Howard County
Public School System

BOARD OF EDUCATION OF HOWARD COUNTY
MEETING AGENDA ITEM

TITLE: Projection Accuracy Report **DATE:** January 29, 2023

PRESENTER(S): Daniel Lubeley, Director of Capital Planning and Construction
Timothy Rogers, Manager of School Planning

Strategic Call To Action Alignment: This process supports the Strategic Call to Action (SCTA) by providing operations and practices that are responsive, transparent, fiscally responsible and accountable.

OVERVIEW: Accurate student enrollment projections are critical to the Howard County Public School System (HCPSS). The annual Operating and Capital Budgets as well as any school attendance area adjustments are developed using student enrollment projections. The Office of School Planning develops K-12 enrollment projections by school, by grade annually for each Howard County elementary, middle and high school. Each year the Office of School Planning provides the Board with the accuracy analysis, which compares the actual September 30 enrollment with what was projected. Projections vary each year based on changes in enrollment, as well as birth and housing data. A description of how projections are developed is attached (Attachment 1).

As of September 30, 2022, the countywide K-12 enrollment of the HCPSS was 56,098. The projection developed in the Spring of 2022 for the same timeframe was 56,477, a 379-student difference (Attachment 2). Approximately 76 percent of the projections by school had error rates at or below 5 percent. Approximately 24 percent of the projections by school were within 10 students of the actual student enrollment (Attachments 3 and 4). The mean absolute percentage error (MAPE) by school was 3.3 percent.

The 2022 projection was developed using data inputs that reflect the impacts of the COVID-19 pandemic. Much of the 379 student difference is due to increased volatility in the enrollment and housing factors that contribute to the projection, as the influence of the pandemic continues.

RECOMMENDATION/FUTURE DIRECTION:
Continue the use of the existing projection methodology. Continue to study enrollment trends and use that analysis to inform the Spring 2023 projections for the SY 2023-2024.

SUBMITTED BY: **APPROVAL/CONCURRENCE:**

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Superintendent

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Scott W. Washington
Chief Operating Officer

INTRODUCTION

The student enrollment projections analyzed in this report were generated in the Spring of 2022, presented in the 2022 Feasibility Study and used in the FY 2024 Capital Budget, FY 2025–2029 Capital Improvement Program, and the FY 2024–2033 Long-Range Master Plan. Additionally, the projections are used to develop the Operating Budget, determine staffing and resource allocations, inform the attendance area adjustment planning process and implementation, and create the Adequate Public Facility School Capacity Chart.

Student enrollment projections are developed annually and are provided by school, by grade. The projections are the result of a collaborative effort between the Howard County Public School System (HCPSS), Howard County Department of Planning and Zoning, Maryland Department of Health and Mental Hygiene, and other county and state agencies. The purpose of this report is to inform the Board of Education (Board) and public about the projection methodology and accuracy for SY 2022-2023.

PROJECTION METHODOLOGY

The projection methodology used by the HCPSS is based on historic *cohort survival ratios*. For our purposes, a *cohort* is a group of students at a specific grade level. The cohort survival methodology looks at past student population patterns within the county to construct *survival ratios* in projecting a particular grade's migration through the school system. For example, cohort survival ratios are used to project how many second graders will result from last year's first graders, how many third graders will result from last year's second graders, continuing until the number of twelfth graders from last year's eleventh graders is predicted. Figure 1 below illustrates a cohort survival ratio. In the example below, the survival rate of 1.15 can be used to predict how many second graders will result from the previous year's first graders. This rate, which is collected over multiple years, is then multiplied by the current year's student population at the first grade level to project the following year's second grade student population. This calculation is done for each grade level, at each school. The cohort survival ratios are calculated based on actual addresses and are aggregated by school attendance area to maintain comparability regardless of any changes in school attendance area boundaries.
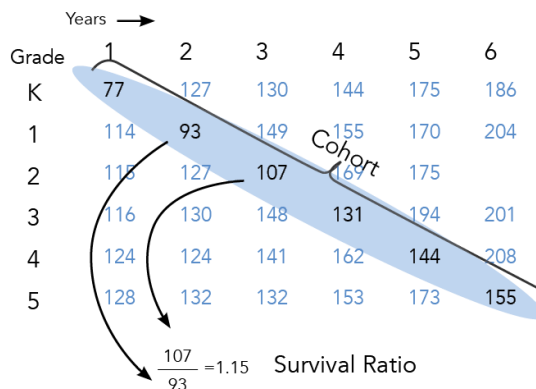

