

This results report is addressed to Leicestershire County Council as Administering Authority to the Leicestershire County Council Pension Fund and **must not be shared with any third party.**

# Leicestershire County Council Pension Fund

## Contribution modelling for stabilised employers

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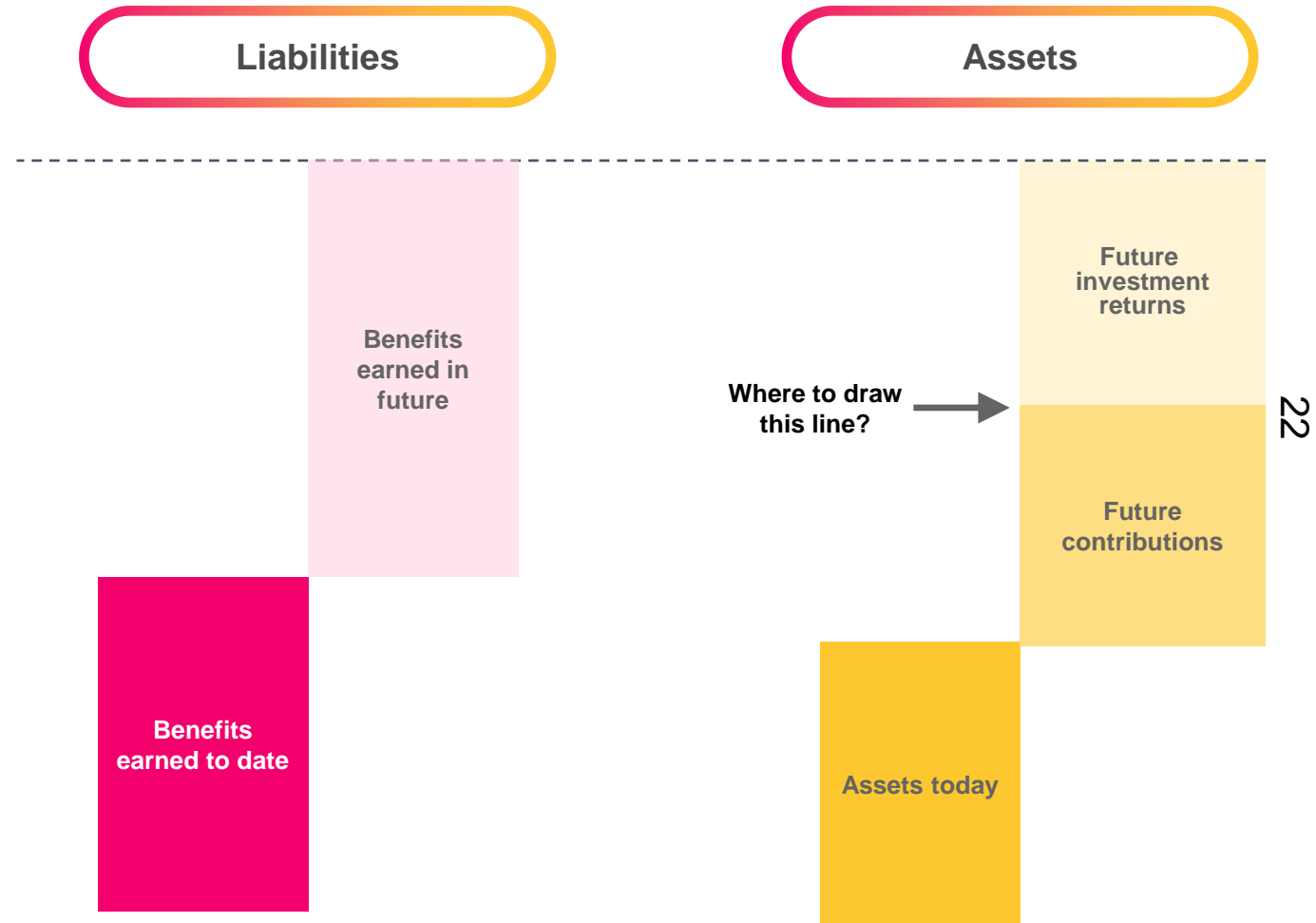
# Addressee and Purpose

