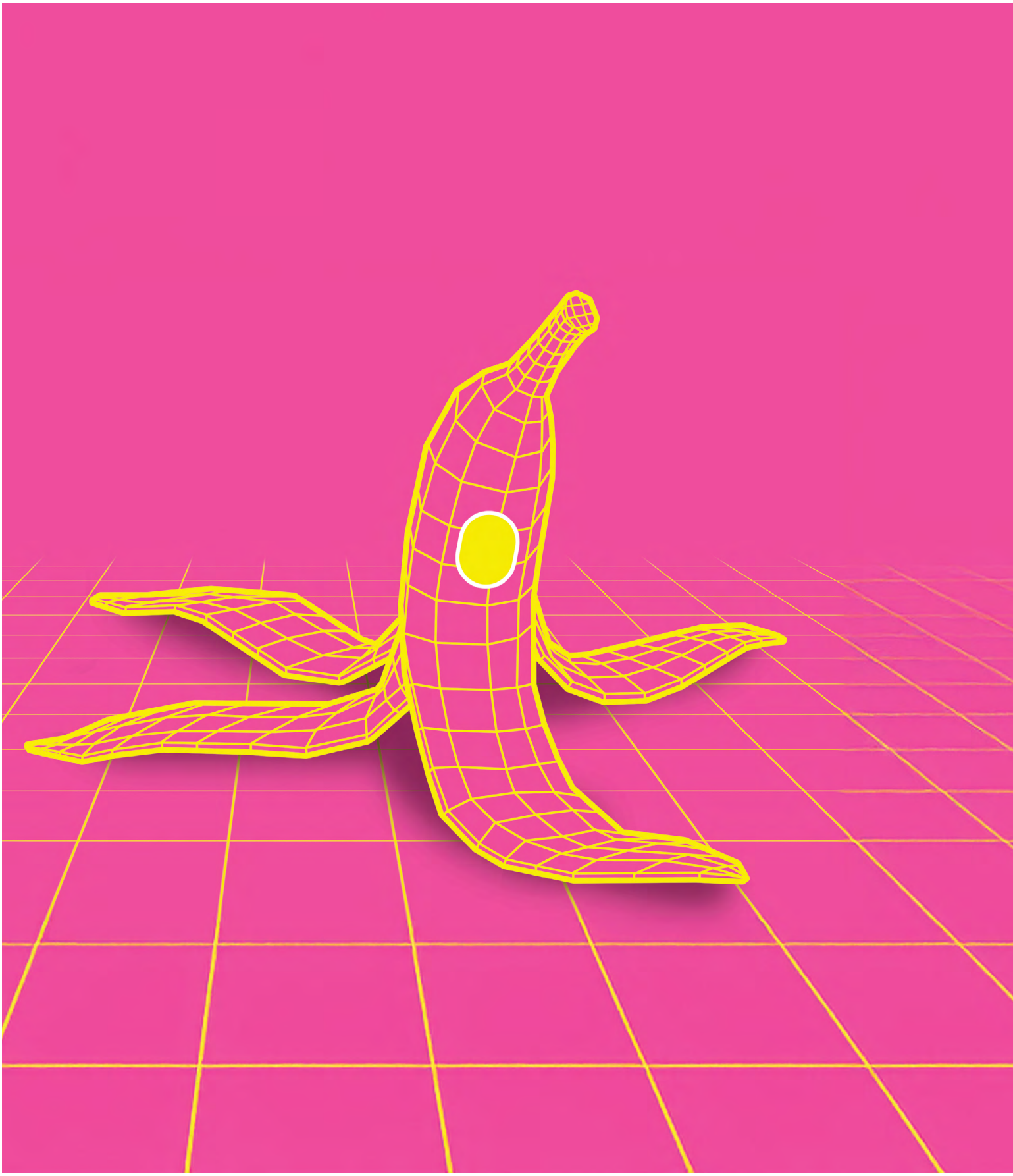


CALCULATED RISK

The Goleta Water District's Risk-Based Reserve Framework

A Case Study for Local Governments

BY THAO PHAM

Reserves are crucial for a government's fiscal stability, especially when facing increasing uncertainties. Risk management for local government, therefore, necessitates a thorough assessment of the appropriate reserve levels. This article presents a risk-based reserve framework developed by GFOA to assist local governments in determining the appropriate level of reserves required based on their risk exposure. A case study of the Goleta Water District (GWD) is included to illustrate the application of this framework. A utility district like GWD carries unique characteristics that distinguish it from general-purpose governments and render it a noteworthy case study for risk-based reserve analysis.

Why should local governments be concerned with risks?

"Risk" is defined as the probability and magnitude of a loss, disaster, or other undesirable events.[1] Some common risks faced by local governments are economic downturns, natural catastrophes, or regulatory changes that can adversely affect their budgets. Managing risks helps governments achieve budget stability by strategically planning for future uncertainties while maintaining the current level of service.

"Reserves" refer to the portion of a local government's fund balance that is available for unforeseen circumstances.[2] Reserves are fundamental for maintaining financial flexibility, sustainability, and continuity of existing service levels. They provide governments with options for emergency response and serve as a buffer against shocks and other risks. But managing reserves can be complex, underscoring the consideration of the appropriate amount of money needed in a reserve, when a reserve is sufficient, and when it becomes excessive.

Risk management is crucial for local governments because it facilitates the identification, assessment, and mitigation of potential threats that may disrupt public services or result in financial losses. By proactively managing risks, local governments can ensure operational continuity, safeguard public assets, and make informed decisions that enhance community resilience and trust.

