

Risk-Based Analysis and Stress Test of General Fund Reserve Requirements for the Salt Lake City, Utah

2024

**Produced by:
The Government Finance Officers Association**



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Section 1 - Executive Summary

A local government's "reserves" are the portion of fund balance which serves as a hedge against risk. The City of SLC ("the City" or "SLC") has asked the questions: "what is the right amount of general fund reserves for us?" and "how resilient would any potential reserve target be to losses?" The Government Finance Officers Association (GFOA) has helped the City answer this question by examining the risks that it is subject to.

First, we identified the risks that posed the most clear and present danger to the City's general fund. Among the major risks we examined are:¹

- Recessions and revenue volatility
- Earthquakes
- Flooding
- Wildfires
- Tornadoes

Next, for each risk, we calculated the probability that the City would experience the risk over a ten-year period and, if an event were to occur, what the magnitude of the loss would be for the City's general fund. To calculate the probability and magnitude of events, we did the following:

- **Analyzed SLC's own experience and the experiences of other cities.** For example, a wildfire might produce comparable losses in cities of comparable size with comparable exposure to wildfires.
- **Reviewed research produced by other agencies.** For instance, the Federal Emergency Management Agency (FEMA) has data on costs that natural disasters have caused.
- **Drew from the expertise of City staff.** City staff work every day on preparing the City for the risks it faces. Staff provided their expertise to help us estimate risks. For example, City staff helped us understand the nuances of natural disaster risks and revenue instability risks in SLC. The City's Emergency Operations Plan was also a valuable resource.

Readers interested in how each risk was analyzed are invited to consult Sections 4 and 5 of the full report.

We modeled each risk individually and then combined each individual risk into a ten-year model of the City's reserves. The model is intended to answer the question: what amount of reserves will give SLC sufficient confidence that it will be able to cover the losses from the risks GFOA has analyzed?

We combined all the information above to create a ten-year **risk model**. The City's goal for this analysis was to find an amount that can give the City sufficient comfort that its reserves will cover its risks.

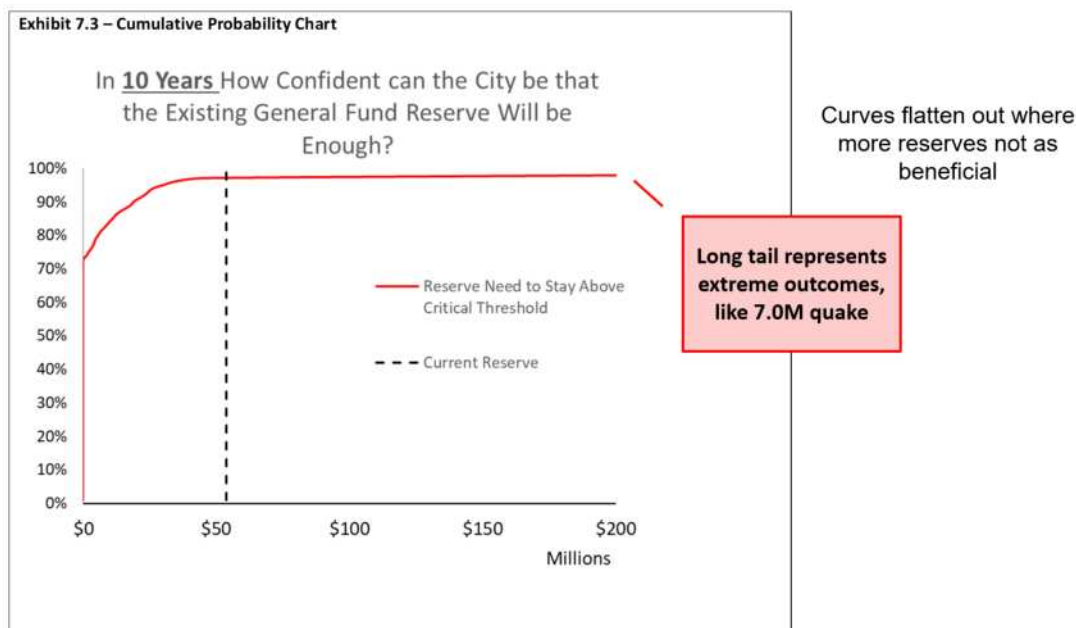
GFOA cannot recommend a precise amount of reserves the City should maintain, but our analysis does provide a clear general direction and the ability to "stress test" different reserve strategies. The reason we cannot make a precise recommendation is that a big part of determining a desirable reserve amount is the "risk appetite" of SLC officials. Officials who are risk averse may prefer more reserves. Those who are less averse and perhaps more sensitive to the opportunity costs of holding reserves may prefer less.

¹ We used the City's Emergency Operations Plan to help identify all of the relevant risks.

GFOA should not substitute its own values for those of SLC officials. Thus, SLC officials should take time to consider their risk appetite as it relates to reserves in light of the information presented in this report.

Here are some of the most important findings of our analysis that could inform SLC's risk appetite.

- There is a less than a 5% chance that the City's reserve will reach zero over the ten-year analysis period. This assumes that the City is willing to cut up to 3% of its budget during recessions, that the City will use any surpluses it generates in non-recession years to replenish the reserve as quickly as possible, and that FEMA or other forms of reimbursement will be provided for many extreme events within two years of the event.²
- Over a ten-year period, on average, the City's reserves will remain relatively stable, given the assumptions above.
- The City is likely to remain within the parameters for the size of fund balance associated with a AAA bond rating. It should be noted that the strong fund balances maintained in other SLC funds makes a strong contribution to the City's ability to stay within the AAA fund balance parameters.
- The City can use the results of this report to optimize the range of general fund reserves it would like to hold. GFOA recommends the City establish a floor and a ceiling amount. Below is an example of a chart produced by the GFOA risk model. This is a cumulative probability chart. It shows the confidence available from varying levels of reserves. The main take-away from this graphic is the reserves have a diminishing return at a certain point because the flatter the line gets, the less confidence an additional dollar of reserve "buys" you. This is because the further to the right you go on the graph, the more extreme the events are that must be covered by reserves. This graphic shows that the City has reached the point of diminishing returns, if zero is considered the critical threshold. The City would not be as well served by accumulating reserves past the point where the line starts to flatten out, **if zero is the critical threshold**. So, the City could explore points along the red line and where an appropriate floor and ceiling are, given SLC officials' risk appetites.



² The risk model developed by GFOA uses several assumptions to provide realistic simulations of reimbursement. See Section 7 of the report for details on this as well as assumptions on budget cuts and surpluses.

This analysis can be used to assist the City in taking the following steps:

- SLC council and administration can determine the preferred amount of reserves based on risk appetite and the data presented here.
- SLC council and administration can consider a comprehensive reserve policy.
- As part of the deliberations on the preferred amount of reserves, take into account the relationship between the general fund and other funds. Though the strong balances in other funds do help SLC meet bond rating agency expectations, the general fund does have responsibilities for good overall municipal management that go beyond the scope of rating agency expectations.
- GFOA has been working with City staff to show them the details of how the model works and will provide the model to the City staff at the end of the project. City staff can update and change assumptions to examine scenarios besides those we focused on in this report.

This report also provides several recommendations for how SLC can strengthen its financial position to respond to the risks analyzed in this report. See the end of Section 7 of the full report for details.

Section 2 - Introduction

“Reserves” are the portion of a local government’s fund balance that are available to respond to the unexpected. Reserves are the cornerstone of financial flexibility, sustainability, and continuity of existing service levels. Reserves provide a government with options to respond to emergencies and provide a buffer against shocks and other forms of risk. Managing reserves, though, can be a challenge. Foremost is the question of how much money to maintain in a general fund reserve. How much is enough and when does a reserve become too much?

In 2023, Salt Lake City (the City) has been considering the implication that several types of extreme events, like natural disasters, could have on the City government’s financial condition, particularly its reserve levels for the general fund. The City engaged the GFOA to produce a recommendation to help it decide the appropriate reserve level for the general fund, given the risks from extreme events. GFOA is a non-profit association of more than 21,000 state and local government finance professionals and elected officials from across North America. A key part of GFOA’s mission is to promote best practices in public finance, including reserve policies. The analysis by GFOA also shed light on the potential broader economic losses to the community, not just City government.

GFOA’s approach to reserves does not suppose “one-size-fits-all.” Ideally, a local government’s reserve strategy will be customized to the risk that the local government faces. For example, GFOA’s “Best Practice” on general fund reserves recommends that general-purpose governments maintain reserves of no less than two months of regular operating revenues or regular operating expenditures (i.e., reserves equal to about 16.7 percent of revenues or expenditures), but that local governments should determine a reserve target that is most appropriate for their circumstances.³ Therefore, GFOA worked with the City to conduct an analysis of the risks influencing the need for reserves as a hedge against uncertainty and loss.

A “risk” is defined as the probability and magnitude of a loss, disaster, or other undesirable event.⁴ The GFOA’s framework of risk assessment is based on the risk management cycle: identify risk; assess risk; identify risk mitigation approaches; assess expected risk reduction; and select and implement mitigation methods. Our analysis focuses primarily on risk retention, or using reserves, to manage risk. However, our analysis also encourages the City to think about how other risk management methods might alleviate the need to hold larger reserves. In other words, can the City manage its risks in some other way besides holding reserves? For example, could insurance or borrowing strategies complement the City’s reserve strategy? A thorough examination of the risk factors should lead to a range of desired reserves and improve the City’s understanding of its overall risk profile. A risk-aware analysis helps the City *stress test* its reserve strategy.

³ GFOA Best Practice. “Appropriate Level of Unrestricted Fund Balance in the General Fund.” GFOA. 2009.

⁴ Definition of risk taken from: Douglas W. Hubbard. *The Failure of Risk Management: Why It’s Broken and How to Fix It*. John Wiley and Sons, Inc. Hoboken, New Jersey. 2009.

As a first step to this project, GFOA conducted a review of the risk factors influencing the amount of reserves a municipal government should hold.⁵ This review identified the risks on Exhibit 2.1 as the most salient risks to the City's general fund reserve.

Exhibit 2.1 – Primary Risk Factors that Influence Reserve Levels for Berkeley	
Revenue source stability, particularly as it relates to the potential for revenue decline from an economic downturn	
Vulnerability to extreme events and public safety concerns, with emphasis on:	
• Earthquakes • Floods • Wildfires	• Tornados • High winds (other than tornados) • Other hazards (primarily human-caused)

The next section gives an overview of how we analyze these risks and what you can expect to see in the rest of this report.

⁵ The risk factors and basic review method were developed and published in the GFOA publication: Shayne C. Kavanagh. *Financial Policies*. (Government Finance Officers Association: Chicago, IL) 2012.

Section 3 - The Approach to Uncertainty

The accomplished forecasting scientist, Spyros Makridakis, suggests a “Triple-A” approach for dealing with highly uncertain phenomena.⁶

1. **Accept.** First, we must accept that we are subject to uncertainty. For example, the severity and timing of an earthquake is unpredictable. Salt Lake City could go years without experiencing a serious earthquake or one could occur next month!
2. **Assess.** Next, we must assess the potential impact of the uncertainty, with history providing a useful reference point. The experiences of other local governments are also a good reference point. For example, we used the historical experiences of Salt Lake City and other relevant municipalities to estimate the potential impact of future extreme events. However, historical experiences are not perfectly predictive of the future. That leads us to the next point...
3. **Augment.** The range of uncertainty we face will almost always be greater than what we initially assess it to be. Therefore, we must augment our understanding of risk beyond what our historical experiences show us. For example, very few people saw the 2008 Great Recession coming or thought it could be as bad as it was. They were unprepared for this historically unprecedented recession. We can augment our understanding of risk using a technique called “Probability Management.”⁷ Probability Management is an application of modern information processing technology that allows us to simulate thousands of potential events (e.g., floods, recessions, etc.) so that we can observe the probability of events of various magnitudes happening. The statistical technique that Probability Management is based on is called “Monte Carlo analysis.” This technique was established in the late 1940s, but until very recently required special computers and software to use. Modern information technology has made Monte Carlo analysis accessible to anyone with a personal computer.

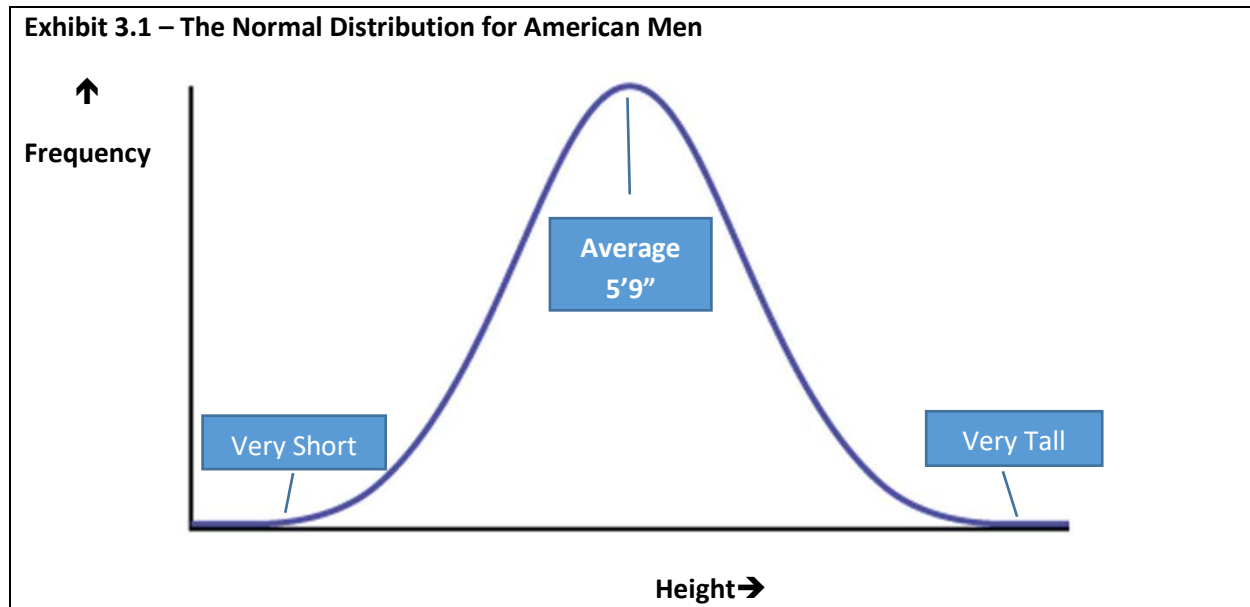
In order to use Probability Management, we express any given type of extreme event as a range of possibilities that the City might experience. This range is called a “distribution.” A distribution is a shape that signifies how frequently the City might expect to experience a certain type of event and/or how severe the event might be.

The most common type of distribution is called the “normal distribution,” more popularly known as the “bell curve.” Many phenomena fit a bell curve. To help us understand how to read a distribution, we can start with an example that is related to everyday life: the height of American men.

⁶ See: Spyros Makridakis, Robin Hogarth, and Anil Gaba. *Dance with Chance: Making Luck Work for You*. (Oneworld Publications: Oxford, England). 2009.

⁷ 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.

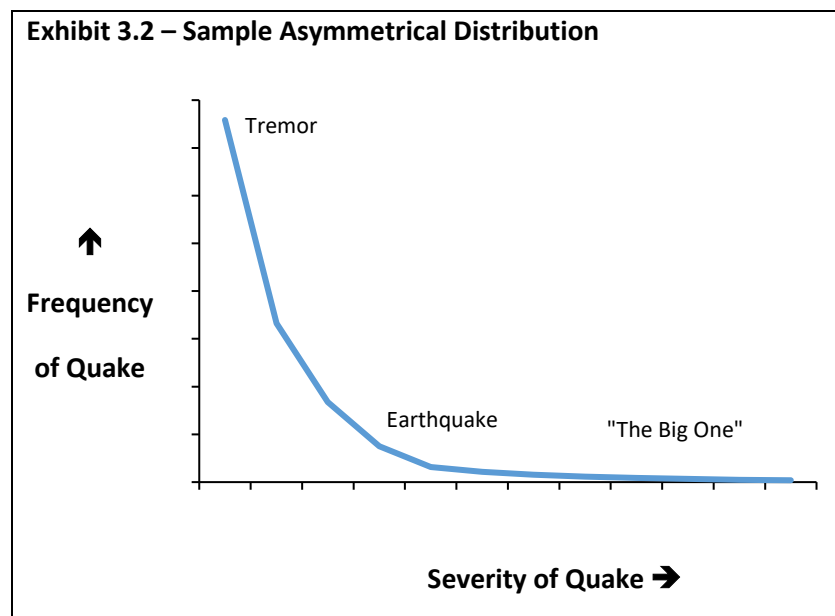
Exhibit 3.1 shows a bell curve for the height of American men. The horizontal axis of Exhibit 3.1 represents height. The vertical axis represents frequency. The most common height is 5'9", so it is shown at the top of the curve. Much taller men, like NBA centers, would be found on the right-hand side of the curve. Very short men would be found on the left.



The normal distribution can help analyze risk. To illustrate, the severity of an economic downturn is approximately normally distributed. A few downturns are slight, a few are severe, but most are closer to average.

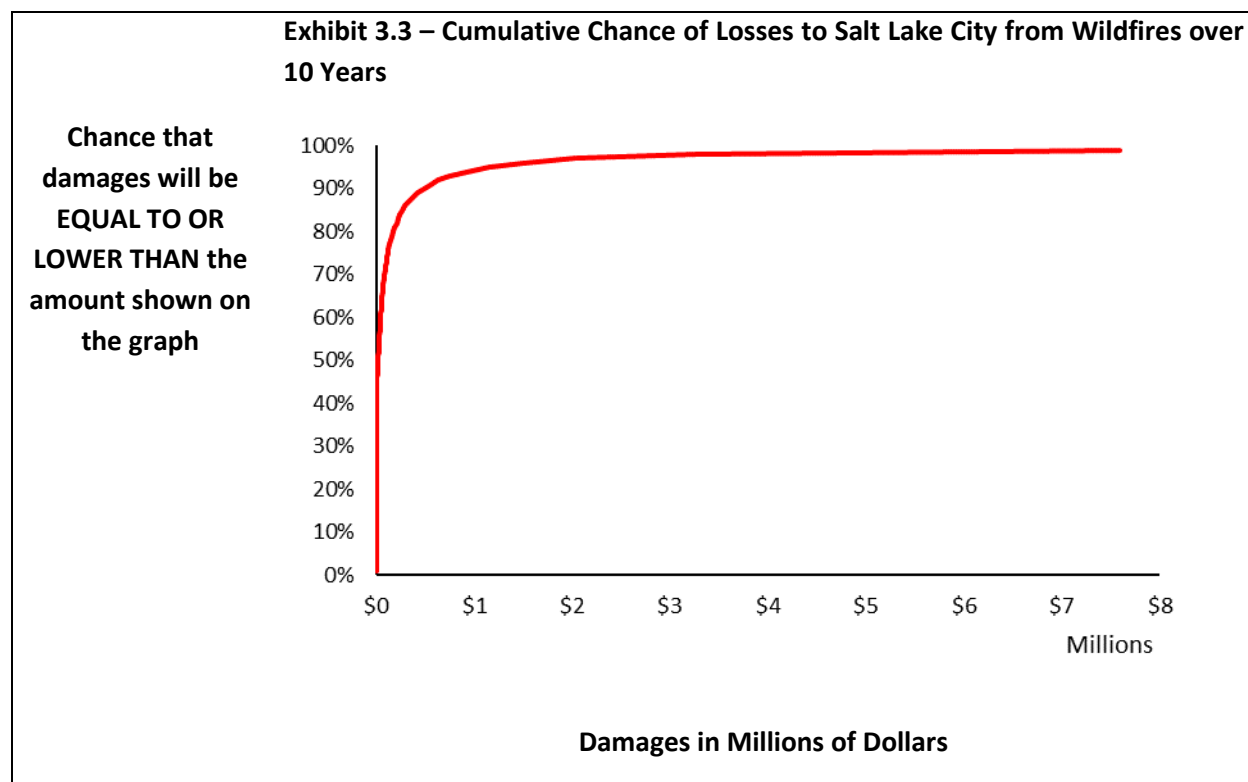
Another type of distribution we use in our analysis is an asymmetrical distribution, shown in Exhibit 3.2. Earthquakes fit an asymmetrical distribution. Exhibit 3.2 shows that tremors are the most common. Large earthquakes are relatively rare. The distribution is “asymmetrical” because the frequency with which we will experience these events are not evenly distributed around the middle of the distribution.

