching remedies are certainly only a beginning—providing the likely future enrollments and the more general context in terms of alternatives to the status quo.

Table 1[*]

Number of Births in the Quaker Valley School District by Municipality &Year: 1990-2013

	Aleppo Twp	Bell Acres Boro	Edgeworth Boro	Glenfield Bo	Hayesville Boro	Leet Twp	Leetsdale Boro	Osborne Boro	Sewickley Boro	Sewickley Heights Boro	Sewickley Hills Boro	Σ
1990	9	12	19	7	0	18	10	5	37	10	9	136
1991	13	17	17	5	2	24	17	10	43	10	6	164
1992	8	17	20	5	0	20	10	3	56	15	8	162
1993	9	12	16	6	0	11	15	6	47	15	1	138
1994	11	8	21	1	0	18	13	7	42	11	7	139
1995	10	11	17	5	0	14	20	2	34	12	3	128
1996	13	16	14	0	0	22	19	4	48	7	6	149
1997	7	16	19	5	1	15	14	2	38	4	6	127
1998	9	13	15	1	1	7	13	2	39	6	2	108
1999	7	15	16	1	0	17	11	5	51	7	7	137
2000	7	9	19	0	0	14	13	7	51	5	7	132
2001	7	12	21	1	0	10	11	7	41	7	9	126
2002	7	11	22	3	1	12	11	4	43	9	5	128
2003	4	12	14	4	0	19	16	6	33	9	3	120
2004	10	15	16	3	2	15	8	9	29	8	6	121
2005	9	7	15	1	0	16	9	6	40	9	5	117
2006	6	8	13	2	0	10	12	3	33	6	2	95
2007	8	5	13	2	1	17	15	3	31	3	4	102
2008	7	10	8	1	1	14	13	2	43	5	4	108
2009	5	7	8	2	2	12	10	7	32	9	9	103
2010	14	12	8	3	0	18	10	2	35	2	1	105
2011	8	12	9	1	0	12	8	5	30	10	3	98
2012	10	10	7	3	2	9	11	4	34	7	3	100
2013	12	11	13	3	1	10	7	0	35	12	2	106

[*] Source: 1990-2012 Allegheny County Health Department; 2013: Pennsylvania Department of Health (preliminary)

	Aleppo Twp	Bell Acres Boro	Edgeworth Boro	Glenfield Boro	Hayesville Boro	Leet Twp	Leetsdale Boro	Osborne Boro	Sewickley Boro	Sewickley Heights Boro	Sewickley Hills Boro	∑
∑ 1990-1994	50	66	93	24	2	91	65	31	225	61	31	739
∑ 1995-1999	46	71	81	12	2	75	77	15	210	36	24	649
∑ 2000-2004	35	59	92	11	3	70	59	33	197	38	30	627
∑ 2005-2009	35	37	57	8	4	69	59	20	179	32	24	525
∑ 2010-2013	44	45	37	10	3	49	36	11	134	31	9	409
Average/Year												
1990-1994	10.0	13.2	18.6	4.8	0.4	18.2	13.0	6.2	45.0	12.2	6.2	147.8
1995-1999	9.2	14.2	16.2	2.4	0.4	15.0	15.4	3.0	42.0	7.2	4.8	129.8
2000-2004	7.0	11.8	18.4	2.2	0.6	14.0	11.8	6.6	39.4	7.6	6.0	125.4
2005-2009	7.0	7.4	11.4	1.6	0.8	13.8	11.8	4.0	35.8	6.4	4.8	105.0
2010-2013	11.0	11.3	9.3	2.5	0.8	12.3	9.0	2.8	33.5	7.8	2.3	102.3
Δ1[1]	-0.8↓	+1.0↑	-2.4↓	-2.4↓	0	-3.2↓	+2.4↑	-3.2↓	-3.0↓	-5.0↓	-1.4↓	-18.0↓
Δ2	-2.2↓	-2.4↓	+2.2↑	-0.2↓	+0.2↑	-1.0↓	-3.6↓	+3.6↑	-2.6↓	+0.4↑	+1.2↓	-4.4↓
Δ3	0	-4,4↓	-7.0↓	-0.6↓	+0.2↑	-0.2↓	0	-2.6↓	-3.6↓	-1.2↓	-1.2↓	-20.4↓
Δ4	+4.0↑	+3.9↑	-2.1↓	+0.9↑	0	-1.5↓	-2.8↓	-1.2↓	-2.3↓	+1.4↑	-2.5↓	-2.7↓

[1] All Δ's pertain to shifts over time in the average number of births per year. Δ1: (1995-99) – (1990-94); Δ2: (2000-04) - (1995-99) ; Δ3: (2005-09) - (2000-04) ; and Δ4: (2010-13) - (2005-09) .

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Table 2

Number of Births by Age of Mother and Year for the Quaker Valley School District Residents[1]

		15-19	20-24	25-29	30-34	35-39	40-44	45+	∑
1990-1994	1990	6	19	40	51	17	3	0	136
	1991	6	19	51	45	36	7	0	164
	1992	5	12	61	56	24	4	0	162
	1993	4	11	39	54	22	8	0	138
	1994	10[α]	14	27	52	34	0	0	139[Φ]
	∑	31[α]	75	218	258	133	22	0	739Φ
	% of ∑	.042	.102	.296	.350	.180	.030	0	
	Avg/Yr	6.2	15.0	43.6	51.6	26.6	4.4	0	147.8
1995-1999	1995	6	12	34	48	21	7	0	128
	1996	8	18	21	70	24	8	0	149
	1997	3	8	27	48	37	4	0	127
	1998	3	17	15	38	31	4	0	108
	1999	6	17	22	57	30	5	0	137
	∑	26	72	119	261	143	28	0	649
	% of ∑	.040	.111	.183	.402	.220	.043	0	
	Avg/Yr	5.2	14.4	23.8	52.2	28.6	5.6	0	129.8
2000-2004	2000	6	11	31	43	35	6	0	132
	2001	4	12	26	42	35	6	1	126
	2002	5	9	20	49	35	10	0	128
	2003	2	13	23	46	26	10	0	120
	2004	6[β]	5	17	51	34	6	2	121
	∑	23	50	117	231	165	38	3	627
	% of ∑	.037	.080	.187	.368	.263	.061	.005	
	Avg/Yr	4.6	10.0	23.4	46.2	33.0	7.6	0.6	125.4
2005-2009	2005	5	8	16	41	37	9	0	117[Ψ]
	2006	3	8	17	35	28	4	0	95
	2007	5	11	18	37	24	6	1	102
	2008	3	11	30	30	24	7	3	108
	2009	5	12	26	31	24	5	0	103
	∑	21	50	107	174	137	31	4	525
	% of ∑	.040	.095	.204	.332	.261	.059	.010	
	Avg/Yr	4.2	10.0	21.4	34.8	27.4	6.2	0.8	105.0
2010-2012	2010	3	11	23	45	16	5	2	105
	2011	3	8	23	32	26	6	0	98
	2012	2	9	25	38	22	3	1	100
	∑	8	28	71	115	64	14	3	303
	% of ∑	.026	.092	.234	.380	.211	.046	.010	
	Avg/Yr	2.7	9.3	23.7	38.3	21.3	4.7	1.0	101.0

