Written Statement of Thomas G. Doe

President and Founder Municipal Market Analytics, Inc. (MMA)

Before the Senate Committee on the Budget

Wednesday, January 10, 2024

Municipal Bonds & Climate Hearing

Thank you, Chair Whitehouse, Ranking Member Grassley, and Members of the Committee, for inviting me here today. My discussions with state and local sustainability and resilience officers have revealed woeful ignorance regarding the capital market's essential role in financing their climate adaptation needs.

My name is Tom Doe. I founded and am president of Municipal Market Analytics, Inc. (**MMA**) the leading independent research firm in the municipal bond industry. For 30 years the firm's mission has been to assess market risks and opportunities.

Municipal bond issuance can serve as the initiative-taking financing tool to reduce the federal government's burden in responding to catastrophes via the Federal Emergency Management Agency (FEMA). To date, municipal investors have been able to downplay the climate issue because of FEMA's historical presence to backstop areas impacted by extreme weather events and rating agencies' limited credit outlook to a few years into the future. Investors' positive expectations have inhibited issuers' proactive action to reduce the consequences of future climate related risks.

ST	Political Orientation	Adpatation Plan Finalized	ST	Political Orientation	Adpatation Plan Finalized	ST	Political Orientation	Adpatation Plan Finalized
AL	Red	No	KY	Red	No	ND	Red	No
AK	Red	Yes	LA	Red	No	OH	Red	No
AZ	Red	No	ME	Blue	Yes	OK	Red	No
AR	Red	No	MD	Blue	Yes	OR	Blue	Yes
CA	Blue	Yes	MA	Blue	Yes	PA	Blue	Yes
CO	Blue	Yes	MI	Blue	No	RI	Blue	Yes
CT	Blue	Yes	MN	Blue	No	SC	Red	No
DE	Blue	Yes	MS	Red	No	SD	Red	No
DC	Blue	Yes	MO	Red	No	TN	Red	No
FL	Red	Yes	MT	Red	Yes	TX	Red	No
GA	Red	No	NE	Red	No	UT	Red	No
HI	Blue	No	NV	Blue	No	VT	Blue	No
ID	Red	No	NH	Red	Yes	VA	Red	Yes
IL	Blue	No	NJ	Blue	Yes	WA	Blue	Yes
IN	Red	No	NM	Blue	No	WV	Red	No
IA	Red	No	NY	Blue	Yes	WI	Blue	Yes
KS	Red	No	NC	Red	Yes	WY	Red	No
	Source: MMA and Georgetown University							

Figure 1: Adaptation efforts at the federal, state, and local have been slow to evolve. Only 19 states have finalized adaptation plans as of 3Q23 suggesting more effort is required to prompt proactive action.

Agree or disagree with the cause, the earth's warming has occurred just as Dr. Carl Sagan testified to the Senate in December 1985. The Administration and Congress' climate initiatives have been laudable. However, the federal government has emphasized mitigation over adaptation. And still, as Chair Whitehouse knows, global mitigation efforts to date will not halt the breach of the earth's 1.5 degree warming barrier. As a result, US citizens will rely on state and local governments to execute needed adaptation and resilience measures.

It is fair to characterize the municipal market as the best form of partnership between state, local and federal governments. Municipal bonds have financed seventy-five percent of US public infrastructure. They provide low cost capital for state and local infrastructure needs – both large and small. Since 2004, the municipal market has raised an annual average of $400B for a variety of purposes. Its stability has created investor confidence. Steady regulation has improved the market's integrity. State revolving fund (SRF) programs have served as a shining example for financing future resilience needs.

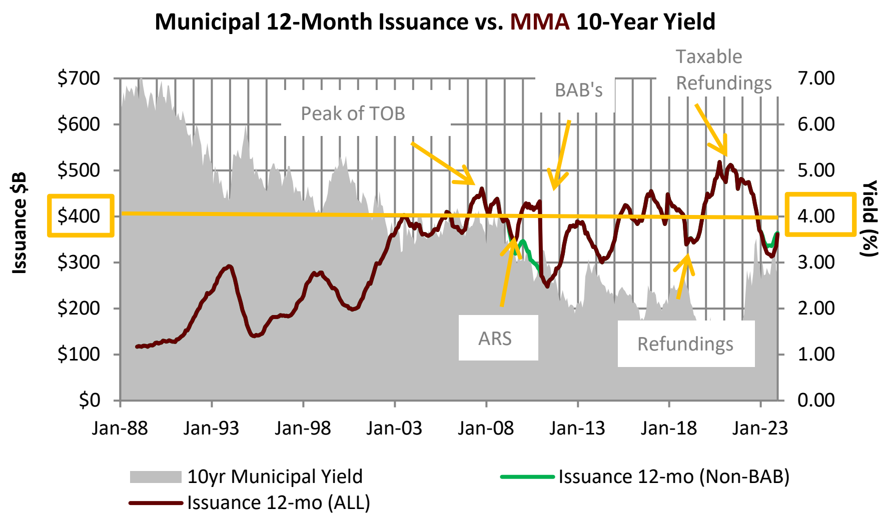

Figure 2: Municipal issuance has averaged nearly $400B annually since 2004. Spikes issuance over $400B (and above $500B) have occurred because of refunding opportunities or specialized demand or federal government programs. Climate needs could push annual municipal issuance above $600B.