Put another way, there are far more tremors that are smaller than the “average” earthquake. Yet, there are far fewer earthquakes (“the big one”) that are larger than the average earthquake.



Expressing Salt Lake City's vulnerability as distributions allows us to calculate the probability that an event of a given magnitude will happen. When we associate a dollar amount with that event, we can estimate the probability or chance that Salt Lake City will need to have a given amount of money on-hand to respond.

Exhibit 3.3 is not a distribution but is a type of graphic we will use in this report. It is called a "cumulative probability chart." It shows the economic losses to Salt Lake City from major wildfires over the course of 10 years. Major wildfires are rare events, so over a ten-year period there is a chance that there will be no major wildfires at all. Hence, the red line intersects the vertical axis at about 50% (there is about a 50% chance of no damage from wildfires). We then see the red line go up and to the right from the vertical axis. This means that the chance of larger and larger losses become increasingly remote. For example, the red line intersects the 70% mark on the vertical axis at about the \$100,000 mark on the horizontal axis. This means there is about a 70% chance losses will be less than \$100,000 over a ten-year period. Eventually, the curve starts to turn right which is the point at which there is a chance of larger losses. For example, there is a 90% chance of losses less than \$500,000 or a 10% chance that losses will be greater. There is a 95% chance that losses will be less than \$1.2 million but a 5% chance they could be more. The red line extending almost horizontally⁸ to the right means there is a very small chance of extreme (multi-million dollar) losses.



⁸ Though difficult for the naked eye to perceive, the red line does continue to move slightly upward across the entire horizontal axis.

It is important for the reader of this report to understand that **there is never one single, objectively best amount of reserves to hold**. The amount of reserves the City will want to hold will partially be a function of the City's willingness to take on risk. If City officials are willing to take on risk, they might opt for lower reserves and spending more money on current services. If officials are more risk averse, they might opt for higher reserves. GFOA's recommendations are informed by where reserves appear to provide the best value or "bang for the buck." The spot on a cumulative probability chart, like Exhibit 3.3, before where the line begins to flatten out is usually where the best bang for the buck lies.

In Section 4, we cover revenue instability owing to economic downturns. In Section 5 of this report, we will review the City's primary risks posed by extreme events, including earthquakes, floods, wildfires, and more. Section 6 reviews secondary risk factors that have less weighty implications for the City's reserve strategy. We include Section 6 to highlight the full range of risks that were considered, even if some of them did not seem to present as clear and present a threat to the City's general fund reserve.

After we analyze the individual risks, in Section 7, we will consider the risks holistically. This section will:

- Consider the risks over a ten-year period. This provides a more complete perspective on potential vulnerability and how to use reserves. For example, the numbers shown in Exhibit 3.3 pertain just to one year. The potential losses are much greater over a ten-year period.
- Consider the potential occurrence of any of the risks we analyzed to occur at the same time. Obviously, if they did occur at the same time, the stress on the City's reserves would be compounded.

Section 4 - Recession Risk: Revenue and Pension Volatility

A recession is a risk for any local government's finances. A recession could cause revenues to go down and pension costs to go up (due to poor investment returns). Reserves can be used to help a local government make a "soft landing" in the event of a revenue downturn. In this section of the report, we will analyze the City's vulnerability to recessions. We will start with revenue downturns and then move onto pension volatility.

For our revenue analysis, we divided the City's revenues into the categories shown in Exhibit 4.1. Sales taxes are, by far, the most important single source, as you can see in Exhibit 4.1. Property tax is also an important source of revenue, so it is also in its own category. For all the other City general fund revenues, we grouped them into one of two categories: revenues that are sensitive to economic downturns and those that are not as sensitive to downturns. Immediately following Exhibit 4.1, we will analyze the risk the City faces in each category.

Exhibit 4.1 – Relative Importance of City Revenues, based on 2022 Data

Revenue	% of Total
Sales Taxes ⁹	40%
Property Taxes ¹⁰	29%
Other Economically Sensitive Revenues ¹¹	9%
All Other Revenues ¹²	22%
TOTAL	100%

We reviewed the revenues month-by-month, rather than fiscal year by fiscal year. The reason is that a recession could span the boundaries of two fiscal years, essentially "splitting" the revenue loss between two fiscal years. Thus, looking only at historical revenues losses across the entire fiscal year could obscure the total size of the downturn.

Below we will briefly review key, relevant features about the volatility of each revenue shown in Exhibit 4.1. The purpose of this section is to be clear about the assumptions that go into our simulation of the City's revenue volatility in the face of recessions.

Property Taxes

Property taxes are a stable source of revenue for the City. They have exhibited a steady upward trajectory since 1999, except during the period of the 2008 Great Recession. Of course, the 2008 recession featured a popping property price bubble that was felt across the United States. Even so, we should not discount the possibility that future recessions could also result in declining property values and property tax

⁹ Excludes energy sales tax.

¹⁰ Excludes personal property, vehicle taxes, and RDA revenues.

¹¹ Includes: Fines; Parking Meter Collections; Interest Income; Construction Permits; All other permits

¹² Includes everything not in the categories above.

revenues. In fact, GFOA's examination of recessions before 1999 shows that housing prices have declined during some of these recessions.

So, to model risk we looked at the decline during the Great Recession and found that the largest annual decrease was 3%. We took this as representative of what could happen during severe recessions. During the 2001 recession, property remained stable. This represents what could happen during a mild recession, like 2001. The 2008 recession is the worst recession, in terms of GDP¹³ decline, since World War II whereas the 2001 recession was one of the mildest. Hence, we can use these two recessions rough "boundaries" on the possibilities for future recessions.¹⁴ In our simulation we did account for the fact that the 2008 recession was unusually weighted towards losses in real estate. This was done in order to avoid overestimating the vulnerability of property taxes to recessions. We looked at how much property values declined, nationally, during a past, more "average" recession and compared that to what happened in 2001 and 2008. This "average" price decline was not exactly in between 2001 and 2008 but was skewed closer to 2001. We included this skew in our simulation, so that an "average" recession would see a property tax decline of 1%. Finally, it is critical to note that due to the nature of the property tax, the revenue losses lag the occurrence of the recession. This is built into our model. This means that the simulation does not presume the revenue losses from recession will happen all at once. Rather, they are spaced out over time. This should make it easier for the City to handle a revenue downturn.

Finally, it is worth noting that Salt Lake City does not have a material risk from concentration of the tax base in one or few taxpayers. An example of this risk would be if a small municipality has a large industrial property, where that property makes up a large portion of the tax base – if the factory were to close, then it would have a big impact on the tax base. Fortunately, Salt Lake City does not appear to have such a risk. The taxpayer with the highest assessed value is the LDS church at about 3.4% of total taxable assessed value. After that is Pacific Corp at 1.7% and Delta Airlines at 1.2%. Though the LDS's share is material it appears highly unlikely that the church would cease operations in the same way a factory might, given LDS's long history in Salt Lake City and deep ties to the community.

Sales Taxes

Sales taxes have a reputation for being more responsive to economic downturns than property taxes, and this is true in Salt Lake City. Sales taxes declined by 8% during the 2001 recession and the worst year-over-year decline during the 2008 recession was 13%.

More recently, sales taxes declined in 2020/21 due to COVID-19. This means that the revenue loss was not due to the economy experiencing an underlying weakness, like it would during a recession. When it comes to COVID-19, the federal government provided financial aid to individual citizens during the pandemic, beyond what is normal for an economic downturn. Hence, we should not take 2019 and the subsequent COVID-19 experience as representative of future possible downturns. We used the 2001 and 2008 recessions as our boundaries for the analysis.

¹³ Gross domestic product, a standard measure of national economic activity.

¹⁴ Our simulation method does not treat these as firm boundaries. Rather there were about ten recessions since World War II, the Great Recession was the worst, the 2001 recession the mildest which puts them at the 10th and 90th percentile. This leaves room for even worse or even milder recessions than these two in our simulations.

Finally, we should note that the City appears to experience losses from recessions with about a 1-year delay from the onset of the recession. The simulation reflects this.

Other Economically Sensitive Revenues

The City has many other sources of revenue besides sales and property taxes, though no individual source is very large. To analyze them, we grouped together all the categories that exhibited a material decline during the 2001 Recession and/or 2008 Great Recession. This includes: fines; parking meter collections; interest income; construction permits; and all other permits. Though these categories only comprise a relatively small portion of the City's revenues (9%), they also have exhibited large declines during recessions, as a group. This group declined by about 22% during the 2001 recession and 15% during the 2008 recession. We use these figures as the parameters for our simulation.

All Other Revenues

The remaining general fund revenue sources (everything not yet covered in this report) comprise about 22% of the City's revenue. As a group, these revenues are much less sensitive to economic downturns than other revenues we have seen so far. In the 2001 recession this group declined by 12% and declined by 2% during the Great Recession. We used these figures as the parameters for our simulation. These revenues also exhibit a lag from when the economic recession occurs to when the City experiences a revenue decline.

Analyzing Revenue Volatility Risk

In order to analyze the risk that the City is subject to we used the information presented above to inform our Risk Model. In addition, we used the following information:

- We used data on how often recessions have occurred and how long those recessions have lasted. The data we used went from 1950 to the present day to simulate the frequency and duration of future recessions.
- As noted above, the losses to property, sales tax, and all other (not economically sensitive) revenues have, historically, lagged the onset of the economic downturn. Thus, we lagged the losses by one year in our simulation.
- The model does not include any **"baked in"** assumptions about what the City might do in response to a recession like cutting expenditures or adding new revenues. However, the simulation does not ignore these possibilities either. The user of the model has the **option** to define the City's assumed response to recessions and see how that impacts the City's financial position. This is discussed in more detail in Section 7 of this report.

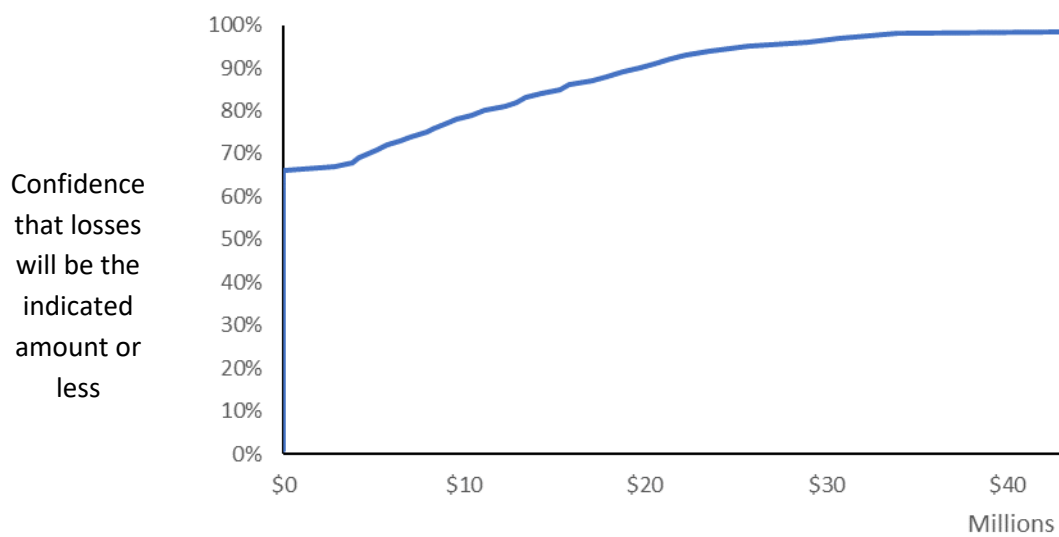
Exhibit 4.2 below shows the cumulative probability curve for a single year loss, accounting for all the information described in this section. The blue line shows the losses given the chance a recession does OR does not occur – meaning, our simulation of the possible losses from a recession in a given year must account for the fact that there might not be a recession at all. The blue line also accounts for the fact that a recession could not occur at all or last less than the entire year.

Note that although the line in Exhibit 4.2 is limited to what could happen in a single year, our simulation also allows for the possibility that a recession could span multiple years. We will discuss the multi-year perspective on all the of the City's risks that we analyzed in Section 7.

In Exhibit 4.2, we can see the blue line remains at zero about 65% of the time, which means that in any given year there is a 65% chance of no losses from recessions. This chance would be higher than 65% if it weren't for the fact that many of the City's revenue losses occur after the recession starts. This means that a given year might experience revenue loss from a recession that occurred one year earlier.

The blue line slopes up and to the right, which means that as we move to the right the potential losses get higher, but we also get higher and higher confidence that the losses would be less than the indicated amount. For example, on the blue line, we can be 80% confident that losses in a given year will be less than \$11 million, and 20% confident that losses will be more. We can also see the blue line flatten out and extend to the right. This shows us that it is possible that there could be historically unprecedented losses from a recession, though this is very unlikely.

Exhibit 4.2 – Cumulative Probability Chart for Annual Recession Losses



Checkpoints

- ✓ Sales tax is the single most important revenue source but is also responsive to economic conditions.
- ✓ Property tax is an important source of revenue for the City and is also very stable.
- ✓ Most other City revenues are relatively stable in recessions, except for: fines; parking meter collections; interest income; construction permits; and all other permits.
- ✓ In a given year, there is about a 65% chance that there would be no impact at all from a recession. There is an 80% chance losses in a given year would be less than \$11 million.
- ✓ The analysis presented in this section does not take account of any willingness on the part of the City to cut its budget in response to a recession. That is addressed in Section 7.

Pension Risk

Like many cities throughout the country, SLC has an employee pension plan where part of the plan is a “defined benefit” plan. This means that employees are guaranteed a certain retirement income. Investments of monies put aside for the pension must keep up with the benefits that have been promised. Any shortfalls, like when a recession causes pension investments to underperform, must be offset by additional contributions. This potential unplanned, unavoidable expenditure places pressure on City finances. Fortunately, the Utah State Retirement (URS) system appears to be in better shape than many pension plans in the United States, according to an analysis by Pew Trusts,¹⁵ but there still appears to be some risk.

First, although the Pew Trust analysis shows the URS is in good shape, the Pew analysis also shows that URS has the second highest historic contribution volatility of the 15 states with the best funded ratio for their pensions.¹⁶ This means taxpayers and budget officials have faced more volatile pension payments, relative to other states in the top 15. Second, when we looked at historical data, we found that the average year-over-year increase in general fund pension costs was 5%. However, there were years where the year-over-year increase was much higher. For our purposes, recession periods are of particular interest. The URS had negative net returns (losses) in 2008 and SLC’s year-over-year pension costs cost went up about 12% in 2011. The URS’s investments also substantially underperformed in 2011 and SLC had a 13% year-over-year increase two years later. This kind of lag between investment underperformance and plan participant contribution increases is not uncommon among the local governments we have worked with. Further, it is good news for SLC’s risk profile because SLC’s revenues tend to underperform during the years of the recession and the year following. If pension increases occur two or three years after the recession, then the revenue decrease is usually not happening at the same time as the pension cost increase. Finally, we should note that although we did control the pension costs for changes in employee headcount, our analysis did not address every possible variable that could have impacted pension costs at SLC. For example, during the great recession the City asked staff to take an across-the-board salary decrease. This could reduce employer contributions. The effect of this kind of strategy is not explicitly included in our risk model, but the model does include a generalized option to include budget cuts in response to financial shocks, like a recession. Thus, cut back strategies are included in the model, in a more general sense.

We modeled pension risk by assuming a 12% increase in pension costs represents a particularly bad recession (like the Great Recession) and scaled potential increases in pension costs from there: 90% of the time the simulation will produce lower increases, and 10% of the time it will produce higher increases. This aligns with the Great Recession’s status as the worst recession after World War 2, but without assuming it represents a “worst case scenario”. Every time the model simulates a recession it then adds

¹⁵ According to an analysis performed by Pew Trusts using 2019 data, the URS had one of the highest funded ratios in the country and a positive net amortization, which means that the size of the pension system’s debt is headed in the right direction. <https://www.pewtrusts.org/en/research-and-analysis/issue-briefs/2021/12/pews-fiscal-sustainability-matrix-helps-states-assess-pension-health#7-appendix-a-key-terms>

¹⁶ Contribution volatility refers to the range between the lowest and highest employer contribution rate over a fixed period. A small range means that pension costs have been predictable and stable for that state; a high range means taxpayers and budget officials have faced volatile pension payments.

additional pension costs to the City's financial burden two years later. Much of the time this does not overlap revenue losses from the recession, but occasionally there is some overlap. The model also includes assumptions that the City will reduce its spending in response to economic downturns, not just rely on reserves (you can read more about this in Section 7). When you combine the two-year lag between the recession onset and an impact on the City budget with the City's willingness to cut costs, the overall practical impact of pension volatility risk on the City's reserve is low. However, there is some impact when the timing of a recession causes revenue decreases and pension increases to overlap, though this is not common. Finally, we should note that cutting costs to accommodate pension cost increases is, of course, both painful and potentially disruptive to the City's service priorities, so the results of this analysis should not be interpreted to minimize or dismiss the impact of pension volatility on the City's budget.

Checkpoints

- ✓ Pensions are a risk for the City because poor performance of the pension investment, due to recessions, will result in a need for increased contributions to make up for losses. Theoretically, a recession could cause both revenue losses and pension cost increases at the same time. However, in practice, pension cost increases tend to lag investment under performance (and recessions) by two years, while the City's revenues decrease within the same year as recession or in the next year. Occasionally, there could be some overlap between revenue declines and pension cost increases though.
- ✓ The lag discussed above combined with the City's willingness to reduce spending to help manage the impacts of a recession mean that the practical impact of pension volatility risk on the City's reserves appears to be minimal.