[1] Source: Allegheny County Health Department – these numbers include the following: 1 with an unknown age in 2005, 2 with unknown ages in 1994, as well as including 1 birth to a female aged 10-14 in 1994 and 2 such cases in 2005; in both of the latter cases, the births are listed above in the 15-19 age band.

	[1]Δ_1	-1.0	-0.6	-19.8	+0.6	+2.0	+1.2	0	-18.0
	Δ_2	-0.6	-4.4	-0.4	-6.0	+4.4	+2.0	+0.6	-4.4
	Δ_3	-0.6	0	-2.0	-11.4	-5.6	-1.4	+0.2	-20.4
	Δ_4	-1.4	-0.7	+2.3	+3.5	-6.1	-1.5	+0.2	--4.0
	Δ_5	-3.5	-5.1	-19.9	-13.3	-5.3	+0.3	+1.0	-46.8
	[2]%Δ_1	-.005	-.022	-.109	+.018	+.083	+.031	+.005	
	%Δ_2	-.011	+.012	+.047	+.012	-.052	-.014	+.005	
	%Δ_3	↓ -.016	↓ -.010	↓ -.062	↑+.030	↑ +.031	↑+.016	↑+. 010	

[1] Δ_1= (1990-94 average) → (1995-99 average)
Δ_2= (1995-99 average) → (2000-04 average)
Δ_4= → (2005-09 average) → (2010-12 average)
Δ_3= (2000-04 average) → (2005-09 average)
Δ_5= (1990-94 average) → (2010-12 average

[2] %Δ_1= Δ of % for (1990-94 average) → (2000-2004 average)
%Δ_2= Δ of % for (2000-2004 average) → (2005-2009 average)
%Δ_3= Δ of % for (1990-94 average) → (2010-12 average)

Table 3

Total Fertility Rate for the United States: 1917-2013[*]

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		
1940	2.30	1965	2.91	1990	2.08		
1941	2.40	1966	2.72	1991	2.06		

[*] 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.

Table 4

Total Fertility Rate* for the United States—
White and White (non-Hispanic): 1970-2013

	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

* 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 5[1]

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%)

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[1] Sources: (1) 1990, 2000 and 2010 Data: U.S Census Bureau, Decennial Census

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

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

CHANGE WITHIN AGE COHORT ACROSS TIME[4] → **NET MIGRATION**

	United States		**Pennsylvania**		**Allegheny County**	
	1990→2000 x→x+10[5]	2000→2010 x→x+10	1990→2000 x→x+10	2000→2010 x→x+10	1990→2000 x→x+10	2000→2010 x→x+10
0-4						
5-9						
10-14	+1046K (+11.7%)	+732K(+7.8%)	+32321 (+8.3%)	+30568 (+8.6%)	-608(-1.5%)	-1261 (-3.6%)
15-19	+992K (+11.2%)	+710K(+7.1%)	+33347 (+8.9%)	+38900 (+9.6%)	+723(+1.8%)	+611 (+1.6%)
20-24	+929K (+11.1%)	+566K(+5.7%)	-4494 (-1.2%)	+12013 (+2.9%)	+1788(+5.0%)	+4502 (+11.1%)
25-29	+932K (+10.8%)	+637K(+6.5%)	-35921 (-8.9%)	-28335 (-6.8%)	-1567(-3.9%)	+2393 (+6.0%)
30-34	+844K (+9.0%)	+690K(+7.4%)	-15411 (-3.6%)	-8292 (-2.2%)	-4275(-9.0%)	-1814 (-4.8%)
35-39	+771K (+7.3%)	+555K(+5.8%)	-20625 (-4.1%)	+17716 (+4.8%)	-4087(-7.6%)	-3672 (-9.5%)
40-44	+327K (+3.0%)	+308K(+3.0%)	+38047 (-8.2%)	+10412 (+2.5%)	-4844(-8.2%)	-3894 (-9.0%)

[4] Longitudinally following an age cohort over time, including net migration; in other words change (Δ) in age cohort x in 1990 vs. age cohort x+10 in 2000 and for age cohort x in 2000 vs. age cohort x+10 in 2010. The age cohorts include net migration. Here the X→X+10 data pertain to the x+10 age, ie the end population.

[5] For example, A) the female age cohort 0-4 in 1990 (8,962) compared to B) the female age cohort 10-14 in 2000 (1,008) that is, B-A

Table 6

Changes in Population Age Distribution for Residents Living in the Quaker Valley School District Over the 1990 Decade Due to Migration vs. Cohort Replacement[1]: 1990 and 2000