With or without Congressional intervention, state and local governments are likely to expand medium– and long-term borrowing programs to address climate change mitigation and adaptation. Because spending needs may be immense (e.g., an unaffordable $1.8B for a temporary solution for the Florida Keys), financing will depend on new revenue creation, sweeping spending reallocations, tiers of intergovernmental participation, and very long bond maturities. A new federal SRF investment, to parallel existing clean water and drinking water programs, would be of great assistance. Regardless, trends are strongly bullish for long-term issuance and income projections, but less so for ratings and relative performance.

The pandemic reiterated that, in the US, the avoidance of taxes is a motivational force for investors. Over the past three years, states with population increases have an average state income tax of ~3%, while those who have lost population have a tax rate of ~7%. Ironically, the movement has been to states that have the greatest climate risks. These areas and elsewhere will need to finance adaptation projects to improve storm water management, provide clean water, cool educational and healthcare facilities, secure the provision of electricity, and make transportation systems resilient, while also anticipating catastrophic events. Municipals' tax-exemption not only incentivizes high earners to invest in infrastructure but also allows states and localities to allocate capital to where it is most needed.

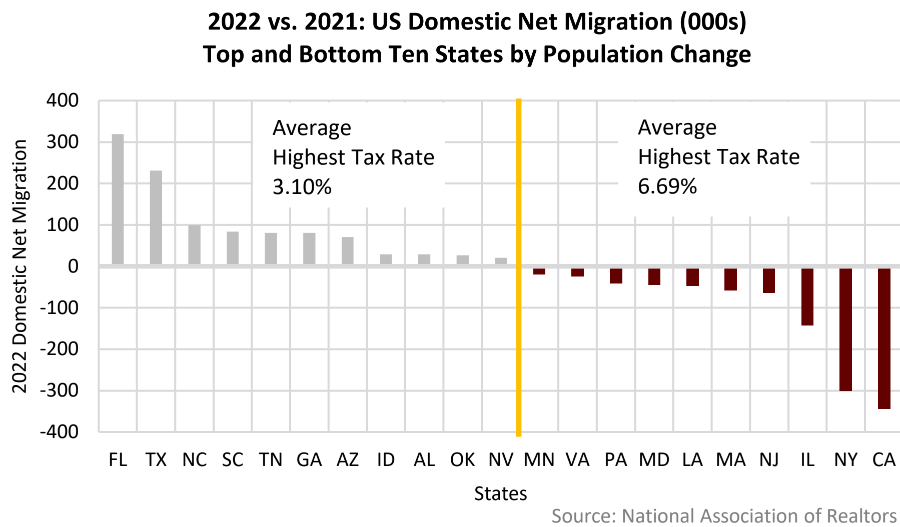

Figure 3: Low state personal income tax coincided with gains in population, while high state personal income tax rates correlated with population losses.

Once again, largely because of FEMA's historical backstop, investors and ratings agencies have not significantly penalized the most climate vulnerable state and local governments with lower prices or ratings. Hence, an absence of a penalty provides a current opportunity for issuers to invest now before a greater investor sensitivity evolves.

Climate change risks and preparedness may become the pension issue for the 2020s. As market participants increasingly integrate climate-risk assessment tools, **MMA** expects analytic outcomes will propel negative rating actions and, eventually, spread widening. Credits in areas most vulnerable to water, wind, and fire-related events are most at risk. An industry pivot could be hastened if FEMA changes its criteria and raises more hurdles between disasters and federal aid, undermining traditional views of FEMA as a credit stabilizer.

Some of the main factors driving climate change higher on the credit concern list include: 1) an uptick in the frequency and severity of climate-related events; 2) efforts by climate change groups to compel a more proactive and explicit assessment in investment decisions and ratings; 3) growth in climate-science technology firms focused on illuminating the impact on municipal governments; 4) more focus on climate risk disclosures by market regulators; 5) the growing federal deficit and how that will constrict federal aid disbursements; and 6) the signing of the Disaster Recovery Reform Act of 2018 (DDRA), which has FEMA working to update the factors considered for disaster declarations to better capture a jurisdiction's own capacity to respond and recover.

For the most part, excessive unfunded governmental pension obligations represent a financial burden and/or stress on future stakeholders in that government. Restructuring pension obligations, reducing other debts or expenditures, and/or raising revenues can be solutions to significantly underfunded pension. While these actions are typically credit negatives, post-restructuring governments can continue to operate, work to further repair fiscal positions, and retain at least partial market access. Climate-related disasters, on the other hand, have the potential to cause a sustained, non-reversible, erosion of the tax base, or devastate it immediately. A year after the Camp Fire, Paradise, CA's population is ~10% of its pre-disaster size and building permits exist for only a portion of what was destroyed.

Before the Camp Fire, Paradise's heightened risk in terms of both probability and potential financial severity of a wildfire event was identifiable and could have been considered in an investment decision, according to work done by risQ, a leader in modeling and translating climate risk into metrics usable in credit and investment decisions.

The DDRA requires that FEMA initiate rulemaking within 2 years of enactment (October 2020) to update the factors considered when declaring a major disaster, including how it determines the cost to and fiscal capacity of the affected governments. The GAO reports that FEMA documentation indicates that the agency is working on rulemaking proposals that include adjusting the per capita factor for inflation, which would increase the threshold for FEMA assistance and undermines a supportive factor of municipal credit quality vis-à-vis natural disasters. Additionally, Moody's recent report on HUD's increasing role in providing disaster aid highlights further risks to local governments. Under HUD's Community Development Block Grants Disaster Relief program (CDBG-DR) funds for rebuilding and to facilitate recovery are provided via a supplemental appropriation outside of the federal budget process and are often used to augment FEMA funds for large or successive disasters. The increasing frequency and severity of climate-related disasters has led to greater reliance on CDBG-DR funds. But the complexity, inefficiency, and lengthy process required means that disbursements to affected governments often do not arrive in a timely manner, which can negatively impact economic activity, revenues, and credit quality.