Section 5 - Extreme Events

Although Salt Lake City can receive reimbursement from insurance and public agencies for natural disasters and some human-caused extreme events, having adequate reserves in place is important to quickly and decisively respond to extreme events. For example, FEMA reimbursement will not cover all the costs the City incurs, and it could take months, if not years, to receive reimbursement. Earthquakes and floods are the leading potential catastrophic disaster risks the City faces. Other important extreme events include wildfires, tornados, strong winds (other than tornados), and a variety of man-made extreme events (e.g., terrorism, etc.).

FEMA and Reserves

The U.S. Federal Emergency Management Agency (FEMA) reimburses local governments for monies spent in response to a federally declared disaster. FEMA reimbursement is only partial (typically 75 percent) and is often not immediate. Therefore, local governments must have the financial capacity to respond quickly and decisively, independent of FEMA assistance.

The following sub-sections (earthquakes, floods, wildfire, tornados, strong winds, other hazards) will explore the potential economic and budgetary implications that these hazards have for the Salt Lake City general fund reserve. These sections will explain any notable features of the data sets we used and discuss the range of potential damage the City could experience, as suggested by the data we gathered.

A. Earthquakes

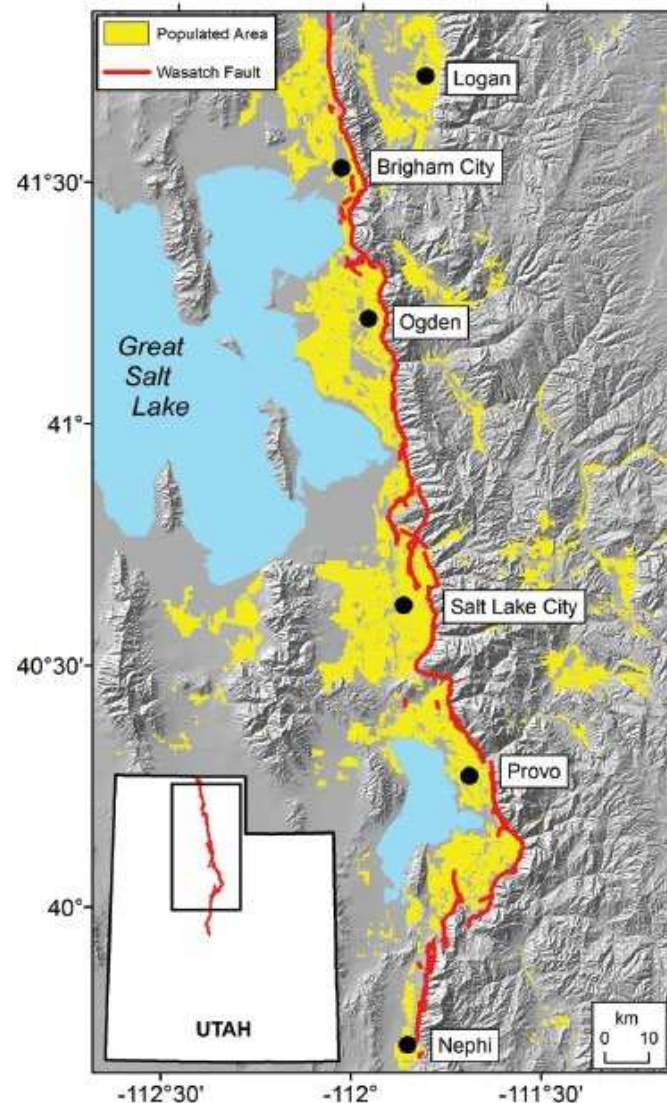
According to a report prepared by the Utah Chapter of the Earthquake Engineering Research Institute for the Utah Seismic Safety Commission, “earthquakes pose the greatest natural threat to Utah’s people, built environment, and economy.”¹⁷ Salt Lake City lies close to the Wasatch fault. Exhibit 5.A.1 shows what is known as the Wasatch Front urban corridor.¹⁸

To address earthquakes, we obtained a data set of simulated earthquakes from Aon¹⁹ for the State of Utah. The simulation includes projected economic losses for earthquakes and estimated total FEMA assistance to governmental entities. This allows us to estimate the losses that governmental entities would experience from a quake. We set a limiter in our model to only address quakes above 5.5 in magnitude. United States Geological Survey reports describe the potential damage from a 5.0 quake as “very light.” The model does provide the ability to manually adjust this parameter, so if the City would like to consider quakes below 5.5, it may do so.

In order to simulate the financial losses to the City, we started by allocating an amount of FEMA assistance and the local share of losses to governments within the Salt Lake City boundary. Based on measures like share of GDP, population, and property values Salt Lake City’s share of statewide activity could be expected to be around 7.5%.

Next, we allocated damages to each of the governments that serve people in Salt Lake City, including the county, school district, water district, and the State of Utah. This was based on each entity’s share of government owned capital assets in Salt Lake

Exhibit 5.A.1 - Wasatch Front Urban Corridor



¹⁷ “Scenario for a Magnitude 7.0 Earthquake on the Wasatch Fault – Salt Lake City Segment”. Prepared by the Utah Chapter of the Earthquake Engineering Research Institute for the Utah Seismic Safety Commission. June 4, 2015.

¹⁸ Taken from: Scenario for a Magnitude 7.0 Earthquake on the Wasatch Fault – Salt Lake City Segment”. Prepared by the Utah Chapter of the Earthquake Engineering Research Institute for the Utah Seismic Safety Commission. June 4, 2015.

¹⁹ Aon is a global purveyor of risk information and insurance.

City.²⁰ Finally, we allocated damages to the City's general fund based on the share of the City's capital assets owned by governmental funds versus other funds. Finally, we compared the results of the simulation to actual losses of California municipal governments from three historical earthquakes.²¹ The results of the simulation were relatively consistent with these historical experiences.²²

Exhibit 5.A.2 shows a cumulative probability chart of losses for a ten-year period. It represents the total losses to the Salt Lake City general fund over ten years.

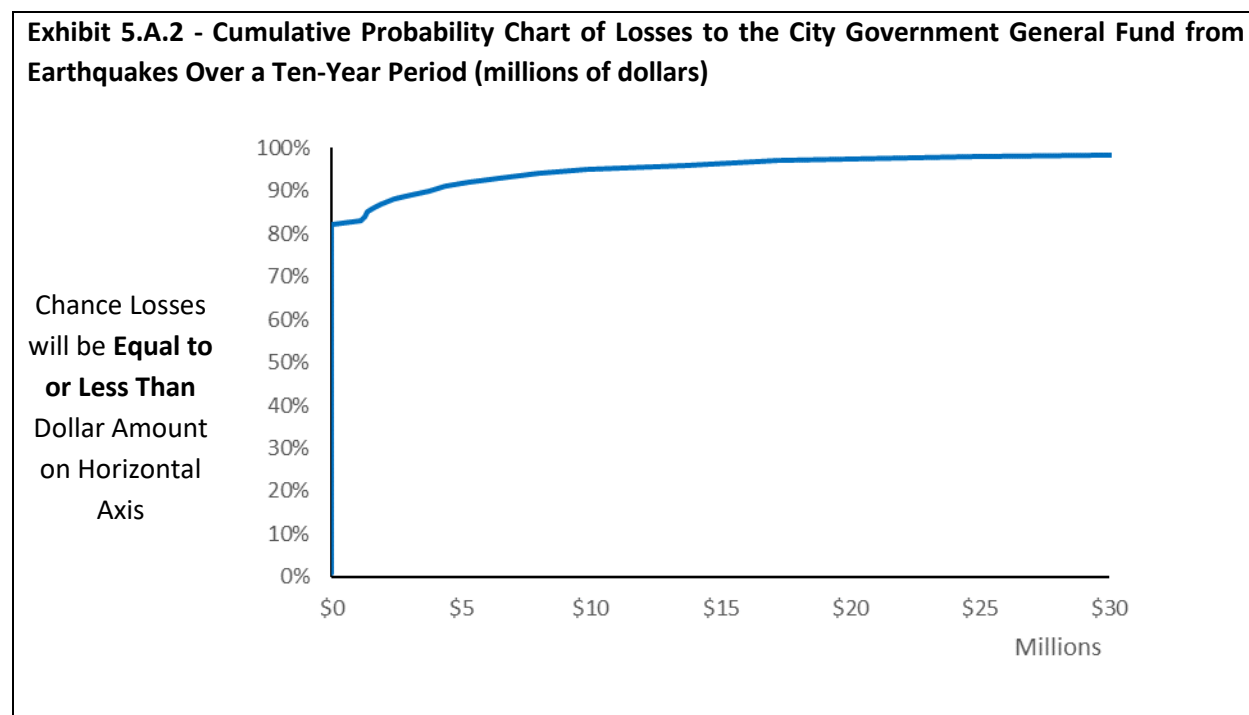


Exhibit 5.A.2 shows that there is about 80% chance of no losses at all. But there is also a chance of large losses. There is a 90% chance that losses are less than \$4 million over a 10-year period, which means there is 10% chance losses could be more. We also see the line extends far to the right, which indicates there is a chance of very large losses. Note that Exhibit 5.A.2 does not include FEMA reimbursement that the City would receive for its losses and nor does it include insurance. These issues will be addressed in Section 7 of this report.

²⁰ This was estimated by taking the value of capital assets from audited financial statements for each entity and then determining the amount attributable to constituents in Salt Lake City by looking the share of each government's debt that Salt Lake City taxpayers are responsible for.

²¹ We used California local governments because there is a large number of governments for which historical earthquake loss information is available.

²² We can only compare the historical results with simulated earthquakes of similar magnitudes that have occurred historically. However, consistency at these magnitudes suggests that damages are other magnitudes of quake would be reasonable. Further, it should be noted that SLC's damage does seem to be higher than the California cities, which is not unreasonable given that SLC's building stock does not appear to be as well adapted to earthquake risk as California's.

Finally, we should address the fact that a powerful earthquake (e.g., 7.0 or greater) could impair the City's taxbase. Many of the City's buildings are made of unreinforced masonry. These buildings are at greater risk of being rendered uninhabitable by a powerful earthquake. Uninhabitable retail buildings could not make sales. Uninhabitable residential buildings would not make purchases. Both would result in lower sales taxes, for example. An impaired tax base would result in lower revenues for the City over a multi-year period, which would not be recoverable through FEMA or by property insurance.

The risk model accounted for tax base impairment. If the model simulates a 7.0 or greater magnitude quake, then a tax base impairment simulation is activated. The assumptions for this simulation were largely taken from the report: "Scenario for a Magnitude 7.0 Earthquake on the Wasatch Fault–Salt Lake City Segment: Hazards and Loss Estimates" developed by the Earthquake Engineering Research Institute, Utah Chapter on behalf of the Utah Seismic Safety Commission. The information in the report was supplemented with estimates from relevant subject matter experts, such as the State of Utah's Earthquake Program Manager and Salt Lake City's building department. Examples of variables that the tax base impairment model addresses include:

- The prevalence of unreinforced masonry (URM) buildings in Salt Lake City.
- The degree of damage to buildings that might be expected to buildings from a 7.0 quake. The prevalence of URMs helps explain why estimates produced by outside agencies²³ predict that a majority of buildings in SLC will be extensively damaged or completely destroyed.
- The estimated time to rebuild damaged buildings, as provided by SLC building officials.
- Short and long-term impacts of tax base impairment and the fact that lost tax revenue is not covered by FEMA assistance. Later in this report (Section 7) we discuss parametric insurance as one way to provide coverage for lost tax revenues, in addition to reserves.
- Offsetting increases in sales tax revenue from construction activity to rebuild, including cost of buildings that are materials, percent of materials that are purchased inside SLC, average value of homes, and the additional cost necessary to rebuild a home vs building new.

The analysis shows the losses to the general fund could be quite large, perhaps exceeding a third of general fund revenue in the first year, before much rebuilding has taken place. SLC's building officials estimate that it would take around 8 years to completely replace all the lost buildings.

Checkpoints

- ✓ Earthquakes pose the greatest natural threat to Utah's people, built environment, and economy. Accordingly, they also present an important risk to the City's general fund reserve.
- ✓ Our simulation shows about an 80% chance that losses will be zero over a ten-year period.
- ✓ There is a 10% chance that losses could be more than \$4 million.
- ✓ Very large losses (in excess of \$10 million) are possible, but the chances are small.
- ✓ The risk model addresses the possibility of an impaired tax base from an earthquake of 7.0 or greater.

²³ We are referring to HAZUS estimates. Hazus is a nationally applicable standardized methodology and software program developed by the Federal Emergency Management Agency (FEMA) in the United States. It's primarily used for estimating potential losses from disasters like earthquakes, floods, and hurricanes. Hazus uses Geographic Information Systems (GIS) technology to estimate physical, economic, and social impacts of disasters.

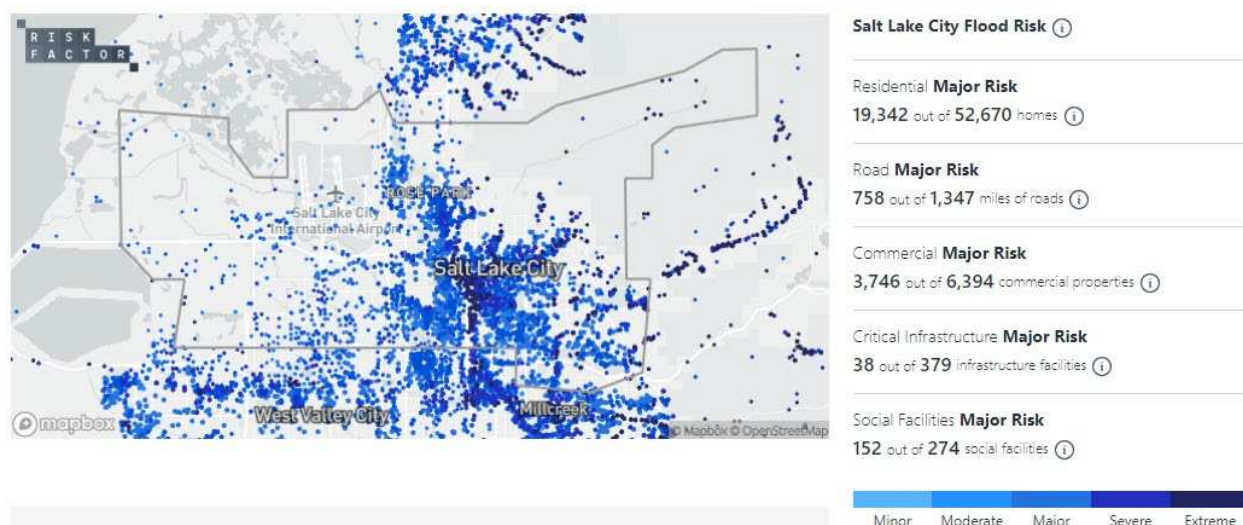
B. Flooding

The City's Emergency Operations Plan (EOP) points out that floods have potentially high consequences. In the last 20 years, the most notable flood to impact the City was in 2011. This flood was large enough to impact over 20 counties in Utah and cost the City over \$600,000 in 2023 dollars. There was also a large flood in 2023 that impacted five counties and was a Presidential Disaster Declaration.

To simulate potential future losses from floods, we started with the frequency of floods. Frequency of major floods are often expressed as "recurrence intervals" or "return periods". For example, a flood may be described as a 100-year flood, which means a flood of that size is expected to happen only once every 100 years. Put another way, there is a 1% chance of such a flood in any given year.

To obtain flood frequencies for our model we worked with FirstStreet.org, a purveyor property risk data for floods, fire, wind, and heat. Exhibit 5.B.1 below shows how FirstStreet.org describes flood risk in Salt Lake City. FirstStreet.org provided data on the number of properties inundated for 5-, 20-, 100-, and 500-year floods.

Exhibit 5.B.1 – Flood Risk in Salt Lake City, According to FirstStreet.org Data



For flood magnitudes, we looked at historical losses that cities have realized from floods. Of course, Salt Lake City's own historical experience is most relevant, but it is just one data point. It may help to examine analogous experiences from other cities. To do so, we examined FEMA records from 1998 onwards. We looked at floods in cities between 100,000 and 1 million people. Presumably, cities of this size are more urbanized than smaller cities, so would be representative of the possible impacts of a flood on more urbanized locales. Further, we classified the flooding risk in each city according to the scale used by FirstStreet and used FirstStreet's analysis to assign the risk. Salt Lake City is considered to be at "major" risk, which is the middle of 5 risk categories established by FirstStreet (see bottom right of Exhibit 5.B.1). Perhaps unsurprisingly, we found the average damage per capita for "major" risk cities was much higher than "moderate, which was much higher than "minor". There were not enough "severe" or "extreme"

risk cities to draw conclusions about their average damages. The damages Salt Lake City experienced from the 2011 flood, on a per capita basis, were also right at the average for the 10 cities we could find that fell into the “major” risk category. This suggests that using the 2011 flood as an analogue for future damages would **not** risk grossly underestimating or overestimating the damages from a flood.²⁴

Per capita losses are not the best way to assess flood damages, though. This is because some portion of the population lives in areas of the city that are not at risk of a flood. For this reason, we obtained from First Street an estimate of the number of properties in Salt Lake City what would be inundated by floods at 4 different recurrence intervals (5, 20, 100, 500). This gave us enough information to construct a probability distribution for the number of properties that would be inundated by a flood of any recurrence interval. We used the 2011 data to establish a standard for damage per property, where we adjusted for the growth that Salt Lake City has experienced since 2011. ***A critical assumption in our risk model is that the 2011 flood was a “50-year flood” (1 in 50 chance of occurring).*** Unfortunately, we could not find any official, published analysis to definitively establish what recurrence interval the 2011 flood represented.²⁵ We believe that an assumption of a 50-year flood is conservative, yet reasonable. For example, the aforementioned FEMA data shows that several cities have experienced much larger losses per capita than Salt Lake City from floods in the last 20 years. A 50-year flood is more frequent than the 100- or 500-year floods that are often depicted on FEMA flood maps. Presumably, at least some of the cities that experienced much larger losses experienced floods that are considered rarer than a 50-year flood. Hence, assuming 2011 was a 50-year flood gives our risk model more room to simulate more severe floods and, thus, higher damages. For example, if a 100-year flood were simulated the damages would be higher than the 2011 flood. Further, according to Utah State Hazard Mitigation Plan the 2011 flood featured a “record breaking snowpack”, suggesting that the flood was probably somewhat rare – thus classifying the 2011 flood as something more common, like a 10- or 20-year flood seemed overly conservative. Finally, we had the opportunity to speak with Kade D. Moncur, PE, CFM, Flood Control Project Manager for Salt Lake County Engineering about the 2011 flood. Mr. Moncur concurred that classifying the 2011 flood as a 50-year flood is the most reasonable recurrence interval to assume.

Before moving on, we should acknowledge two other floods in SLC history. First, there was a very large flood in 1983. We did not include this in the analysis because: A) we did not find useful data on the financial impacts; and B) because this flood was so long ago any impacts we might find could be of questionable relevance. For example, many flood mitigation projects were put in place after 1983, so presumably a similar flood today would be less impactful than it was in 1983. Moving on from the 1983 flood, there was also a flooding event in 2023 that cost the City about \$500,000. The 2011 flood cost about \$615,000 in 2023 dollars. Hence, we used the more expensive flood as our analogue.