A comprehensive review of risk factors can provide a range of preferred reserves and enhance the government's understanding of its overall risk profile. An analysis that considers risk enables the government to evaluate its reserve strategy effectively.

Risk-based reserve analysis differs in application between a general-purpose government and a utility district like GWD due to the nature of their operations and financial risks. For a general-purpose government, the analysis typically focuses on broad fiscal uncertainties such as economic downturns, fluctuations in tax revenues, and unanticipated expenditures across diverse services. In contrast, a water district faces more operational and infrastructure-specific risks, such as droughts, regulatory changes, or major capital repair needs. While both entities use risk-based analysis to determine adequate reserve levels, utility districts often emphasize asset management, rate stability, and service continuity. In contrast, general governments prioritize overall budgetary resilience and flexibility in service delivery.

Risk-based reserve analysis and insurance analysis are both essential instruments for financial risk management, though their methodologies differ. Each is designed to safeguard organizations against unforeseen losses; however, risk-based reserve analysis entails allocating internal funds to cushion potential shocks, whereas insurance analysis involves transferring specified risks to an external insurer via policy arrangements. While reserves provide adaptable and wide-ranging coverage for unpredictable events—albeit with associated opportunity costs—insurance delivers targeted protection for designated risks in return for premium payments. Employed together, these strategies contribute to robust financial resilience.

A risk-based reserve framework

Given the uncertainty, measuring risks is challenging. GFOA developed a framework that relies on both historical data and probability management to evaluate the probability and magnitude of risks. The framework ultimately helps answer the question of how much a local government should hold in reserves, given its exposed risks, to maintain the desired level of performance.