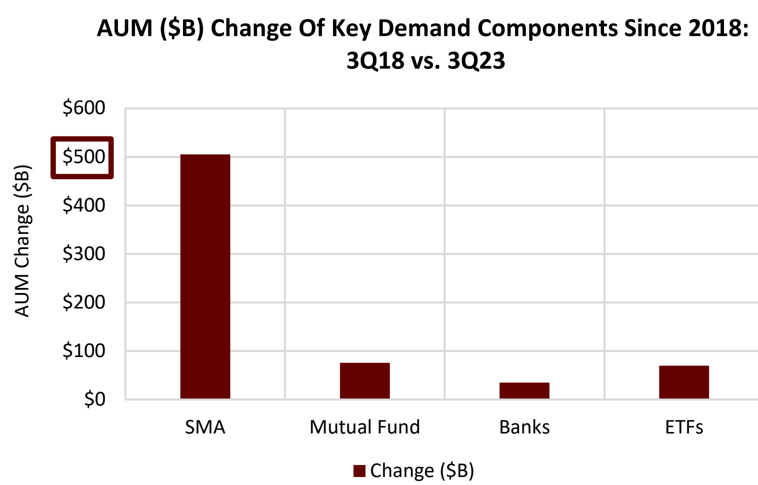

Figure 4: Since 2018, investors have increased their direct holdings of municipal bonds and placed their investments with separate managed account (SMA) managers.

Par (and #) of Outstanding Bonds With Uncured Impairments, Excl. PR Except Where Noted ($M)						Support Detail:
Sector	Last Wk	Impairments	DEFAULT	Support	Other	Bond Reserves
ALL (Inc'l Puerto Rico)	$1,381 (25)	$60,736 (685)	$26,676 (334)	$13,201 (146)	$20,858 (205)	$11,204 (28)
ALL (Exc'l Puerto Rico)	$1,381 (24)	$49,294 (681)	$15,505 (332)	$12,931 (144)	$20,858 (205)	$10,934 (26)
Retirement	$359 (6)	$8,094 (166)	$4,417 (90)	$548 (10)	$3,129 (66)	$431 (1)
IDB	none	$7,664 (56)	$2,734 (33)	$2,124 (9)	$2,806 (14)	$460 ()
Land Secured	$494 (7)	$4,102 (160)	$1,904 (88)	$1,720 (65)	$477 (7)	$1,666 (9)
Local Non-GO	none	$1,888 (16)	$1,560 (5)	$242 (6)	$86 (5)	$141 (1)
Student Housing	none	$1,795 (24)	$941 (11)	$422 (8)	$432 (5)	$422 ()
Hospital	$421 (2)	$12,523 (45)	$790 (8)	$37 (2)	$11,696 (35)	$37 (2)
All Risky Sectors	$1,321 (22)	$44,120 (633)	$13,332 (317)	$10,424 (130)	$20,364 (186)	$8,547 (24)
All Safe Sectors	$60 (2)	$5,175 (48)	$2,173 (15)	$2,507 (14)	$494 (19)	$2,386 (2)
Initially Non-Rated Bonds	$723 (13)	$22,558 (515)	$10,433 (289)	$6,553 (108)	$5,573 (118)	
Initially Rated & Insureds	$658 (12)	$26,736 (170)	$5,072 (45)	$6,378 (38)	$15,285 (87)	
Puerto Ricos	$ (1)	$11,441 (4)	$11,171 (2)	$270 (2)	none	

Figure 5: As of December 2023, there is ~$15B that is in default out of $4T municipal bonds outstanding. An overwhelming amount of defaults are in "risky" credit sectors.

State and local governments have an extremely low default rate, both on an absolute and relative basis. Ninety percent of the $4T public outstanding municipal bond debt is investment grade, suggesting that too great of an emphasis may have been placed on government officials' aspiration for the highest credit rating instead of efficient market utilization. In other words, state and local governments could assume a greater debt burden to address climate risks. Greater debt might result in a possible lower rating today but could put an issuer in a better position to stabilize or improve its future rating. This is admittedly a difficult needle to thread because climate instability poses an unprecedented systemic risk to municipal's hallmark credit quality.

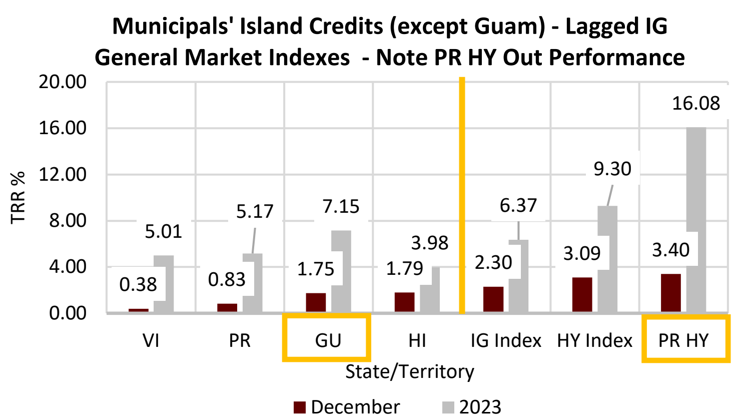

Figure 6: The performance of island credits may reflect some consideration of climate's negative impacts but note that Guam and PR high-yield indexes have outperformed the general market investment-grade and high-yield indexes. Source: Bloomberg

