



Office of Property Assessment

TAX YEAR 2023 RESIDENTIAL RATIO STUDIES

JUNE 2022

OVERVIEW

The Office of Property Assessment (OPA) is responsible for determining the value of all real property in Philadelphia and is dedicated to doing so in a fair, accurate, and understandable way. OPA's primary goal is, through ongoing assessments, to improve the quality and uniformity of all property values and to instill confidence in Philadelphia taxpayers regarding the fairness of the property tax system, as well as the competency and professionalism of the assessment office.

TAX YEAR 2023 ASSESSMENT

For tax year 2023, OPA assessed and valued more than 580,000 properties in the city using mass appraisal valuation. Mass appraisal is the process of determining property values as of a given date by looking at sales information, property characteristics, and using statistical methods. Mass appraisal is a widely accepted methodology for the valuation of property for the purposes of taxation. A detailed overview of OPA's methodology for the Tax Year 2023 reassessment is available at <https://www.phila.gov/documents/assessment-methodologies/>.

As of May 2022, this reassessment resulted in 520,262 market value increases (89.4%), 22,139 decreases (3.8%), and 37,778 (6.5%) assessments that did not change from the prior year. An additional 1,850 (0.3%) assessments were for properties that had no prior value (new construction, subdivisions, etc.).

RATIO STUDY MEASURES

This ratio study measures the quality of residential real property assessments within the city of Philadelphia. This report measures the results of the Tax Year 2023 reassessment against actual market conditions.

OPA uses a ratio study to evaluate the level and uniformity of completed assessments in accordance with International Association of Assessing Officers (IAAO) standards and recommendations. The IAAO is a professional organization of assessing officials that provides standards for assessment administration, educational programs, and research on assessment and tax policy issues. Additionally, the IAAO organization is a founding member of the Appraisal Foundation that developed the Uniform Standards of Professional Appraisal Practice (USPAP).

The IAAO's *Standard on Ratio Studies* was first published in September of 1990 and was revised in April 2013. The IAAO standards are advisory in nature and provide guidance to those performing ratio studies in the mass appraisal field regarding design, statistics, performance measures and related issues in conducting ratio studies. The standards can be reviewed here:

https://www.iaao.org/media/standards/Standard_on_Ratio_Studies.pdf

In accordance with these standards, OPA examines several metrics within the ratio study:

1. **Ratio of assessed value to sales price.** A ratio is the relationship between two numbers; in this case it is the relationship between the assessed value and sale price. The relationship between market value and sale price is commonly expressed as a percentage. This ratio measures how closely OPA market values compare to actual sales prices. Ratio studies that are run against the sales used in the model are part of the model calibration process. Ratio statistics that are run against projected or certified market values give us valuable information about assessment consistency and equity.

Ratios measure the overall level of assessment to selling prices of real estate, as indicated by the Market Value/Time Adjusted Sales Price (TASP) ratio. These may be the average of the assessed value/sale price ratios, the weighted average of the assessed value/sale price ratios or the median of the assessed value/sale price ratios. The average assessed value/sale price ratio is simply the average of all the ratios in the sample. The aggregate or “weighted” assessed value/sale price ratio is the result of dividing the total of the assessments by the total of the sale prices. The median assessed value/sale price ratio, which is the measure that OPA uses, is the midpoint ratio of all ratios after the ratios are arrayed from highest to lowest.

While the average, median, and weighted average measures of central tendency are all usually calculated, the median is the least affected by extreme ratios. Therefore, IAAO observes in its standards that the median is generally the preferred measure of central tendency for monitoring assessment performance. A median ratio of 1.00 indicates that the median assessment exactly matches the median sale price. **The IAAO recommends a level of assessment ratio between 0.90 to 1.10 across all types of properties and markets (90% to 110%).**

2. **Coefficient of Dispersion (COD).** The COD measures uniformity of assessments and is the most commonly used measure of consistency across assessments. The COD is calculated by dividing the average absolute deviation by the median ratio. To calculate the average absolute deviation, subtract the median ratio from the individual ratios for each observation and add all the results, ignoring positive or negative signs, and then divide the sum by the number of ratios. The acceptable level for the coefficient of dispersion depends upon the type of properties being reviewed. In general, the lower the COD, the more consistent and equitable the assessments. **In a large city such as Philadelphia, which has a wide variety of housing stock, the IAAO recognizes that a COD of 15% or less is considered acceptable for single family. A COD 20% or less is considered acceptable for multi-family (2-4 units).**
3. **Price Related Differential (PRD).** The PRD measures equity in high versus low valued properties. The PRD tests to see if higher and lower valued properties are assessed at the same level. The PRD is calculated by dividing the mean ratio by the weighted mean ratio. A

result close to 1.00 is better in that it indicates that high and low valued properties are valued at the same level of assessment. **The IAAO’s Standard on Ratio Studies (IAAO 2013) calls for a PRD of 0.98 to 1.03.** A PRD above 1.03 indicates an under-valuation of high-priced properties, while a PRD below 0.98 shows an under-valuation of low-priced properties.

Table 1 provides more detail around IAAO standards for COD:

Table 1: IAAO Ratio Study Uniformity Standards Indicating Acceptable General Quality*

Table 1-3. Ratio Study Uniformity Standards indicating acceptable general quality*

Type of property—General	Type of property—Specific	COD Range**
Single-family residential (including residential condominiums)	Newer or more homogeneous areas	5.0 to 10.0
Single-family residential	Older or more heterogeneous areas	5.0 to 15.0
Other residential	Rural, seasonal, recreational, manufactured housing, 2–4 unit family housing	5.0 to 20.0
Income-producing properties	Larger areas represented by large samples	5.0 to 15.0
Income-producing properties	Smaller areas represented by smaller samples	5.0 to 20.0
Vacant land		5.0 to 25.0
Other real and personal property		Varies with local conditions

These types of property are provided for guidance only and may not represent jurisdictional requirements.

** Appraisal level for each type of property shown should be between 0.90 and 1.10, unless stricter local standards are required. PRD’s for each type of property should be between 0.98 and 1.03 to demonstrate vertical equity.*

PRD standards are not absolute and may be less meaningful when samples are small or when wide variation in prices exist. In such cases, statistical tests of vertical equity hypotheses should be substituted (see table 1-2).

*** CODs lower than 5.0 may indicate sales chasing or non-representative samples.*

Source: Standard on Ratio Studies; International Association of Assessing Officers; Kansas City, MO; April 2013; p. 17

The following sample table illustrates a sample computation of these statistics. The table is only for illustration and does not reflect results of an OPA assessment.

Rank	Parcel #	Appraised value	Saleprice*	Ratio	Statistic	Result
1	9	\$87,200	138,720	0.629	Number (n)	17
2	10	38,240	59,700	0.641	Total appraised value	\$1,455,330
3	11	96,320	146,400	0.658	Total sale price	\$1,718,220
4	12	68,610	99,000	0.693	Avg appraised value	\$85,608
5	13	32,960	47,400	0.695	Avg sale price	\$101,072
6	14	50,560	70,500	0.717		
7	15	61,360	78,000	0.787	Mean ratio	0.827
8	16	47,360	60,000	0.789	Median ratio	0.820
9	17	56,580	69,000	0.820	Weighted mean ratio	0.847
10	18	47,040	55,500	0.848		
11	19	136,000	154,500	0.880	Coefficient of dispersion	14.5
12	20	98,000	109,500	0.895	Price-related differential	0.98
13	21	56,000	60,000	0.933	PRB	-0.035
14	22	159,100	168,000	0.947	PRB coefficient (t-value)	0.135 (2.4)
15	23	128,000	124,500	1.028		
16	24	132,000	127,500	1.035	95% conf. int. mean (two-tailed)	0.754 to 0.901
17	25	160,000	150,000	1.067	95% conf. int. median (two-tailed)	0.695 to 0.933
					95% conf. int. wtd. mean (two-tailed)	0.759 to 0.935

*No outlier trimming or adjusted sale price

Through these metrics, ratio studies provide several objective standards by which one can evaluate assessment performance and measure the effectiveness of revaluation projects. As a diagnostic tool, they are used to identify locations or property types that are over or under assessed, for which the market is changing, where there are issues with data quality, where uniformity needs improvement, or where sales data may not be representative of unsold properties.

However, it is also important to understand that there are inherent biases in all mass appraisal systems for both low and high value properties. At both the low and high ends of the range of values, there is more variance in price that is not attributable to the characteristics of the property as captured by the mass appraisal data files. In many cases, data for sales of low value properties is missing or incomplete. Many of these sales are not exposed to open markets or do not use real estate professionals that report details about the properties or transactions. The only data available for a specific property may be a deed and what can be seen from the exterior of the property. Properties at the very high end of the spectrum may have significant differences in interior finishes which may not be known to assessors but are reflected in sales transactions. Therefore, some degree of distortion is expected in the ratio statistics for both low and high value properties.

For the 2023 reassessment, the OPA retained the IAAO to review and provide feedback on OPA's reassessment work, including performing an independent ratio study on OPA's assessments for single family residential properties. The IAAO report was released in May and found that the Tax Year 2023 reassessment of properties in Philadelphia met industry standards for single family residential properties. The report is available at the following link:

<https://www.phila.gov/documents/practices-and-procedures-review-of-the-office-of-property-assessment>

RATIO STUDY RESULTS – COMPARISON TO SALE PRICES

The following tables present the results of the Tax Year 2023 ratio study for residential properties.