- This paper has been requested by, and is addressed to, Leicestershire County Council **in its capacity as Administering Authority** to the Leicestershire County Council Pension Fund (“the Fund”).
- The modelling results contained within are in respect of the employers listed below (“the Employers”):
  - Leicestershire County Council
  - Leicestershire City Council
  - Charnwood Borough Council
  - North West Leicestershire District Council
  - Oadby & Wigston Borough Council
  - Rutland County Council
  - The Chief Constable & OPCC
- The results for the above employers will then be applied to not only their funding strategy, but other employers who participate in the Fund’s contribution stability mechanism i.e. other precepting employers.
- This is part of an investigation to allow the officers and committee to consider the interaction of the long term funding for the Employers. It should not be used for any other purpose.
- This paper has been written to provide formal funding advice following discussions with the Fund’s Officers. Any changes to the agreed funding strategy should be documented in the Funding Strategy Statement (FSS) and consulted on in line with the Regulations and guidance that governs the LGPS.
- **This paper should not be disclosed to any third parties (including the Employers or their advisers). We accept no liability to any third parties, unless expressly accepted in writing.**

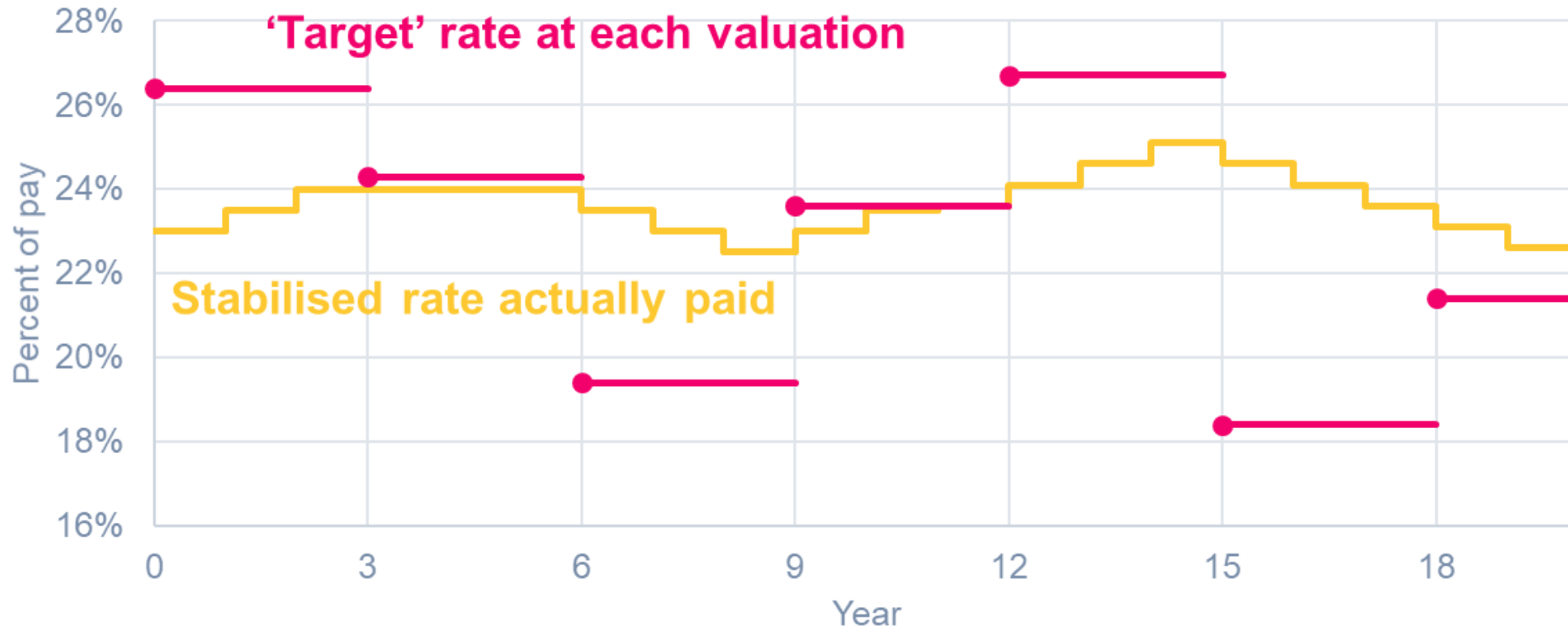
Funding strategy – stabilised  
employers

# Setting funding strategy

- The funding of members’ benefits is achieved by a combination of contributions and investment returns.
- It is therefore critical to consider how much a particular funding strategy (i.e. contribution rates) relies on future investment returns.
- This modelling considers three scenarios for future contribution rates, and 5,000 scenarios for future investment returns as these are unknown and volatile. It is important to understand how much reliance is being placed on investment returns, and therefore how much risk is involved in the funding strategy, as this may impact on future contribution requirements.
- This modelling looks at **total** contributions required (i.e. primary plus secondary) to meet the funding objective.