Figure 1: Example Cohort Survival Ratio

In addition to the calculation and application of cohort survival ratios, the HCPSS utilizes many data points in order to project student population, including live birth data, first-time sales of newly-constructed homes, resales of existing homes, apartment turnover, and enrollment at regional programs. The contribution of each data point is projected separately based on specific, appropriate methodologies for each category. The Office of School Planning uses historical live birth data to create a birth to kindergarten survival ratio and projected birth data to inform later parts of the projection. The Office of School Planning identifies the reasons for each student's most recent enrollment or withdrawal based on housing transactions and enrollment transaction reports. Up to five years of historical data are used to calculate ratios of students yielded from existing and newly-constructed housing, and then aggregated by school attendance area. This ratio is applied to future years, based on existing residential housing unit allocations and projected housing allocations for future new construction. The historical ratios of students yielded from resale of existing housing and apartment turnover are also compiled and included in the development of the projections by school attendance area. Students with no change in housing or school assignment are included in the survival ratio.

As housing units are built around the county, our projection methodology estimates the number of new students arriving at HCPSS schools in two ways. Estimated student yield from the first year the units are occupied, as *new construction*, is calculated using historical yield rates by unit type and school. In subsequent years, those units are then added to the student yield calculation for new students from *resales*. This process ensures students yielded from housing transactions, regardless of the age of housing are considered in the historical data informing our enrollment projection.

Regional programs (e.g., JROTC and JumpStart) that impact enrollment are added to the projection at the receiving school and removed from the projection at the sending school. These variables are combined to project enrollment for each school for September 30 of each future year.

2022 FACTORS

All school enrollment projection methods attempt to predict choices families will make that impact future enrollment using historical data on those choices. The Covid-19 pandemic influenced families' school enrollment, housing, and economic decisions in unpredictable ways. While our day-to-day conditions are mostly back to pre-pandemic, the social and economic impacts are not over. Our enrollment will likely continue to see higher levels of volatility than previous as new trends are established and included in our historical data.

ANALYSIS

The first year of the Spring 2022 projection is compared to the actual September 30, 2022 enrollment in Attachment 2. For SY 2022-2023, the countywide one-year accuracy error rate for grades K–12 was 0.7 percent, while the by level one-year accuracy error rate was 0.03 percent for elementary, 0.7 percent for middle and 1.6 percent for high schools. Prior to the pandemic, between 2012 and 2019, the countywide error rate has ranged from 0.05 percent to 0.6 percent. During the same timeframe, the elementary school level error rate ranged between 0.05 percent and 0.9, the middle school level error rate ranged between 0.04 percent and 0.8 percent and the

high school level error rate ranged between 0.01 percent and 0.5 percent. All of the 2022 error rates have decreased, approaching pre-pandemic levels, compared to the 2021 error rates. The countywide, elementary, and middle error rates returned to the 2012-2019 ranges, while the high school rate remained about 1 percent higher than the 0.01 to 0.5 range performance from those same years.

Of the seventy-four schools for which HCPSS provides annual projections, approximately 76 percent had error rates at or below 5 percent. Approximately 24 percent of the schools were within 10 students of the actual student enrollment (Attachments 3 and 4). The mean absolute percentage error (MAPE) by school was 3.3 percent. Attached to this report are the Projection Accuracy tables for all schools.