This study considers time-adjusted sales price data for the period starting in January 2016 and ending in December 2020. During a multi-year sales analysis period, market conditions may change. Through regression analysis, OPA builds a compound adjustment index for each assessment model that allows sales from earlier periods to be calibrated to the effective date of appraisal. By adjusting each sale for time, OPA is able to remove the time adjustment variables from the model and eliminate the need to “weight” sales based on the time that they occurred.

Only sales that have been validated as arm’s-length transactions that are indicative of the values of other similar properties are used. Arm’s-length means that a real estate transaction occurred in an open market arrived at through normal negotiations between an independent buyer and seller. Sales between related parties, to or from financial institutions or government agencies, sales to persons or organizations that typically do not engage in arms-length transactions, or sales with extreme ratios (which indicate abnormal transactions) are typically not used in this study. In addition, sales where the property changed in a significant way between the time of sale and the date of valuation are excluded. For example, if a property was sold in poor condition, but was subsequently rehabbed, and valued as rehabbed, the sale price no longer bears relationship to the market value of the property. Including these sales in a ratio study would distort the results. For more information on sales validation and sales adjustments, see *Standard on Verification and Adjustment of Sales* (IAAO 2020):

https://www.iaao.org/media/standards/Verification_Adjustment_of_Sales.pdf

The data file used for ratio studies includes all the records used to model each zone group. Outliers were removed on a model-by-model basis using Cook's Distance and Studentized Residual metrics, which are standard statistical methods for identifying outliers. Additional records were excluded whose characteristics at the time of sale did not match current characteristics. For more information on outlier standards, see the *Standard on Ratio Studies* (IAAO 2013) and *Residuals and Influence in Regression* (Cook, R.D. and Weisberg, S. 1982).

Residential – Combined

Results for all residential properties across the city are presented in Table 2 below. There were more than 27,000 sales examined within this ratio study. Citywide, the median ratio is 97.5% for all residential properties. This means that residential properties have been valued at 97.5% of their respective sale prices. This result falls within the IAAO range of 90% to 110%. The citywide COD for residential properties is 13.1% which is within the IAAO accepted range (< 15%) for assessed values in a jurisdiction like Philadelphia. The PRD is 1.024 which is also within the IAAO recommended range (0.98 to 1.03). A PRD within this range means that there is no statistically meaningful bias between how low value and high value properties are assessed. The below table shows that the Tax Year 2023 assessment of residential properties meets IAAO standards for all performance measures.

Table 2: Combined Residential Properties

Areas shaded in green indicate where the OPA meets IAAO standards.

Style Group	Sales	Median Ratio	Mean Ratio	Weighted Mean Ratio	PRD	COD
Overall	27,382	97.5%	98.9%	96.6%	1.024	13.1%
IAAO Standard		90%-110%	90%-110%	90%-110%	0.98-1.03	< 15%

Residences by zone and style

Results for single family and multi-family residences are examined separately by geographic zone and major property type in the sections below.

Please note there is a general relationship between statistical reliability and the number of observations in a sample. The larger the sample size, the greater the reliability. These ratio study metrics are most reliable and useful when applied at the jurisdiction (citywide) level. Lack of sufficient sales, outliers, or overrepresentation of one geographic area or type of property can distort results of these studies, and these issues become more pronounced as the dataset is broken up into smaller sections. With the below analysis by geographic zone and major property type, these data distortions can have an impact on the performance measures. These more specific analyses still provide valuable information, but the citywide ratio measures above provide the most reliable measure of the equity, uniformity, and accuracy of the Tax Year 2023 assessment values.

Single Family Residences

Results for single family residences are summarized by geographic zone and major property type (singles/twins/rows) below. Results are based on more than 25,000 sales.

The median ratio for single family residential properties across the city is 97.6%, which is within the IAAO range of 90% to 110%. This means that single family residential properties citywide have been valued at approximately 97.6% of their respective sale prices.

The City’s overall COD for single family residential properties is 12%, which is within the IAAO accepted range (< 15%) for assessed values for a jurisdiction like Philadelphia.

The City’s overall PRD is 1.015, which is also within the IAAO accepted range (0.98 to 1.03). This means that there is no meaningful statistical bias between low value and high value property valuations across the city.

Table 3: Single Family Residences by Style

Style	Sales	Median Ratio	Mean Ratio	Weighted Mean Ratio	PRD	COD
Row	19,556	97.1%	98.1%	96.3%	1.018	12.8%
Single	1,332	100.2%	101.0%	99.8%	1.013	9.1%
Twin	4,213	99.0%	99.8%	98.8%	1.010	9.3%
Overall	25,101	97.6%	98.5%	97.0%	1.015	12.0%
IAAO Standard		90%-110%	90%-110%	90%-110%	0.98-1.03	< 15%

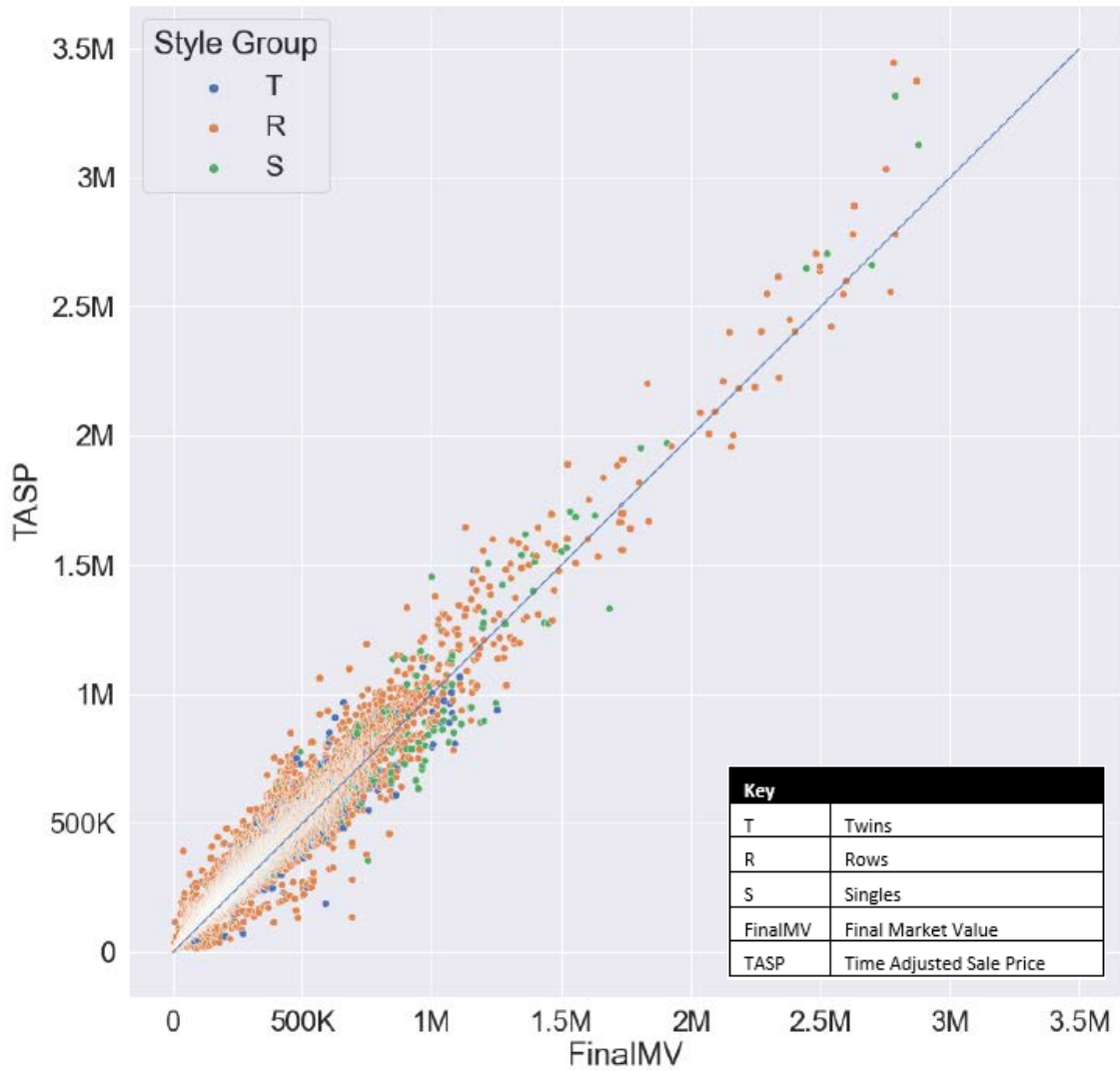
Table 4: Single Family Residences by Zone

For a map of the zones, see <https://www.phila.gov/documents/assessment-methodologies/>.

Zone	Sales	Median Ratio	Mean Ratio	Weighted Mean Ratio	PRD	COD
A	1,854	92.7%	94.5%	93.1%	1.015	18.2%
B	778	87.9%	91.4%	88.7%	1.031	20.7%
C	2,610	99.7%	100.6%	100.0%	1.006	6.6%
D	1,658	99.0%	99.7%	99.0%	1.008	7.8%
E	3,609	98.2%	99.8%	98.4%	1.014	10.2%
F	1,320	98.5%	100.3%	99.0%	1.013	12.7%
G	737	94.7%	97.4%	92.3%	1.055	17.5%
H	970	84.4%	90.5%	76.9%	1.177	28.0%
J	2,123	97.9%	99.5%	97.8%	1.018	10.9%
K	2,073	95.8%	97.8%	96.8%	1.010	13.4%
L	725	98.8%	100.4%	98.9%	1.015	11.2%
M	2,564	97.3%	99.2%	97.8%	1.014	12.7%
N	1,389	98.8%	99.7%	98.8%	1.010	7.4%
P	999	98.5%	99.5%	98.0%	1.015	9.6%
Q	435	97.0%	97.7%	96.1%	1.017	8.7%
S	1,257	98.7%	99.6%	98.5%	1.011	9.5%
Overall	25,101	97.6%	98.5%	97.0%	1.015	12.0%
IAAO Standard		90%-110%	90%-110%	90%-110%	0.98-1.03	< 15%

The following scatter diagram illustrates how closely market values match time adjusted sales prices (TASP). Each point represents the intersection of TASP and assessed value. The line indicates where TASP and Assessed Value are equal.