The Committee's prior hearings have revealed data sources to inform investors of climate risks in security offering documents. Fortunately, the Government Finance Officers Association (GFOA) in 2021, led in part by Florida's debt leadership, provided best practice guidance for climate disclosure. Also, the SEC is continually reviewing state and local borrowers' disclosure practices, which have been disappointingly inconsistent or silent regarding climate change's specific risks and the plans to address them. It is egregious that state and local governments' easily quantified climate risks are not clear to investors who deliver capital and to the federal government who provides the critical subsidy.

Ratings agencies, while investing considerable resources on ESG practices and climate data, have not communicated climate risk as clearly, nimbly, and concisely as needed. The new era will require new practices to better inform investors of climate risks and steps taken by issuers to mitigate those risks. Under Dodd Frank there is a section that addresses "Information from sources other than the issuer" which requires that a rating agency shall consider information from credible sources that are potentially significant to the determination of a rating.

Therefore, the SEC could improve the communication of climate risk to investors, under Dodd-Frank by:

- Require that rating agencies provide in annual disclosures and/or answer questions in annual reviews regarding how the agency systematically considers publicly and privately available climate-related data in its determination of ratings;
- Require the rating agencies to have policies that ensure that rating committees are constructed so that there is sufficient expertise to adequately assess publicly and privately available climate information and determine the level of incremental default risk that should be incorporated in the rating; and
- Require the rating agencies disclose in rating reports the specific climate related risks that were assessed, the climate scenarios used in assessing the risk, the time horizon considered, the impact (positive, negative, neutral) on the rating, and if the time horizon is less than the maturity of the bonds and elongating such would have an impact on the assigned rating, requiring that such be acknowledged in the rating report.

These requirements would reasonably lead the rating agencies to level up their expertise (and focus) in assessing climate risks in the ratings process, highlight risks in the analysis (e.g., time horizon, climate scenarios utilized), and generally improve transparency on the topic.

Environmental risks and costs of adaptation are part of the disclosure gap that exists in available information related to issuers' infrastructure obligations. A lack of information regarding an issuer's unfunded current and future infrastructure adaptation costs means that investors could be underestimating their investment's exposure to future financial and political consequences of a major infrastructure failure or climate change effects. The Municipal Securities Rulemaking Board (MSRB) has issued a request for information (RFI) to better understand the current state of disclosure of risks related to ESG factors and ESG-bond labeling. This inquiry is not terribly surprising as it follows market participants' growing thirst for information on these risks, particularly climate risks.

State or local government's physical asset liability (PAL) is a combination of past funding choices and future funding needs, meaning: 1) historical underinvestment in routine maintenance that jeopardizes future asset use or economic capacity, or its deferred maintenance obligation (DMO); and 2) the estimated prospective costs related to climate adaptation necessary to maintain critical infrastructure and viability of the tax-base, or its climate adaptation obligation (CAO). The CAO is similar to an unfunded pension or OPEB liabilities because those costs will reasonably need to be incurred, although the range of potential and/or estimated costs are obviously subject to greater variability.

The amount of the nation's ASCE-estimated \$2.59T 10-year funding gap for deferred maintenance (DMO) is not allocated to and recognized as a liability on states and local governments' financial statements. Nor is it uniformly disclosed. There is some debate on whether the obligation is a debt (owed to anyone) and therefore relevant to be measured in financial statements; but we'd argue the debt is owed by the governmental entity to the taxpayer to maintain the health, safety, and welfare of those living and operating within its jurisdiction. Information on infrastructure liabilities, both the current DMO and the future CAO, should be part of the disclosure package in bond offering documents and updated through commitments made via continuing disclosure agreements.

To do this successfully, efforts to measure individual governments' PAL related obligations and future costs should be more robust. For the DMO, this should start with an audit of a government's physical infrastructure, condition, and cost to bring it to and maintain it at a reasonable state of repair, similar to the requirements of GASB's modified approach available as an alternative to depreciating capital assets. And, all governments—either on their own or with the guidance of their respective state government—will reasonably need to assess the costs required to preserve their infrastructure and tax-base, the CAO, or the economic implications of not doing so. Once again, the growing research and resources available to assess climate related risks and adaptation costs will reasonably make not knowing this information unacceptable.

I appreciate your invitation to join you today and look forward to your questions and discussion.

APPENDIX

The following is **MMA**'s 2023 analysis of climate disclosure practices in two areas of the country – AZ and TX. Climate disclosure in security offering documents is inconsistent or absent in most cases.

Maricopa Co. AZ

PHOENIX AZ AREA ILLUSTRATES THE INCONSISTENCY OF CLIMATE DISCLOSURE FOR ISSUERS EXPOSED TO SIMILAR RISKS: In May 2023, the Phoenix Civic Improvement Corporation issued bonds for its airport. In the offering statement "climate change impacts" were disclosed. The document outlined the risks not only to the physical infrastructure but also its operation and related economic impact of disruptions caused by severe weather conditions. The paragraph from the offering statement is below:

"The Airport's ability to generate Airport Revenues is at risk from climate change impacts and other force majeure events, such as extreme weather events, wildfires, and other natural occurrences, although the Airport's geographic location reduces some of these risks compared to other large commercial airports. Furthermore, the long-term effects of climate change, combined with the increasing passenger awareness of the climate change impacts of aviation, could reduce demand for travel globally or locally. Increased frequency and intensity of weather patterns, including droughts and fires, may have an adverse impact on the Airport's operations and infrastructure."