Figure 2 below shows the historical projection accuracy of the K–12 countywide enrollment for the first-year projection. The labels on the charts indicate the difference between the enrollment and projection. As of September 30, 2022, the countywide K-12 enrollment of the HCPSS was 56,098. The projection developed in the Spring of 2022 for the same timeframe was 56,477, a 379-student difference. Elementary, middle and high school accuracy follows in Figure 3, Figure 4 and Figure 5. Using the same comparison, the elementary school difference was 7 the middle school difference was 86 and the high school difference was 300.
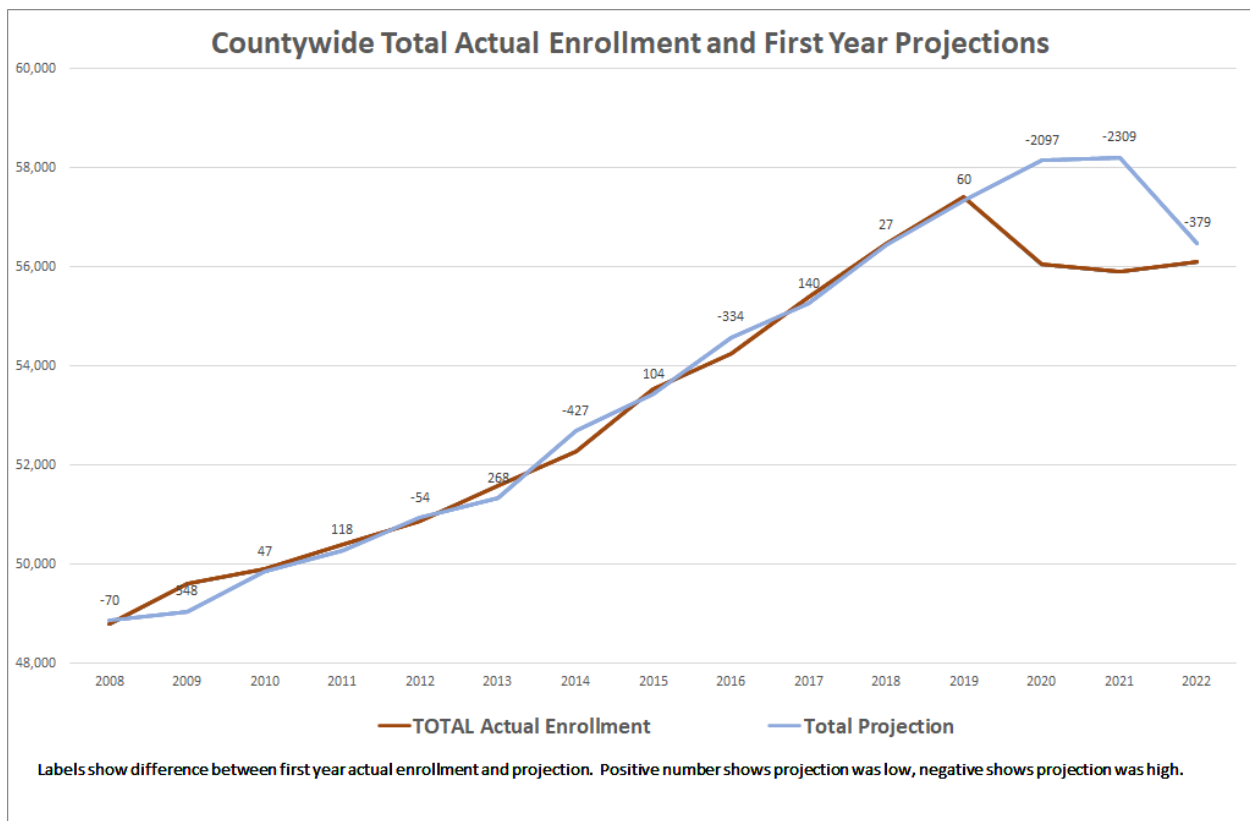
Figure 2: Countywide First Year Projection Accuracy

Elementary School Total Actual Enrollment and First Year Projections

Labels show difference between first year actual enrollment adn projection. Positive number shows projection was low, negative shows projection was high.

Figure 3: Elementary School Level First Year Projection Accuracy

Middle School Total Actual Enrollment and First Year Projections

Labels show difference between first year actual enrollment adn projection. Positive number shows projection was low, negative shows projection was high.