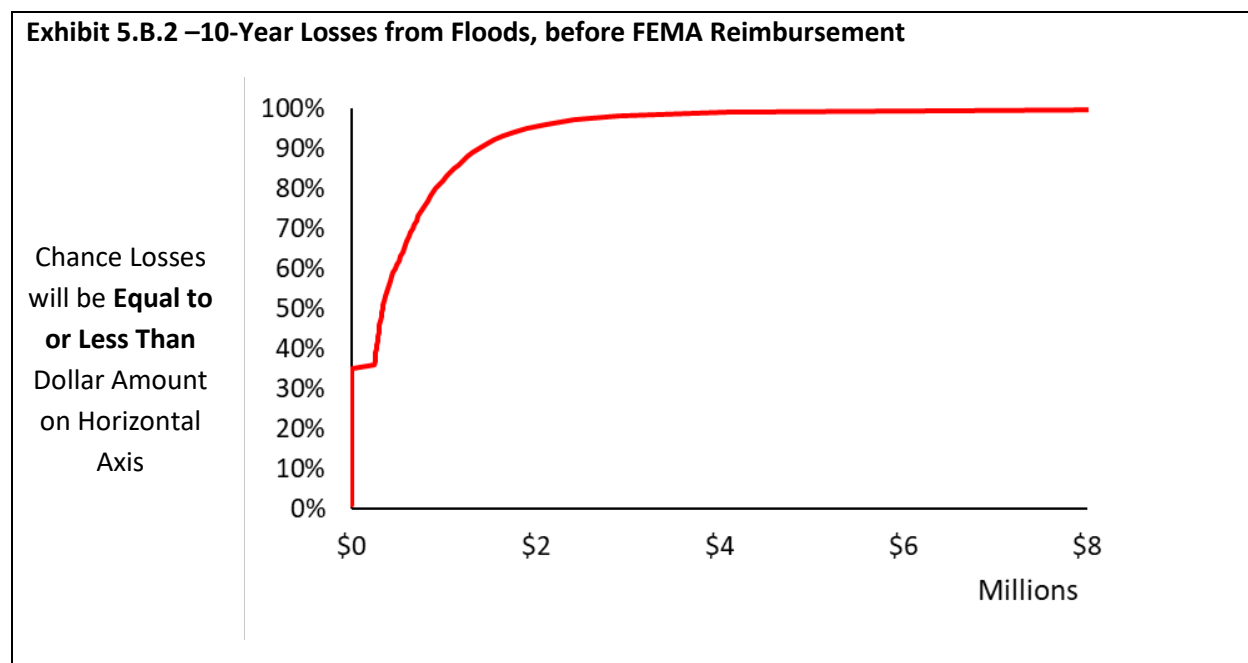
²⁴ Insufficient data from 2023 flood was available to include in the analysis, but the model can be updated to reflect what can be learned from the 2023 flood.

²⁵ For example, Chapter 7 (Floods) of the Utah State Hazard Mitigation Plan lists the recurrence interval of the 2011 flood as “unknown”.

Another important assumption is that the City could handle a 10-year flood, or anything less severe than that, within the City's existing operating budget. This assumption can also be adjusted by the City. Our model simulates a 10-year flood causing around \$250,000 in losses.

This analysis resulted in the 10-year cumulative probability chart of losses to the City from floods, shown in Exhibit 5.B.2. This chart represents the total losses to Salt Lake City's general fund reserve before FEMA reimbursement. We see that the red line stays even with zero on the horizontal axis until about the 35% mark on the vertical axis, which means there is a 3.5 in 10 chance that the City's losses to the general fund reserve from floods will be zero over a ten-year period. You will notice a hitch in the line at that point. This is the point at which we assume the City's operating budget can no longer absorb the loss and the general fund reserve will be relied upon. The line goes sharply upwards from there, which means there is a good chance that the City's losses will be low. For example, there is about an 80% chance that losses to the general fund reserve will be less than \$1,000,000 over a ten-year period. Eventually, the curve starts to turn right which is the point at which there is a chance of larger losses. For example, there is a 95% chance of losses less than \$2,000,000 or a 5% chance that losses will be greater. There is a 99% chance that losses will be less than \$4 million but a 1% chance they could be more. The red line extending almost horizontally to the right means there is a very small chance of extreme (multi-million dollar) losses.

Section 7 of this report, "Putting it All Together" combines this analysis with the additional risks we have analyzed (e.g., recessions, earthquakes, etc.), adds in FEMA reimbursement, and introduces additional considerations such as the City's ability to run budget surpluses, cut costs in other areas, etc.



Checkpoints

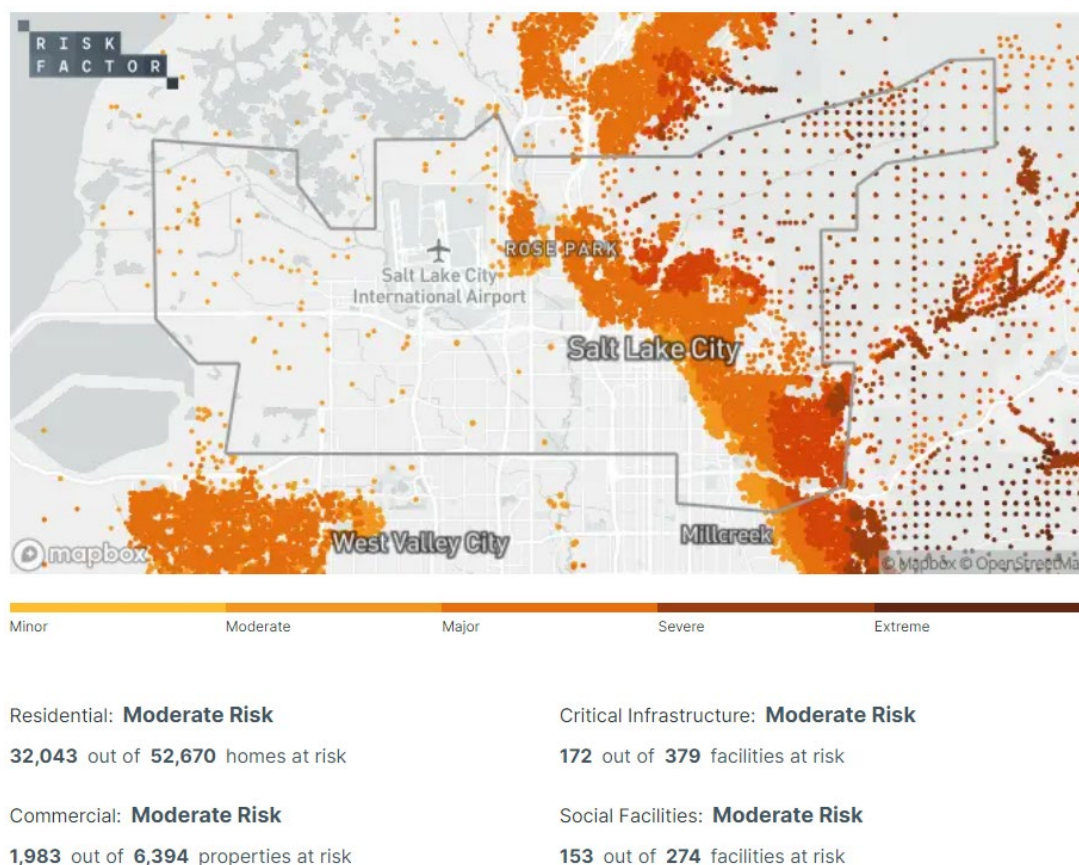
- ✓ Floods are an important risk for Salt Lake City. First Street Foundation's Risk Factor rates the City's risk as "major."
- ✓ We assumed the frequency of a flood that is large enough to impact the general fund reserve is one that is more frequent than 1 in 10 or a 10% annual chance.
- ✓ The financial consequences (costs) were suggested by the actual experiences of Salt Lake City with its 2011 flood.
- ✓ There is a high chance (60%) that the City's losses over a ten-year period will be low – less than \$500,000 or even zero. There is a very small chance of multi-million-dollar losses.

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C. Wildfires

According to First Street Foundation's²⁶ "Risk Factor" wildfire analysis method, Salt Lake City is at "moderate" risk from wildfire which means that 55% of all properties in Salt Lake City have some risk of being affected by wildfire in the next 30 years. Exhibit 5.C.1 shows a map of Salt Lake City's risk as produced by Risk Factor. Note that the risk of exposure to wildfire is determined by the color of the dots, not the density of the dots. So, for example, the area to the northeast of the City has darker (riskier) dots because it has more vegetation. The density of dots refers to the density of properties with at least some wildfire risk exposure.

Exhibit 5.C.1 – Wildfire Risk According to First Street Foundation's "Risk Factor" Analysis



There are parallels with the City's Emergency Operations Plan (EOP), which characterizes the consequences of wildfires as "moderate." The EOP defines this as: "localized damage may be severe; citywide impact minimal to moderate. Handled with city resources and some mutual aid".

²⁶ First Street Foundation is a non-profit research and technology group dedicated to quantifying and communicating those risks by incorporating world class modeling techniques and analysis with the most up to date science available in order to simply, and effectively, inform Americans of their risk today and into the future from all environmental changes.

To simulate the potential losses to the City we first need an assumption for how often a wildfire with material consequences for City finances might occur. The EOP defines the frequency of wildfires as “high,” which means “annually” according to the EOP. An assumption of annual frequency may be true for wildfires if wildfires are defined to include *primarily* minor events that can be easily handled within the City’s normal fire suppression budget. However, since we mean to address very large fires that cause extraordinary financial distress then we need a different frequency. The next frequency category in the EOP is “medium” which means “between 1 and 25 years”. Hence, a conservative approach could be to associate damaging wildfires with this frequency category and take a median value within this category of 13 years (halfway between 1 and 25). We also added an assumption that if a wildfire occurs then the annual chance of a subsequent fire is reduced by 1/4. If a fire burns an area, then that area can’t burn so easily in the next few years. A small reduction in the burn chance is intended to represent this reduction in risk. This assumption only makes a small difference in the risk model results, though.

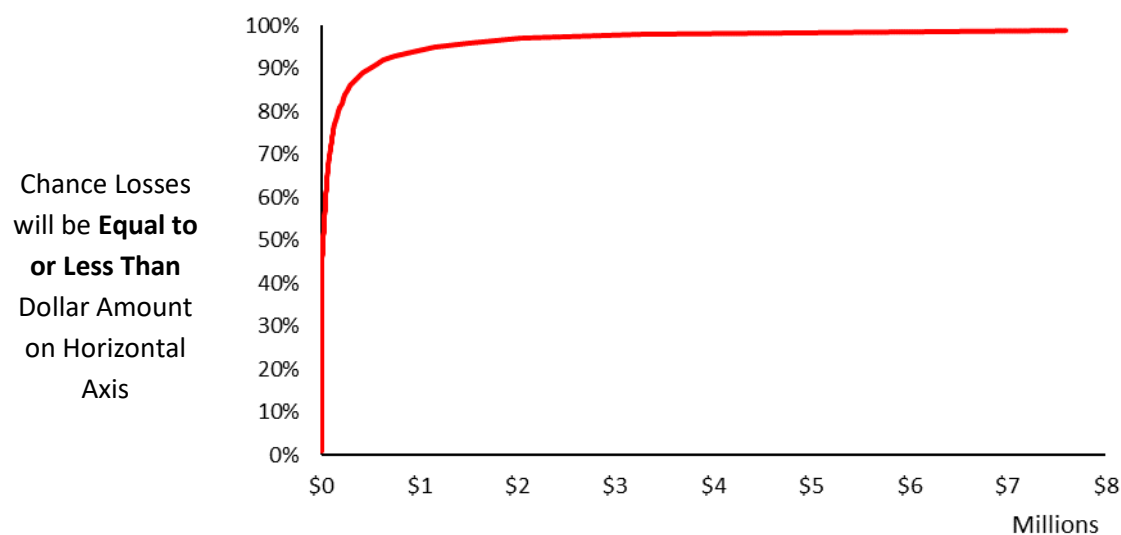
Next, we need to simulate the consequences of a fire. To do this we looked at FEMA records for wildfire damages to cities across the United States since 1999. We considered cities with a population between 125,000 and 1 million. Presumably, cities this large have an urban character, somewhat similar to Salt Lake City. We also looked up the Risk Factor Score for each of the cities. As we can see in the colored bar beneath the map in Exhibit 5.C.1, there are five categories of risk that could be assigned by Risk Factor. Salt Lake City’s “moderate” score is second best score. Among the cities in the data set we looked at, most of them had a score of major, severe, or extreme. We dropped the cities with severe or extreme scores due to concerns that their exposure to wildfire risk was too different from Salt Lake City. Indeed, when we looked at per capita losses these cities suffered, the losses were much more than those cities in the moderate or major categories. The losses experienced by those cities in the major category were also larger than those cities in the moderate category. We kept the data from the major category to simulate the possibility of extreme losses from a wildfire but did balance out the observations so that observations from major risk cities did not outweigh those from moderate risk cities. There were no cities in the data set with a “minor” score. Finally, we should note that balancing the moderate and major risk observations probably does still result in a conservative bias in the model. Though the major risk observations do not outnumber the moderate observations, it seems plausible that the major risk observations still may increase the total risk that the model simulates to an amount that might be greater than an optimal representation of the risk Salt Lake City faces. Unfortunately, we do not have access to data that allows us to determine what the optimal representation of risk for Salt Lake City would be. Our approach errs on the side of caution by not underestimating the chance of higher damages, but at the same time we took steps to make sure we excluded extreme possibilities that do not seem to be useful analogues for Salt Lake City’s circumstances.

This analysis resulted in the 10-year cumulative probability chart of losses to the City from wildfires, shown in Exhibit 5.C.2. This chart represents the total losses to Salt Lake City before FEMA reimbursement. We see that the red line stays even with zero on the horizontal axis until about the 45% mark on the vertical axis, which means there is a 4.5 in 10 chance that the City’s losses from wildfires will be zero over a ten-year period. The line goes sharply upwards from there, which means there is a good chance that the City’s losses will be low. For example, there is about a 70% chance that losses will be less than \$100,000 over a ten-year period. Eventually, the curve starts to turn right which is the point at which there is a chance of

larger losses. For example, there is a 90% chance of losses less than \$500,000 or a 10% chance that losses will be greater. There is a 95% chance that losses will be less than \$1.2 million but a 5% chance they could be more. The red line extending almost horizontally to the right means there is a very small chance of extreme (multi-million dollar) losses.

Section 7 of this report, “Putting it All Together” combines this analysis with the additional risks we have analyzed (e.g., recessions, earthquakes, etc.), adds in FEMA reimbursement, and introduces additional considerations such as the City’s ability to run budget surpluses, cut costs in other areas, etc.

Exhibit 5.C.2 –10-Year Losses from Wildfires, before FEMA Reimbursement



Checkpoints

- ✓ Wildfires are a salient risk for Salt Lake City. First Street Foundation’s Risk Factor rates the City’s risk as “moderate.”
- ✓ We assumed the frequency of a fire that is potentially large enough to cause large losses is 1 in 13 or about an 8% annual chance.
- ✓ The financial consequences (costs) were suggested by the actual experiences of other cities with a population between 125,000 and 1 million people, excluding cities with “severe” or “extreme” wildfire risk, according to First Street. We included cities with “major” risk. Though these cities did experience more losses than “moderate” risk cities, we included them in the model but did balance them with the moderate observations.
- ✓ There is a high chance (70%) that the City’s losses over a ten-year period will be negligible (less than \$100,000 or even zero. There is a very small chance of multi-million-dollar losses.

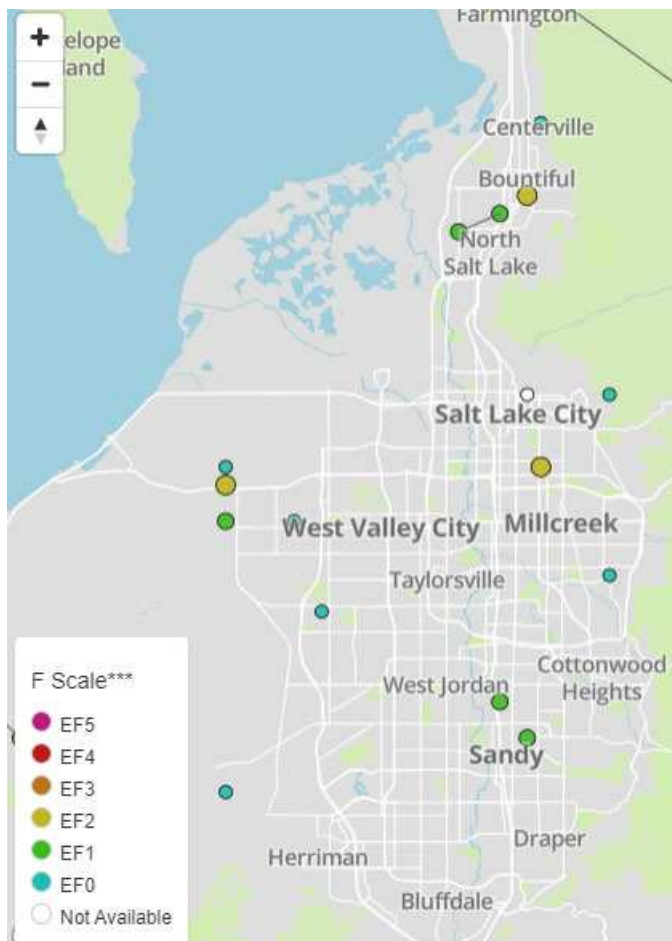
D. Tornadoes

The City’s Emergency Operations Plan (EOP) points out that tornadoes have potentially high consequences, though they occur with low frequency. The only tornado Salt Lake City itself, has experienced since 1950

occurred in August 1999. The EOP tells us that a tornado touched down in downtown Salt Lake City, killing one person and injuring at least one hundred people. This tornado caused widespread power outages as well as large-scale debris, mainly from downed tree limbs. Estimated damages to the entire community were over \$150 million.²⁷ FEMA reimbursed the City government for over \$650,000 in 2023 dollars. Factoring in a local share of 25%, that would be close to \$900,000.²⁸

To simulate potential future losses from tornadoes, we started by examining the potential frequency of tornadoes. Exhibit 5.D.1 shows a map of all tornadoes in the Salt Lake County areas since 1950.

Exhibit 5.D.1 - Tornadoes in Salt Lake County Region Since 1950²⁹



We see there were fifteen tornadoes since 1950 or 15 over a 73-year period (1950 to 2023). That equates to an average of 0.2 tornadoes per year.³⁰ We used this figure to simulate the number of tornadoes that

²⁷ Community losses includes losses in the private sector.

²⁸ According to records downloaded from FEMA.gov. These figures only reflect losses the City corporate entity and do not reflect losses to the private sector.