Date	Issuer Description	Type	Climate Disclosure	Security Type
01/02/2023	Higley Unified School District No. 60 of Maricopa Co., AZ	Negotiated	None	Certificates of Participation
01/09/2023	Deer Valley Unified School District No. 97 of Maricopa Co., AZ	Negotiated	None	G.O. Unlimited Bonds
01/09/2023	Estrella Mountain Ranch Community Facilities District (City of Goodyear, AZ)	Negotiated	None (Environmental Matters page 28)	Special Assessment
01/10/2023	City of Scottsdale, AZ	Competitive	None	G.O. Unlimited Bonds
01/16/2023	Roosevelt Elementary School District No. 66 of Maricopa Co., AZ	Negotiated	None	G.O. Unlimited Bonds
01/30/2023	Cadence Community Facilities District (City of Mesa, AZ)	Negotiated	None (Environmental Matters page 24)	G.O. Unlimited Bonds
01/30/2023	Eastmark Community Facilities District No. 1 (City of Mesa, AZ)	Negotiated	None (Environmental Matters page 26)	G.O. Unlimited Bonds
02/06/2023	Pendergast Elementary School District No. 92 of Maricopa Co., AZ	Negotiated	None	G.O. Unlimited Bonds
02/13/2023	Salt River Project Agricultural Improvement and Power District, AZ	Negotiated	Substantative	Revenue Bonds
03/06/2023	Cartwright Elementary School District No. 83 of Maricopa Co., AZ	Negotiated	None	G.O. Unlimited Bonds
03/28/2023	Tempe Union High School District No. 213 of Maricopa Co., AZ	Competitive	None	G.O. Unlimited Bonds
04/17/2023	Arizona Board of Regents Arizona State University	Negotiated	None	Revenue Bonds
04/24/2023	Mystic at Lake Pleasant Heights Community Facilities District (Peoria, AZ)	Negotiated	None (Environmental Section pages 30 & 31)	G.O. Unlimited Bonds
05/01/2023	Glendale Union High School District No. 205 of Maricopa Co., AZ	Negotiated	None	G.O. Limited Bonds
05/08/2023	Gilbert Unified School District No. 41 of Maricopa Co., AZ	Negotiated	None	G.O. Unlimited Bonds
05/08/2023	Phoenix Elementary School District No. 1 of Maricopa Co., AZ	Negotiated	None	G.O. Unlimited Bonds
05/15/2023	Phoenix Civic Improvement Corporation, AZ	Negotiated	Substantative	Revenue Bonds
05/22/2023	City of Tempe, AZ	Negotiated	Extensive Drought Disclosure—Appendix - pages A-24 & A-25	G.O. Unlimited Bonds
06/05/2023	City of Litchfield Park, AZ	Negotiated	None	Revenue Bonds
06/05/2023	Madison Elementary School District No. 38 of Maricopa Co., AZ	Negotiated	None	G.O. Unlimited Bonds
06/05/2023	Washington Elementary School District No. 6 of Maricopa Co., AZ	Negotiated	None	G.O. Unlimited Bonds
06/19/2023	Alamar Community Facilities District (Avondale, AZ)	Negotiated	None (Environmental Matters Page 26-27, Water Availability)	G.O. Unlimited Bonds
06/19/2023	City of Maricopa, AZ	Negotiated	None	G.O. Unlimited Bonds
07/24/2023	Fowler Elementary School District No. 45 of Maricopa Co., AZ	Negotiated	None	G.O. Unlimited Bonds
08/07/2023	Verrado District 1 Community Facilities District (City of Buckeye, AZ)	Negotiated	None (Environmental Matters Page 29)	G.O. Unlimited Bonds
Date	**Issuer Description**	**Bond Counsel**	**Municipal Advisor**	**Underwriter Counsel**
01/02/2023	Higley Unified School District No. 60 of Maricopa Co., AZ	Gust Rosenfeld P.L.C.	None	Greenberg Traurig LLP
01/09/2023	Deer Valley Unified School District No. 97 of Maricopa Co., AZ	Gust Rosenfeld P.L.C.	None	Greenberg Traurig LLP
01/09/2023	Estrella Mountain Ranch Community Facilities District (City of Goodyear, AZ)	Gust Rosenfeld P.L.C.	Hilltop Securities Inc	Greenberg Traurig LLP
01/10/2023	City of Scottsdale, AZ	Greenberg Traurig LLP	Piper Sandler & Co	None
01/16/2023	Roosevelt Elementary School District No. 66 of Maricopa Co., AZ	Gust Rosenfeld P.L.C.	None	Greenberg Traurig LLP
01/30/2023	Cadence Community Facilities District (City of Mesa, AZ)	Greenberg Traurig LLP	Hilltop Securities Inc	Squire Patton Boggs LLP
01/30/2023	Eastmark Community Facilities District No. 1 (City of Mesa, AZ)	Greenberg Traurig LLP	Hilltop Securities Inc	Squire Patton Boggs LLP
02/06/2023	Pendergast Elementary School District No. 92 of Maricopa Co., AZ	Gust Rosenfeld P.L.C.	None	Squire Patton Boggs LLP
02/13/2023	Salt River Project Agricultural Improvement and Power District, AZ	Chiesa Shahinian & Giantomas	PFM Financial Advisors LLC	Katten Muchin Rosenbaum LLP
03/06/2023	Cartwright Elementary School District No. 83 of Maricopa Co., AZ	Gust Rosenfeld P.L.C.	None	Greenberg Traurig LLP
03/28/2023	Tempe Union High School District No. 213 of Maricopa Co., AZ	Gust Rosenfeld P.L.C.	Hilltop Securities Inc	None
04/17/2023	Arizona Board of Regents Arizona State University	Ballard Spahr LLP	RBC Capital Markets	Squire Patton Boggs LLP
04/24/2023	Mystic at Lake Pleasant Heights Community Facilities District (Peoria, AZ)	Greenberg Traurig LLP	PFM Financial Advisors LLC	Snell & Wilmer L.L.P.
05/01/2023	Glendale Union High School District No. 205 of Maricopa Co., AZ	Gust Rosenfeld P.L.C.	None	Greenberg Traurig LLP
05/08/2023	Gilbert Unified School District No. 41 of Maricopa Co., AZ	Gust Rosenfeld P.L.C.	Piper Sandler & Co	Greenberg Traurig LLP
05/08/2023	Phoenix Elementary School District No. 1 of Maricopa Co., AZ	Gust Rosenfeld P.L.C.	None	Greenberg Traurig LLP
05/15/2023	Phoenix Civic Improvement Corpotation, AZ	Greenberg Traurig LLP	Frasca & Associates, LLC	Squire Patton Boggs LLP
05/22/2023	City of Tempe, AZ	Greenberg Traurig LLP	None	Squire Patton Boggs LLP
06/05/2023	City of Litchfield Park, AZ	Greenberg Traurig LLP	None	Snell & Wilmer L.L.P.
06/05/2023	Madison Elementary School District No. 38 of Maricopa Co., AZ	Gust Rosenfeld P.L.C.	None	Squire Patton Boggs LLP
06/05/2023	Washington Elementary School District No. 6 of Maricopa Co., AZ	Gust Rosenfeld P.L.C.	None	Squire Patton Boggs LLP
06/19/2023	Alamar Community Facilities District (Avondale, AZ)	Greenberg Traurig LLP	Stifel, Nicolaus & Company, Inc.	Squire Patton Boggs LLP
06/19/2023	City of Maricopa, AZ	Greenberg Traurig LLP	Lewis Young Robertson & Burningham, Inc.	Gust Rosenfeld P.L.C.
07/24/2023	Fowler Elementary School District No. 45 of Maricopa Co., AZ	Gust Rosenfeld P.L.C.	Hilltop Securities Inc	Squire Patton Boggs LLP
08/07/2023	Verrado District 1 Community Facilities District (City of Buckeye, AZ)	Gust Rosenfeld P.L.C.	Hilltop Securities Inc	Greenberg Traurig LLP
This data was assembled from publicably available sources and was compiled with best efforts, but may not be definitive.				