Visual Comparison of 2020 Single Family Residences Market Values to Time Adjusted Sale Prices by Property Style



Multi-Family Residences

Results for small multi-family residences (2 to 4 units) are summarized by property type (built as or converted duplexes/triplexes/quadruplexes) and by major geographic areas of the city. Results are based on more than 2,200 sales.

The median ratio for multi-family residential properties across the city was 96%, which is within the IAAO range of 90% to 110%. This means that multi-family residential properties citywide have been valued at approximately 96% of their respective sale prices.

The City’s overall COD for multi-family residential properties was 26.1%, which is outside the IAAO recommended range (< 20%) for assessed values for multi-family residential properties (2-4 units). The City’s overall PRD was 1.112, which is outside of the IAAO recommended range (0.98 to 1.03).

Prior to the next reassessment, OPA will evaluate steps to address performance measure issues in small multi-family residences. These steps will include examining the market value review process to confirm it functions as intended, reviewing OPA’s multi-family property data to ensure it is as accurate as possible, and examining the approach used for small multi-family properties to see if it can be adjusted.

Table 5: Multi-Family Residences by Style

Style	Sales	Median Ratio	Mean Ratio	Weighted Mean Ratio	PRD	COD
Duplex Built-As (M2B0)	862	94.9%	97.5%	92.8%	1.051	16.3%
Duplex Conv. (M2C0)	748	101.8%	110.1%	95.5%	1.153	30.4%
Triplex Built-As (M3B0)	96	97.2%	98.9%	93.2%	1.061	23.4%
Triplex Conv. (M3C0)	440	92.8%	103.4%	89.4%	1.156	35.0%
Quadplex Built-As (M4B0)	33	101.0%	109.0%	107.7%	1.012	26.0%
Quadplex Conv. (M4C0)	102	91.9%	99.7%	87.1%	1.144	31.2%
Overall	2,281	96.0%	103.1%	92.7%	1.112	26.1%
IAAO Standard		90%-110%	90%-110%	90%-110%	0.98-1.03	< 20%

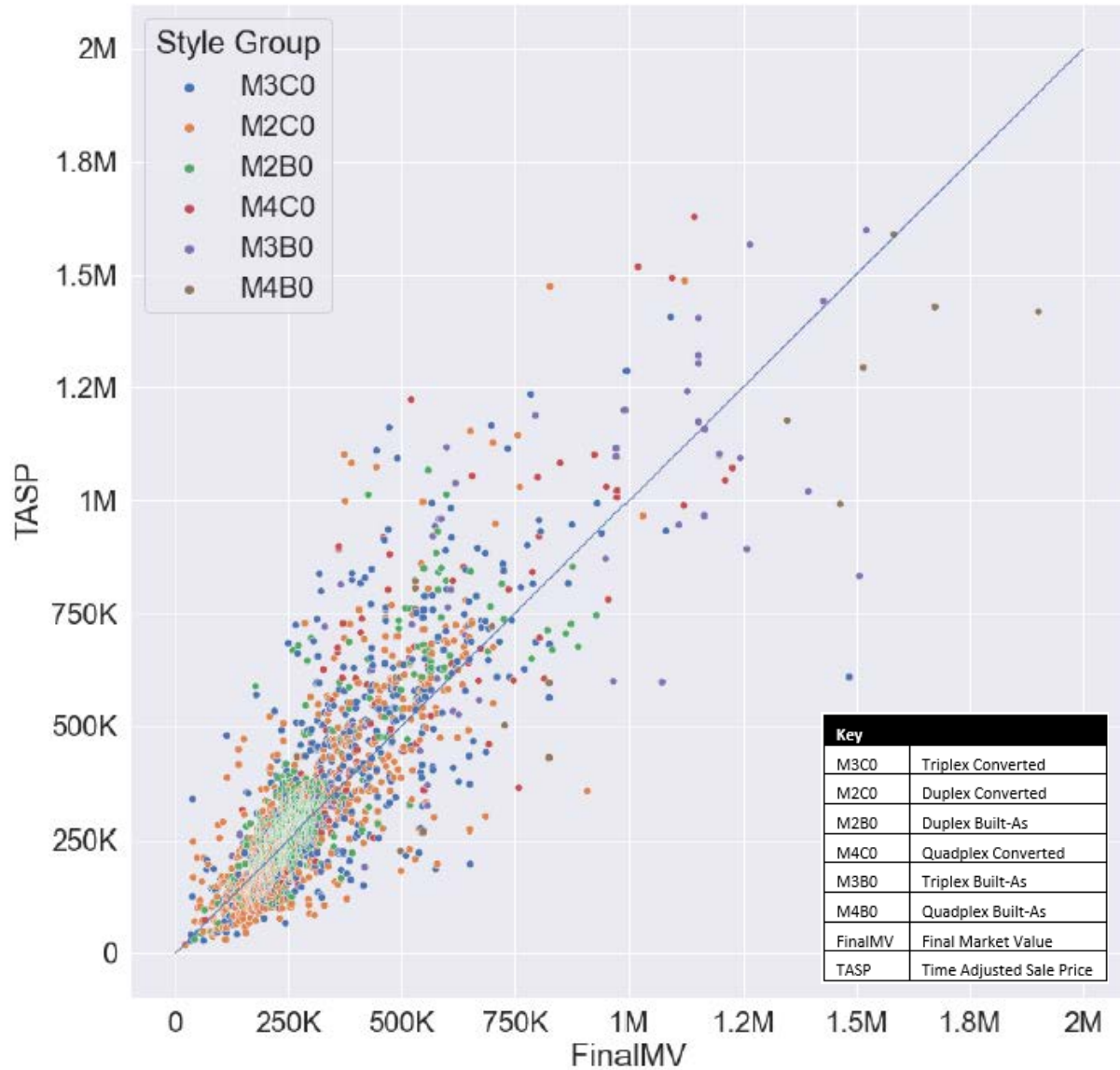
Table 6: Multi-Family Residences by Zone

For a map of the zones, see <https://www.phila.gov/documents/assessment-methodologies/>.

ZONE	Sales	Median Ratio	Mean Ratio	Weighted Mean Ratio	PRD	COD
A	361	92.1%	101.3%	82.4%	1.230	39.9%
B	54	142.8%	145.5%	122.9%	1.184	30.6%
C	209	93.2%	93.4%	92.6%	1.009	8.5%
D	206	102.5%	104.1%	102.6%	1.015	9.6%
E	363	99.9%	102.0%	96.3%	1.060	19.7%
F	38	120.7%	126.5%	112.9%	1.120	25.4%
G	90	79.8%	83.0%	65.0%	1.277	33.5%
H	234	95.0%	117.6%	94.7%	1.242	47.0%
J	112	89.4%	91.8%	86.5%	1.061	17.5%
K	75	112.2%	113.0%	106.2%	1.063	19.1%
L	116	116.3%	122.7%	114.7%	1.069	19.3%
M	200	88.5%	91.1%	85.0%	1.071	18.7%
N	85	83.5%	86.0%	82.7%	1.040	14.6%
P	68	97.6%	100.6%	99.1%	1.016	18.4%
Q	31	90.3%	92.9%	90.6%	1.025	10.4%
S	39	115.3%	121.9%	117.4%	1.038	24.4%
Overall	2281	96.0%	103.1%	92.7%	1.112	26.1%
IAAO Standard		90%-110%	90%-110%	90%-110%	0.98-1.03	< 20%

The following scatter diagram illustrates how closely market values match time adjusted sale prices (TASP). Each point represents the intersection of TASP and assessed value. The line indicates where TASP and Assessed Value are equal.

Visual Comparison of 2020 Multi-Family Market Values to Time Adjusted Sale Prices by Property Type



Comparison of Tax Year 2022 and Tax Year 2023

The following pages contain several maps showing comparisons between Tax Year 2022 and Tax Year 2023 for COD, PRD, current median ratio, and weighted average market value by Geographic Market Areas (GMA).