²⁹ <https://data.thespectrum.com/tornado-archive/>

³⁰ 15 divided by 73 is 0.2.

might occur over ten years in the Salt Lake County Region.³¹ We also simulated the strength of any given tornado by using past frequency of strengths. Exhibit 5.D.1 shows the strength of the 15 historical tornadoes. There have never been any EF3 or higher tornadoes in all of Utah since 1950.³² However, it may be unwise to assume it is impossible that a EF3 tornado could take place. For that reason, we also included a small chance that a tornado could be an EF3 tornado.

Number of EF0 Tornadoes	8
Number of EF1 Tornadoes	4
Number of EF2 Tornadoes	3

The final step in estimating likelihood was to estimate the chance a given tornado in the Salt Lake County area would impact Salt Lake City. To do this, we divided the area of Salt Lake City by the County area. We used that to estimate chance given tornado in the county area hits the City (a 13% chance).³³

To estimate possible damages, we examined FEMA records for damages from tornadoes to cities across the USA since 1999. We focused mostly on larger cities, but also looked at mid-sized cities. We used these records to develop ranges of potential damages per capita³⁴ for each strength of tornado and also adjusted the data for inflation.³⁵ Because there are only so many historical experiences to draw from, especially for larger cities, we did have to make some assumptions, like using examples of mild damages from EF3 tornadoes to estimate what might represent high damages from an EF2 tornado.

This analysis resulted in the 10-year cumulative probability chart of losses to the City from tornadoes, shown in Exhibit 5.D.2. The chart shows that there is an almost 9-in-10 chance of no losses at all from tornadoes over a ten-year period. It shows that the most extreme (though very rare) losses could reach multi-millions of dollars. Finally, note that the losses shown in Exhibit 5.D.2 **do not** include FEMA reimbursement. FEMA reimbursement is addressed when we combine all the risks the City faces together, along with offsetting circumstances like FEMA reimbursements, the City's ability to run budget surpluses, etc. We will address the effect of FEMA reimbursement and other mitigations in Section 7 of this report, "Putting it All Together".

³¹ We included the area just north of Salt Lake City, even though it is not part of the county. Tornadoes obviously don't care about political boundaries and the geographic proximity of this area suggested it should be included in the analysis. Also, we used a type of simulation that accounts for the fact that you could have more than one tornado in a year.

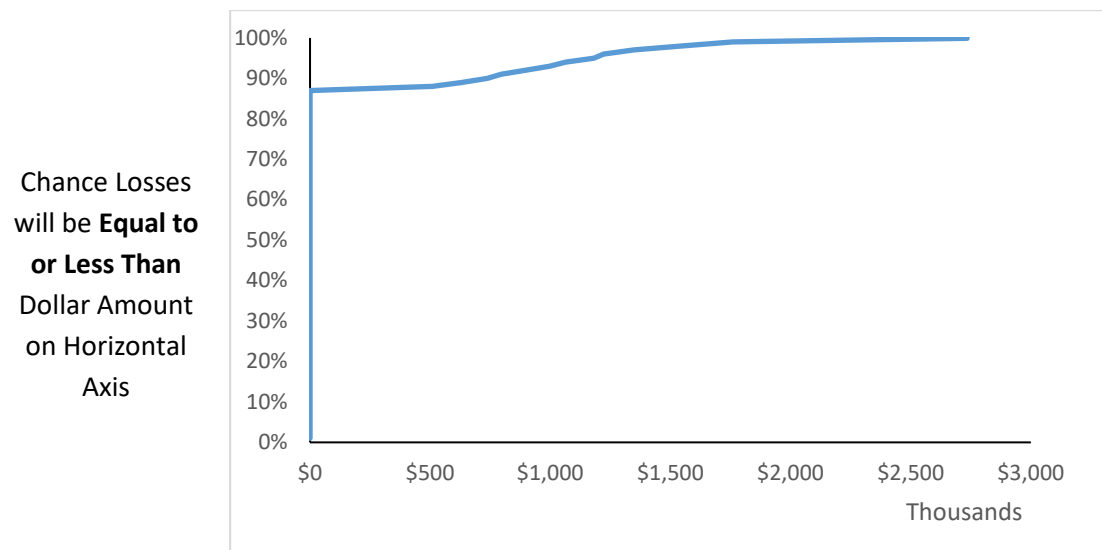
³² According to: <https://data.thespectrum.com/tornado-archive/>. The Utah State Hazard Mitigation plan shows that there was an "F3" tornado in 1993 in the Uinta Mountains, but F3 is not the same thing as EF3.

³³ This included a small adjustment for the areas outside Salt Lake County's boundaries that were included in the analysis.

³⁴ The rationale of per capita analysis is that a very small city could more easily have close to its entire population impacted by a tornado, whereas that is highly unlikely with a larger city.

³⁵ We also accounted for the 25% local match that goes along with the customary 75% reimbursement rate.

Exhibit 5.D.2 – Simulated Losses to Salt Lake City from Tornadoes Over Ten Years (thousands of dollars)



Checkpoints

- ✓ Tornadoes are a risk to Salt Lake City. Tornadoes are very rare, but the most extreme tornadoes could cause multi-million-dollar losses to the City government
- ✓ Because tornadoes are rare, our simulation showed almost a 9-in-10 chance of no losses at all from tornadoes, over a ten-year period.
- ✓ Our simulation did include a small allowance for a tornado of historically unprecedented strength for the region, but otherwise the simulation is completely reflective of historical experience.

E. Strong Winds (Straight-Line Winds)

According to the State of Utah's Hazard Mitigation Plan, straight-line winds are defined as "all winds produced by a thunderstorm not associated with the rotation of tornadoes. Straight-line winds are responsible for most thunderstorm wind damage...". Straight line winds can impact Salt Lake City, but the risk appears to be relatively moderate. The largest loss to the **entire community** in the last 30 years was in 1994 when there was a bit over \$2 million in damages (in 2023 dollars).³⁶ That was by far the largest loss. The next largest was in 2010 when there was just under \$300,000 in damages to the **entire community**. More recently, there was a large wind event in 2020 that was a state emergency declaration.

To simulate potential losses to City government from straight line winds, we began by simulating the frequency of high wind losses. According to data from the National Oceanic and Atmospheric Administration (NOAA), there have been 9 years with damage to the community from strong winds out of the last 30 years. That equates to about a 30% chance of any given year experiencing damage (9 divided by 30).

³⁶ Community losses includes losses in the private sector.

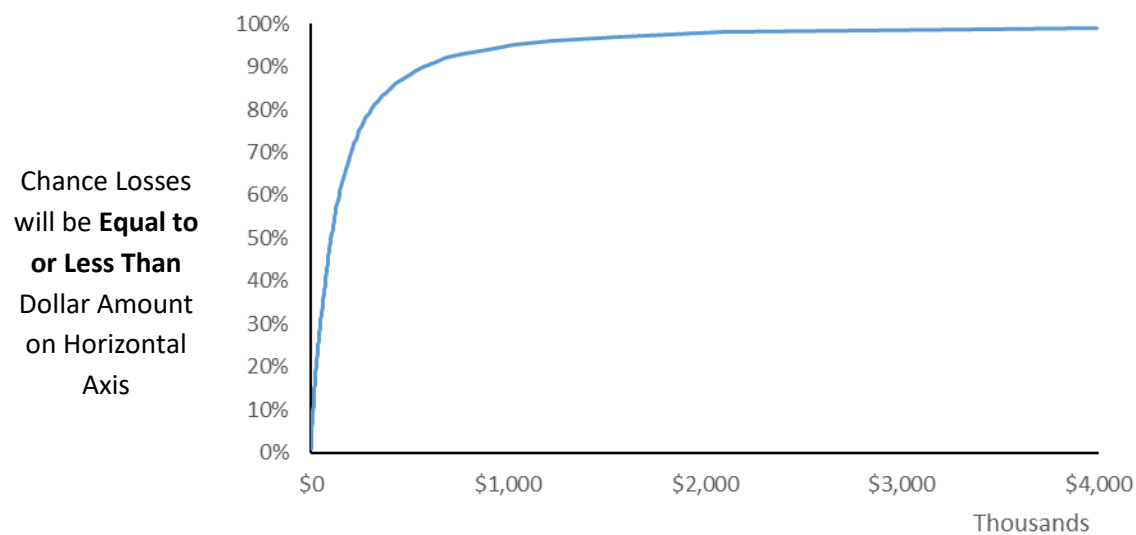
Next, we simulated losses. We looked at all annual historical losses and adjusted them to 2023 dollars. This historical data from NOAA provided the range of potential losses. As mentioned above, most losses were quite small (under \$300,000 for the entire community), but 1994 demonstrates that larger losses are possible. Furthermore, the simulation did not assume that the 1994 experience represents a maximum possible loss. A statistical analysis of the data suggested that we allow for a 3% chance of larger losses.

We only had access to data on losses to the entire community. To translate this to losses to City government, we assumed City government losses would range between 11% and 32% of community losses. This range was suggested by analysis of natural catastrophes procured by GFOA from Aon.³⁷

This analysis and simulation resulted in the 10-year cumulative probability chart of losses to the City from straight-line winds, shown in Exhibit 5.E.1. The chart shows that there is an almost 9-in-10 chance that total losses to the City over 10 years would be less than \$500,000. It shows that the most extreme (though very rare) losses could reach multi-millions of dollars. Further, we should note two important caveats. First, the most common type of loss is from frequent, but low consequence wind events. It is highly likely that the City could either absorb the cost from low consequence events in the regular budget (e.g., routine cleanup work performed by the City's public works department) or that could be covered by commercial insurance that the City purchases (minor damage to public buildings). These mitigations are **not** shown in the cumulative probability chart. We, though, address the effect of these mitigations in Section 7 of this report, "Putting it All Together".

³⁷ Aon is a global insurance and risk management data provider.

Exhibit 5.E.1 – Simulated Losses to Salt Lake City from Straight-Line Winds Over Ten Years (thousands of dollars)



Checkpoints

- ✓ Straight-line winds can impact Salt Lake City
- ✓ Most straight-line wind events are of low consequence.
- ✓ Larger events are possible and though several low consequence events could add up, there is a 9 in 10 chance that losses to the City will be less than \$500,000 over ten years.

Other Hazards

In addition to the hazards we have already discussed, the City's Emergency Operations Plan (EOP) contemplates several additional hazards such as epidemics, terrorism, and more. These hazards have a few common characteristics:

- Many are human-caused, rather than natural hazards. These include hazardous material spills, radiological incidents, utility outages, telecommunications disruptions, urban fires, biological / chemical weapon releases, and terrorism.
- There are often few or no historical analogs to draw upon either in Salt Lake City or in other larger cities. For example, there are very few, if any, historical experiences with radiological incidents, terrorism, and biological / chemical weapon releases. Utility outages or telecommunication disruptions severe enough to constitute a "disaster" or "catastrophe" are also very rare in large urban areas in the US, meaning there is limited historical experience to draw upon.

- There are very few, if any studies or data sources, concerning the risk posed to urban areas by these events. This contrasts with natural hazards like earthquakes, floods, and wildfires for which there are many studies and data sources, some of which we've referenced in this report.

To model other hazards, the first step was to determine which hazards to represent in the model. The City's EOP identified just under 20 hazards as the subject of the plan. Several of these have been addressed elsewhere in this report, such as earthquakes, tornados, and flooding. A few others were deemed by the EOP to have low potential consequences, such as avalanches, landslides, lightning strikes, and transportation accidents. A couple hazards deemed "medium" consequence by the EOP were thought to have minimal potential impact on general fund reserves, with droughts and snowstorms being leading examples. We ignored these and the remaining hazards were represented in our risk model and are shown in Exhibit 5.F.1.

Before we move on to analyze the risk posed by other hazards, the reader should note that the **intent of this model is not to distinguish between the impacts of each of the particular hazards described in 5.F.1.** Rather, it is to recognize that the City is subject to many different types of hazards, many of which are extremely rare and perhaps even historically unprecedented. Thus, the true purpose of this analysis is to recognize and simulate the potential impact of highly unusual events that could befall the City, regardless of the specific source of that event (e.g., terrorism, fire, etc.). Another way to think about this analysis is that it is intended to account for the "unknown unknowns" or "black swan events" that could befall the City. These terms refer to highly consequential risks that were totally unforeseen before they happened. Earthquakes, for example, are a "known unknown". We know a large earthquake will eventually happen; we just don't know when. For some risks in Exhibit 5.F.1, is plausible that Salt Lake City will never experience such an event or at least never experience such an event large enough to have material financial consequences for the City's general fund. It is also possible the City could experience large costs from some event that doesn't fit into neatly into categories described in the EOP. For example, in 2020 the City experienced a civil disorder event that cost the City \$1.2 million in 2023 dollars. Nevertheless, the categories in the EOP are probably broadly representative enough of the sources that an "unknown unknown" could arise from. Thus, the purpose of this analysis is not to explore the finer points of what an urban fire, domestic terrorism, or radiological incident might look like. Rather, the purpose is broad exploration of the financial exposure presented by these kinds of other hazards, generally, as a group.

Modeling the financial risks to Salt Lake City from these other hazards requires modeling both frequency of the event and magnitude of the associated loss, just as we have done for all risks described in this report.

To model frequency, we started with the frequency suggested by the EOP. Many of the hazards shown in Exhibit 5.F.1 were described in the EOP as "low" frequency, which means "less than every 25 years". There were some exceptions. Domestic terrorism and biological / chemical weapons did not have a frequency associated with them, so we assumed these risks would also be "low" frequency. Hazardous materials were described as "medium" frequency, but if we limit the definition of hazardous material spills to events severe enough to require a major response from City government, then low frequency seems reasonable.

Next, we translated these qualitative descriptions of frequency into probabilities. The EOP defines “low” as “less than every 25 years”. 1 in 26 years (1/26) would be the most conservative mathematical interpretation of this definition. We shared this interpretation with the City’s Division Chief/Emergency Manager of SLCFD Emergency Management. The Division Chief shared it with his colleagues for feedback. The feedback we got **did not** support making a **less** conservative interpretation of frequency. One exception is epidemics, where we do have an available history of major epidemics in urban areas. History suggests they are rare, so we adjusted the chance to 1 in 50 years. See Exhibit 5.F.1 for frequencies associated with each event.

Exhibit X.Y.1 – Other Hazards and their Frequencies

Hazard	1 Event in...	...Years	Frequency*
Hazardous materials	1	26	3.8%
Radiological incident	1	26	3.8%
Utility Outage	1	26	3.8%
Telecommunication Disruption	1	26	3.8%
Urban Fire	1	26	3.8%
Domestic Terrorism	1	26	3.8%
Biological / Chemical Weapons	1	26	3.8%
Epidemic	1	50	2.0%

*Frequencies suggested by City EOP, with exception of epidemic, terrorism, and bio/chem weapons

The frequencies above were then used by the risk model to simulate if such a hazard occurs. The model also accommodates the possibility of more than one such hazard happening in a single year, though this would be rare.

To determine the magnitude of possible losses, we looked at the consequences of other hazards that the City has experienced. Exhibit 5.F.2 shows the results. This provides us with useful information as it shows that most events are relatively small compared to the largest expense (2021’s COVID costs). This is consistent with the theory of how extreme events work³⁸ and what we observe in the data for low frequency, high consequence events like earthquakes, floods, and wildfires. It is also important to note that it is quite possible that some of these events could have no material costs for the City government. For example, GFOA performed a similar analysis for a large general-purpose government in southern California, where a larger utility (power) outage had recently occurred. We could not find evidence that the power outage caused material extraordinary costs for that government. That doesn’t mean that a power outage would never cause extraordinary costs, just that we should acknowledge that it is quite possible that the occurrence of a hazard, depending on size, scope and other factors, might not have a material financial impact on the City’s general fund. All of this information was used to develop a

³⁸ Many kinds of extreme events follow a “power law” distribution, which means that most observations are relatively small in comparison to those events in the “long tail” exhibited in the power law distribution. You can learn more about this phenomenon in the introductory section of this report where we discussed “asymmetrical distributions”.

distribution of possible losses from the occurrence of an “other hazard” event, where most occurrences will be around \$1 million, a few could be much larger, and some will entail negligible costs.

Exhibit 5.F.2 – Summary of City’s Recent Experience with Other Hazards

Historical Cost of Misc Risks	Total Cost, 2023 Dollars
May 2020 Civil Disorder	\$ 1,172,154
2011 Chevron Hazmat Spill	\$ 1,068,916
2020 COVID	\$ 1,142,914
2021 COVID	\$ 13,862,252
All COVID	\$ 15,005,166

Finally, we considered the question of reimbursement of costs by outside entities. GFOA’s experience with other governments, and which proved true in SLC, is that reimbursement can vary widely for these kinds of hazards. For example, FEMA involvement for large earthquakes, floods, etc. is common. FEMA involvement in human-caused hazards is irregular. For example, prior to 2020 we could find only 3 examples of FEMA providing reimbursement to local governments for a terrorist, chemical, or biological event (9/11 terrorist attack, Boston marathon bombing, and a 2014 West Virginia chemical spill).³⁹

If we look at the City’s history of other hazards (the ones in Exhibit 5.F.2), we see that the City received reimbursement for 2 out of the 3. The May 2020 civil disorder did not receive reimbursement. The 2011 hazmat spill was reimbursed by Chevron. COVID costs were reimbursed by special federal legislation. Hence, we built the simulation to provide for a 66% chance that any given occurrence of a hazard will be eligible for reimbursement (2 out of 3 chance of receiving reimbursement).

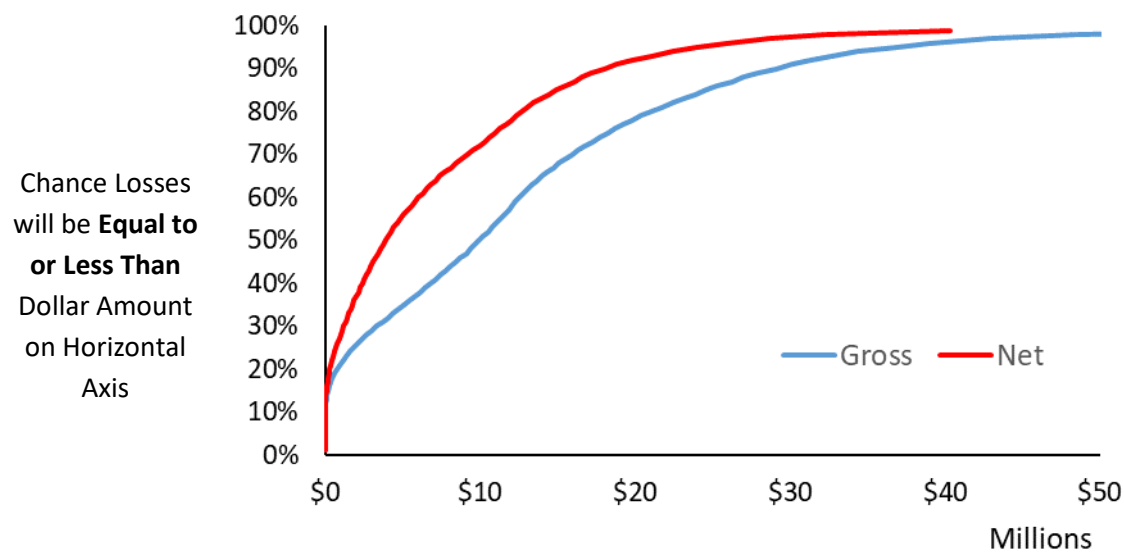
As for the amount of the reimbursement, based on past history and the FEMA standard of 75% support for when FEMA does get involved, we assumed that reimbursement rates will usually be high, including 90% to 100% in some cases. For example, both the 2011 hazardous material costs and COVID costs were fully or almost fully covered by outside entities. We also included some chance of a low reimbursement. The larger point here is that, unlike natural catastrophes, there is no clear precedent for the rate of reimbursement. Furthermore, the costs associated with some kinds of human-caused catastrophes might be reimbursable by the perpetrator as was the case with the 2011 Chevron Hazmat. Hence, we reflected this uncertainty in the risk model by allowing for a larger range of potential reimbursements than we assumed for natural catastrophes.