Age	1900 Pop	Birth Years		2000 Pop	Birth Years		Δ Net Migration & Aging	Δ Cohort Replacement
<5	780	1986-90	EB2	696	1996-2000	EB4[2]		-84 (-11%)
5-9	862	1981-85	EB1	865	1991-95	EB3		+3 (0%)
10-14	874	1976-80	bb2	979	1986-90	EB2	+199 (+26%)	+105 (+12%) ***EB→bb***
15-19	826	1971-75	bb1	821	1981-85	EB1	-41 (-5%)	-5 (-1%) ***EB→bb***
20-24	656	1966-70	TC	432	1976-80	bb2	-442 (-51%)	***-224 (-34%)*** bb →TC
25-29	894	1961-65	BB4	523	1971-75	bb1	***-303 (-37%)***	***-371 (-41%)*** bb→BB
30-34	983	1956-60	BB3	711	1966-70	TC	***-55 (-8%)***	***-272 (-28%)*** TC→BB
35-39	1,167	1951-55	BB2	976	1961-65	BB4	-82 (-9%)	-191 (-16%) BB→BB
40-44	1,123	1946-50	BB1	1,131	1956-60	BB3	-148 (-15%)	+8 (+1%) BB→BB
45-49	919	1941-45		1,152	1951-55	BB2	-15 (-1%)	***+233 (+25%) BB→***
50-54	733	1936-40	De2	1,070	1946-50	BB1	-53 (-5%)	***+337 (+46%) BB→De***
55-59	752	1931-35	De1	793	1941-45		-126 (-14%)	+41 (+5%)
60-64	879	1926-30		627	1936-40	De2	-106 (-14%)	***-252 (-29%) De→***
65-69	838	1921-25		573	1931-35	De1	-179 (-24%)	***-265 (-32%) De→***
70-74	704	1916-20		709	1926-30		-170 (-19%)	+5 (+1%)
75-79	511	1911-15		595	1921-25		-243 (-29%)	+84 (+16%)
80-84	344	1906-10		410	1916-20		-294 (-42%)	+66 (+19%)
85+	231	Pre-1906		304	Pre-1916			+73 (+32%)
Total	14,076			13,366				-780 (-5%)

[1] Data Sources:
(1) 1990 and 2000: US Decennial Census

[2] EB: Echo Boom Cohort; BB: Baby Boom Cohort; bb: Baby Bust Cohort; De: Great Depression Cohort; TC: Transition Cohort between Baby Boom & baby bust

Table 7

Changes in Population Age Distribution for Residents Living in the Quaker Valley School District Over the Past Decade Due to Migration vs. Cohort Replacement[1]: 2000 and 2010

Age	2000 Pop	Birth Years		2010 Pop	Birth Years		Δ Net Migration & Aging	Δ Cohort Replacement
<5	696	1996-2000	EB4[2]	635	2006-2010			-61 (-9%)
5-9	865	1991-95	EB3	884	2001-2005			+19 (+2%)
10-14	979	1986-90	EB2	1,019	1996-2000	EB4	+323 (+46%)	+40 (+4%)
15-19	821	1981-85	EB1	902	1991-95	EB3	+37 (+4%)	+81 (+10%) EB→EB
20-24	432	1976-80	bb2	510	1986-90	EB2	-469 (-48%)	***+78 (+18%) EB→bb***
25-29	523	1971-75	bb1	539	1981-85	EB1	-282 (-34%)	***+16 (+3%) EB→bb***
30-34	711	1966-70	TC	525	1976-80	bb2	***+93 (+22%)***	-186 (-26%) bb →TC
35-39	976	1961-65	BB4	645	1971-75	bb1	-122 (-7%)	-311 (-32%) bb→BB
40-44	1,131	1956-60	BB3	929	1966-70	TC	+218 (+31%)	-202 (-18%) TC→BB
45-49	1,152	1951-55	BB2	1,073	1961-65	BB4	+97 (+10%)	-78 (-7%) BB→BB
50-54	1,070	1946-50	BB1	1,177	1956-60	BB3	+46 (+4%)	***+107 (+10%) BB→BB***
55-59	793	1941-45		1,091	1951-55	BB2	-60 (-5%)	***+298 (+38%) BB→***
60-64	627	1936-40	De2	922	1946-50	BB1	-148 (-14%)	***+295 (+47%) BB→De***
65-69	573	1931-35	De1	654	1941-45		-139 (-18%)	+81 (+14%)
70-74	709	1926-30		543	1936-40	De2	-84 (-13%)	-166 (-23%)
75-79	595	1921-25		535	1931-35	De1	-38 (-7%)	-60 (-10%)
80-84	410	1916-20		607	1926-30		-102 (-14%)	***+197 (48%)***
85+	304	Pre-1916		744	Pre-1926			***+440 (+145%)***
Total	13,366			13,934				+568 (+4%)

[1] Data Sources:
(1) 2000 and 2010: US Decennial Census

[2] EB: Echo Boom Cohort; BB: Baby Boom Cohort; bb: Baby Bust Cohort; De: Great Depression Cohort; TC: Transition Cohort between Baby Boom & baby bust

Table 8

Population Distribution and Change via Two Mechanisms for the Reproductive Female Population in the Overall School District: 1990→2000→2010

Age Cohort	Female Population		
	1990	2000	2010
10-14	450	512	514
15-19	405	408	452
20-24	364	219	259
25-29	455	279	262
30-34	518	368	268
35-39	612	535	360
40-44	615	601	496
45-49	498	611	577

	1990→2000	2000→2010	1990→2000	2000→2010
	POPULATION DISTRIBUTION CHANGE VIA “REPLACEMENT” BY YOUNGER COHORTS		POPULATION DISTRIBUTION CHANGE VIA COHORT AGING AND MIGRATION[α]	
10-14	+62	+2	-231	-253
15-19	+3	+44	-126	-146
20-24	-145	+40	+4	+49
25-29	-176	-17	+80	+81
30-34	-150	-100	+83	+128
35-39	-77	-175	-1	+42
40-44	-14	-105		
45-49	+113	-34		

	1990→2000 % Δ	2000→2010 % Δ	1990→2000 % Δ	2000→2010 % Δ
	CHANGE IN POPULATION DISTRIBUTION VIA “REPLACEMENT” BY YOUNGER COHORTS		DISTRIBUTION CHANGE VIA COHORT AGING AND MIGRATION	
10-14	+.138	+.004	-.513	-,494
15-19	+.007	+.108	-.311	-.358
20-24	-.398	+.183	+.011	+.224
25-29	-.387	-.061	+.176	+.290
30-34	-.290	-.271	+.160	+.348
35-39	-.126	-.327	-.002	+.079
40-44	-.023	-.175		
45-49	+.227	-.056		

[α] For example, the 10-14 age cohort in 1990 due to aging and migration over ten years will become the 20-24 age cohort in 2000.