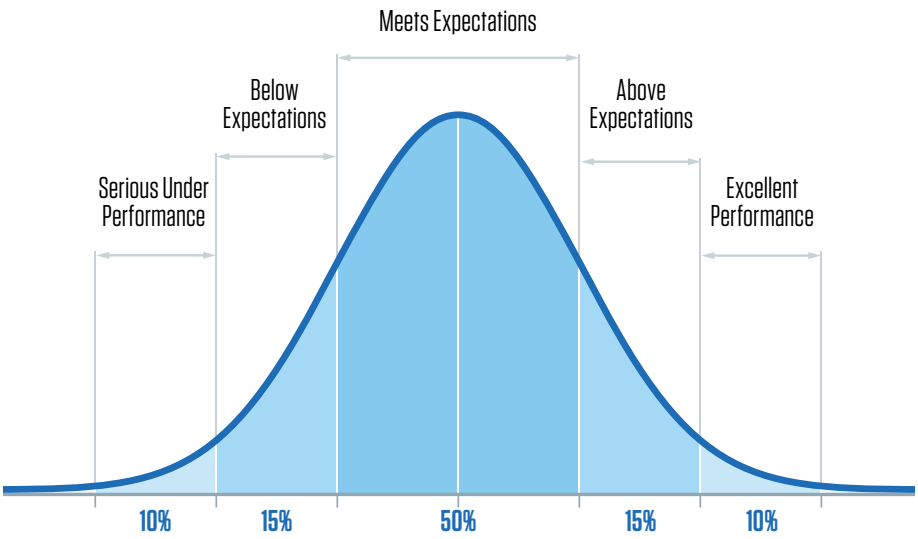
The historical data provides critical reference points for the potential impact of any given risk. It is important to acknowledge that because of the shared attributes, past experiences from similar or adjacent municipalities can also be valuable input for the analysis of another. Despite the informative nature of data, it can be difficult to properly simulate the chance of future events based solely on past occurrences. Therefore, we incorporate probability management methodology in our framework.[3]

Probability management helps augment our understanding of risks by extending measurement beyond the analysis of historical data. This methodology enables the simulation of numerous potential events/risks, such as recessions or earthquakes, allowing for the observation of the probabilities associated with events of varying magnitudes. To perform such simulations, probability management employs a statistical technique known as Monte Carlo analysis.

The Monte Carlo technique is widely used in risk-based reserve analysis to estimate the appropriate level of financial reserves needed to withstand uncertain future events. By running thousands of simulations using randomized inputs for key risk factors—such as disasters, economic downturns—Monte Carlo analysis generates a probability distribution of potential financial outcomes. This allows decision-makers to quantify the likelihood of reserve depletion under various scenarios and determine a reserve target that balances fiscal resilience with operational flexibility. It provides a data-driven foundation for managing financial uncertainty more effectively.[4]

The principles of probability management are based on "distribution"—a function representing the possible values for a variable and their frequency. A "normal distribution," often called a "bell curve," is the most common type of distribution (see Exhibit 1). Many phenomena follow this pattern.[5] The normal distribution is especially beneficial for risk analysis because it can be used to calculate the likelihood that an event of a certain magnitude will occur. By associating a monetary value with that event, it allows an estimate of the chance a municipality must have a specific amount of reserves available to ensure proper response.

EXHIBIT 1 | Example of a normal bell curve distribution for performance at work[6]