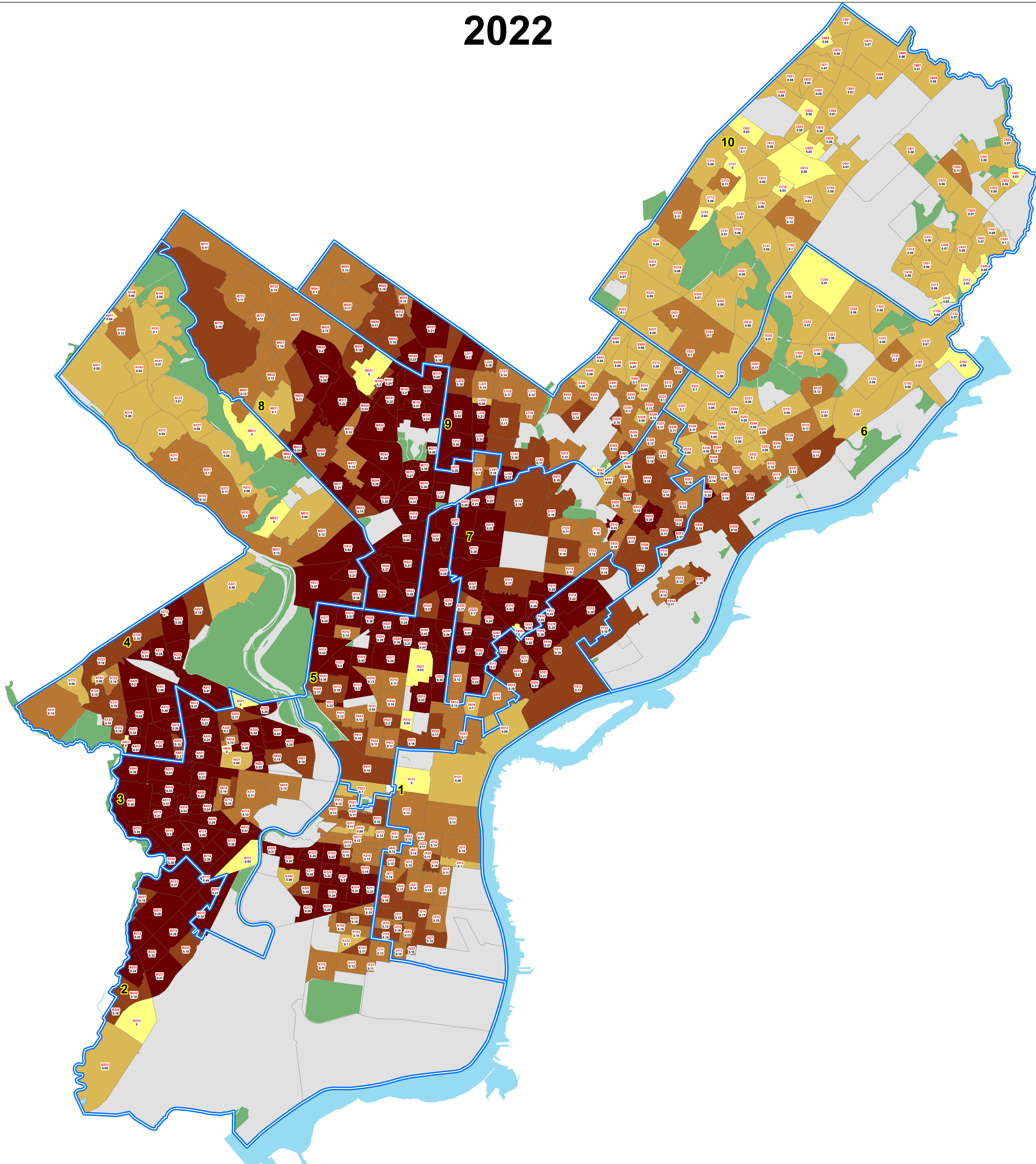
OPA did not conduct citywide reassessments in Tax Years 2021 and 2022 due to the operational issues posed by the implementation of OPA's computer-assisted mass appraisal, or CAMA, system (TY21) and the COVID-19 pandemic (TY22). These delays, coupled with an historic real estate market in recent years, led to many areas not meeting industry standards prior to the Tax Year 2023 reassessment.

These maps show how the Tax Year 2023 reassessment improved performance measures throughout Philadelphia, creating more accurate and reliable assessments.

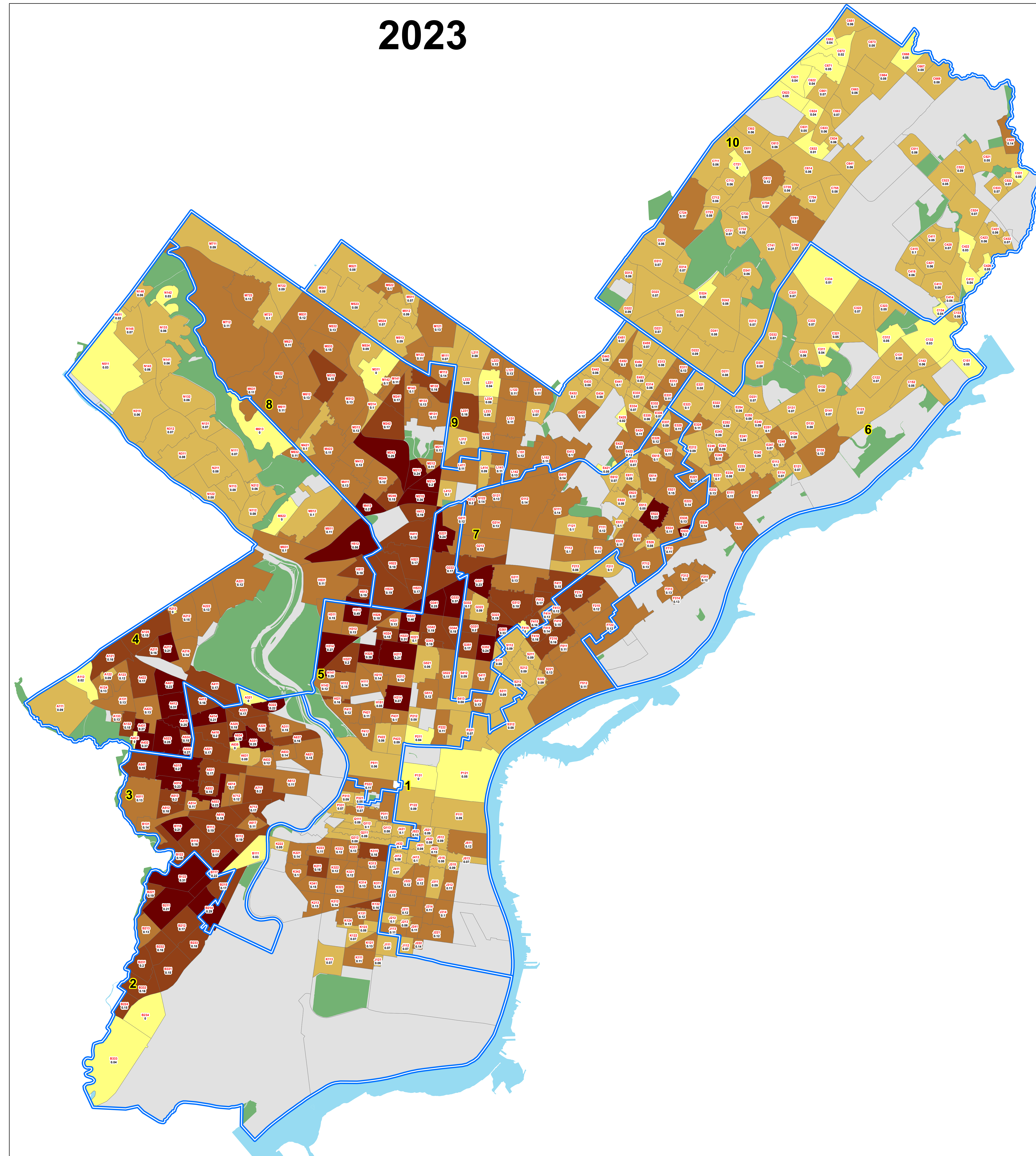
Using the zoom function provides a more detailed view of the smaller geographic units.

C.O.D by GMA - Single Family (Start to Finish)

2022



2023



Ratio Study - 2022 Using 2022 Certified Values

OPA GIS UNIT
May, 2022

0 2,700 5,400 10,800 16,200 21,600 Feet

Legend

COD		
Upto 5%	(31)	
6% - 10%	(133)	
11% - 15%	(137)	
16% - 20%	(93)	
Over 20%	(161)	
No S.F Accounts		

Legend

	Council District
	Fairmount Park
	Hydrology

P.B.D



Ratio Study - 2022 Using 2023 Certified Values

OPA GIS UNIT
May, 2022

0 2,700 5,400 10,800 16,200 21,600 Feet

Legend

COD		
Upto 5%	(43)	
6% - 10%	(221)	
11% - 15%	(176)	
16% - 20%	(73)	
Over 20%	(42)	
No S.F Accounts		