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Table 9

Age-Specific Shifts in Births Relative to Age-Specific Shifts in Number of Reproductive Age Females (NRAF)

Forward Looking from 1990 & 2000

	A	**B**	**C**	**D**
	Shifts in Births (1990-94)-(2000-04)	Shifts in NRAF (1990→2000)	Δ (A-B)	
15-19	-26%	+1%	-27%	↓ (100)
20-24	-33%	-40%	+7%	**#** (**83**;17)
25-29	-46%	-39%	+7%	**#** (**85**;15)
30-34	-10%	-29%	+19%	↑,# (66;**34)**
35-39	+24%	-13%	+37%	↑ (100)
40-44	+73%	-2%	+75%	↑ (100)

Backward Looking from 2000 & 2010

	A	**B**	**C**	**D**
	Shifts in Births (1995-99)-(2005-09)	Shifts in NRAF (2000→2010)	Δ (A-B)	
15-19	-19%	+18%	-37%	↓ (100)
20-24	-31%	-6%	-25%	↓,# (81;**19**)
25-29	-10%	-27%	+17%	↑,# (63;**37**)
30-34	-33%	-33%	0	**# (100)**
35-39	-4%	-17%	+13%	#,↑ (**57**;43)
40-44	+11%	-6%	+17%	↑ (100)

Forward Looking from 2000 & 2010

	A	**B**	**C**	**D**
	Shifts in Births (2000-02)-(2010-12)	Shifts in NRAF (2000→2010)	Δ (A-B)	
15-19	-47%	+11%	-58%	↓ (100)
20-24	-13%	+18%	-31%	↓ (100)
25-29	-8%	-6%	-2%	**# (75;**25**)**
30-34	-14%	-27%	+13%	#,↑ (**52**;48)
35-39	--39%	-33%	-6%	**#,**↓ (**82**;18)
40-44	-36%	-17%	-19%	↓,# (53;**47**)

TABLE 10

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 11

Evidence of Net Migration of Families with Preschool Children by Municipality and Overall School District

1995-2000

Municipalities	Column A 2000 Census Children < 5 Yrs. Of Age	Column B Births 1995-99	Column C Net Migration (Preschoolers) ∆ (A-B)
Aleppo Township	42	46	-4
Bell Acres Borough	64	71	-7
Edgeworth Borough	125	81	+44
Glenfield Borough	12	12	0
Hayesville Borough	2	0	0
Leet Township	91	75	+16
Leetsdale Borough	63	77	-14
Osborne Borough	29	15	+14
Sewickley Borough	200	210	-10
Sewickley Hgts Borough	34	36	-2
Sewickley Hills Borough	34	24	+10
TOTAL	**696**	**649**	**+47 (+9.4/yr) or +7%**

2005-2010

Municipalities	Column A 2010 Census Children < 5 Yrs. Of Age	Column B Births 2005-09	Column C Net Migration (Preschoolers) ∆ (A-B)
Aleppo Township	48	35	+13
Bell Acres Borough	46	37	+9
Edgeworth Borough	82	57	+25
Glenfield Borough	9	8	+1
Hayesville Borough	3	4	-1
Leet Township	86	69	+17
Leetsdale Borough	54	59	-5
Osborne Borough	26	20	+6
Sewickley Borough	216	179	+37
Sewickley Hgts Borough	36	32	+4
Sewickley Hills Borough	29	24	+5
TOTAL	**635**	**525**	**+110 (+22.0/yr) or +21%**

Table 12

Shifts in Annual Retention Ratios 1990-2013
Four-Year Averages

	1990-1993	1994-1997	1998-2001	2002-2005	2006-2009	2010-2013
K→G1	1.110	1.144	1.142	1.166	1.141	1.122
G1→G2	.993	.986	1.052	1.009	1.042	1.028
G2→G3	1.033	1.039	1.054	1.050	1.035	1.027
G3→G4	.976	.993	1.034	1.013	1.033	1.023
G4→G5	.984	1.029	1.042	1.029	1.032	1.025
G5→G6	.973	1.030	1.030	1.014	1.040	1.021
G6→G7	1.004	1.058	1.037	1.012	1.039	.995
G7→G8	1.002	1.019	1.047	1.003	.989	1.014
G8→G9	.978	1.057	1.078	1.048	1.041	1.008
G9→G10	1.024	1.019	.998	.973	.977	.986
G10→G11	1.006	.967	.986	.959	.984	.987
G11→G12	.983	.989	.976	.969	1.017	.994
B_{t-5}→K_t*	.832	.740	.881	.885	.959	1.126

* Annual averages over four year periods in the first six (6) columns for K through G11. However, for B_{t-5} to K_t we are actually using .75 (B_{t-5})+.25 (B_{t-6}), corresponding to the October cutoff point and hence January-September for t-5 and October-December for t-6

Table 13

Overall Exit-Entry Exchange (E3) and Net Migration (NM) for the Quaker Valley School District Using Baseline "Replacement" of Grade 12 Students in Year t-1 by Kindergarten Students in Year t: 1994-2013

	K_t	$G12_{t-1}$	(E3) Δ_1 without migration[ᵃ]	Total Student Population$_t$	Δ_2[ᵇ]	Net Migration[ᶜ] (NM)
t= 1995-96	93	121	-28	1741	-1	+27
1996-97	104	115	-11	1799	+58	+69
1997-98	110	149	-39	1808	+9	+48
1998-99	127	136	-9	1825	+17	+26
1999-00	109	136	-27	1814	-11	+16
2000-01	102	146	-44	1839	+25	+69
2001-02	142	151	-9	1908	+69	+78
2002-03	128	147	-19	1978	+70	+89
2003-04	101	158	-57	1962	-16	+41
2004-05	102	163	-61	1920	-42	+19
2005-06	115	150	-35	1892	-28	+7
2006-07	134	158	-24	1916	+24	+48
2007-08	110	154	-44	1906	-10	+34
2008-09	130	156	-26	1942	+36	+62
2009-10	121	136	-15	1995	+53	+68
2010-11	109	161	-52	1981	-14	+38
2011-12	120	157	-37	1961	-20	+17
2012-13	118	178	-60	1914	-47	+13
2013-14	130	132	-2	1944	+30	+32
2014-15	96	177	-81	1920	-24	+57
∑ 1995-1999			-114		+72	+186
∑ 2000-2004			-190		+106	+296
Prior 5 years: ∑ 2005-2009			-144		+75	+219
Last 5 years: ∑ 2010-2014			-232		-75	+157

[ᵃ] $\Delta_1 = K_t - G12_{t-1}$, 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.