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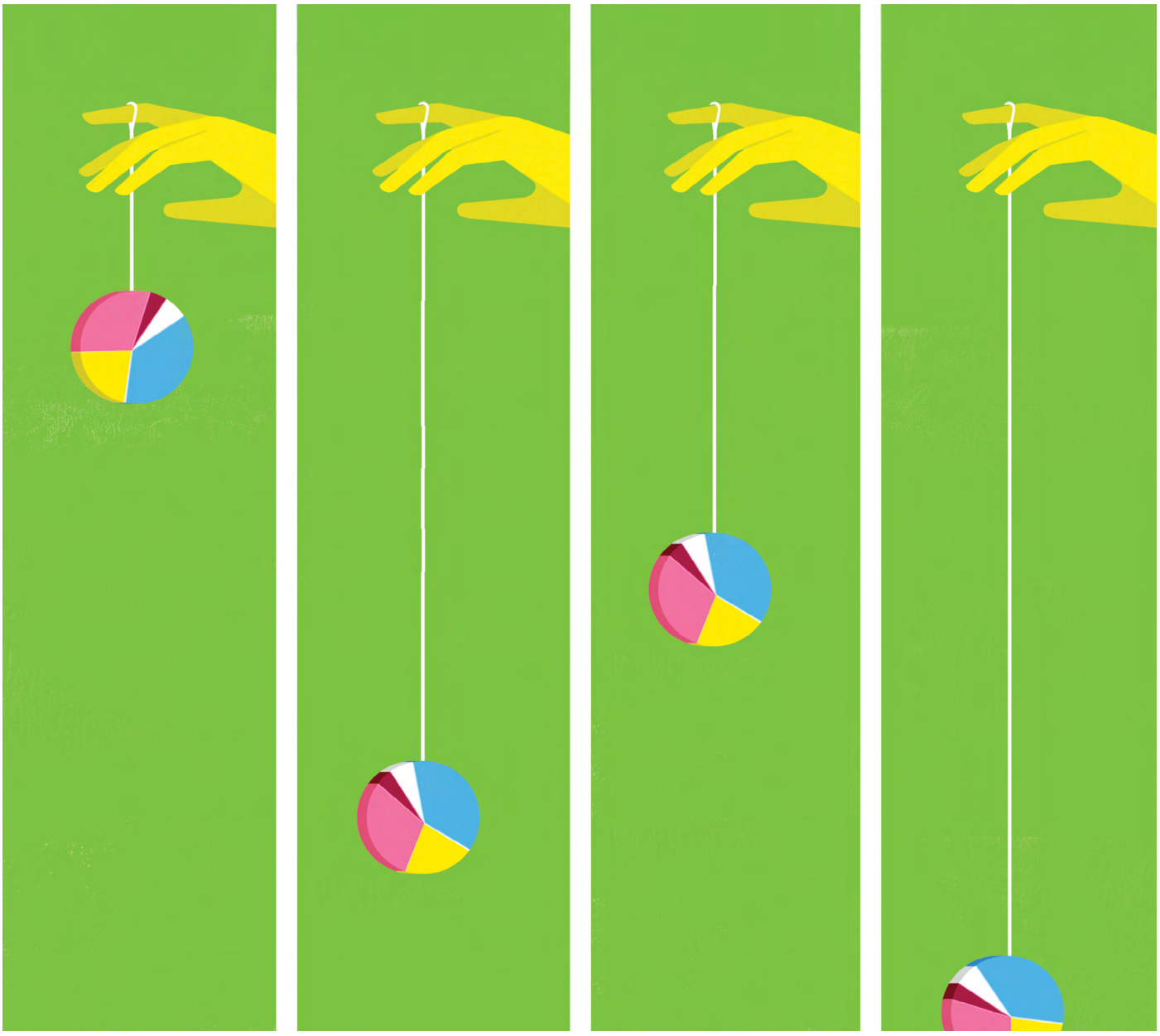

Because governments may face multiple risks concurrently, the framework proposes a multi-risk (pooled risk) estimate to determine appropriate reserve levels. This approach has several advantages. First, evaluating all risks collectively helps prevent overestimating the total reserve requirement. Summing the worst-case scenarios of individual risks—such as a severe recession, a major earthquake, and a significant fire—can lead to an overly conservative reserve target. In practice, the likelihood of all such events occurring simultaneously within a short time frame is extremely low. Second, this method accounts for "risk interdependencies," where the occurrence of one risk could affect the probability or magnitude of a related risk. For instance, recession may affect the chance of unfunded pensions, both of which pose significant threats to many governments. Finally, it accommodates the heterogeneity in the likelihood of different types of risks. For example, a recession is more probable within the next decade than a 7.0-Richter earthquake. The framework uses the relative chances of each major risk occurring over a ten-year period to develop a comprehensive model of risks over a defined time horizon.

> By proactively managing risks, local governments can ensure operational continuity, safeguard public assets, and make informed decisions that enhance community resilience and trust.

EXHIBIT 2 | Filter system at GWD's Corona Del Mar treatment facility[8]

CASE STUDY

From framework to application: the Goleta Water District

GWD provides an example of introducing a risk-based reserve framework.