This analysis resulted in the 10-year cumulative probability chart of losses to the City from other hazards, shown in Exhibit 5.F.3. The chart shows both gross losses (before reimbursement) and net (after

³⁹ This may be because the authoring legislation for FEMA is oriented more towards natural disasters, rather than human-caused. For example, <https://www.fema.gov/disaster/how-declared> states “the President can declare a major disaster for any *natural* event...” (emphasis added). Though this is far from a prohibition against FEMA involvement in human-caused disasters, it does show that FEMA probably more likely to be involved in natural disasters than man-made ones.

reimbursement).⁴⁰ We see that the net (red) line goes more sharply upwards, which means there is a higher chance that the net cost will be lower than the gross cost. The chart shows that there is an 80% chance that **net** costs will be less than \$12.7 million over ten years and 80% chance that **gross** costs will be less than \$21 million over ten years. We can see that reimbursement has a big effect on the financial impact of these other hazards. Section 7 of this report, “Putting it All Together” combines this analysis with the additional risks we have analyzed (e.g., recessions, earthquakes, etc.) and introduces additional considerations such as the City’s ability to run budget surpluses, cut costs in other areas, etc.

Exhibit 5.F.3 – Gross and Net 10-Year Total Cost of Other Hazards



Checkpoints

- ✓ Salt Lake City is at risk for a variety of hazards other than those we have analyzed elsewhere in this report. This mostly covers various kinds of human-caused catastrophes and is intended to be broadly representative of “unknown unknown” risks.
- ✓ The frequency of these risks was suggested by the City’s Emergency Operation Plan.
- ✓ The financial consequences (costs) and potential for reimbursement were both suggested by the City’s past history with idiosyncratic risks like COVID, a 2011 hazardous material spill, and a 2020 civil disorder event. We also used experiences from other large local governments to inform the model.
- ✓ Reimbursement for these events is more irregular than for natural catastrophes. Hence, we looked at both gross costs over a ten-year period and costs net of reimbursement. The effects of reimbursement can be substantial. For example, the simulation an 80% chance that **net** costs will be less than \$12.7 million over ten years and 80% chance that **gross** costs will be less than \$21 million over ten years.

⁴⁰ Note that the net line will not include all simulated reimbursements. For example, a simulated event in year 10 that is simulated to be reimbursed 1 or more years in the future will not impact the net cost since the net only includes reimbursements received in years 1 through 10.

Section 6 - Secondary Risks and Comparable Analysis

Prior sections of this report reviewed the risks of the greatest financial consequence to SLC. In this section we briefly review other risks that were considered, but that did not appear to be as important to SLC's general fund reserve as the other risks we examined. This is not to say that SLC should not prepare for these risks. It is only to say that these events were not included in the scope of our analysis because of the low potential impact on the general fund.

Also, in this section we examine how SLC compares to other cities in terms of indebtedness and the amount of fund balance maintained.

A. Secondary Risks

We identified several risks that are not primary risks. These risks are not primary risks because they are judged to be of low probability, of low severity, or both.⁴¹ Some of the more notable risks are listed in the table below.

Secondary Risks
High Heat
Snow Fall
Cyberattack

Because risks like those in the table above are not thought to be primary risks for the City, we did not quantitatively analyze them. However, that is not to say the City shouldn't be prepared for these risks in some way. Below we discuss these risks in more detail.

High Heat

According to First Street Foundation's "Risk Factor" tool for assessing community risk to natural hazards, Salt Lake City is at "moderate" risk from heat. Risk Factor has six categories of risk for heat: Minimal, Minor, Moderate, Major, Severe, and Extreme. When we look at individual properties within city limits, over 90% of properties in Salt Lake City are in the Moderate category. A little less than 8% are in the Major category and a handful are in the Minimal or Minor category. None are in the Severe or Extreme category. After discussions with City staff, it was judged that the potential financial impact to general fund due to high heat was minimal. Further we discussed heat risk with the CFO of the City of Chandler, Arizona, which is classified as "extreme" heat risk by First Street. She told us that Chandler's general fund reserve has seen no impact from responding to high heat events. Thus, if Chandler's general fund reserve has not been impacted by high heat, it seems reasonable to conclude that the potential impact of high heat on SLC's reserve is low.

⁴¹ This could be low intrinsic risk or because the City has transferred the risk via commercial insurance.

Snow Fall

High snow fall could cause the City to incur more expenses for snow removal. Discussions with City staff indicate that the City has sufficient financial capacity outside of the general fund reserve to deal with extreme snow seasons. Hence, the potential impact on the general fund reserve is negligible.

Cyberattack

Local governments are at high risk for cyberattack, particularly ransomware attack. In fact, studies have shown that local governments are the most popular ransomware targets for cybercriminals. The City currently has coverage under a cyber liability program. GFOA is not an insurance expert, and a detailed examination of the policy was outside the scope of this project. However, cyber insurance is a notable risk for the general fund reserve for two reasons:

- Cyber risk policies are often not straightforward and often include various limitations and exclusions that result in the insured retaining more risk than they expected. GFOA has a publicly available report that outlines the most common issues in cyber insurance the local governments should watch out for: “Cyber Risk Savvy” is available at the GFOA website at <https://www.gfoa.org/materials/cyber-risk-savvy>. Retained risk is risk that de facto self-insured.
- In recent years, cyber coverage has gotten more expensive or even impossible to maintain if certain underwriting standards are not met by the insured. Currently the City has insurance coverage against cyber attacks. But, perhaps self-insurance (partial or full) could become a more economically attractive option in the future, depending on how the market for commercial insurance develops.

Besides the risks listed above, other risks that were considered minor include: avalanches, landslides, droughts, lightning, and transportation accidents. All of these were judged to have low potential consequences for the general fund reserve.⁴²

Finally, it is worth noting that the “primary” risks included an “other hazards” category that was intended to simulate “unknown unknown” risks. So, although we did not quantitatively model the risks described here under “secondary risks”, the “other hazards” simulation does provide for reserve capacity beyond the specific primary risks we modeled like recessions, earthquakes, floods, etc.

Secondary Risk Checkpoints

- ✓ We identified several other risks to be insufficiently likely and/or severe to be categorized as a primary risk. We did not quantitatively model these risks.
- ✓ The City should still prepare for these risks, though. When it comes to reserves, the “Other Hazards” simulation we performed under the primary risks does provide some additional reserves capacity. Thus, our reserve recommendation is not limited to just exposure from the specific primary risks we modeled.

⁴² This conclusion was reached primarily on the strength of the City’s Emergency Operations Plan (EOP), which describes the potential consequences of these risks as “low: some citywide impact possible. Usually handled with available city resources”. The exception is drought, which was described “medium” consequence, but discussions with City staff indicate minimal potential impact of the general fund.

B. Comparable Analysis

This section compares Salt Lake City to other cities on indebtedness and the amount of fund balance they maintain. This information provides context for the City in selecting its own reserve levels. Debt and reserves are both determinants of financial flexibility. A high debt burden means less flexibility, which then would suggest that reserves are especially important for providing flexibility. A lower debt burden would mean the converse.

Debt

At the end of FY 2021, Salt Lake City's total direct and overlapping debt amounted to \$623.6 million, of which \$290.8 million was direct debt. The City's general obligation bond rating is Aaa from Moody's and AAA from Fitch Ratings. Exhibit 6.B.1 compares Salt Lake City with the medians of cities with population greater than 50,000 across different Moody's credit ratings. The top row shows the direct debt a city has relative to its full value or total assessed value. For this indicator, Salt Lake City's direct debt is 0.63% of its full value, lower than the median across all ratings. The second row shows direct debt a city has relative to its total operating revenues. For this indicator, Salt Lake City is 0.69 times its operating revenues, again, lower than the median across all ratings.

Exhibit 6.B.1 – Comparison of Salt Lake City's Financial Indicators to Cities with Population Greater Than 50,000

	<i>Salt Lake City</i>	Aaa	Aa	A	Baa	Ba & Below
Direct Debt / Full Value (%)	0.63%	0.7%	1.1%	2.0%	2.9%	2.1%
Direct Debt / Operating Revenues (x)	0.69	0.79	0.78	0.76	1.23	1.14

Source: Moody's Investors Service, "2021 US Local Government Medians Cities and Counties"

To further explore measures of debt, we examined how Salt Lake City compares to a group of peer cities that the City evaluates itself against based on a combination of factors, including demographics and population. Exhibit 6.B.2 provides summary statistics from each of the cities' FY 2021 annual comprehensive financial report and includes four commonly used measures of indebtedness. The measures are categorized as measures of overall debt and measures of direct debt.

Measures of overall debt capture the full burden placed on the public by debt issued by all local governments that overlap the city. Within this category, the first measure, overall debt per capita, shows the burden placed on citizens by municipal indebtedness inclusive of direct and overlapping debt. The second measure, overall debt burden, compares direct debt plus the debt of overlapping jurisdictions as a percent of the full assessed value of properties in the jurisdiction.

Measures of direct debt include debt service (inclusive of principal and interest payments) as a percentage of the city's expenditures. This measure gauges the pressure placed on the budget by debt payments. The second measure shows direct debt as a percent of the city's full value to show the debt burden relative to the City's tax base.

Exhibit 6.B.2 – Comparison of Salt Lake City's Debt Measures with Peer Cities

		Measures of Overall Debt		Measures of Direct Debt	
	Population	Overall Debt per Capita	Overall Debt Burden (Overall Net Debt as % Full Value)	Debt Service as a % of Expenditures	Direct Net Debt as % of Full Value
<i>Salt Lake City</i>	199,723	\$3,122	1.36%	9.05%	0.63%
Chandler, AZ	280,178	\$2,170	1.65%	7.47%	0.58%
Denver, CO	749,103	\$11,784	4.59%	8.12%	0.97%
Las Vegas, NV	655,489	\$3,248	3.29%	5.86%	0.79%
Orlando, FL	314,506	\$2,069	0.97%	4.93%	0.64%
Portland, OR	652,503	\$5,255	2.16%	18.73%	0.32%
Washington, DC	716,510	\$19,585	3.95%	6.50%	3.95%
Mean	509,716	\$6,748	2.57%	8.67%	1.13%
Median	652,503	\$3,248	2.16%	7.47%	0.64%

Sources: FY 2021 annual comprehensive financial report of each city and U.S. Census Bureau's 2020 Decennial Census

Among its peers, Salt Lake City's overall debt per capita is \$3,122, which is lower than both the mean and median of the peer cities. Orlando, FL and Chandler, AZ both have slightly lower debt per capita at \$2,069 and \$2,170, respectively. Denver, CO and Washington, DC have significantly higher debt per capita than their peers. It is important to note that both encompass services beyond traditional municipal services. Denver operates as the city and county and Washington, DC functions largely independently with a greater scope of services. With respect to overall debt burden, Salt Lake City is fairly low at 1.36% of full value, with only Orlando, FL recording a lower share.

In examining direct debt measures, Salt Lake City is above the mean for debt service as a percentage of expenditures at 9.05%. Only the City of Portland is higher at 18.73%. When considering direct net debt as a percentage of full value, Salt Lake City is near the median at 0.63%, with Chandler, AZ and Portland, OR recording lower figures.

Salt Lake City is comparable based on medians of cities with populations of 50,000 or greater. However, comparing figures in Exhibit 6.B.1 to Exhibit 6.B.2, the peer cities maintain a lower level of direct debt. While debt could play a role in the City's risk mitigation strategy, it should be used cautiously.

Claims on Fund Balance

It is important to gain an understanding of existing claims on the City's general fund balance in order to fully see funds available to the City in case of a major, unforeseen expenditure or emergency.

To help the City consider the amount of reserves to maintain, Exhibit 6.B.3 provides a table of general fund balances as a percent of general fund revenues for peer cities. Several notes should be made about Exhibit 6.B.3 in order for the reader to fully understand its meaning. First, “fund balance” is an accounting term describing the difference between assets and liabilities in the general fund. “Reserves” (which are the main topic of GFOA’s analysis for Salt Lake City) are the portion of fund balance set aside, by City policy, as a hedge against risk. Hence, not all “fund balance” is necessarily available as a reserve. The right-hand section of Exhibit 6.B.3 shows how much each city holds in fund balance as a percentage of general fund revenues. Each of the four columns on the right in this exhibit examine fund balances from a different perspective between its relationships to risk mitigation. Going from left to right, the columns show a broad to narrow perspective on funds available for risk mitigation.

The first column shows “unrestricted” fund balance as a percentage of general fund operating revenues.

This column is the broadest perspective of funds available for risk mitigation. It captures the portion of the fund balance that does not have constraints placed on their use by an outside entity (e.g., through a legal agreement) and is spendable (e.g., cash or other liquid assets). An “unrestricted” fund balance may still have constraints placed upon its use, but these constraints would be created by the city government itself. One common constraint is to dedicate some portion of fund balance to hedging against the types of risks described in this report. However, other constraints have nothing to do with risk mitigation—to illustrate: a common self-imposed constraint is setting aside fund balance to pay for a special capital project. The City does have such a constraint, including fund balance assigned for capital projects and park maintenance improvements, which *could* be removed and made available for risk mitigation.

The second column shows the amount of fund balance available for risk mitigation. Compared to the first column, this column removes portions of the fund balance that have self-imposed restrictions unrelated to risk mitigation. This leaves portions of the fund balance set aside to address a specific risk as well as the portion of fund balance that do not have a dedicated use (unassigned), which could easily be used for responding to emergency events if needed.

The third column includes fund balances set aside to address a risk. Compared to the second column, the third column does not include portions of the fund balance that do not have a dedicated use (unassigned fund balance). The third column only captures what has been specifically set aside for risk. Of the peer cities, only Salt Lake City and Las Vegas do not have fund balances specifically set aside to address a risk.

The risks that peer cities have set aside funds for vary. The City of Chandler has assigned portions of its fund balance for self-insurance purposes as well as for pension contributions. The City of Denver restricted funds for emergency use.⁴³ The City of Orlando has assigned funds for long-term benefit obligations. The City of Portland committed funds for general fund stabilization. Washington, DC has the largest percentage of general fund revenues dedicated to risk mitigation, which includes contingency and

⁴³ GFOA worked with the City and County of Denver to establish these categories after a similar risk analysis. Denver made the determination on the level of fund balance to maintain for extreme events and economic volatility.

emergency cash reserves as mandated by the U.S. Congress and fiscal stabilization and cash flow reserves adopted into the D.C. Code.

It should be noted that the analysis in Exhibit 6.B.3 is based only upon the information included in each city's FY 2021 annual comprehensive financial report. Cities may also have a legislative policy document which might call for maintaining a given amount in fund balance as a reserve without creating an accounting restriction that would show up in the financial report. Several of the peer cities have such a legislative policy in place. The City of Chandler's policy calls for a general fund contingency reserve equal to 15 percent of general fund operating revenues. The City of Denver's policy calls for a contingency reserve of no less than 2% of total expenditures, an emergency reserve mandated by the State Constitution of 3% of covered funds, and an unassigned fund balance of at least 10% and target of 15% of total budgeted expenditures. Lastly, the City of Orlando's reserve policy targets a range of between 15% and 25% of budgeted expenditures for the general fund, a range of between 0% and 20% of budgeted expenditures for other funds, and a range of 10% to 15% of outstanding liability for its risk management fund.

Exhibit 6.B.3 – Comparison of Salt Lake City's General Fund Balance as Percentage of Revenues to Peer Cities

City	Unrestricted	Available for Risk Mitigation	Dedicated to Risk Mitigation*
Salt Lake City	30.3%	30.3%	0.0%
Chandler, AZ	83.5%	43.5%	10.1%
Denver, CO	24.2%	23.1%	4.3%
Las Vegas, NV	34.6%	26.1%	0.0%
Orlando, FL	30.7%	22.3%	1.0%
Portland, OR	20.3%	17.6%	8.7%
Washington, DC	25.6%	15.6%	15.6%
Mean	35.6%	25.5%	5.7%
Median	30.3%	23.1%	4.3%

*The figures are based on details identified in each city's annual financial report. A city may have a legislative policy to maintain a certain amount in fund balances as a reserve without creating an accounting restriction.

Sources: FY 2021 annual comprehensive financial report

As mentioned previously, the columns in Exhibit 6.B.3 provide a broader to a narrower perspective on funds available for risk mitigation going from left to right. The first column shows the broadest view in terms of percentage of unrestricted general fund balance as a percentage of general fund revenues. Here, Salt Lake City represents the median of peer cities at 30.3% of general fund revenues. When we look more closely to portions of the fund balance set aside to address a specific risk along with the portion of fund balance that do not have a dedicated use (unassigned) that can be utilized in case of an emergency, the amount Salt Lake City has available for risk mitigation is the second highest, behind the City of Chandler, AZ. The third column takes a narrower perspective on funds available for risk mitigation and includes only

what has been dedicated to a specific risk. As noted previously, Salt Lake City and Las Vegas have not imposed any accounting restrictions for risk mitigation purposes.

Compared to its peer cities, Salt Lake City maintains an average level of general fund balance that could be a hedge for risk through the unassigned portion of its fund balance. A more deliberate analysis, such as the approach in this report, will provide greater insights into if such a level is appropriate given the risk factors that the City faces as well as what other peer cities are considering as risks, and if they are using reserves as a way to address such risks. From there, the City could create accounting restrictions on portions of the fund balance to set aside funds for specific risks it faces.

Section 7 - Putting it All Together

In Sections 4 and 5 we examined individual risks such as recessions, earthquakes wildfires, floods, and more. We examined each of these risks individually to best understand the nature of each risk and the financial implications. However, to arrive at a final reserve strategy for the City, we need to consider these risks as a group. Considering the risks as a group has important advantages.

The first advantage is that considering risks as a group recognizes the diversity in the risks that the City faces. This diversity is an advantage for City finances! Diversity in risks means we should not simply add together a reserve for each individual risk. This may overstate the amount of reserves that the City really needs. This is because it is unlikely that the City will experience a deep recession, a severe earthquake, and severe flood (or other hazards) all within a short time period.

The second advantage of considering all the risks together is that not all of the risks have an equal chance of occurring over a given time period. Recessions are more common than a 100-year flood. The reserve analysis should reflect this fact. We can use relative chance of each of the major risks occurring over a ten-year period to build a model of risks over a long-term time horizon.