Legend

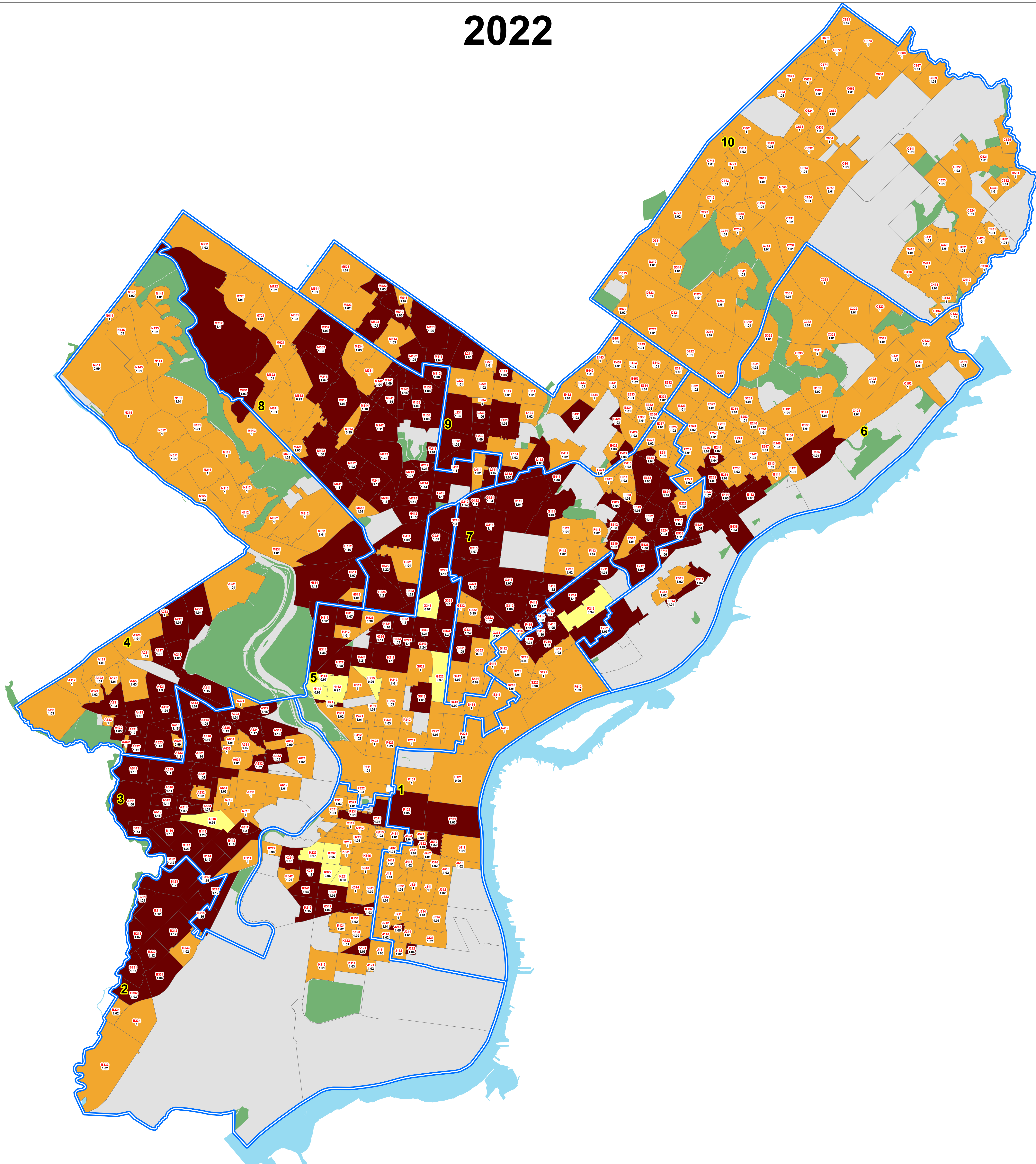
	Council District
	Fairmount Park
	Hydrology

P.B.D

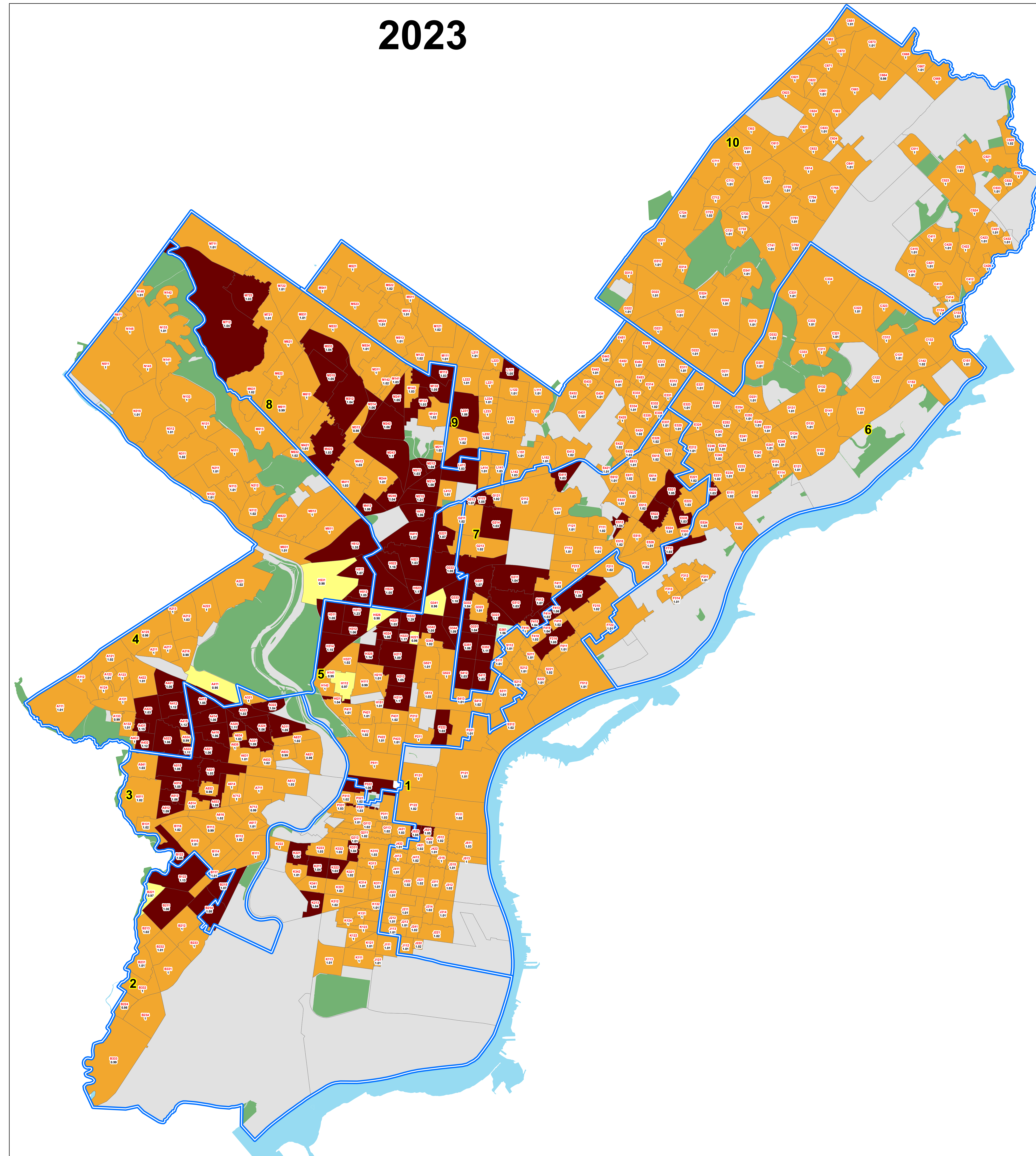


P.R.D by GMA - Single Family (Start to Finish)