# Stabilisation model



**Future contributions within the model are restricted to small increases (of +/-1% p.a.) to improve stability and aid budgeting certainty for the tax-raising bodies**

# Context for results

# Strong investment returns since 2019

Asset progression (31 March 2019 = 100)



25

**Resulting in improvement in past service funding positions**

# What drives the contributions?

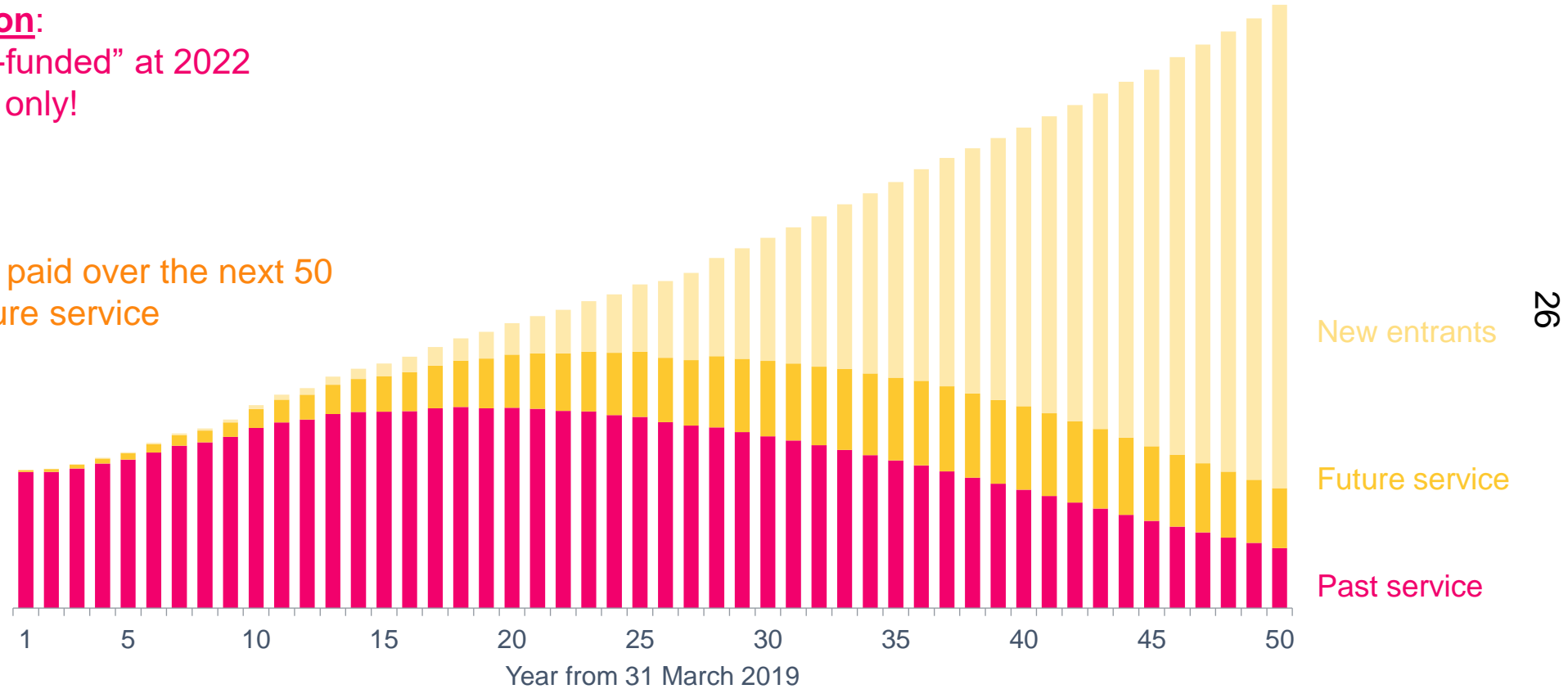
Projected benefit payments from 2019 valuation

**Past service funding position:**

Many employers will be “fully-funded” at 2022 but this refers to past service only!