The final advantage of considering all the risks together is that we can consider “risk interdependencies.” This simply means that the occurrence of one risk could impact the probability and/or magnitude of a related risk. In Salt Lake City’s case, the most important interdependency appears to be between revenue volatility and a powerful earthquake: a large earthquake could impair the City’s taxbase. There are also interdependencies between revenues during a recession. Some revenues decline right away while others take longer to decline. High pension costs are also related to poor economic performance. Other than that, there does not appear to be any critical interdependencies. It is not unusual for local governments GFOA has worked with to not have many interdependencies.

To realize the advantages described above, we built a model that considers the City’s risks over a ten-year time horizon. The GFOA Risk Model runs hundreds, thousands, or even ten thousand simulations of possible futures for the City. Below are the key assumptions behind the model. Some of these assumptions are user-definable so that the City can explore alternative scenarios to those described in the report. Below, we have italicized user definable variables and described the default values included in the model.

- **Probability of an undesirable event.** The probability of any undesirable event occurring is consistent with the assumptions in the detailed analysis of each risk.
- **Magnitude of an undesirable event.** Should a simulation show that an undesirable event occurs in a given year, the magnitude is generated randomly in a manner identical to how we described for the risks earlier in this report.
- **FEMA reimbursement.** The City could recoup some of its losses from extreme events, such as earthquakes, floods, and fires from reimbursements from FEMA. The model assumes the reimbursements are received *two years after the event occurs*.⁴⁴ The model assumes all large natural catastrophes would be assisted by FEMA. Small ones may not. We also assume the City will be reimbursed at the customary *rate of 75% of incurred costs* by FEMA. We also assume there

⁴⁴ Our research shows that FEMA reimbursements are completed 18 months after the disaster occurs, on average. So, this is a conservative assumption.

is some amount of losses that do not fit into FEMA reimbursement (beyond the 25% local share) that the City will need to bear. The amount varies by type of disaster but ranges from 35% to 50%.⁴⁵

- **The City does cut some spending to help offset the impact of a recession or an extreme event.** At least some of the losses from a recession or extreme event could be absorbed by cutting back on the City's regular spending. The Risk Model provides the user with the ability to set the amount of spending the City is willing to cut. For the purposes of this report, we assume the City is willing to cut up to 3% of its entire budget in any given year to close a deficit, before using reserves. This is consistent with some past experiences the City has had in balancing its budget.
- **The City will usually generate budget surpluses in years when there is not a recession.** The City has historically generated surpluses in non-recessionary years. Annual surpluses can be used to offset unexpected costs or help pay for capital projects. The Risk Model simulates budget surpluses for non-recessionary years. We started with the City's historical surpluses and deficits and then used the City staff's judgement⁴⁶ to adjust the ranges to account for historical anomalies. This resulted in a range of about 6% surplus to 2% deficit for most years in the model.⁴⁷
- **Critical threshold.** *This is the amount that the City does not want reserves to go below.* For the purposes of this report, we have tied the critical threshold to bond rating agency expectations. The City has been rated at AAA and, according to Fitch rating agency, the rating reflects "the city's superior gap-closing capacity, which results from a high level of revenue control and solid reserves, supported by strong financial management practices." Reserves can help the City maintain its rating. Thus, the model has three settings for the critical threshold. One setting puts the desired minimum at the standard associated with AAA, which according to Moody's is 35% of revenues *for the entire local government*.⁴⁸ The second setting puts the minimum at the amount associated with AA, which is 25%.⁴⁹ The third setting puts the minimum at the amount associated with A, which is 15%. Note that these standards refer to not only the general fund, but to SLC as a whole. Salt Lake City's goal is to maintain a AAA bond rating. Currently, the other funds in SLC have large enough fund balances that, in theory, SLC's general fund reserve could go below zero and still satisfy rating agency expectations. In practice, of course, rating agencies would probably not look favorably on negative fund balance. So, instead we used zero as the threshold for the purposes of discussion in this report.
- **City's starting reserve.** The starting reserve assumptions comes in two parts. First there is the general fund unassigned fund balance. That number was taken from the City's latest annual comprehensive financial report (ACFR), with a deduction for amounts that City has already directed to other spending. Further, not all of the unassigned fund balance was considered part of the "reserve". The reserve is monies set aside for managing risks. This was set at 13% of expenditures as per Council policy. The second part is fund balance from other funds.⁵⁰ This is relevant because Moody's bond rating is now based on fund balances across all funds. Therefore,

⁴⁵ A recent high wind event in the City produced costs that were not reimbursable by FEMA in an amount equal to about 50% of the costs that were. Hence, 50% is not an unrealistic upper limit.

⁴⁶ City staff went through a calibration training program provided by GFOA to improve staff abilities to make probabilistic judgments.

⁴⁷ The first year of a model includes a slightly higher (8%) upper limit to account of anticipated difficulty in filling positions and consequently higher potential for vacancy savings in the budget.

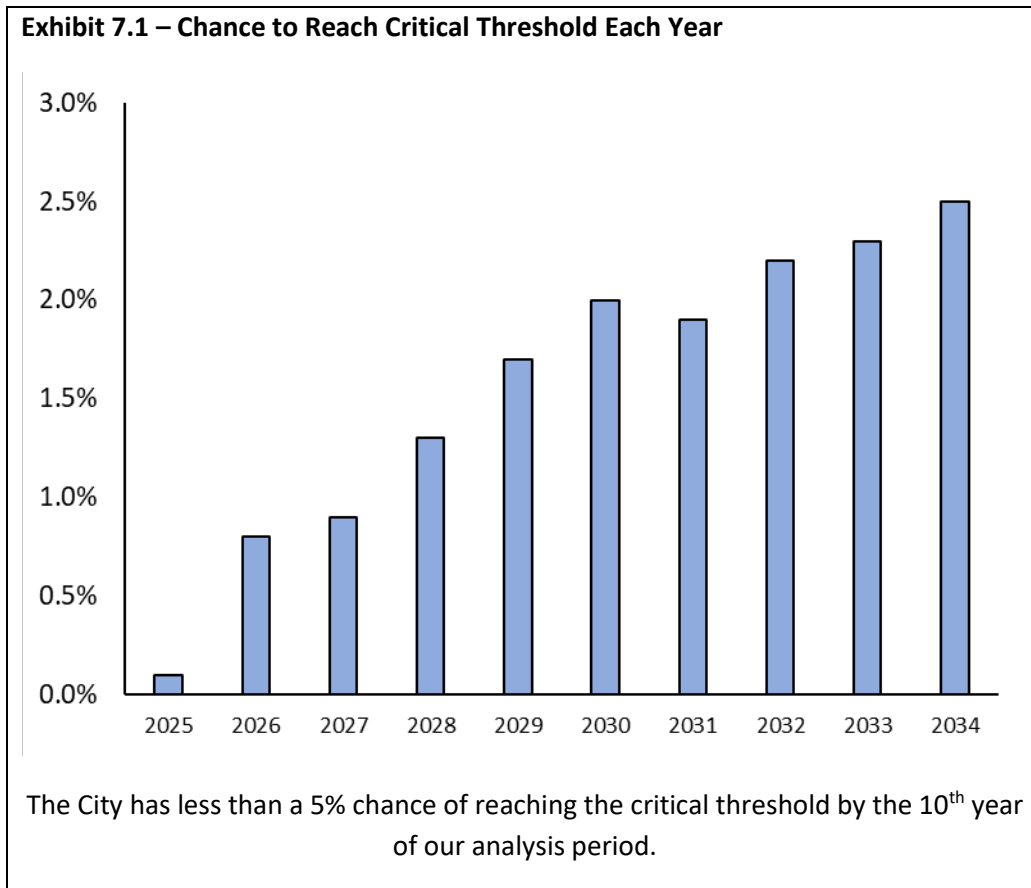
⁴⁸ Moody's publishes explicit standards for how much fund balance they look for, so we used those standards.

⁴⁹ The user can also remove the critical threshold entirely or add new threshold options.

⁵⁰ Technically, proprietary funds do not have "fund balances". The closest equivalent is "net current assets", which is used by Moody's in its calculations.

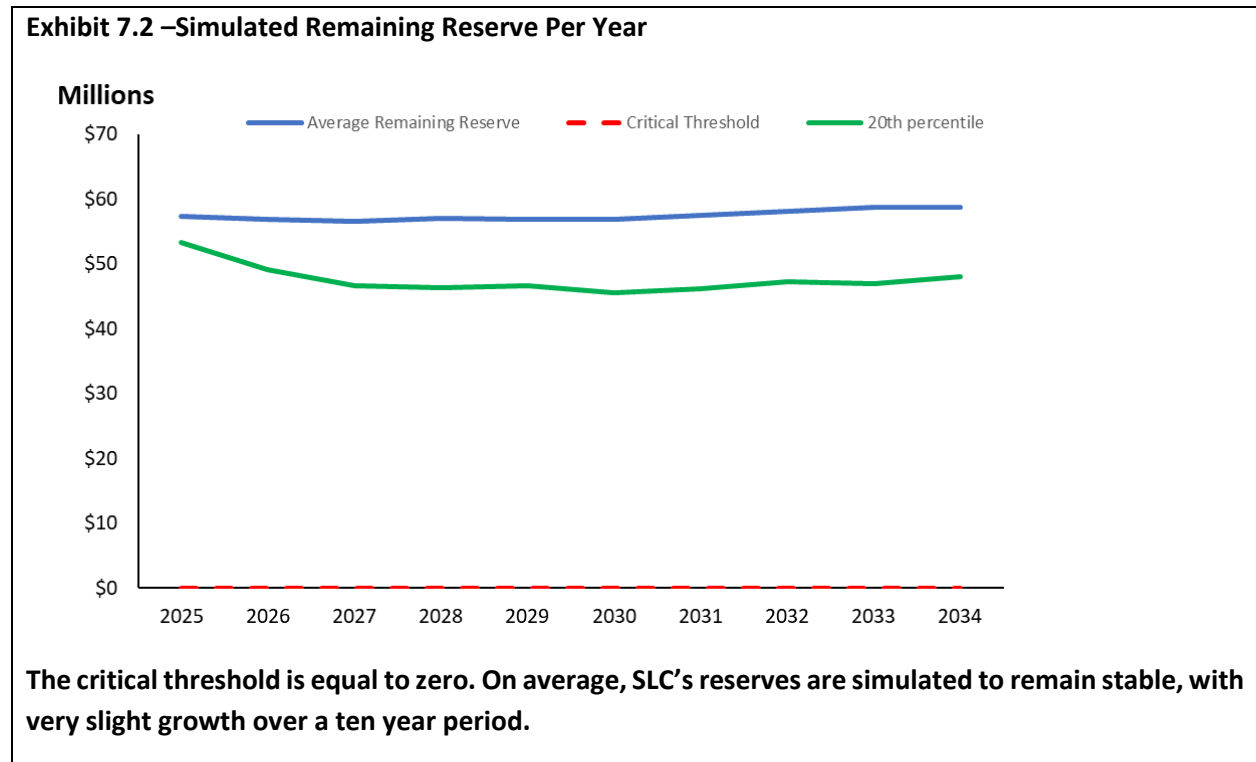
if there are large fund balances in other funds, there is less of a need for general fund balances in order to satisfy bond rating agencies and vice versa. Again, we used the City's latest ACFR with a deduction for amounts that City has already directed to other spending.

We combined all of the information described above to create a ten-year probabilistic risk model. The City's goal for this analysis was to find an amount that can give the City sufficient comfort that its reserves will cover its risks. We next present a series of graphics based on this risk model. Exhibit 7.1 shows the chance that the City's current reserve will reach the critical threshold (go below Moody's expectations) each year. GFOA has observed that many municipalities are comfortable with anything less than a 10% of reaching their critical threshold by the end of the analysis period. We can see SLC is well within this benchmark – the chances are routinely less than 5%. It is important to note that, generally, the blue bars will always get higher the further in the future we look because more bad things can happen.



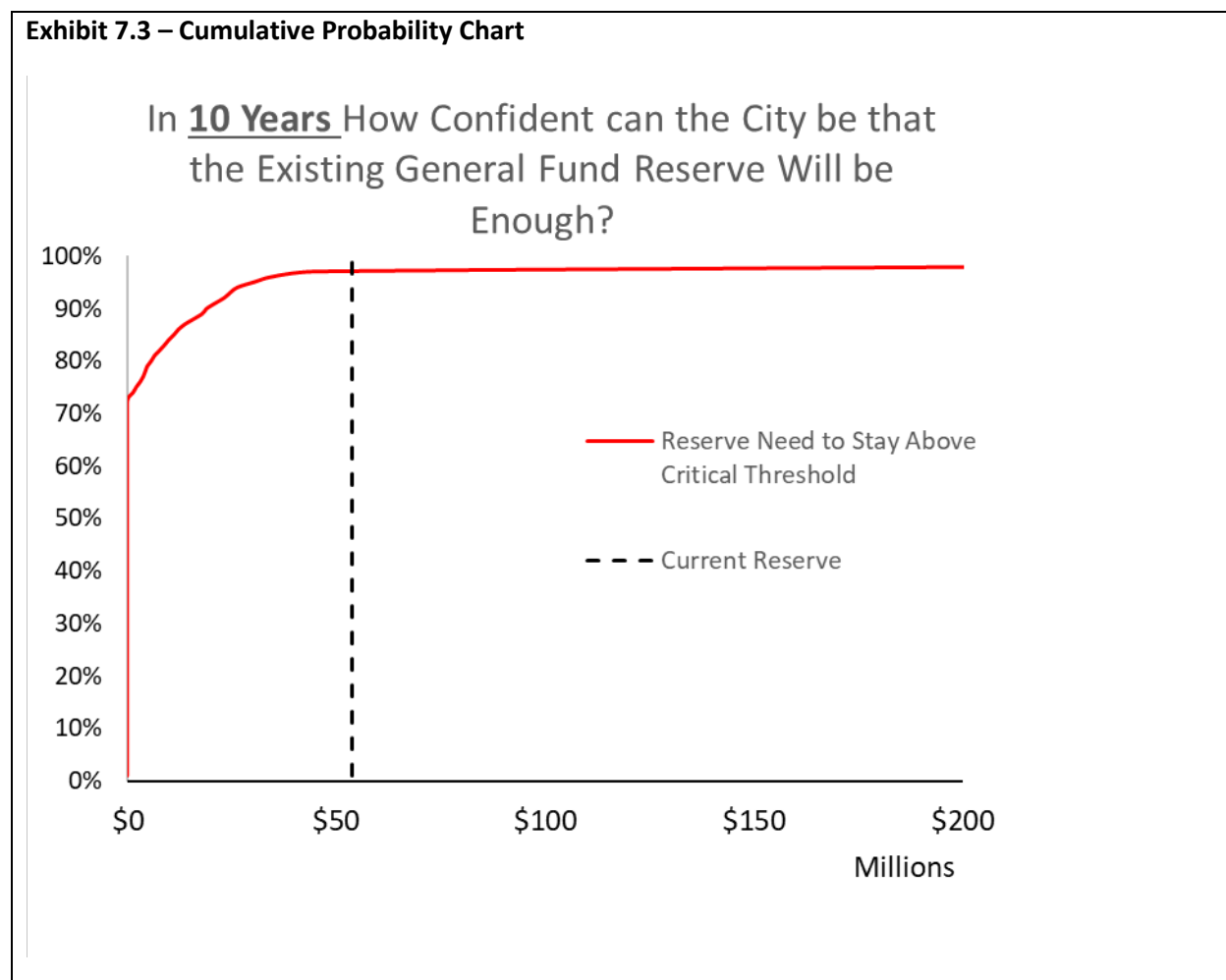
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Exhibit 7.2 shows the average remaining reserve per year (blue line). The exhibit shows the City’s reserves are simulated to remain fairly stable, with slight growth, under “average” conditions. This is sufficient to keep the City well above the critical threshold (dotted red line that is equal to zero). The chart also shows the 20th percentile (green line), which means the simulation shows reserves to be at or under the green line 20% of the time. This is representative of some of the less favorable outcomes of the simulation. We see that even then, SLC stays well above the critical threshold.



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Finally, below is Exhibit 7.3. This is a cumulative probability chart. It shows the confidence available from varying levels of reserves. The main take-away from this graphic is the reserves have a diminishing return at a certain point because the flatter the line gets, the less confidence an additional dollar of reserve “buys” you. This is because the further to the right you go on the graph, the more extreme the events are that must be covered by reserves. This graphic shows that the has reached the point of diminishing returns, **if zero is considered the critical threshold**. This City would not be as well served by accumulating reserves past the point where the line starts to flatten out, if zero is the critical threshold.



The implication of the line going flat is that not all points on the line are equally cost effective. Let’s examine Exhibit 7.3. According to the graph, to be 80% confident of staying above the critical threshold requires a reserve of \$5.8 million. To be 90% confident requires a reserve of \$19.1 million, a difference of about \$13.3 million from 80% confidence. To be 95% confident requires \$30.4 million, which is about \$11.3 million more than the amount required to be 90% confident. Thus, it costs about the same to “buy” an increase in confidence of half the size.

The City can use the results of this report to optimize the range of general fund reserves it would like to hold. GFOA recommends the City establish a floor and a ceiling amount of reserves. The ceiling is as

amount of reserves SLC will try not to exceed and a floor is an amount that SLC will try not to go below and will try to replenish the reserves quickly if they do go below the floor. GFOA cannot recommend a precise amount of reserves the City should maintain, but our analysis does provide a clear general direction and our risk provide provides the ability to “stress test” different reserve strategies. The reason we cannot make a precise recommendation is that a big part of determining a desirable reserve amount is the “risk appetite” of SLC officials. Officials who are risk averse may prefer more reserves. Those who are less averse and perhaps more sensitive to the opportunity costs of holding reserves may prefer less.

City officials will also want to think about other factors to finalize the reserve target range. This is because Exhibit 7.3 cannot account for every possible factor that should go into deciding how much Salt Lake City should keep in its reserve. The numbers shown in the exhibit are what is needed to protect the City from just the risks described in this report and to keep the reserve above zero. Usually, municipal governments have other concerns they expect their reserves to address. Here are examples of such concerns:

- The critical threshold is based on what it would take to keep SLC in line with rating agency expectations for how much fund balance a AAA rated city would maintain. There are two important implications here:
 - a. Though, mathematically, SLC has enough fund balance in other funds that it could maintain compliance with rating agency expectation while **reserves** in the General Fund go to zero. That said, we must also recognize that the City’s reserves are only about 1/3 of the City’s general fund unrestricted fund balance. That’s the size necessary to meet the council policy of reserves equal to 13% of expenditures. So, the reserves going to zero is **not** the same as the general fund balance going to zero.
 - b. The model assumes that the fund balance of other funds will remain as robust in the future as they are today. There is no reason we know of today that this will cease to be the case, but the world can change.
- There are risks that are sometimes called “unknown unknowns.” These are risks that are totally unanticipated. Our model does include an “other hazards” simulation which should go a long way towards addressing unknown unknowns.
- Our Risk Model is based largely on historical data, which, by definition, does not capture the potential future impacts of climate change. It is impossible to say what the future impacts of climate change will be. This might suggest a more “risk averse” approach to reserves (i.e., maintaining more, rather than less).
- The City might wish to use fund balances for purposes other than mitigating risks – for example, building a capital project using cash financing. The Risk Model gives the City the ability to estimate the cost of potential projects to see the financial impact of redirecting reserves to other uses.⁵¹ More broadly, City officials should consider opportunity costs of holding reserves: what are alternative uses of the funds and how do those benefits compare to self-insuring against the risks described in this report?