2022



2023



Ratio Study - 2022 Using 2022 Certified Values

OPA GIS UNIT
May, 2018

0 2,700 5,400 10,800 16,200 21,600 Feet

Legend

PRD		
	< 0.98	(13)
	0.99 - 1.03	(345)
	> 1.03	(197)
	No S.F Accounts	

Legend

	Council District
	Fairmount Park
	Hydrology

P.B.D



Ratio Study - 2022 Using 2023 Certified Values

OPA GIS UNIT
May, 2018

0 2,700 5,400 10,800 16,200 21,600 Feet

Legend

PRD		
	< 0.98	(8)
	0.99 - 1.03	(431)
	> 1.03	(115)
	No S.F Accounts	

Legend

	Council District
	Fairmount Park
	Hydrology

P.B.D

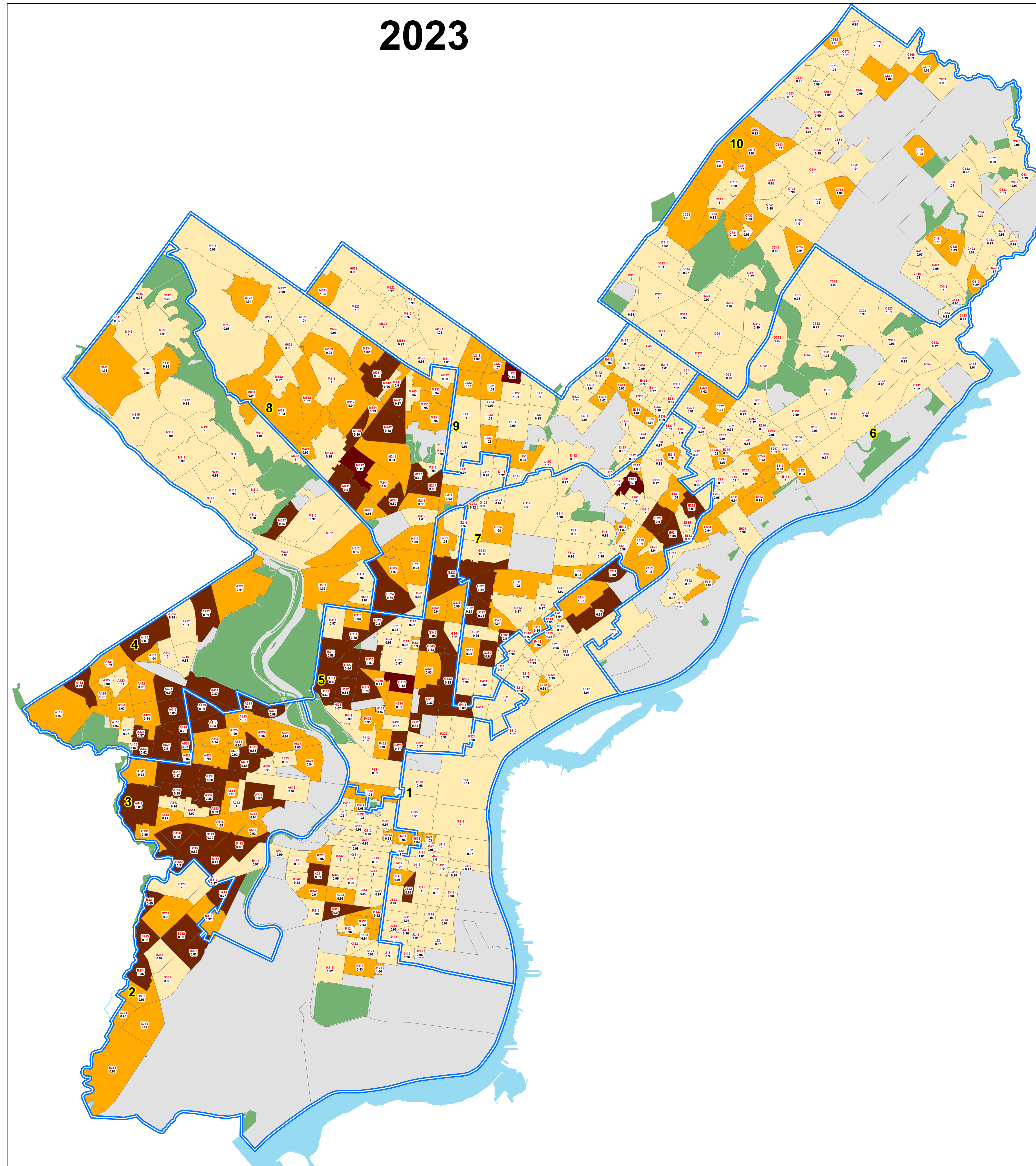


Median Ratio by GMA - Single Family (Start to Finish)

2022



2023



Ratio Study - 2022 Using 2022 Certified Values

OPA GIS UNIT
May, 2022

0 2,700 5,400 10,800 16,200 21,600 Feet

Legend

MEDIAN		
	< 0.90	(532)
	0.90 - 0.94	(19)
	0.95 - 1.02	(4)
	1.03 - 1.10	(0)
	> 1.10	(0)
	No S.F Accounts	

Legend

- Council District
- Fairmount Park
- Hydrology

P.B.D



Ratio Study - 2022 Using 2023 Certified Values

OPA GIS UNIT
May, 2022

0 2,700 5,400 10,800 16,200 21,600 Feet

Legend

MEDIAN		
	< 0.90	(79)
	0.90 - 0.94	(76)
	0.95 - 1.02	(328)
	1.03 - 1.10	(68)
	> 1.10	(4)
	No S.F Accounts	

Legend

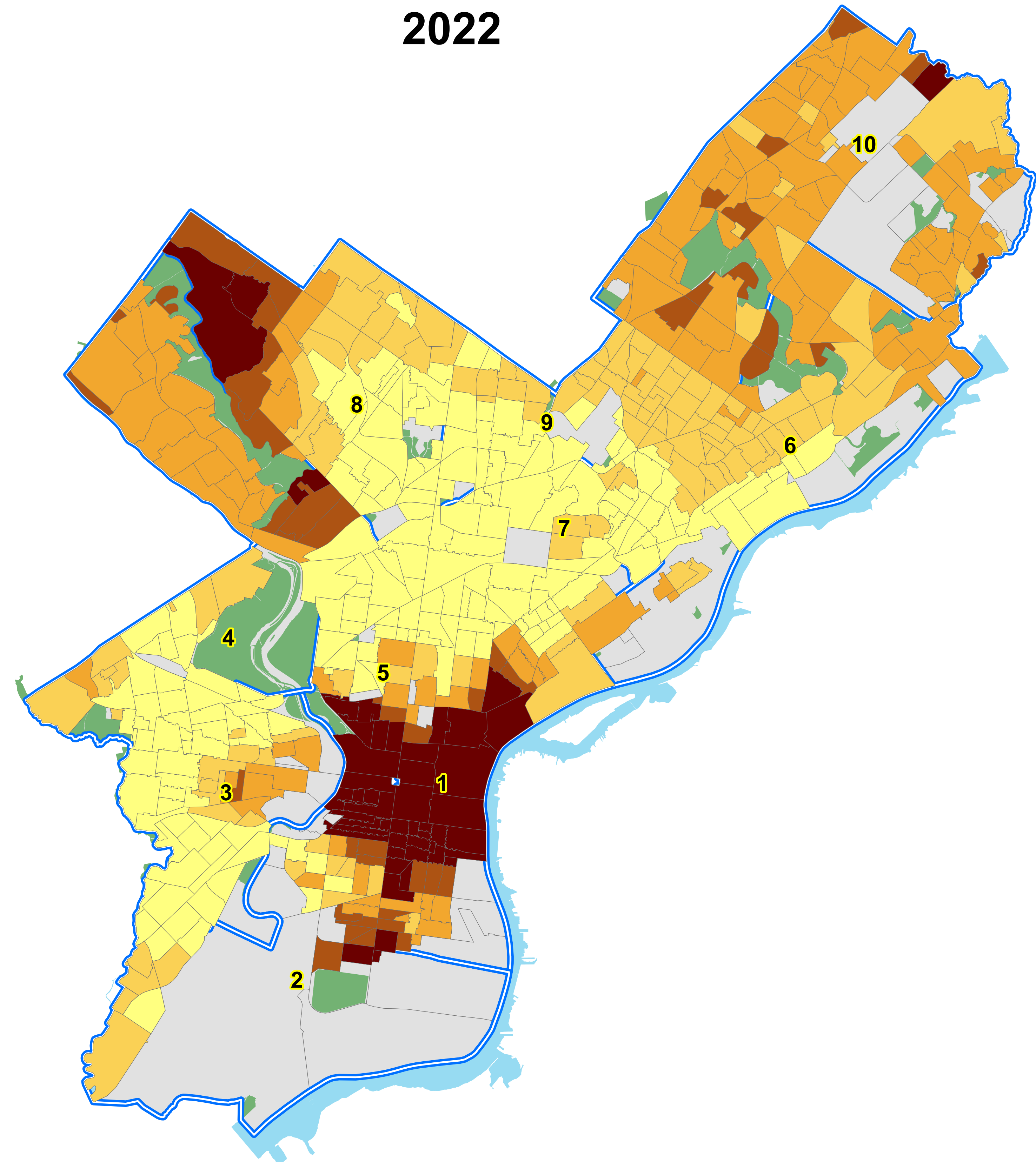
- Council District
- Fairmount Park
- Hydrology

P.B.D

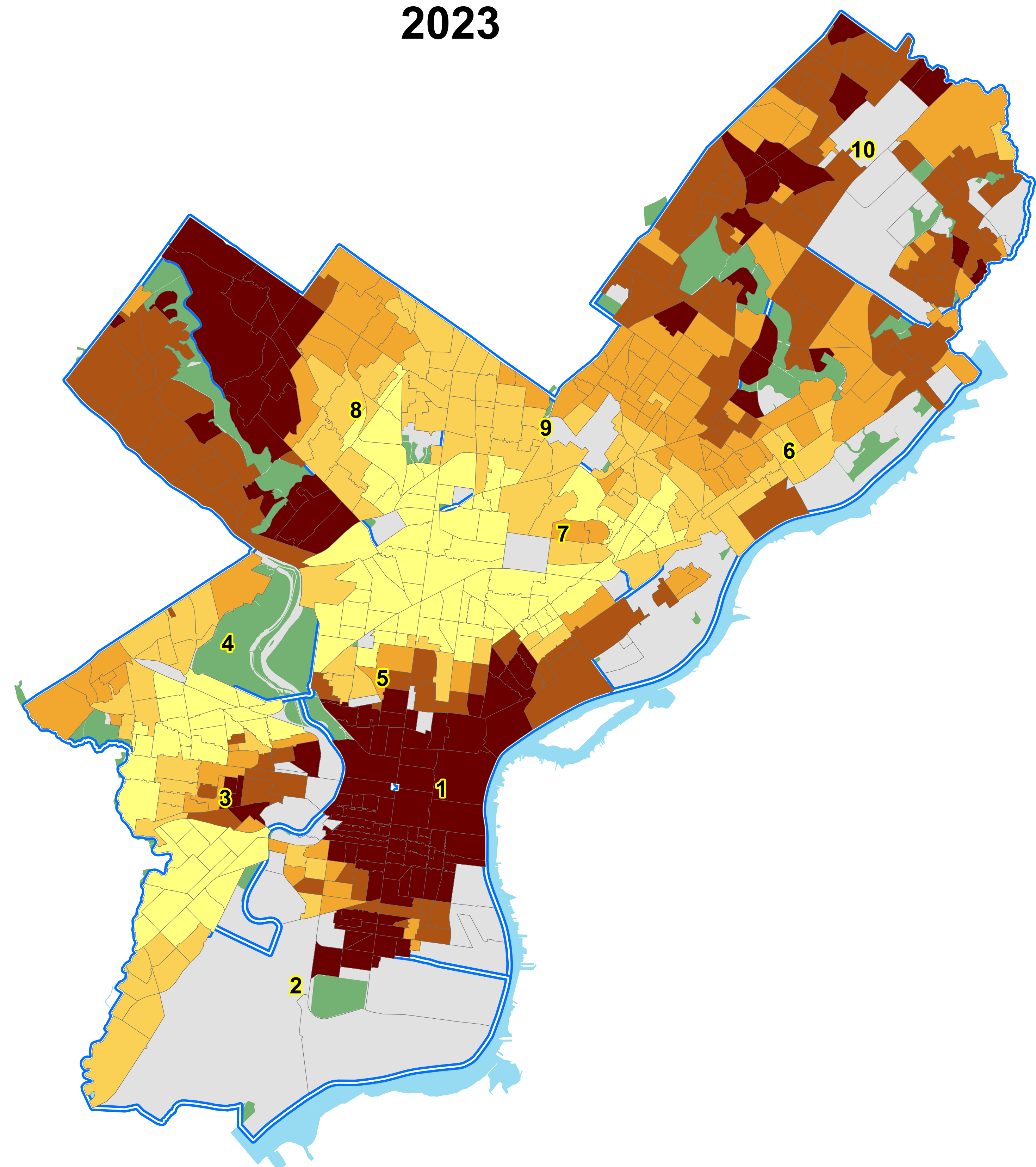


Weighted Average Market Value Per Sq. Ft by GMA Single Family (2022 & 2023)