**Future service**

Around 2/3rds of the benefits paid over the next 50 years will be in respect of future service



**In general cost of future benefits is more important than past service funding position**



# Future outlook has worsened

## Short to medium term outlook (next 20 years)

## Longer term outlook (20 years+)

### Expected investment returns

- Broadly unchanged since 2019 i.e. median returns of c.6.0% p.a.

- Long-term expected returns are lower now than in 2019, increasing assets required to be fully funded in 20 years\*

### Expected benefit increases

- Higher than at 2019, increasing the expected cost of benefits

- Long-term CPI inflation expectations are broadly unchanged at 2% p.a.

\*the Fund’s funding time horizon of 14 years is impacted to a similar extent

# Key risks at 2022 - 4 C's

What is the possible impact on the results?

**Consumer Prices Inflation** - higher inflationary environment

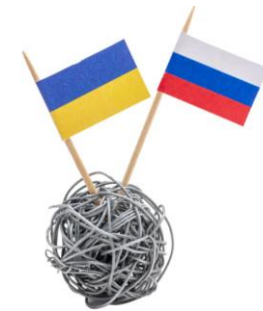
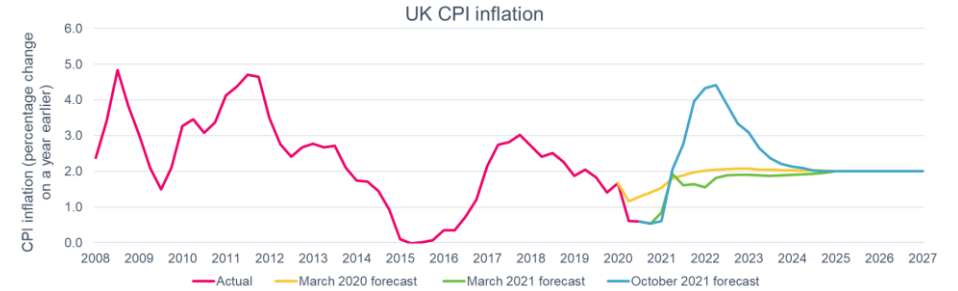
**Conflict** - economic impact of events in Ukraine

**Climate / transition risks** - TCFD requirements for funding

**COVID** - impact on long term mortality

The model already captures volatility in future returns and inflation across the 5,000 future economic scenarios modelled, so in general the long-term funding strategy should remain resilient to these risks.

However, the Fund should remain cautious despite the recent strong returns and improved past service funding positions expected at 2022.



# Summary

## Past service position

- Strong investment performance has improved the past service funding position.
- However, the cost of future benefits has a greater impact on contribution rates.

## Future outlook

- Future market conditions have worsened increasing the cost of future benefits

## Indicative impact on rates

- Improved past service funding position may help to offset any increases in the contributions needed to pay for future benefit payments.
- However, overall contribution rates may need to increase for some employers.

## Wider considerations – key risks

- The modelling allows 5,000 future economic scenarios, so volatility in markets is already captured.
- However, there remains key risks at the 2022 valuation that should be monitored and considered in the decision making around the modelling results.

# Contribution strategy modelling

# Approach to 2022 valuation review

- Adopt similar approach to 2019 valuation
- Review funding strategy for seven representative employers in the precepting employer group
- Apply results to all employers in the precepting employer group
- Desired outcomes of review
  - Set rates for next 3 years (1 April 2023 to 31 March 2026)
  - Ensure that an explicit stabilisation mechanism is appropriate in the long-term

# Why model only seven employers?

The results of the modelling carried out for the Employers is dependent on various factors which include: Maturity (% of liabilities in respect of active members), Gearing (liabilities vs payroll OR deficit vs payroll) and Net cashflow (contributions – pensions paid).

We can inspect these metrics for the precepting employers and identify similar employers. By matching ‘similar’ employers, we can generally apply the conclusions of the modelling for one employer to others in the group. This helps with the costs of the modelling exercise.