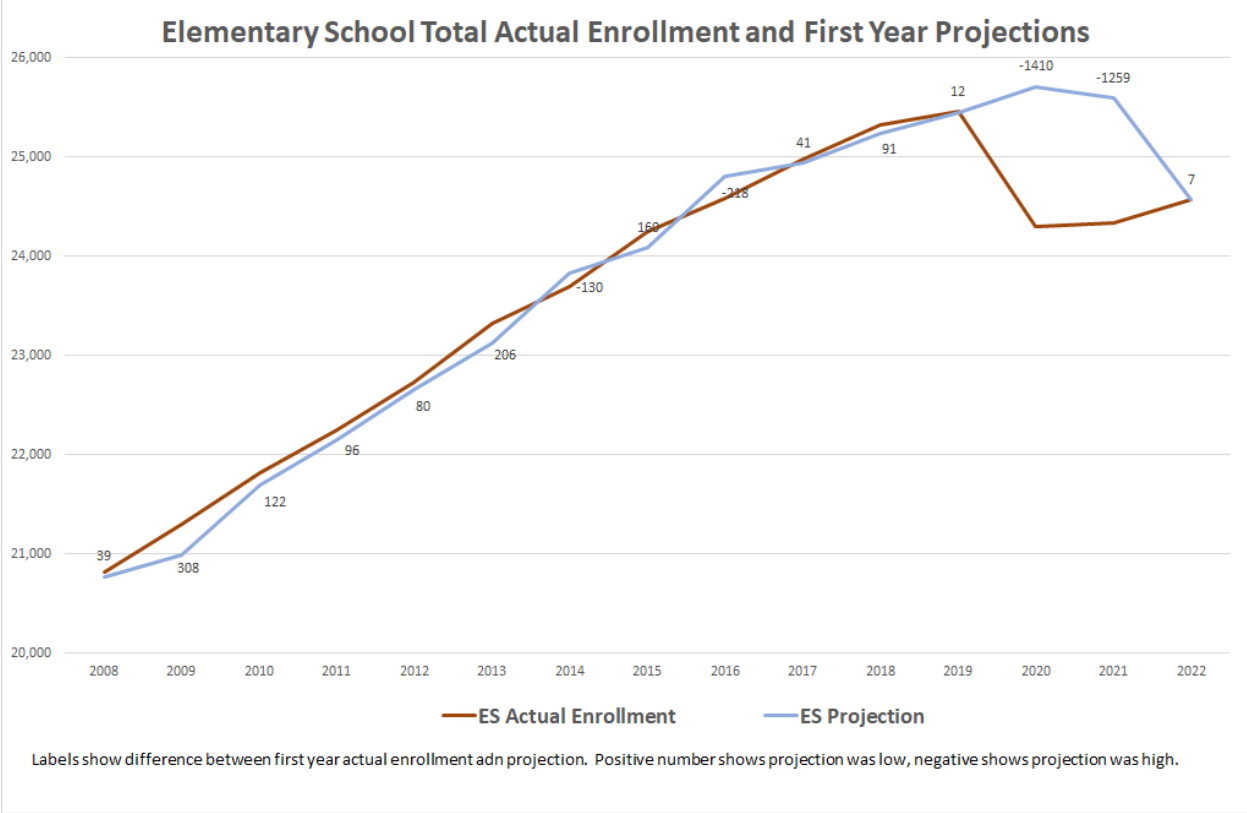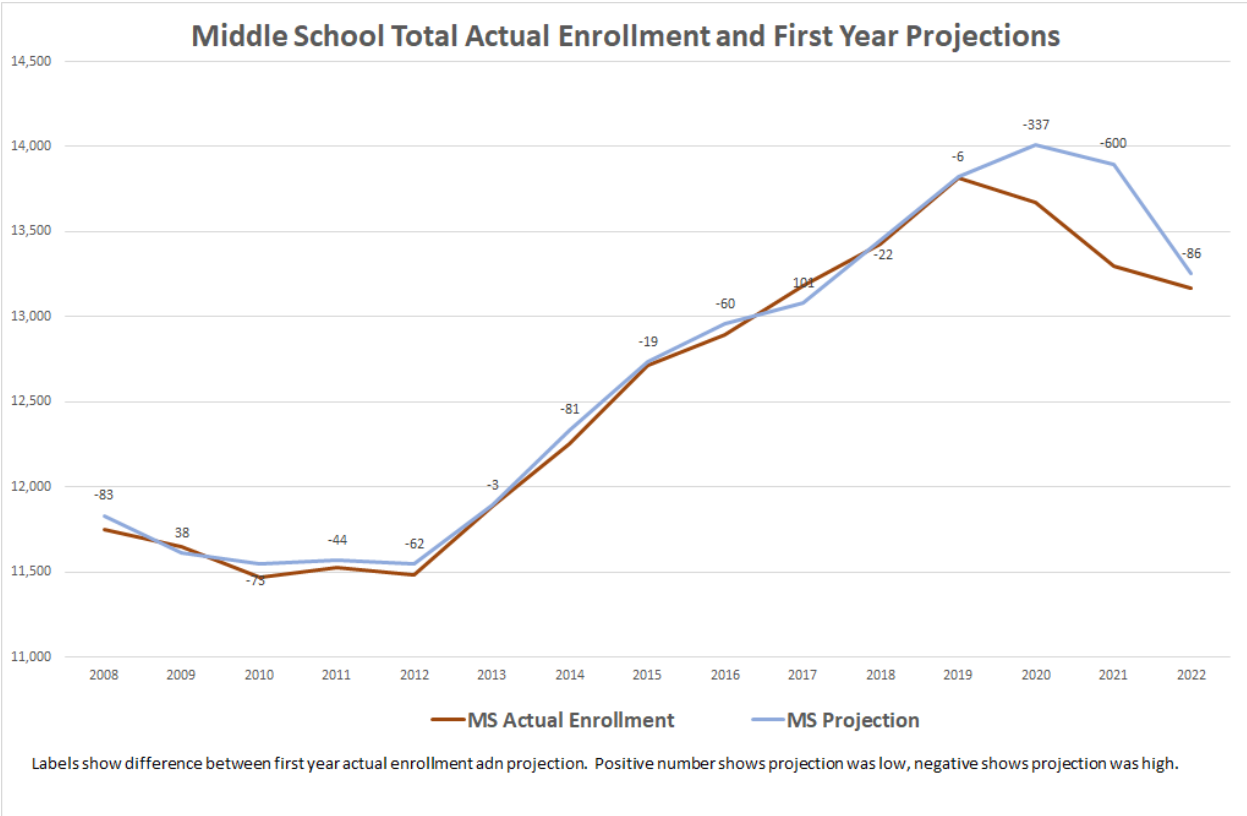*Figure 4: Middle School Level First Year Projection Accuracy*