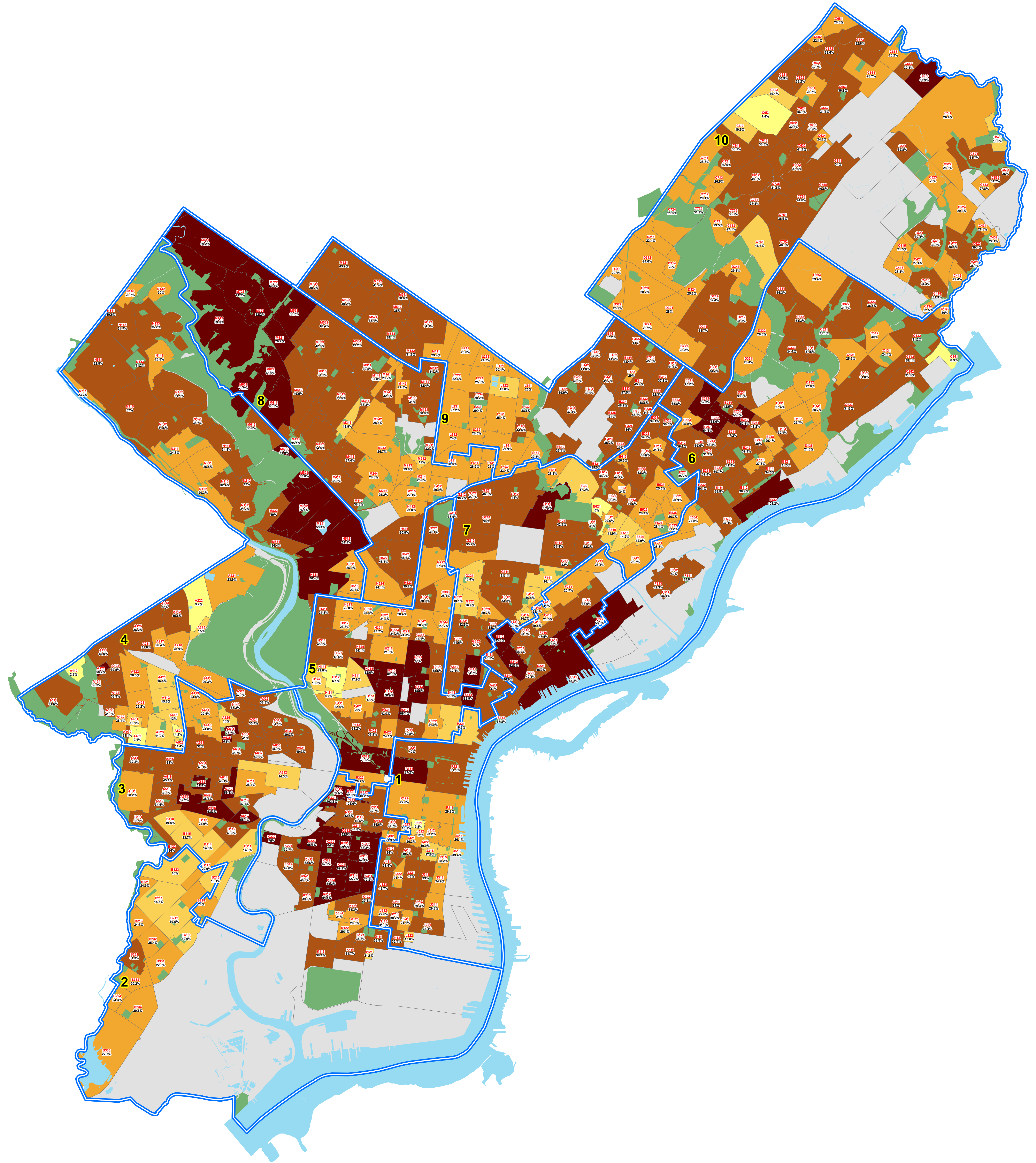
2022



2023



Weighted Average Market Value Per Sq.Ft Percentage Change by GMA Single Family (2022 & 2023)