Through discussions with officers in January 2022, we have assigned appropriate groups for the modelling results to apply equally.

| Employer                                           | Contribution Rate (2022/23) | Maturity (duration) | Gearing (deficit/payroll) | Net cashflow | Similar employer |
|----------------------------------------------------|-----------------------------|---------------------|---------------------------|--------------|------------------|
| <b>Leicestershire County Council</b>               | 28.0%                       | 17.4                | 2.6                       | -0.4%        | County           |
| Melton Borough Council                             | 27.6%                       | 17.4                | 2.9                       | -0.4%        | County           |
| <b>Leicester City Council</b>                      | 27.4%                       | 18.9                | 2.0                       | 1.4%         | City             |
| <b>Charnwood Borough Council</b>                   | 33.0%                       | 17.2                | 3.7                       | -0.4%        | Charnwood        |
| Harborough District Council                        | 32.2%                       | 17.7                | 4.1                       | -0.4%        | Charnwood        |
| <b>North West Leicestershire District Council*</b> | 26.5%                       | 18.5                | 2.6                       | 0.5%         | NWLDC            |
| Blaby District Council                             | 26.9%                       | 18.5                | 2.8                       | 0.6%         | NWLDC            |
| Hinckley & Bosworth Borough Council                | 28.0%                       | 18.4                | 2.5                       | 0.7%         | NWLDC            |
| <b>Oadby &amp; Wigston Borough Council</b>         | 34.0%                       | 16.7                | 4.9                       | -1.1%        | Oadby            |
| <b>Rutland County Council</b>                      | 25.8%                       | 18.1                | 2.5                       | 0.7%         | Rutland          |
| <b>The Chief Constable &amp; OPCC</b>              | 24.5%                       | 21.8                | 1.3                       | 3.1%         | Police           |
| Fire Service Civilians                             | 25.6%                       | 21.6                | 2.1                       | 1.5%         | Police           |

\*NWLDC prepaid secondary their secondary contributions in Year 22/23 – the certified rate is 19.0%

# Key decision making framework

- **Time horizon**

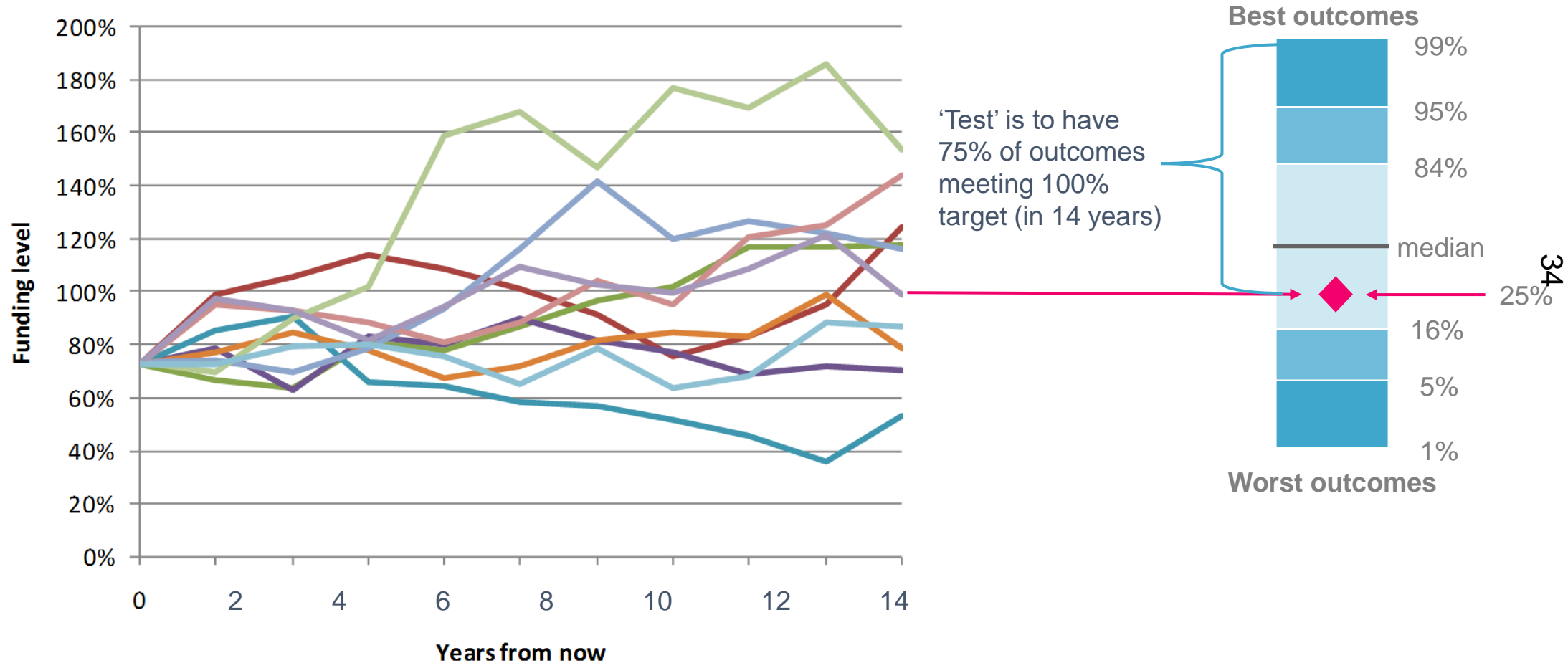
- We have considered the position after **14 years.** This reflects a continuation of the funding plan set 3 years ago (at the 2019 valuation) where a 17 year time horizon was adopted.