Figure 5: High School Level First Year Projection Accuracy

High School Total Actual Enrollment and First Year Projections

Labels show difference between first year actual enrollment adn projection. Positive number shows projection was low, negative shows projection was high.
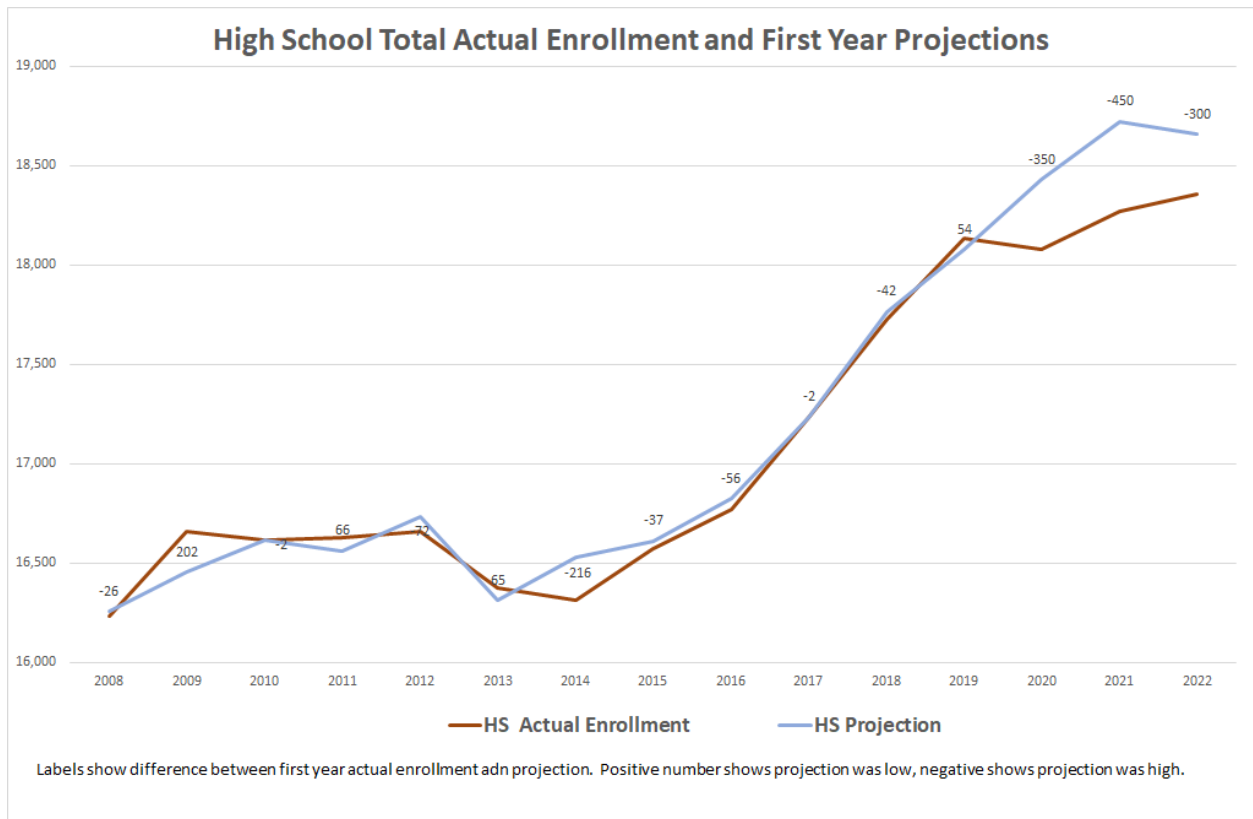
ATTACHMENT 2