Phoenix's climate disclosure prompted **MMA** to examine the offering documents of other Phoenix issuers that raised capital via the municipal market in 2023. The **table above** presents the issuers, issuance manner, whether or not there is climate disclosure, bond counsel, municipal advisor, and underwriter's counsel. The data revealed that issuers with the same climate risks have varied in how the exposure has been articulated, if at all. Historically such variance could be attributed to security type. Perhaps the most interesting is that the two issuers with distinctively complete climate disclosure utilized advisors and counsels that were not often providers of their services to most Phoenix AZ area issuers. Of further curiosity was that Phoenix's bond counsel was also associated with area issuers with similar climate risks that did not provide similar climate disclosure as did the airport deal—an inconsistency. The data suggests a deeper review of procedures, policies and disclosures is merited that could prompt more proactive comment or action by ratings agencies and evaluation services. As the tax-exempt industry has demonstrated over its 100+ year history, it has preferred to respond to crisis rather than to anticipate negative events and adequately inform investors of risks. Such practice is no longer good enough for this new era.

The recent events in HI were preceded by adequate disclosure but were followed by ratings downgrades and sharp security evaluation declines. The question from HI, and as it relates to the Phoenix area issuers (and the industry more broadly), is at what point do ratings agencies and evaluation services shift from reflecting the current conditions and become more proactive in communicating risks and assessing the value associated with potential catastrophes? Because after all, even current conditions at the surface can obfuscate the long-term problems. Is it enough to maintain the status quo or should entities who access the capital markets be held more accountable and responsible for their efforts to (or not to) address quantifiable and known climate risks of the future? Rather than reflecting the comparable transactions to determine the value of a municipal bond in an investor portfolio, should evaluation services factor in the potential and degree of future loss so that holders know the risks they own? HI municipal indexes have suffered significant losses in the wake of the wildfire damage, but should evaluation processes adjust to a potentially more frequent and vulnerable environment? Should investors demand greater accountability from their service providers to incorporate such risks into their valuations? In the case of residential real estate, such risks as wildfire, floods, hurricanes, and environmental waste negatively impact prices of homes assessments so why not for municipal bonds? The industry has a rare opportunity to lead in how to address the complexities associated with climate risk. In fact, it could be argued it has a legal and regulatory responsibility to do so. Such actions could reverberate positively across the financial industry, as well as the regulatory and political landscape.