- **Likelihood of success ('LoS')**

- What is the “risk” tolerance? i.e. how likely will the employer be fully funded at the end of the time horizon?
- Likelihoods are shown as a snapshot at the chosen time horizon
- **Minimum likelihood (level of prudence) of 75%** was agreed at the November 2021 Committee

- **Wider considerations** including downside risk, asset shocks, climate risk, employer budgetary pressures, recent legal rulings and external scrutineers

# Method: 5,000 scenarios gives an outcome distribution



Understand future volatility and risk in a particular funding strategy



# Results

# Summary of all employers modelled

The table below summarises the likelihood of success of the contribution strategies for every employer modelled (over a 14 year time horizon).

| Modelled Employer                          | Likelihood of success          |                     |                              |
|--------------------------------------------|--------------------------------|---------------------|------------------------------|
|                                            | Increase by 1% p.a. until 2026 | Freeze (until 2026) | Reduce by 1% p.a. until 2026 |
| Leicestershire County Council              | 75%                            | 73%                 | 71%                          |
| Leicester City Council                     | 78%                            | 76%                 | 74%                          |
| Charnwood Borough Council                  | 74%                            | 72%                 | 70%                          |
| North West Leicestershire District Council | 76%                            | 73%                 | 71%                          |
| Oadby & Wigston Borough Council            | 70%                            | 68%                 | 66%                          |
| Rutland County Council                     | 74%                            | 71%                 | 68%                          |
| The Chief Constable & OPCC                 | 78%                            | 76%                 | 73%                          |

- The results suggest that the current funding strategy is still appropriate for these stabilised employers and that the Fund can continue to offer a long-term contribution stability mechanism.
- In the short-term (rates payable between 2023 and 2026), for some employers, the results suggest that the rates may need to increase from current levels to continue to meet the Fund’s desired level of prudence over the 14 year time horizon being targeted.
- When agreeing funding strategies, the decision making process also considers factors which the modelling cannot cover e.g. affordability, fairness, precedents, past agreements etc

# Contribution rate recommendations (for noting by Committee)

## Leicester City Council and The Chief Constable & OPCC (and Fire Civilians by proxy)

- the results suggest that freezing rates at current levels for next full 3 years is appropriate as this meets the 75% likelihood target.

## All other employers (except Oadby)

- In the short-term (rates payable between 2023 and 2026), the results suggest that the rates may need to increase from current levels to continue to meet the Fund's desired level of prudence over the 14 year time horizon being targeted.
- the recommendation is to increase by 1% of pay in 2023/24 only, followed by a freeze at that level in 2024/25 and 2025/26.
- The rationale for this recommendation is:
  - Affordability: whilst increasing the rates by 1% p.a. for the full 3 years would improve the funding outcomes, the Fund should recognise the current affordability issues being faced by employers.
  - Security: freezing (or reducing) contributions brings the likelihood of success below the minimum threshold. Increasing rates will provide the Fund with further protection against future funding risks.