The district's background

Established in 1944, GWD serves as a vital public utility in Santa Barbara County, California. Spanning approximately 29,000 acres along the South Coast—from the City of Santa Barbara to El Capitan State Beach—the district provides water services to around 87,000 residents through an extensive network of over 270 miles of pipeline[7] (see Exhibit 2).

Today, GWD maintains a diversified water portfolio comprising Lake Cachuma, the Goleta Groundwater Basin, recycled water, and imported water from the State Water Project, collectively providing approximately 16,500 acre-feet annually. The district is also a pioneer in water conservation, having introduced the nation's first low-flow toilet rebate program in 1986.

Risk-based reserve analysis for GWD

GWD is exposed to some critical risks, including:[9]

- Revenue loss from droughts due to stage restrictions.
- Large-scale unanticipated infrastructure failures.
- Wildfires.
- Earthquakes.
- The cost of new regulations (e.g., new water treatment standards).

The analysis also considers the role of capital and special projects in the district's reserve strategy. Each risk is modeled separately and then combined into a ten-year model of the district's fund balance and reserves. The Monte Carlo technique is employed to calculate the probability of each risk occurring within a ten-year period and the potential magnitude of loss for the district's reserve if such an event were to occur. Data is collected from sources including hazard plan reports, Federal Emergency Management Agency (FEMA) reports, and calibrated estimates from the district's staff.

ABOUT THE GOLETA WATER DISTRICT

The Goleta Water District serves a diverse community of about 87,000 residents in the Goleta Valley, catering to residential, agricultural, commercial, industrial, and institutional needs. Its water infrastructure comprises over 270 miles of pipelines, a water treatment plant, storage reservoirs, pumping facilities, active wells, a recycled water system, and connections to Lake Cachuma and the State Water Project. For more information, visit **goletawater.com**.

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Exhibit 3 displays the average remaining reserve per year (blue line) over a ten-year period. The district's reserves are projected to remain stable, on average, during this time frame, staying well above the critical threshold indicated by the dotted pink line (associated with an A-level bond rating or a $5 million reserve threshold). Additionally, the chart presents the 50th percentile (green line), which serves as an alternative measure of likely outcome, mitigating the impact of extreme possible outcomes on the results. The 50th percentile can be considered a more optimistic view of the average. As demonstrated, the district's current reserve level is also well above the average threshold for the next ten years.

The average reserve shown in Exhibit 3 is compared to a "critical threshold." The model permits the district to set the value of the critical threshold. In this case study, it is set to an amount indicative of what rating agencies may consider for an A-rated credit - 35 days of spending, or approximately 1/10th of annual expenditures.[10]

In addition to maintaining the A-level bond rating, the district aims to achieve a AA rating. Based on our analysis, the district's current reserves surpass the threshold typically associated with a AA rating, which is equivalent to 150 days of spending, or 40 percent of annual expenditure. However, as shown in Exhibit 4, the average reserves are projected to fall below the AA-rating benchmark within approximately five years. This exhibit also demonstrates how the model accommodates stress-testing, which in this case is the change of the critical threshold.

Finally, the cumulative probability chart in Exhibit 5 illustrates the confidence derived from various levels of reserves over a ten-year period necessary to attain a AA-rating. The district's current reserve aligns with the pink line at the 40 percent level, which signifies a 40 percent likelihood of remaining above rating agency expectations associated with a AA rating over the next ten years and a 50 percent likelihood over five years.

The key takeaway from Exhibit 5 is that reserves exhibit diminishing returns at a certain threshold, as indicated by the flattening of the curve. This pattern suggests that additional reserves beyond this threshold (or diminishing point) provide increasingly less confidence per dollar. The reason for this phenomenon is that further along the graph, reserves must cover more extreme events. Therefore, accumulating reserves past the point where the curve flattens would not be advantageous for the district. The implication of a flattened curve is that not all positions on the line offer equal cost-effectiveness. To illustrate, points along the flatter segments of the curve are less cost-effective compared to those on the steeper segments.