[ᵇ] Δ_2=Student Population$_t$ – Student Population$_{t-1}$; in 1994 the total student population was 1,742.

[ᶜ] 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 13A

The Exit-Entry Exchange (E3) and Net Migration (NM) at the Elementary[*] Level: 1994-2013

	K_t	$G5_{t-1}$	(E3) Δ_1 without migration[§]	Total Student $Population_t$	Δ_2[ξ]	Net Migration (NM)[λ]
t= 1995-96	93	142	-49	787	-24	+25
1996-97	104	144	-40	772	-15	+25
1997-98	110	146	-36	756	-16	+20
1998-99	127	140	-13	760	+4	+17
1999-00	109	143	-34	767	+7	+41
2000-01	102	142	-40	760	-7	+33
2001-02	142	129	+13	828	+68	+55
2002-03	128	115	+13	876	+48	+35
2003-04	101	157	-56	864	-12	+44
2004-05	102	156	-54	828	-36	+18
2005-06	115	164	-49	800	-28	+21
2006-07	134	148	-14	835	+35	+49
2007-08	110	166	-56	807	-28	+28
2008-09	130	154	-24	837	+30	+54
2009-10	121	127	-6	877	+40	+46
2010-11	109	153	-44	855	-22	+22
2011-12	120	149	-29	848	-7	+22
2012-13	118	171	-53	810	-38	+15
2013-14	130	140	-10	833	+23	+33
2014-15	96	155	-59	820	-13	+46
∑ 1995-1999			-172		-44	+128
∑ 2000-2004			-124		+61	+185
Prior 5 years: ∑ 2005-2009			-149		+49	+198
Last 5 years: ∑ 2010-2014			-195		-57	+138

[*] Note: The schools were reconfigured in 1997 with the Elementary which was previously K→G6 now K→G5; the Junior High which was previously G7→G9 and is now renamed the Middle School with Grades 6-8; and the High School which was previously Grades 10-12, now having Grades 9-12. We are using the current grade alignment throughout.

[§] $\Delta_1 = K_t – G5_{t-1}$

[ξ] Δ_2=Elementary Student $Population_t$ – Elementary Student $Population_{t-1}$; in 1994 the total Elementary student population in grades K-G5 was 811.

[λ] The basic equation for net migration is (Δ_2-Δ_1); that is, the actual change in elementary student population minus what it would have been without migration, i.e., replacing the G5 population at t-1 who move up to middle school by t with the new entrants at K in t, 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 13B

The Exit-Entry Exchange (E3) and Net Migration (NM) at the Middle School[*] Level: 1994-2013

	$G5_{t-1}$	$G8_{t-1}$	(E3) Δ_1 without migration[ç]	Middle School $Population_t$	Δ_2[§]	Net Migration (NM)[λ]
t= 1995-96	142	134	+8	426	+27	+19
1996-97	144	129	+15	457	+31	+16
1997-98	146	160	-14	463	+6	+20
1998-99	140	156	-16	454	-9	+7
1999-00	143	151	-8	449	-5	+3
2000-01	142	160	-18	437	-12	+6
2001-02	129	146	-17	435	-2	+15
2002-03	115	156	-41	435	0	+41
2003-04	157	163	-6	454	+19	+25
2004-05	156	150	+6	450	-4	-10
2005-06	164	164	+30	474	+24	-6
2006-07	148	162	-14	469	-5	+9
2007-08	166	153	+13	491	+22	+9
2008-09	154	162	-8	480	-11	-3
2009-10	127	146	-19	478	-2	+17
2010-11	153	180	-27	469	-9	+18
2011-12	149	165	-16	446	-23	-7
2012-13	171	139	+32	488	+42	+10
2013-14	140	158	-18	477	-11	+7
2014-15	155	157	-2	484	+7	+9
∑ 1995-1999			-15		+50	+65
∑ 2000-2004			-76		+1	+77
Prior 5 years: ∑ 2005-2009			+2		+28	+26
Last 5 years: ∑ 2010-2014			-31		+6	+37

[*] Note: The schools were reconfigured in 1997 with the Elementary which was previously K→G6 now K→G5; the Junior High which was previously G7→G9 and is now renamed the Middle School with Grades 6-8; and the High School which was previously Grades 10-12, now having Grades 9-12. We are using the current grade alignment throughout.

[ç] $\Delta_1 = G5_{t-1} – G8_{t-1}$

[§] Δ_2=Middle School $Population_t$ – Middle Student $Population_{t-1}$; in 1994 the Middle School (G6-G8) Student Population was 399.

[λ] Net migration is Δ_2-Δ_1.

Table 13C

The Exit-Entry Exchange (E3) and Net Migration (NM) at the High School[*] Level: 1994-2013

	$G8_{t-1}$	$G12_{t-1}$	(E3) Δ_1 without migration[1,§]	High School $Population_t$	Δ_2[§]	Net Migration (NM)[λ]
t= 1995-96	134	121	+13	528	-4	-17
1996-97	129	115	+14	570	+42	+28
1997-98	160	149	+11	589	+19	+8
1998-99	156	136	+20	611	+22	+2
1999-00	151	136	+15	598	-13	-28
2000-01	160	146	+14	642	+44	+30
2001-02	146	151	-5	645	+3	+8
2002-03	156	147	+9	667	+22	+13
2003-04	163	158	+5	644	-23	-28
2004-05	150	163	-13	642	-2	+11
2005-06	134	150	-16	618	-24	-8
2006-07	162	158	+4	612	-6	-10
2007-08	153	154	-1	608	-4	-3
2008-09	162	156	+6	625	+17	+11
2009-10	146	136	+10	640	+15	+5
2010-11	180	161	+19	657	+17	-2
2011-12	165	157	+8	667	+10	+2
2012-13	139	178	-39	616	-51	-12
2013-14	158	132	+26	634	+18	-8
2014-15	157	177	-20	616	-18	+2
∑ 1995-1999			+73		+66	-7
∑ 2000-2004			+10		+44	+34
Prior 5 years: ∑ 2005-2009			+3		-2	-5
Last 5 years: ∑ 2010-2014			-6		-24	-18

[*] Note: The schools were reconfigured in 1997 with the Elementary which was previously K→G6 now K→G5; the Junior High which was previously G7→G9 and is now renamed the Middle School with Grades 6-8; and the High School which was previously Grades 10-12, now having Grades 9-12. We are using the current grade alignment throughout.