Harris Co. TX

TX TRUE TO FORM CHOOSES "EXTREME WEATHER" RATHER THAN "CLIMATE CHANGE": **MMA**'s Outlook of August 21, 2023, examined the climate disclosure for this year's issuers from Maricopa Co. AZ. The study revealed an inconsistency at best and absence at worst of the disclosure of risks associated with climate change. In AZ's example, the conditions of greatest concern were extreme heat and sustained drought.

As a next step, **MMA** delved into issues from Harris Co. TX, which included the City of Houston, as well as several state deals. There was not an intention to make a direct comparison to the Maricopa Co. AZ study simply because of the difference in the magnitude and frequency of municipal issuance. Therefore, **MMA** focused on issues that were $100 million or larger, and that came to market in 2023. Of note, both Harris and Maricopa counties are in states that are "red" in their political orientation and have not finalized a state climate adaptation plan. The review of the issues captured the challenge that TX issuers and their counsels have regarding the terminology of "climate change." Most of the issuers chose to provide a laundry list of extreme weather events as a means to disclose risks associated with natural catastrophes. However, this strategy comprises the communication of systemic risks posed by the faster than anticipated changes in the severity of climate change and the persistence of the stresses caused by global warming.

The inevitability of warming temperatures has only exacerbated the risks posed to US infrastructure and particularly TX where in 2023 heat was sustained at higher temperatures and storms demonstrated greater volatility and severity than historically experienced. As winter begins, TX's ERCOT has already issued warnings of potential energy grid failure should temperatures fall below freezing for the 4th consecutive winter. TX's weather extremes and unsatiable demand for electricity have and will continue to test the state's vulnerable infrastructure.

TX has demonstrated a defensive posture in its approach toward the climate issue in order to protect the state's critical economic relationship with the oil and gas industry. Sadly, the perspective that an acknowledgement of climate risks necessitates an obfuscation strategy with regards to the fossil fuel industry is a disservice to the protection of the state's citizens and development of stabilizing strategies for modernizing infrastructure in order to adapt to a new era of "extreme weather." There were two issuers that did mention "climate change" and three issuers which chose to avoid the broader issue of weather completely. The TX and AZ issues' review highlighted the regional, societal, and political dynamics that investors must consider when purchasing a municipal security and a want for regulatory intervention to improve processes.

Date	Issuer Description	Type	Moody's	S&P	Climate Disclosure	Security Type
01/09/2023	Tomball Independent School District, TX	NEGT	Aaa	AAA	Extreme Weather Events Disclosure	G.O. Unlimited Bonds
01/23/2023	Spring Independent School District, TX	NEGT	Aa2	AA-	Extreme Weather Events Disclosure	G.O. Unlimited Bonds
02/13/2023	Houston Independent School District, TX	NEGT	Aaa	AAA	Extreme Weather Events Disclosure	G.O. Limited Bonds
02/13/2023	Lower Colorado River Authority, TX	NEGT		A	Extreme Weather Events Disclosure	Revenue Bonds
02/27/2023	TX Department of Housing & Community Affairs	NEGT	Aaa	AA+	None	Revenue Bonds
03/06/2023	TX Natural Gas Securitization Finance Corporation	NEGT	Aaa		Mentions Climate Change	Revenue Bonds
03/06/2023	Board of Regents of the Univ. of TX System	NEGT	Aaa	AAA	Mentions Potential Natural Disasters	Revenue Bonds
04/24/2023	Katy Independent School District, TX	NEGT	Aaa	AAA	Extreme Weather Events Disclosure	G.O. Unlimited Bonds
05/15/2023	Harris Co.TX Industrial Development Corporation	NEGT	Baa3	APPLIED	Mentions Potential Natural Disasters	Revenue Bonds
06/05/2023	Harris Co., TX Toll Road First Lien Rev	NEGT	Aa2		Extreme Weather Events Disclosure	Revenue Bonds
06/19/2023	Harris Co. Flood Control District, TX	NEGT	Aaa		Extreme Weather Events Disclosure	G.O. Limited Bonds
06/26/2023	Houston, TX Airport System Subordinate Lien Rev Ref	NEGT	A1		Extreme Weather Events Disclosure	Revenue Bonds
06/27/2023	Klein Independent School District, TX	COMP	Aaa	AAA	Extreme Weather Events Disclosure	G.O. Unlimited Bonds
06/28/2023	State of TX	COMP	Aaa	APPLIED	None	G.O. Unlimited Bonds
07/31/2023	Grand Parkway Transportation Corporation, TX	NEGT	Aa1		Extreme Weather Events Disclosure	Revenue Bonds
07/31/2023	TX Private Activity Bond Surface Corporation	NEGT	Baa1		Extreme Weather Events Disclosure	Revenue Bonds
08/07/2023	Harris Co., TX Perm Impt Ref & Unltd Tax Road Ref	NEGT	Aaa		Extreme Weather Events Disclosure	G.O. Limited Bonds
08/07/2023	Port of Houston Authority of Harris Co., TX	NEGT	Aa3	AA+	Mentions Climate Change	Revenue Bonds
09/04/2023	Pasadena Independent School District, TX	NEGT	Aaa	AAA	Extreme Weather Events Disclosure	G.O. Unlimited Bonds
09/25/2023	TX Water Development Board	NEGT		AAA	Extreme Weather Events Disclosure	Revenue Bonds
10/09/2023	Houston, TX Public Impt & Ref	NEGT	Aa3		Extreme Weather Events Disclosure	G.O. Limited Bonds
10/16/2023	North TX Tollway Authority	NEGT	Aa3	AA-	Mention Air Quality Control Requirements	Revenue Bonds
10/23/2023	Cypress-Fairbanks Independent School District, TX	NEGT	Aaa	AAA	Extreme Weather Events Disclosure	G.O. Unlimited Bonds
10/23/2023	TX Public Finance Authority	NEGT		AAA	None	G.O. Unlimited Bonds