ENROLLMENT - PROJECTION[1]
1 year COMPARISON - 2022

Countywide - Grades K-12			Error Rate[2]	
Year	Actual	Proj	Diff[3]	%[4]
2013	51595	51327	+268	0.5%
2014	52412	52691	-279	0.5%
2015	53534	53430	+104	0.2%
2016	54247	54581	-334	0.6%
2017	55391	55251	+140	0.3%
2018	56471	56444	+27	0.0%
2019	57406	57346	+60	0.1%
2020	56165	58142	-1977	3.5%
2021	55899	58208	-2309	4.1%
2022	**56098**	**56477**	**-379**	**0.7%**

Elementary - Grades K-5			Error Rate[2]	
Year	Actual	Proj	Diff[3]	%[4]
2013	23327	23121	+206	0.9%
2014	23698	23828	-130	0.5%
2015	24245	24085	+160	0.7%
2016	24582	24800	-218	0.9%
2017	24978	24937	+41	0.2%
2018	25320	25229	+91	0.4%
2019	25459	25447	+12	0.0%
2020	24295	25705	-1410	5.8%
2021	24329	25588	-1259	5.2%
2022	**24574**	**24567**	**+7**	**0.0%**

Middle - Grades 6-8			Error Rate[2]	
Year	Actual	Proj	Diff[3]	%[4]
2013	11890	11893	-3	0.0%
2014	12276	12336	-60	0.5%
2015	12715	12734	-19	0.1%
2016	12897	12957	-60	0.5%
2017	13180	13079	+101	0.8%
2018	13427	13449	-22	0.2%
2019	13815	13821	-6	0.0%
2020	13682	14008	-326	2.4%
2021	13297	13897	-600	4.5%
2022	**13167**	**13253**	**-86**	**0.7%**

High - Grades 9-12			Error Rate[2]	
Year	Actual	Proj	Diff[3]	%[4]
2013	16378	16313	+65	0.4%
2014	16438	16527	-89	0.5%
2015	16574	16611	-37	0.2%
2016	16768	16824	-56	0.3%
2017	17233	17235	-2	0.0%
2018	17724	17766	-42	0.2%
2019	18132	18078	+54	0.3%
2020	18188	18429	-241	1.3%
2021	18273	18723	-450	2.5%
2022	**18357**	**18657**	**-300**	**1.6%**

(1) These charts compare the actual student enrollment counts from September 30th of each year to what was projected for that year. The projections were prepared approximately six months in advance of the actual.

(2) The error rate is a demonstration of the performance of the enrollment projection model's performance at the countywide (system total), organizational (elementary, middle and high school) and school levels.

(3) The difference is shown under the column "Diff".

(4) The percentage error is shown under the column "%".