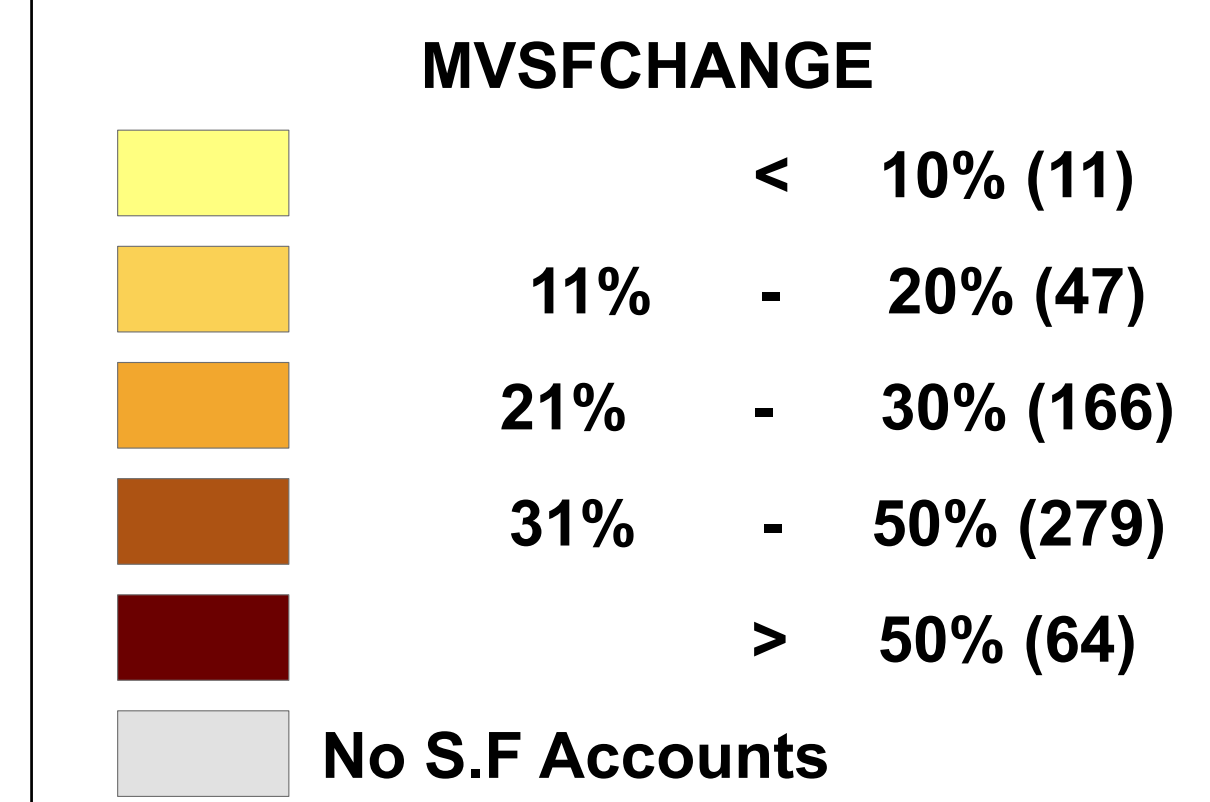


Ratio Study - 2022
Using 2022 - 2023 Certified Values

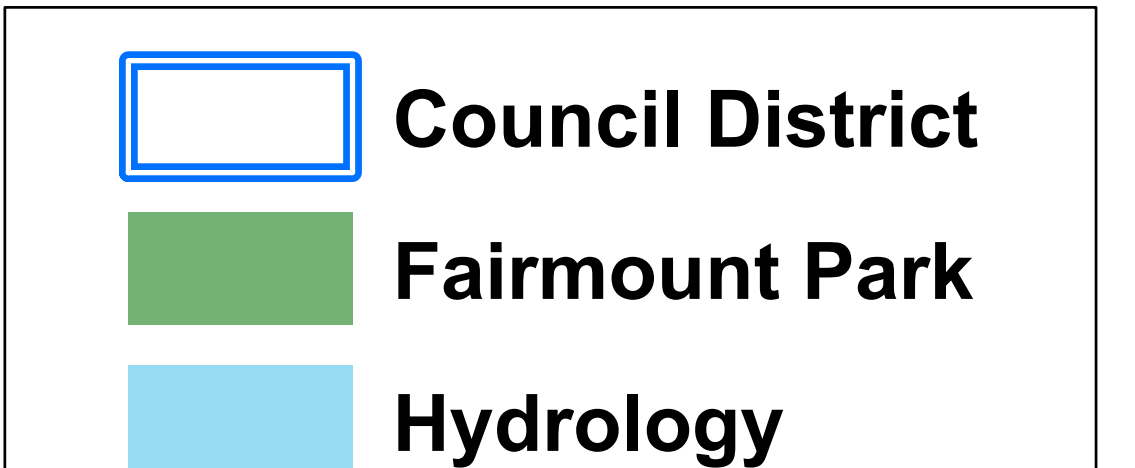
OPA GIS UNIT
May, 2022

0 4,900 9,800 19,600 29,400 39,200 Feet

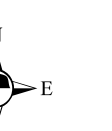
Legend



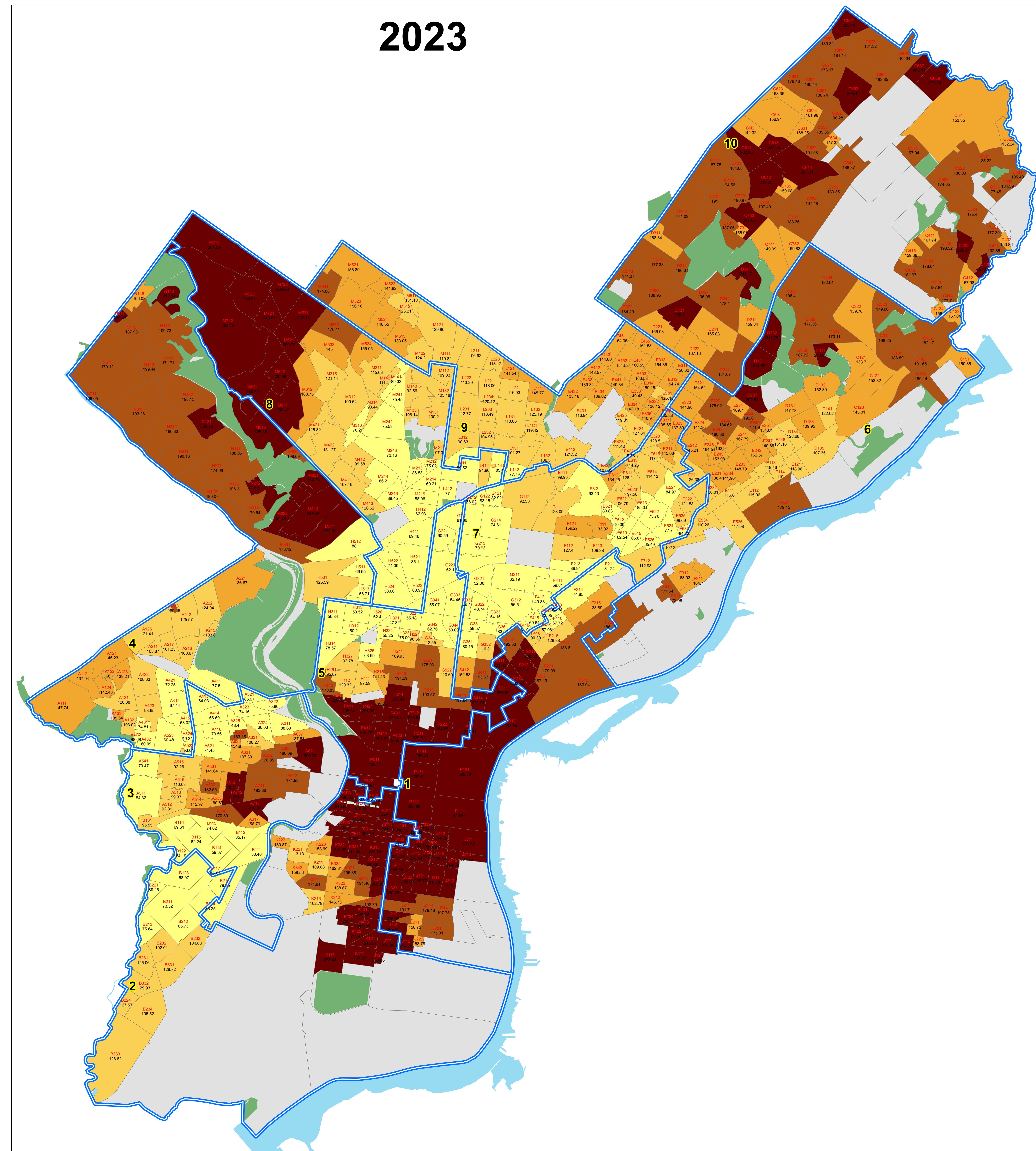
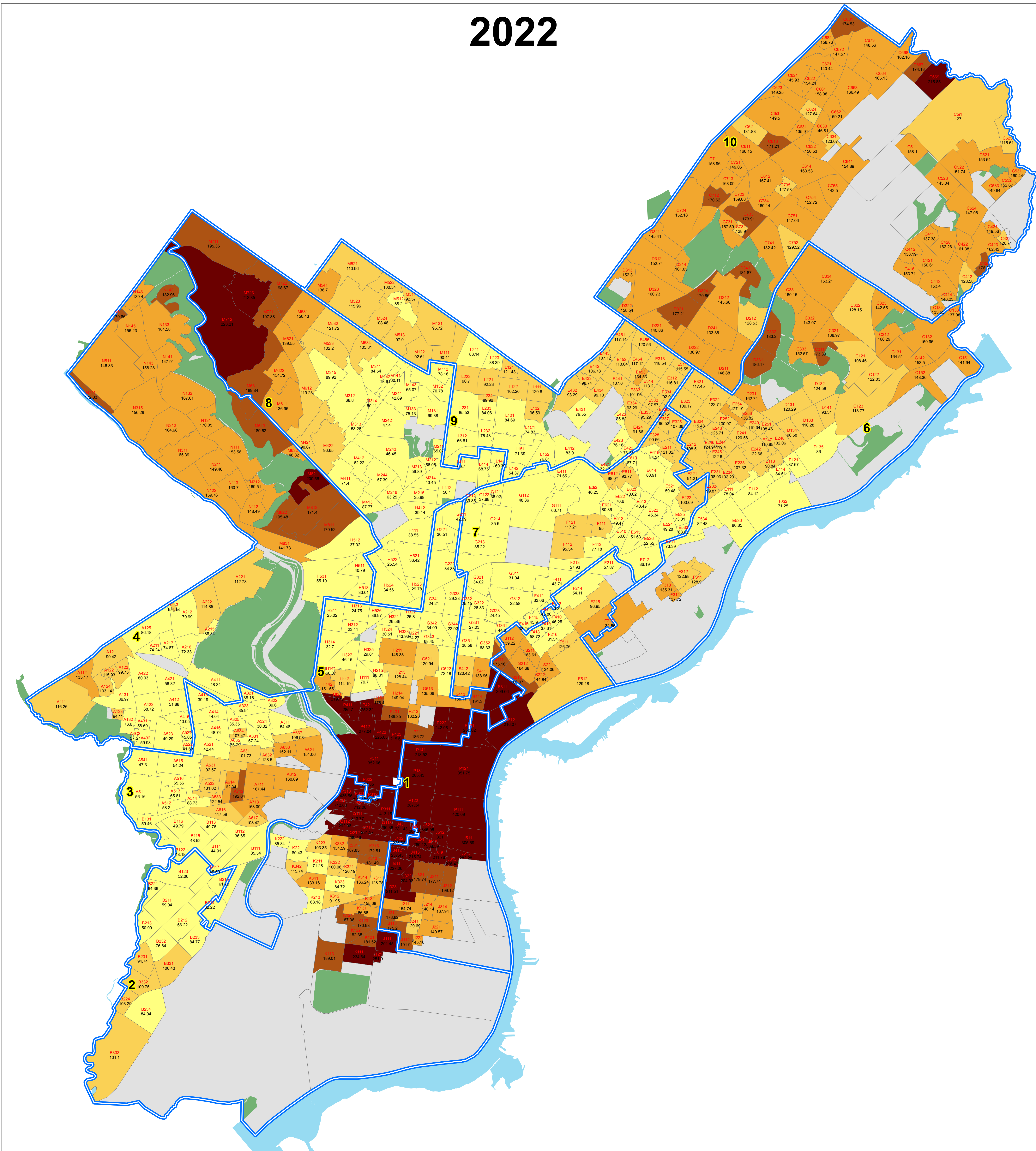
Legend



RBD



Weighted Average Market Value Per Sq.Ft by GMA - Single Family (2022 & 2023)



Ratio Study - 2022 Using 2023 Certified Values

OPA GIS UNIT
May, 2022

0 2,700 5,400 10,800 16,200 21,600 Feet

Legend

X022WAMVSF	Count
< \$89.94	(203)
\$89.95 - \$132.24	(135)
\$132.25 - \$170.11	(134)
\$170.12 - \$199.73	(44)
> \$199.74	(51)
No S.F Accounts	

Legend

	Council District
	Fairmount Park
	Hydrology



Ratio Study - 2022 Using 2023 Certified Values

OPA GIS UNIT
May, 2022

0 2,700 5,400 10,800 16,200 21,600 Feet

Legend

X023WAMVSF	Count
< \$89.94	(114)
\$89.95 - \$132.24	(113)
\$132.25 - \$170.11	(112)
\$170.12 - \$199.73	(115)
> \$199.74	(112)
No S.F Accounts	

Legend

	Council District
	Fairmount Park
	Hydrology