Date	Issuer Description	Bond Counsel	Municipal Advisor	Underwriter Counsel
01/09/2023	Tomball Independent School District, TX	Orrick, Herrington & Sutcliffe LLP	BOK Financial Securities, Inc.	Bracewell LLP
01/23/2023	Spring Independent School District, TX	Bracewell LLP	Post Oak Municipal Advisors LLC	Orrick, Herrington & Sutcliffe LLP, and The Bates Law Firm PLLC
02/13/2023	Houston Independent School District, TX	Orrick, Herrington & Sutcliffe LLP	Estrada Hinojosa & Company, Inc.	Cantu Harden Montoya LLP, and Kassahn & Ortiz PC
02/13/2023	Lower Colorado River Authority, TX	McCall, Parkhurst & Horton LLP	Specialized Public Finance Inc.	Bracewell LLP
02/27/2023	TX Department of Housing & Community Affairs	Bracewell LLP	Stifel, Nicolaus & Co., Inc.	Chapman and Cutler LLP
03/06/2023	TX Natural Gas Securitization Finance Corporation	Norton Rose Fullbright US LLP	Estrada Hinojosa & Company, Inc.	Orrick, Herrington & Sutcliffe LLP
03/06/2023	Board of Regents of the Univ. of TX System	Bracewell LLP	N/A	Orrick, Herrington & Sutcliffe LLP and Kassahn & Ortiz, PC
04/24/2023	Katy Independent School District, TX	Orrick, Herrington & Sutcliffe LLP	Hilltop Securities Inc.	Bracewell LLP
05/15/2023	Harris Co.TX Industrial Development Corporation	Bracewell LLP	N/A	Hunton Andrews Kurth LLP
06/05/2023	Harris Co., TX Toll Road First Lien Rev	Greenberg Traurig LLP	Masterson Advisors LLC, and TKG & Associates LLC	McCall, Parkhurst & Horton LLP and Baker Williams Mattheisen LLP
06/19/2023	Harris Co. Flood Control District, TX	Holland & Knight LLP and The Bates Law Firm, PLLC	Masterson Advisors LLC, and TKG & Associates LLC	McCall, Parkhurst & Horton LLP and Levi Benton & Associates PLLC
06/26/2023	Houston, TX Airport System Subordinate Lien Rev Re	Bracewell LLP and West & Associates, LLP	Masterson Advisors LLC and The RSI Group LLC	McCall, Parkhurst & Horton LLP and Levi Benton & Associates PLLC
06/27/2023	Klein Independent School District, TX	Bracewell LLP, The Bates Law Firm PLLC, and Spalding, Nichols, Lamp, Langlois LLP	RBC Capital Markets, LLC	N/A
06/28/2023	State of TX	McCall, Parkhurst & Horton LLP	Hilltop Securities Inc.	N/A
07/31/2023	Grand Parkway Transportation Corporation, TX	McCall, Parkhurst & Horton LLP	Estrada Hinojosa & Company, Inc.	Locke Lord LLP, and Cantu Harden Montoya LLP
07/31/2023	TX Private Activity Bond Surface Corporation	McCall, Parkhurst & Horton LLP	Sperry Capital Inc.	McGuireWoods LLP
08/07/2023	Harris Co., TX Perm Impt Ref & Unltd Tax Road Ref	Bracewell LLP, and West & Associates, LLP	Masterson Advisors LLC and TKG & Associates LLC	Haynes and Boone, LLP and Bratton & Associates, PLLC
08/07/2023	Port of Houston Authority of Harris Co., TX	Greenberg Traurig LLP, and Baker Williams Matthiesen LLP	PFM Financial Advisors LLC and TKG & Associates LLC	Orrick, Herrington & Sutcliffe LLP and Hardwick Law Firm, LLC
09/04/2023	Pasadena Independent School District, TX	Jackson Walker LLP	BOK Financial Securities, Inc.	Bracewell LLP
09/25/2023	TX Water Development Board	McCall, Parkhurst & Horton LLP	Hilltop Securities Inc.	Orrick, Herrington & Sutcliffe LLP
10/09/2023	Houston, TX Public Impt & Ref	Bracewell LLP and Burney & Foreman	Masterson Advisors LLC and The RSI Group LLC	Holland & Knight LLP
10/16/2023	North TX Tollway Authority	McCall, Parkhurst & Horton LLP, and Locke Lord LLP	Hilltop Securities Inc., Estrada Hinojosa & Co., Inc, and RSI Group LLC	Bracewell LLP, and West & Associates
10/23/2023	Cypress-Fairbanks Independent School District, TX	Bracewell LLP	Post Oak Municipal Advisors LLC	Jackson Walker LLP
10/23/2023	TX Public Finance Authority	McCall, Parkhurst & Horton LLP	RBC Capital Markets, LLC	Greenberg Traurig LLP