Increasing rates in year 1 and then freezing at that level for the next 2 years strikes a balance between affordability and security.

## Oadby & Wigston Borough Council

- the results are worse than the other employers, so the recommendation is to increase contributions by 1.5% of pay in year 1, followed by a freeze at that level in years 2 & 3.

# Appendix A – inputs and methodology

# Model inputs: current rates in payment

- The rates in payment (in % of pay terms) for the final year of the existing Rates and Adjustments certificate for each modelled group are shown below and **exclude** expenses:

| Employer / Pool                            | Rate in payment (% of pay) 2022/23 |
|--------------------------------------------|------------------------------------|
| Leicestershire County Council              | 28.0%                              |
| Leicester City Council                     | 27.4%                              |
| Charnwood Borough Council                  | 33.0%                              |
| North West Leicestershire District Council | 26.5%*                             |
| Oadby & Wigston Borough Council            | 34.0%                              |
| Rutland County Council                     | 25.8%                              |
| The Chief Constable & OPCC                 | 24.5%                              |

\*NWLDC prepaid secondary their secondary contributions in Year 20/21 – the certified rate is 19.0%

- In practice, employer certified contributions are often expressed as both percentage of pay and a monetary amount. However, for the purpose of this modelling, we have converted the monetary element into % of pay terms.
- These rates are referred to as “current rate” on the following slide

# Model inputs: contribution scenarios

## All Modelled Employers

| Rate pattern   | 2021-22                                                                | 2022-23 | 2023-24           | 2024-25           | 2025-26           | Thereafter* |
|----------------|------------------------------------------------------------------------|---------|-------------------|-------------------|-------------------|-------------|
| Increase       | Current contributions as certified in Rates and Adjustment certificate |         | Current rate + 1% | Current rate + 2% | Current rate + 3% | Stabilised  |
| Step down      |                                                                        |         | Current rate – 1% | Current rate – 2% | Current rate – 3% | Stabilised  |
| Freeze 3 years |                                                                        |         | Current rate      | Current rate      | Current rate      | Stabilised  |

\* Stabilisation mechanism set at +/- 1% of pay p.a.

# Model inputs: investment strategies

- For the purpose of exploring the contribution rate strategies in this modelling, we have only considered the Fund’s current long-term investment strategy.
- The table details the asset allocation of the investment strategy we have modelled (this was provided by the Fund)..

| Asset Class                        | Current strategic |
|------------------------------------|-------------------|
| <b>Total Growth</b>                | <b>55.25%</b>     |
| UK equities                        | 5.0%              |
| Global equity                      | 32.0%             |
| Emerging market equity             | 5.0%              |
| Diversified Growth                 | 7.5%              |
| Private equity                     | 5.75%             |
|                                    |                   |
| <b>Total Income</b>                | <b>36.75%</b>     |
| Property                           | 10.0%             |
| Multi-asset credit (sub inv grade) | 4.0%              |
| Private lending                    | 10.5%             |
| Emerging Market Debt               | 2.5%              |
| Infrastructure                     | 9.75%             |
|                                    |                   |
| <b>Total Protection</b>            | <b>7.5%</b>       |
| Medium ILGs                        | 4.5%              |
| UK corp bonds (A rated average)    | 3.0%              |
|                                    |                   |
| <b>Total Cash</b>                  | <b>0.5%</b>       |
| Cash                               | 0.5%              |
|                                    |                   |
| <b>TOTAL</b>                       | <b>100%</b>       |

# Model inputs: liabilities and assets

## Liabilities

- Liability values are based on membership data for the Employer groups provided as at 31 March 2021 by the Fund, and the methodology from the 2019 valuation
- The assumptions used for the funding position summary on the following page are shown here in Table 1.
- The liability values at the end of the projection period (funding time horizon) are calculated using the ongoing funding target which uses the financial assumptions set out in Table 2. The demographic assumptions match those that applied at the 2019 formal funding valuation
- The liabilities include an allowance for changes to members’ benefits resulting from the McCloud case. However, no allowance has been made for the Cost Cap valuation (which currently remains unknown).