[§] $\Delta_1 = G8_{t-1} - G12_{t-1}$

[§] Δ_2=High School $Population_t$ – High Student $Population_{t-1}$; in 1994 the High School Student Population in Grades 9-12 was 532.

[λ] Net migration is $\Delta_2 - \Delta_1$

Table 14

Total Student Enrollment in the Quaker Valley School District by Year and Level: 1990-2014[1]

School Yr.	Elementary	Middle	High School	Total	Δ
1990	810	404	506	1720	
1991	838	412	521	1771	+51
1992	846	442	527	1815	+44
1993	790	393	543	1726	-89
1994	811	399	532	1742	+16
1995	787	426	528	1741	-1
1996	772	457	570	1799	+58
1997	756	463	589	1808	+9
1998	760	454	611	1825	+17
1999	767	449	598	1814	-11
2000	760	437	642	1839	+25
2001	828	435	645	1908	+69
2002	876	435	667	1978	+70
2003	864	454	644	1962	-16
2004	828	450	642	1920	-42
2005	800	474	618	1892	-28
2006	835	469	612	1916	+24
2007	807	491	608	1906	-10
2008	837	480	625	1942	+36
2009	877	478	640	1995	+53
2010	855	469	657	1981	-14
2011	848	446	667	1961	-20
2012	810	488	616	1914	-47
2013	833	477	634	1944	+30
2014	820	484	616	1920	-24
Δ 1990-2000	-50	+33	+136		+119
Δ 2000-2010	+95	+32	+15		+142
Δ 2010-2014	-35	+15	-41		-61
Δ 2009-2014[2]	-57	+6	-24		-75
Δ 2004-2009	+49	+28	-2		+75
Δ 1999-2004	+61	+1	+44		+106
Δ 1994-1999	-44	+50	+66		+72

[1] The schools were reconfigured in 1997 with the Elementary which was previously K→G6 now K→G5; the Junior High which was previously G7→G9 and is now renamed the Middle School with Grades 6-8; and the High School which was previously Grades 10-12, now having Grades 9-12. We are using the current grade alignment throughout.

[2] Last 5 years

Table 15A

Housing Development 1990-1999
(Number of Building Permits Issued/Year)[*]

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	Σ	No. Yrs.	Avg./ Yr.
Aleppo Township	1	9	2	6	1	0	1	6	8	8	42	10	(4.2) 4
Bell Acres Borough	4	1	2	3	3	1	4	2	10	8	38	10	(3.8) 4
Edgeworth Borough	0	2	3	2	1	1	1	0	3	0	13	10	(1.3) 1
Glenfield Borough											0	10	0
Hayesville Borough											0	10	0
Leet Township	NA	NA	1	1	2	0	1	0	0	0	5	8	(.6) 1
Leetsdale Borough											0	10	0
Osborne Borough	----	---	---	---	---	5	---	---	---	1	6[**]	10	(.6) 1
Sewickley Borough	1	0	4	NA	NA	NA	NA	NA	NA	1	6	4	(1.5) 2
Sewickley Hts. Boro	NA	2	0	1	2	0	2	2	1	4	14	9	(1.6) 2
Sewickley Hills Boro	NA	NA	3	4	3	2	1	1	5	0	19	8	(1.9) 2
	6	14	15	17	12	4	10	11	27	22	143		14-17

[*] Data collected from all eleven municipalities by year.
[**] Five (5) additional homes were built in Osborne between 1990 and 1998, but the year in which the building permit was issued is not available.

Table 15B

Housing Development 2000-2009
(Number of Building Permits Issued/Year)·

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	Σ	No. Yrs.	Avg./ Yr.
Aleppo Township	7	8	8	0	0	1	8	0	1	1	34	10	(3.4) 3
Bell Acres Borough	10	5	7	9	3	8	3	5	2	3	55	10	(5.5) 6
Edgeworth Borough	0	0	3	0	0	0	0	0	2	0	5	10	(0.5) 1
Glenfield Borough	0	0	0	0	0	0	0	0	0	0	0	10	0
Hayesville Borough											0	10	0
Leet Township	0	3	11	12	14	0	0	NA	NA	NA	40	7	(5.7) 6
Leetsdale Borough											0	10	0
Osborne Borough	1	1	2	0	0	0	0	0	0	0	4	10	(.4) 0
Sewickley Borough	1	10	1	4	0	3	0	0	0	1	20	10	(2.0) 2
Sewickley Hts. Boro	0	2	2	0	1	1	1	1	2	2	12	10	(1.2) 1
Sewickley Hills Boro	4	1	0	1							6	4	(1.5) 2
	23	30	34	26	18	13	12	5	5	5	176		18-21

· Data collected from all eleven municipalities by year.

Table 15C

Housing Development 2010-2015
(Number of Building Permits Issued/Year)[·]

	2010	2011	2012	2013	2014	2015	Σ	No. Yrs.	Avg./ Yr.
Aleppo Township	3	0	1	3	1	1	9	6	(1.5) 2
Bell Acres Borough	4	2	0	0	0	4	10	6	(1.7) 2
Edgeworth Borough	1	0	1	0	1	0	3	6	(0.5) 1
Glenfield Borough	0	0	0	0	0	0	0	6	0
Hayesville Borough							0	6	0
Leet Township			0	0	0	0	0	4	0
Leetsdale Borough							0	6	0
Osborne Borough	0	0	1	0	0	3	4	6	(.7) 1
Sewickley Borough	2	0	11	1	3	11	28	6	(4.7) 5
Sewickley Hts. Boro	2	0	2	2	2	0	8	6	(1.3) 1
Sewickley Hills Boro	5	10	13	7	1	1	37	6	(6.2) 6
	17	12	29	13	8	20	99	6	17-18

[·] Data collected from all eleven municipalities by year.