ATTACHMENT 3

ELEMENTARY SCHOOLS[1] - 2022

School	Grades K-5		Error Rate[2]	
	Actual	Proj	Diff[3]	%[4]
Atholton ES	465	456	+9	1.9%
Bellows Spring ES	733	707	+26	3.5%
Bollman Bridge ES	655	651	+4	0.6%
Bryant Woods ES	343	333	+10	2.9%
Bushy Park ES	581	566	+15	2.6%
Centennial Lane ES	670	656	+14	2.1%
Clarksville ES	581	561	+20	3.4%
Clemens Crossing ES	543	547	-4	0.7%
Cradlerock ES	436	436	0	0.0%
Dayton Oaks ES	727	680	+47	6.5%
Deep Run ES	650	664	-14	2.2%
Ducketts Lane ES	558	559	-1	0.2%
Elkridge ES	751	787	-36	4.8%
Forest Ridge ES	612	630	-18	2.9%
Fulton ES	830	811	+19	2.3%
Gorman Crossing ES	704	768	-64	9.1%
Guilford ES	458	475	-17	3.7%
Hammond ES	651	634	+17	2.6%
Hanover Hills ES	800	788	+12	1.5%
Hollifield Station ES	732	772	-40	5.5%
Ilchester ES	495	486	+9	1.8%
Jeffers Hill ES	377	398	-21	5.6%
Laurel Woods ES	598	604	-6	1.0%
Lisbon ES	453	399	+54	11.9%
Longfellow ES	450	466	-16	3.6%
Manor Woods ES	662	702	-40	6.0%
Northfield ES	747	701	+46	6.2%
Phelps Luck ES	697	657	+40	5.7%
Pointers Run ES	778	759	+19	2.4%
Rockburn ES	598	602	-4	0.7%
Running Brook ES	346	374	-28	8.1%
St Johns Lane ES	641	666	-25	3.9%
Stevens Forest ES	290	302	-12	4.1%
Swansfield ES	556	521	+35	6.3%
Talbott Springs ES	409	416	-7	1.7%
Thunder Hill ES	472	506	-34	7.2%
Triadelphia Ridge ES	605	586	+19	3.1%
Veterans ES	792	842	-50	6.3%
Waterloo ES	557	535	+22	3.9%
Waverly ES	814	801	+13	1.6%
West Friendship ES	366	377	-11	3.0%
Worthington ES	391	386	+5	1.3%
Elementary School Level Total	**24574**	**24567**	**+7**	**0.0%**

(1) These charts compare the actual student enrollment counts from September 30th of each year to what was projected for that year. The projections were prepared approximately six months in advance of the actual.

(2) The error rate is a demonstration of the performance of the enrollment projection model's performance at the elementary school level.

(3) The difference is shown under the column "Diff".

(4) The percentage error is shown under the column "%".

ATTACHMENT 4

MIDDLE & HIGH SCHOOLS[1] - 2022

School	Grades 6-8		Error Rate[2]	
	Actual	Proj	Diff[3]	%[4]
Bonnie Branch MS	682	668	+14	2.1%
Burleigh Manor MS	806	791	+15	1.9%
Clarksville MS	649	637	+12	1.8%
Dunloggin MS	619	609	+10	1.6%
Elkridge Landing MS	680	698	-18	2.6%
Ellicott Mills MS	670	681	-11	1.6%
Folly Quarter MS	683	646	+37	5.4%
Glenwood MS	493	463	+30	6.1%
Hammond MS	570	624	-54	9.5%
Harpers Choice MS	499	504	-5	1.0%
Lake Elkhorn MS	599	579	+20	3.3%
Lime Kiln MS	643	648	-5	0.8%
Mayfield Woods MS	716	736	-20	2.8%
Mount View MS	894	907	-13	1.5%
Murray Hill MS	591	618	-27	4.6%
Oakland Mills MS	475	474	+1	0.2%
Patapsco MS	661	677	-16	2.4%
Patuxent Valley MS	768	828	-60	7.8%
Thomas Viaduct MS	858	836	+22	2.6%
Wilde Lake MS	611	629	-18	2.9%
Middle School Level Total	**13167**	**13253**	**-86**	**0.7%**

School	Grades 9-12		Error Rate[2]	
	Actual	Proj	Diff[3]	%[4]
Atholton HS	1473	1535	-62	4.2%
Centennial HS	1400	1406	-6	0.4%
Glenelg HS	1339	1342	-3	0.2%
Hammond HS	1293	1364	-71	5.5%
Howard HS	1745	1715	+30	1.7%
Long Reach HS	1723	1735	-12	0.7%
Marriotts Ridge HS	1720	1693	+27	1.6%
Mt Hebron HS	1623	1621	+2	0.1%
Oakland Mills HS	1415	1431	-16	1.1%
Reservoir HS	1847	1924	-77	4.2%
River Hill HS	1424	1457	-33	2.3%
Wilde Lake HS	1355	1434	-79	5.8%
High School Level Total	**18357**	**18657**	**-300**	**1.6%**

(1) These charts compare the actual student enrollment counts from September 30th of each year to what was projected for that year. The projections were prepared approximately six months in advance of the actual.

(2) The error rate is a demonstration of the performance of the enrollment projection model's performance at the middle and high school levels.

(3) The difference is shown under the column "Diff".

(4) The percentage error is shown under the column "%".