The analysis suggests that the district should establish a range for reserve amounts where the ceiling is the maximum reserve level and the floor is the minimum reserve level the district aims to maintain. If reserves fall below the floor, the district should replenish them quickly.

The analysis does not recommend a single dollar amount of reserves the district should maintain. Instead, it provides a clear general direction in the form of a suggested range, and the risk model provides the ability to stress test different reserve strategies. The driving factor for this approach is the risk appetite of district officials. Risk-averse officials may prefer more reserves and vice versa.

EXHIBIT 3 | Simulated average reserve per year (A-rating threshold)

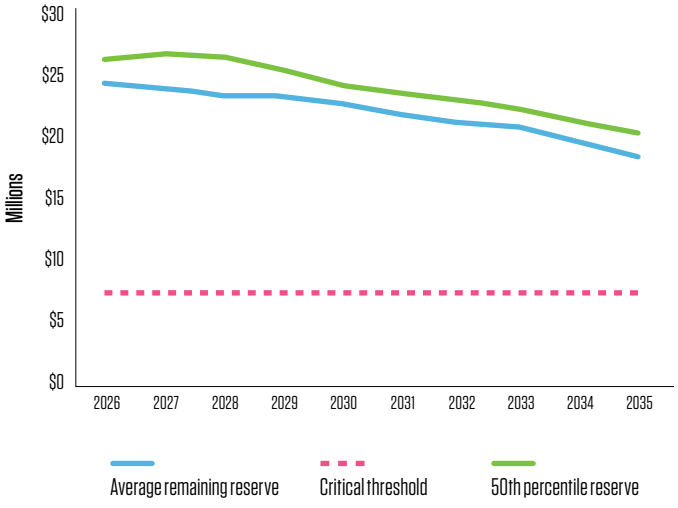
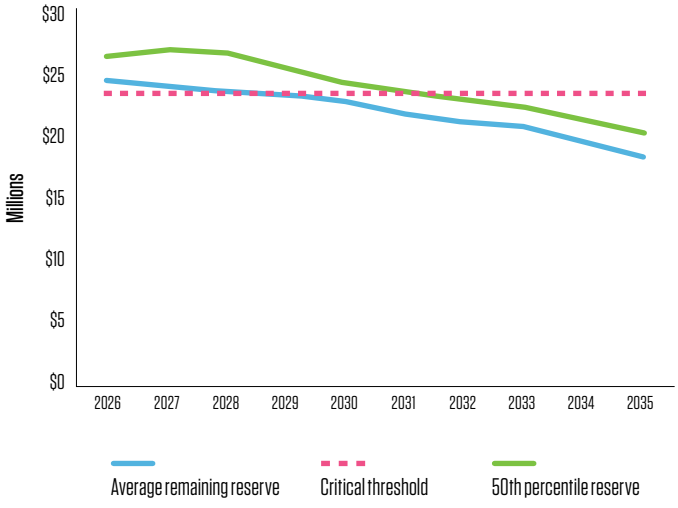


EXHIBIT 4 | Simulated average reserve per year (AA-rating threshold)



The risk-based reserve framework recommends a range of reserves to help local governments better prepare for their exposed risks while attempting to achieve their performance goals.

The range accommodates different risk appetites while also providing solid assurances of staying above the critical threshold and avoiding the flat part of the curve in Exhibit 5.