Table 16

Quaker Valley School District Forecasts per Grade: 2015-2024 Fertility/Aging/Embedded Growth Scenario with Current Retention and Birth to Kindergarten Ratios and Current Fertility Levels [Scenario I]·

	K	G1	G2	G3	G4	G5	Total K→G5	G6	G7	G8	Total G6→G8	G9	G10	G11	G12	Total G9 → G12	Total K → G12	Outside	Total
2014	96	145	140	148	130	161	820	154	147	183	484	158	154	145	159	616	1920	20	1940
2015	118	108	149	144	151	133	803	164	153	149	466	184	156	152	144	636	1905	20	1925
2016	113	132	111	153	147	155	811	136	163	155	454	150	181	154	151	636	1901	20	1921
2017	113	127	136	114	157	151	798	158	135	165	458	156	148	179	153	636	1892	20	1912
2018	118	127	131	140	117	161	794	162	159	137	458	166	154	146	178	644	1896	20	1916
2019	115	132	131	135	143	120	776	164	161	161	486	138	164	152	145	599	1861	20	1881
2020	115	129	136	135	138	147	800	123	163	163	449	162	136	162	151	611	1860	20	1889
2021	115	129	133	140	138	141	796	150	122	165	437	164	160	134	161	619	1852	20	1872
2022	115	129	133	137	143	141	798	144	149	124	417	166	162	158	133	619	1834	20	1854
2023	115	129	133	137	140	147	801	144	143	151	438	125	164	160	157	606	1845	20	1865
2024	115	129	133	137	140	144	798	150	143	145	438	152	123	162	159	596	1832	20	1852

159	2014	2019	2024	Δ2019-2014	Δ2024-2019	Δ2024-2014
K→G5	820	776	798	-44	+22	-22
G6→G8	484	486	438	+2	-48	-46
G9→G12	616	599	596	-17	-3	-20
Outside	20	20	20	0	0	0
Total	1940	1881	1852	-59	-29	-88

· This scenario uses the following parameters: (1) Baseline four-year retention ratios (2010-2013), as shown in Table 12; (2) Birth at t-5 to K enrollment ratio of 1.126; this is derived as follows: (a) a baseline .75 (t-5 Births) + .25 (t-6 Births) for births in years 2005-2009 and 2011-2014 K enrollments. For years 2015-2018, observed births in 2009-2013 in the Quaker Valley School District were used. For years 2019-2024, the average number of births for 2010-2013 was used (102); see Table 1.

Table 17

Quaker Valley School District Forecasts per Grade: 2015-2024 Fertility/Aging/Embedded Growth Scenario with Current Retention and Birth to Kindergarten Ratios and Higher Fertility Levels [Scenario II]·

	K	G1	G2	G3	G4	G5	Total K→G5	G6	G7	G8	Total G6→G8	G9	G10	G11	G12	Total G9 → G12	Total K → G12	Outside	Total
2014	96	145	140	148	130	161	820	154	147	183	484	158	154	145	159	616	1920	20	1940
2015	118	108	149	144	151	133	803	164	153	149	466	184	156	152	144	636	1905	20	1925
2016	113	132	111	153	147	155	811	136	163	155	454	150	181	154	151	636	1901	20	1921
2017	113	127	136	114	157	151	798	158	135	165	458	156	148	179	153	636	1892	20	1912
2018	118	127	131	140	117	161	794	162	159	137	458	166	154	146	178	644	1896	20	1916
2019	141	132	131	135	143	120	802	164	161	161	486	138	164	152	145	599	1887	20	1907
2020	141	158	136	135	138	147	855	123	163	163	449	162	136	162	151	611	1915	20	1935
2021	141	158	162	140	138	141	880	150	122	165	437	164	160	134	161	619	1936	20	1956
2022	141	158	162	166	143	141	911	144	149	124	417	166	162	158	133	619	1947	20	1967
2023	141	158	162	166	170	147	944	144	143	151	438	125	164	160	157	606	1988	20	2008
2024	141	158	162	166	170	174	971	150	143	145	438	152	123	162	159	596	2005	20	2025

159	2014	2019	2024	∆2019-2014	∆2024-2019	∆2024-2014
K→G5	820	802	971	-18	+169	+151
G6→G8	484	486	438	+2	-48	-46
G9→G12	616	599	596	-17	-3	-20
Outside	20	20	20	0	0	0
Total	1940	1907	2025	-33	+118	+85

· This scenario uses the following parameters: (1) Baseline four-year retention ratios (2010-2013), as shown in Table 12; (2) Birth at t-5 to K enrollment ratio of 1.126; this is derived as follows: (a) a baseline .75 (t-5 Births) + .25 (t-6 Births) for births in years 2005-2009 and 2011-2014 K enrollments. For years 2015-2018, observed births in 2009-2013 in the Quaker Valley School District were used. For years 2019-2024, the average number of births was assumed to return to the 2000-2004 level of 125/year; see Table 1.

Table 18

Quaker Valley School District Forecasts per Grade: 2015-2024 Fertility/Aging/Embedded Growth Scenario with Current Retention and Birth to Kindergarten Ratios and Moderately Higher Fertility Levels [Scenario III][·]

	K	G1	G2	G3	G4	G5	Total K→G5	G6	G7	G8	Total G6→G8	G9	G10	G11	G12	Total G9 → G12	Total K → G12	Outside	Total
2014	96	145	140	148	130	161	820	154	147	183	484	158	154	145	159	616	1920	20	1940
2015	118	108	149	144	151	133	803	164	153	149	466	184	156	152	144	636	1905	20	1925
2016	113	132	111	153	147	155	811	136	163	155	454	150	181	154	151	636	1901	20	1921
2017	113	127	136	114	157	151	798	158	135	165	458	156	148	179	153	636	1892	20	1912
2018	118	127	131	140	117	161	794	162	159	137	458	166	154	146	178	644	1896	20	1916
2019	129	132	131	135	143	120	790	164	161	161	486	138	164	152	145	599	1875	20	1895
2020	129	145	136	135	138	147	830	123	163	163	449	162	136	162	151	611	1890	20	1910
2021	129	145	149	140	138	141	842	150	122	165	437	164	160	134	161	619	1898	20	1918
2022	129	145	149	153	143	141	860	144	149	124	417	166	162	158	133	619	1896	20	1916
2023	129	145	149	153	157	147	880	144	143	151	438	125	164	160	157	606	1924	20	1944
2024	129	245	149	153	157	161	894	150	143	145	438	152	123	162	159	596	1928	20	1948

159	2014	2019	2024	Δ2019-2014	Δ2024-2019	Δ2024-2014
K→G5	820	790	894	-30	+104	+74
G6→G8	484	486	438	+2	-48	-46
G9→G12	616	599	596	-17	-3	-20
Outside	20	20	20	0	0	0
Total	1940	1895	1948	-45	+53	+8

[·] This scenario uses the following parameters: (1) Baseline four-year retention ratios (2010-2013), as shown in Table 12; (2) Birth at t-5 to K enrollment ratio of 1.126; this is derived as follows: (a) a baseline .75 (t-5 Births) + .25 (t-6 Births) for births in years 2005-2009 and 2011-2014 K enrollments. For years 2019-2024, observed births in 2009-2013 in the Quaker Valley School District were used. For years 2019-2024, fertility was increased at a more moderate level than in Scenario II—to 115 births/year, but above the current level in 2010-2013 of 102 births/year, used in Scenario I. See text for more details.