The considerations above could be reflected by adjusting the “critical threshold”. As described earlier, GFOA’s discussions with the City staff suggest a critical threshold of zero is representative of where the City’s **reserves** need to stay above to help the City maintain a good reputation with investors in municipal

⁵¹ Note that the City has historically done some level of cash financing of projects. The model already accounts for “normal” spending that takes place in the City’s annual budget, so this feature of the Risk Model would be used for larger projects that exceed what might be considered “typical.”

debt and maintain a AAA rating.⁵² This amount is shown in Exhibit 7.3. The City could choose to vary this critical threshold, which would then change the total amount of reserves the City would need to maintain in order to achieve a given degree of confidence that reserves would stay above the threshold.

Here are some other conclusions we can draw from the graphics presented on the previous pages:

- Salt Lake City's ability to consistently generate surpluses provides a great deal of protection from the impacts of unplanned, unavoidable expenditures over the long-term.
- The City should remain mindful of the potential for extreme consequence events. In particular, a large earthquake could impair the taxbase. GFOA found that this caused SLC's simulation to produce some extreme results. In Exhibit 7.3 the reader will notice that the red line extends very far to the right, past \$200 million. This tells us that there is a small chance of some very extreme outcomes. Typically, our risk simulations don't produce such a long tail, but SLC's vulnerability to earthquakes and tax base impairment does. Later on in this document, we will discuss parametric insurance as an alternative to reserves to protect SLC against these extreme cases.

So, with this in mind the City might consider taking the following steps:

- ***SLC council and administration can determine the preferred amount of reserves based on risk appetite and the data presented here.***
- ***SLC council and administration can consider a comprehensive reserve policy (see below for more details).***
- ***As part of the deliberations on the preferred amount of reserves, take into account the relationship between the general fund and other funds. Though the strong balances in other funds do help SLC meet bond rating agency expectations, the general fund does have responsibilities for good overall municipal management that go beyond the scope of rating agency expectations.***
- ***GFOA has been working with City staff to show them the details of how the model works and will provide the model to the City staff at the end of the project. City staff can update and change assumptions to examine scenarios besides those we focused on in this report.***

This report also provides several recommendations for how SLC can strengthen its financial position to respond to the risks analyzed in this report, which are described in the following pages.

The City should adopt a robust reserves policy. GFOA has conducted extensive research into what it takes for a local government to be financially sustainable. We call this body of work "Financial Foundations for Thriving Communities" (Financial Foundations). This research has shown that local governments require clear decision-making boundaries. A policy on the target level of reserves that the City should maintain, and the acceptable use of those reserves provides clear decision-making boundaries for reserves. Furthermore, GFOA has found that a policy that identifies a floor and ceiling for reserves, rather than just a single target number, may provide more useful guidance. This is because a City government will rarely, if ever, have exactly the amount of reserves called for by its policy. Having a range defines the acceptable tolerances the reserves should stay within.

⁵² We will reiterate that reserves are a subset of fund balance. We are not suggesting that rating agencies would be sanguine or even just unperturbed by zero fund balance. In fact, they'd probably find such a development concerning, regardless of balances in SLC's other funds.

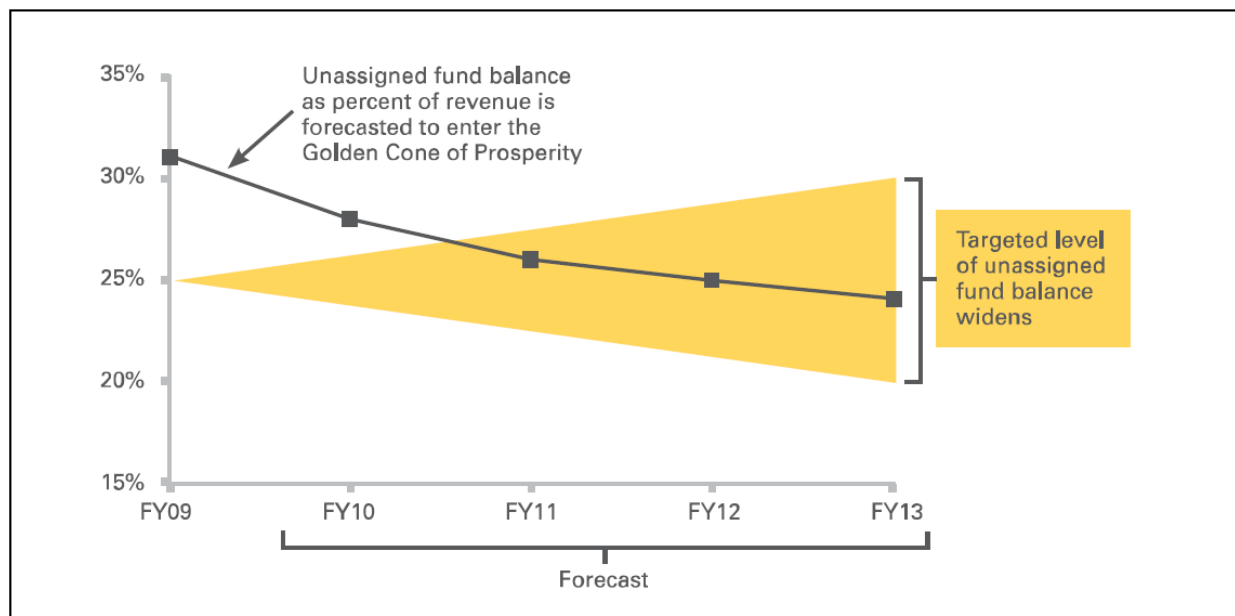
This City is currently working on a draft policy, in conjunction with GFOA, that includes all the essential features of such a policy. The policy will be presented to the City Council for formal consideration.

The City should adopt a mechanism to monitor its own compliance with the policy. GFOA's Financial Foundations research suggests that boundaries (e.g., financial policies) must be monitored in order to be fully effective.

The City of Tempe, Arizona provides a good example of how a reserve policy can be monitored. Tempe's policy is to maintain the general fund reserve equal to between 20% and 30% of general fund revenues. The general fund reserve policy is combined with Tempe's five-year financial forecast, where the goal is to keep reserves within the 20% to 30% boundary during the five-year forecast period. This approach originated in 2009 when Tempe had a policy to maintain reserves equal to 25% of general fund revenues. However, Tempe had been maintaining fund balances above 30%, which was causing some to question why Tempe was not in alignment with the policy and whether Tempe had a fund balance that was too large. The City Council and staff agreed to change the policy to set a goal for the reserves to be between 20% and 30% of revenues. This range would provide more discretion, but it would also create clear bounds for what Tempe would consider acceptable maximum and minimum reserves.

Tempe staff developed a presentation of Tempe's revenue forecast in the context of this new arrangement and informally called it the "Golden Cone of Prosperity." Exhibit 7.4 shows the presentation as it was in 2009, where the yellow cone representing the range of desired fund balance widens over the forecast horizon as the new policy is phased in and the black line representing actual fund balance gradually enters the cone.

Exhibit 7.4 — Tempe's Golden Cone of Prosperity in 2009



The meaning of the Golden Cone of Prosperity is straightforward, and its design and name give it a memorable character. As of 2020, Tempe staff still present the Golden Cone twice per year to help public

officials to understand the big picture and to show whether Tempe is staying within agreed-upon boundaries. This is a testament to the communicative power of the Golden Cone. Salt Lake City could develop a similar presentation to help make sure the City stays within its agreed upon financial boundaries.

Adopt a policy of objective forecasting and conservative budgeting. There are several policies that Salt Lake City could adopt to help make sure its on-going cost structure does not become misaligned with its on-going revenues. Such misalignment would put pressure on the City's reserves. These policies include:

- **One-time revenue policy.** Limit the use of one-time, non-recurring revenues to one-time, non-recurring expenditures or to pay down liabilities (e.g., catching up on deferred asset maintenance, like a park, road, etc.). An example of a one-time, non-recurring revenue would be proceeds from a lawsuit or the sale of an asset. Another important example is excess reserves: reserves accumulated above the ceiling amount called for in the City's policy.
- **Volatile revenue policy.** Some revenues, like sales taxes, are recurring, but they can go up and down substantially from year to year. A volatile revenue policy would treat extraordinarily high annual revenues from a volatile source as a one-time revenue. The bulk of the revenue income would be treated like a recurring revenue – it is just the extraordinary amount that would have more limited uses. This protects the City from using peak revenues to over-invest in programs that have to be supported for many years.
- **Adopt a structurally balanced budget.** Cities are required to adopt a balanced budget by law. However, this just means financial sources must be equal to uses. So, for instance, City Hall could be sold off (a non-recurring revenue) and the proceeds used to hire more firefighters (a recurring expenditure). This would, of course, be a bad idea. A structurally balanced budget policy commits the City to balancing its recurring revenues and recurring expenditures and balancing its non-recurring revenues and expenditures, separately.
- **Adopt a phased schedule of spending on non-recurring expenditures and condition spending on forecasts being met.** As part of its budget, the City could adopt a prioritized list of one-time expenditures, in addition to its regular on-going expenditures. The total of the one-time and on-going expenditures would be equal to or less than the City's projected revenue. The one-time expenditures would then be made throughout the year, in priority order, and conditioned on revenues coming in as projected. If revenues underperform the City's forecasts, then the lower priority expenditures would not be made.
- **Adopt flexible strategies for providing on-going services.** It is unlikely that all of the City's service goals can be met through one-time expenditures. New on-going services may be needed. The City could look for opportunities to adopt flexible service models, where costs can be scaled up or down. For example, contracted services often can provide flexibility that in-house staff cannot. This is not to say that in-house staffing is undesirable. There may be situations where in-house staffing is better, but there may also be opportunities where contracts can provide financial flexibility.
- **Affirmative reauthorization of spending.** The conventional approach to budgeting is that once a new service is authorized it is "baked in" to the budget and is funded year after year. This can lead to financial distress when new services are layered on top of old services. An alternative is to require affirmative reauthorization for a new service. This could be especially useful where a new service is intended to achieve some clear public policy goal. At the end of some set period, the City Council could be required to explicitly reauthorize funding based on whether or not the program is achieving its stated goals.

The City may need to consider further investments in cybersecurity. Cybersecurity is an emerging and growing threat for local governments. As we described earlier, available data suggests several sobering points:

- Local governments are the most attractive targets for cybercriminals and ransomware attacks against local governments are becoming more common.
- The amount of damage from an attack appears to only be weakly correlated to the size of the government. Data suggests that the average attack costs around \$100,000 but attacks can and have cost local governments many millions of dollars.
- Cyber insurance policies have been getting more expensive and harder to come by.

Given the points above, the City might consider the following recommendations that have implication for the City's reserves:

- Continue planning for enhanced security and make cost-effective investments in cybersecurity controls that both: A) reduce the likelihood of a successful attack; and B) reduce the potential damages, if an attack succeeds. Because reserves are ultimately a form of self-insurance there could be a strong case for using some of the City's reserves to strengthen its cybersecurity. This is because a dollar invested in prevention is usually going to be more effective than a dollar invested in remediation.
- Be prepared to retain more risk on a cyber insurance policy. If policies get substantially more expensive (or, worst case, unavailable), Salt Lake City could lower the cost by retaining more risk. This could be accounted for in the reserve amount.

For natural hazards, particularly earthquakes, consider "parametric" insurance in addition to traditional indemnity insurance. Indemnity insurance is the type of insurance that most governments have traditionally purchased, where the insurance corresponds to the value of the assets being insured and reimbursement is paid out after a certain deductible has been met. The advantage of traditional indemnity insurance is that there is a known damage threshold past which the City is covered.

Parametric insurance is a newer type of insurance for providing coverage for extreme events, having increased in popularity in the last 15 years or so in the public sector but has been in use in the private sector for decades. Parametric coverage provides the policyholder (the City) with a payment amount that is defined ahead of time, should a defined event come to pass (an earthquake larger than a given magnitude). Parametric insurance could be more useful for providing an injection of liquidity because the policyholder receives the defined payment immediately upon verification by a third-party that the given event occurred, which usually would be within a matter of days.

For Salt Lake, the most obvious potential application of parametric insurance is for cash payment upon 7.0 or greater earthquake,⁵³ after the magnitude is verified by a third-party, such as the USGS. This feature of parametric insurance also eliminates much of the administrative hassle that would be associated with a traditional indemnity policy (e.g., working with claims adjusters). A final advantage is that the proceeds from the policy payout are completely fungible – the City could use them to fund whatever service it

⁵³ Parametric policies are often developed with scaled payments, so that the City would not be in a position where it would get zero payment upon a 6.9 magnitude quake, for example.

deems necessary or to counteract revenue loss from tax base impairment, whereas indemnity policies might require the policyholder to use the funds to repair or replace the asset that was insured. As we discussed earlier, in this report taxbase impairment is a very clear and present danger arising from a very strong earthquake. Lost revenues are not reimbursable by FEMA. Further, because a larger earthquake is a relatively rare event, this should help limit the cost of obtaining such a policy.

Parametric policies are not without their drawbacks, though, and are not a substitute for traditional insurance. The City can learn more about parametric policies in the publicly available GFOA research report “Parametric Insurance: An Emerging Tool for Financial Risk Management.”⁵⁴

A robust insurance strategy could make use of both traditional indemnity and parametric insurance. For example, traditional indemnity insurance is used to protect against loss of the City’s assets, while parametric insurance could be used to compensate the City for the losses in tax revenue it would experience from an impaired tax base, for instance.

The City could consider a robust internal borrowing policy. There will always be some chance that Salt Lake could find that it needs access to more financial resources than are available in its reserves. GFOA’s research suggests that interfund borrowing could be a practical “last line of defense” in emergency circumstances. Some other funds might be able to make short-term loans to the general fund in case of an emergency. The City could develop policies to provide the flexibility to use these borrowing tools while also providing the necessary guidelines and limitations to ensure that borrowing occurs in a fiscally prudent manner.

Salt Lake might consider if a policy could recognize internal borrowing’s role as a supplementary risk management tool. A policy would “pre-position” the City to better respond to an extreme financial catastrophe. This could be especially useful given the robust financial position of many of SLC’s funds. A policy could address the following points:

- The rationale for using internal borrowing (reserves may not be able to handle every possible contingency).
- When internal borrowing may be used (if reserves are ever exhausted by an extreme event).
- Differentiate between short-term (to be paid back within the same fiscal year) and long-term borrowing.
- How the interest on the borrowing will be calculated (can have multiple alternatives to be determined on a case-by-case basis); and
- General repayment terms (e.g., interest only, fully amortized, duration, etc.).

GFOA’s analysis has its limits. It is impossible for any risk analysis to be completely comprehensive of all considerations facing the City. Appendix 1 to this report lists the important limitations of this analysis.

⁵⁴ Available at: <https://www.gfoa.org/parametric-insurance/>.

Appendix 1 – Limitations of GFOA’s Analysis

This section highlights the most important limitations of our analysis.

Our analysis is not predictive. GFOA does not forecast future recessions, natural disasters, or other extreme events. Rather, our model generates hundreds or even thousands of different scenarios to show how the future could unfold. This helps the City think more broadly about risk so that it can be more prepared for whatever future event does eventually come to pass. Finally, it is important to note that low probability events are still possible events. Hence, even if our model says an event has a low probability, then that does not mean it won’t occur.

GFOA is not a risk management consultant. We worked with the City to find out which risks the City believes are most salient and then modeled those risks quantitatively to judge the potential financial impact. We are not risk managers and it is not our role to tell the City which risks it should be more concerned about or less concerned about or what the best way is to manage those risks.

Our analysis is based on historical records. Historical data is often a good way to model potential future outcomes. However, historical data may not be perfect. For example, global climate change could increase the City’s vulnerability to naturally occurring extreme events.⁵⁵ This means that historical data could underestimate the likelihood and/or severity of extreme events in the future. Unfortunately, no one can say precisely what the impact of climate change will be. Hence, GFOA can’t speculate if an upward adjustment to the reserves is necessary and, if so, by how much. However, this does mean that there could be a case for reserving a higher amount than the efficient range described in our report (or pursuing other risk management strategies). Also, GFOA’s Microsoft Excel Risk Model provides the City with the ability to adjust the likelihood and/or magnitude of floods. This feature could be used to test different scenarios, including ones where climate change is assumed to increase the likelihood and/or magnitude of extreme events.

Our analysis is not inclusive of every risk the City could possibly face. We examined the City’s past history and worked with City staff to identify the risks that posed the most clear and present danger to the City. However, it is possible that the City could experience a shock that no one was expecting. Hence, there is a case for reserving more than our analysis suggest is efficient. This could provide additional protection against risks that no one can foresee. Being prepared for these “unknowable” events is part of the value of the “red line” or critical threshold that our reserve analysis took into account. However, this does not mean that the City doesn’t need to prepare for risks that aren’t included in our model.

Our model is focused on general fund reserves as a risk mitigation tool. Other mitigation tools, such as insurance, can provide additional resources to respond to an extreme event. We did not judge the adequacy of the City’s insurance program.

⁵⁵ According to the Fourth National Climate Assessment created by the U.S. Global Change Research Program (USGCRP) and released in November 2018: “more frequent and extreme weather and climate-related events, as well as changes in average climate conditions, are expected to continue to damage infrastructure, ecosystems, and social systems.” The report cites climate-related risks to communities “from adverse weather and climate related events such as extreme storms or wildfires.” <https://nca2018.globalchange.gov/chapter/1/>.

Good decisions do not always lead to good outcomes. Excel simulation tools can enhance one's perception and understanding of uncertainty and risk.⁵⁶ However, when dealing with uncertainty, even the best decision may not lead to a good outcome, if luck goes against you.⁵⁷ To illustrate, imagine an insurance company was willing to sell SLC an insurance policy against being hit by a meteor for \$50 million. A meteor strike is an extremely remote risk, so spending \$50 million on an insurance policy would not be a wise decision. Imagine the City does then get hit by a meteor that causes \$100 million in damage. Should you criticize the decision not to buy insurance? No, because the decision was reasonable given the information available at the time and there was no way to predict a meteor hitting the City. Similarly, our model may show that a given amount of reserves is reasonable under most conditions, but the City could encounter a confluence of undesirable events that the reserves are insufficient to address.

⁵⁶ To survive in an increasingly unpredictable world, we need to train our brains to embrace uncertainty, Emre Soyer, Quartz Magazine, January 9, 2017 <https://qz.com/879162/to-survive-in-an-increasingly-unpredictable-world-we-need-to-train-our-brains-to-embrace-uncertainty/>.

⁵⁷ This is one of the primary lessons in: Annie Duke. *Thinking in Bets: Making Smarter Decisions When You Don't Have All the Facts*. Portfolio. 2019.