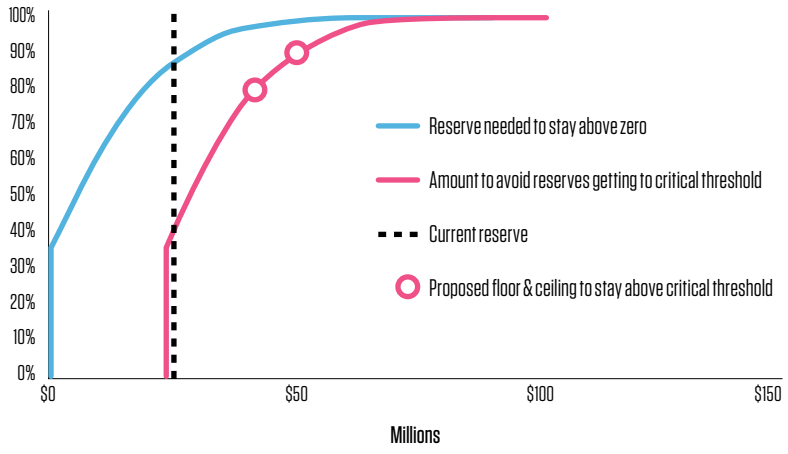
Beyond the framework

In addition to maintaining reserves based on the estimates derived from our framework, the district implemented further measures aligned with its specific attributes to mitigate the potential impact of encountered risks. For instance, during a podcast interview with GFOA, district staff shared that droughts pose arguably the most significant risks to the district. Therefore, GWD has developed contingency plans, including purchasing supplemental water and implementing restrictive water use in more vulnerable jurisdictions during extreme droughts. This approach alleviates pressure on reserves and provides flexibility in the district's risk management strategy.

In general, the risk-based reserve framework recommends a range of reserves to help local governments better prepare for their exposed risks while attempting to achieve their performance goals. The framework also allows stakeholders to stress-test strategies tailored to their own attributes and risk philosophies. But the framework is not immune to limitations.

EXHIBIT 5 | **Cumulative probability chart**

In 10 years, how confident can the District be that the existing general fund reserve will be enough?



For instance, the analysis mainly concerns the recession impact on the general fund, whereas the scope of financial planning can be beyond this fund. Furthermore, since the presented framework primarily measures risks based on historical data, it can't anticipate new and unobserved risks. The evolving nature of risks underscores the importance of regularly assessing the current situation and potential future uncertainties. Finally, certain risk mitigation tools besides rainy-day funds, such as insurance or contingency plans, are not fully integrated in the framework. Therefore, although the framework can serve as a guiding material for risk management, governments and stakeholders need more comprehensive assessment and consideration of different risk elements and corresponding strategies to address the exposed risk situation properly.

Conclusion

To sum up, because risks are unavoidable, managing risks is fundamental for good governance. A local government's reserve strategy should address its specific risks. Therefore, in addition to data analysis, collaboration with risk stakeholders is essential to assess necessary reserves, risk appetite, and related response strategies to mitigate uncertainty and sustain public-service performance.

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[1] See Douglas W. Hubbard, *The Failure of Risk Management: Why It's Broken and How to Fix It* (John Wiley and Sons, 2009).

[2] See Government Reserves, OECD indicators (oecd.org/en/data/indicators/government-reserves.html).

[3] The discipline of probability management was developed by Dr. Sam Savage, author of *The Flaw of Averages*. You can learn more about probability management at probabilitymanagement.org.

[4] For further information about Monte Carlo simulation, see Chris Bernard, "How to Run a Monte Carlo Simulation in Excel: 5 Key Steps," Datamation website, May 20, 2024 (datamation.com/big-data/how-to-run-monte-carlo-simulation-in-excel/).

[5] Certain phenomena can have an "asymmetric" distribution. For more information, see Saul McLeod, "Introduction to the Normal Distribution (Bell Curve), Simply Psychology website, October 11, 2023 (simplypsychology.org/normal-distribution.html).

[6] Sachinsoni, "A comprehensive guide to the normal distribution," Medium website, October 28, 2023.

[7] See Santa Barbara YP by Names and Numbers, the city's local data portal (santabarbarayp.com/biz/25702/goleta-water-district).

[8] Source: Goleta Water District website (goletawater.com/newsletters-and-press/photos/).

[9] These risks are identified through review of the state and district's hazard plans as well as discussion with the district's staff.

[10] See Moody's rating methodology at Rating Methodologies, US Cities and Counties, Moody's website, July 24, 2024 (moodys.com).