Table 19

Quaker Valley School District Forecasts per Grade: 2015-2024 Fertility/Aging/Embedded Growth Scenario with Current Retention and Birth to Kindergarten Ratios and Much Higher Fertility Levels from 2015 Onward [Scenario IV]·

	K	G1	G2	G3	G4	G5	Total K→G5	G6	G7	G8	Total G6→G8	G9	G10	G11	G12	Total G9 → G12	Total K → G12	Outside	Total
2014	96	145	140	148	130	161	820	154	147	183	484	158	154	145	159	616	1920	20	1940
2015	141	108	149	144	151	133	826	164	153	149	466	184	156	152	144	636	1928	20	1948
2016	141	158	111	153	147	155	865	136	163	155	454	150	181	154	151	636	1955	20	1975
2017	141	158	162	114	157	159	891	158	135	165	458	156	148	179	153	636	1985	20	2005
2018	141	158	162	166	117	161	905	162	159	137	458	166	154	146	178	644	2007	20	2027
2019	141	158	162	166	170	120	917	164	161	161	486	138	164	152	145	599	2002	20	2022
2020	141	158	162	166	170	174	971	123	163	163	449	162	136	162	151	611	2031	20	2051
2021	141	158	162	166	170	174	971	178	122	165	465	164	160	134	161	619	2055	20	2075
2022	141	158	162	166	170	174	971	178	177	124	479	166	162	158	133	619	2069	20	2089
2023	141	158	162	166	170	174	971	178	177	179	534	125	164	160	157	606	2111	20	2131
2024	141	158	162	166	170	174	971	178	177	179	534	180	123	162	159	624	2129	20	2149

159	2014	2019	2024	Δ2019-2014	Δ2024-2019	Δ2024-2014
K→G5	820	917	971	+97	+54	+151
G6→G8	484	486	534	+2	+48	+50
G9→G12	616	599	624	-17	+25	+8
Outside	20	20	20	0	0	0
Total	1940	2022	2149	+82	+127	+209

· This scenario uses the following parameters: (1) Baseline four-year retention ratios (2010-2013), as shown in Table 12; (2) Birth at t-5 to K enrollment ratio of 1.126; this is derived as follows: (a) a baseline .75 (t-5 Births) + .25 (t-6 Births) for births in years 2005-2009 and 2011-2014 K enrollments. For all years, 2015-2024, births equivalent to 125/year (as in 2000-2004) were used from the onset to set an upper bound on the projections.

Table 20

Edgeworth Elementary School
Forecasts per Grade: 2015-2024
[Scenario IIIa][·]

	K	G1	G2	G3	G4	G5	Total K→G5
2014	55	81	75	98	66	85	460
2015	57	59	75	72	81	67	411
2016	63	64	61	77	74	83	422
2017	62	71	66	63	79	76	417
2018	69	70	73	68	64	81	425
2019	71	77	72	75	70	66	431
2020	71	80	79	74	77	72	453
2021	71	80	82	81	76	79	469
2022	71	80	82	84	83	78	478
2023	71	80	82	84	86	85	488
2024	71	80	82	84	86	88	491

	2014	2019	2024	Δ2019-2014	Δ2024-2019	Δ2024-2014	ΔPeak	Peak Size
Overall	460	431	491	-29	+60	+31	+31	491

[·] This scenario uses the following parameters: 1) Baseline four-year retention ratios (2010-2013), as shown in Table 12; (2) Birth to K enrollment ratio of 1.126; this is derived as follows: (a) a baseline .75 (t-5 Births) + .25 (t-6 Births) for births in years 2005-2009 and 2011-2014 K enrollments. For years 2015-2018, observed births in 2009-2013 in the Edgeworth attendance area were used. For years 2019-2024, we assumed a moderate overall increase in births, as in Scenario III—115 per year, with a .55 allocation to Edgeworth. See text for more details. Both the 2014 and 2015 enrollments are observed and the projections pertain to the 2016-2024 enrollments. See text for the rationale for the 2015 starting date.

Table 21

Osborne Elementary School
Forecasts per Grade: 2015-2024
[Scenario IIIb][·]

	K	G1	G2	G3	G4	G5	Total K→G5
2014	41	64	65	50	64	76	360
2015	58	49	67	66	62	64	366
2016	51	65	50	69	68	64	367
2017	50	57	67	51	71	70	366
2018	48	56	59	69	52	73	357
2019	59	54	58	61	71	53	356
2020	59	66	56	60	62	73	376
2021	59	66	68	58	61	64	376
2022	59	66	68	70	59	63	385
2023	59	66	68	70	72	60	395
2024	59	66	68	70	72	74	409

	2014	2019	2024	Δ2019-2014	Δ2024-2019	Δ2024-2014	ΔPeak	Peak Size
Overall	360	356	409	-4	+53	+49	+49	409

[·] This scenario uses the following parameters: 1) Baseline four-year retention ratios (2010-2013), as shown in Table 12; (2) Birth to K enrollment ratio of 1.126; this is derived as follows: (a) a baseline .75 (t-5 Births) + .25 (t-6 Births) for births in years 2005-2009 and 2011-2014 K enrollments. For years 2015-2018, observed births in 2009-2013 in the Osborne attendance area were used. For years 2019-2024, we assumed a moderate overall increase in births, as in Scenario III—115 per year with a .45 allocation to Osborne. See text for more details. . Both the 2014 and 2015 enrollments are observed and the projections pertain to the 2016-2024 enrollments. See text for the rationale for the 2015 starting date.