**Table 1**

| % p.a.            | 31 March 2019 | 31 March 2021 |
|-------------------|---------------|---------------|
| Discount rate     | 3.8%          | 3.6%          |
| Salary increases  | 2.8%          | 2.9%          |
| Pension increases | 2.3%          | 2.3%          |

**Table 2**

| Funding target assumption |                                          |
|---------------------------|------------------------------------------|
| Discount rate             | 2.2% above risk free market rate         |
| Salary increases          | Consumer Price Index Inflation plus 0.5% |
| Pension increases         | Consumer Price Index inflation           |

## Assets

- Asset values are taken from 31 March 2021 HEAT.

**Assets and liabilities are valued consistently**



# Model inputs: liabilities and assets

| 31 March 2021<br>(£m)    | County       | Melton     | City         | Charnwood   | Harborough | NWL        | Blaby      | Hinckley   | Rutland    | Oadby      | Chief constable | Fire        |
|--------------------------|--------------|------------|--------------|-------------|------------|------------|------------|------------|------------|------------|-----------------|-------------|
| <b>Liabilities</b>       |              |            |              |             |            |            |            |            |            |            |                 |             |
| Actives                  | 489          | 12         | 622          | 45          | 21         | 45         | 31         | 36         | 29         | 9          | 138             | 14          |
| Defferreds               | 287          | 9          | 285          | 28          | 11         | 20         | 12         | 14         | 24         | 10         | 48              | 8           |
| Pensioners               | 777          | 24         | 655          | 75          | 31         | 49         | 30         | 35         | 45         | 27         | 81              | 12          |
| <b>Total liabilities</b> | <b>1,552</b> | <b>45</b>  | <b>1,562</b> | <b>148</b>  | <b>63</b>  | <b>114</b> | <b>73</b>  | <b>86</b>  | <b>98</b>  | <b>46</b>  | <b>266</b>      | <b>34</b>   |
| <b>Asset share</b>       | <b>1,475</b> | <b>41</b>  | <b>1,542</b> | <b>132</b>  | <b>56</b>  | <b>111</b> | <b>66</b>  | <b>79</b>  | <b>91</b>  | <b>39</b>  | <b>271</b>      | <b>34</b>   |
| <b>Surplus/(deficit)</b> | <b>(77)</b>  | <b>(4)</b> | <b>(20)</b>  | <b>(16)</b> | <b>(7)</b> | <b>(3)</b> | <b>(7)</b> | <b>(7)</b> | <b>(7)</b> | <b>(8)</b> | <b>5</b>        | <b>0</b>    |
| <b>Funding level</b>     | <b>95%</b>   | <b>91%</b> | <b>99%</b>   | <b>90%</b>  | <b>89%</b> | <b>97%</b> | <b>90%</b> | <b>92%</b> | <b>93%</b> | <b>83%</b> | <b>102%</b>     | <b>100%</b> |

43

Figures may not sum exactly due to rounding. 2021 assets are from HEAT, liabilities have been calculated using membership data as at 31 March 2021.

# Comparison with 2019 figures

| 31 March 2019 (£m)       | County       | Melton     | City         | Charnwood   | Harborough  | NWL         | Blaby       | Hinckley    | Rutland     | Oadby       | Chief constable | Fire       |
|--------------------------|--------------|------------|--------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-----------------|------------|
| <b>Liabilities</b>       |              |            |              |             |             |             |             |             |             |             |                 |            |
| Actives                  | 419          | 12         | 558          | 39          | 19          | 37          | 25          | 30          | 24          | 10          | 115             | 14         |
| Deferreds                | 282          | 9          | 281          | 28          | 10          | 20          | 13          | 12          | 21          | 10          | 43              | 6          |
| Pensioners               | 745          | 22         | 597          | 75          | 30          | 47          | 28          | 34          | 42          | 24          | 69              | 11         |
| <b>Total liabilities</b> | <b>1,446</b> | <b>43</b>  | <b>1,436</b> | <b>141</b>  | <b>58</b>   | <b>103</b>  | <b>66</b>   | <b>77</b>   | <b>87</b>   | <b>45</b>   | <b>227</b>      | <b>31</b>  |
| <b>Asset share</b>       |              |            |              |             |             |             |             |             |             |             |                 |            |
| <b>Asset share</b>       | <b>1,276</b> | <b>35</b>  | <b>1,301</b> | <b>115</b>  | <b>48</b>   | <b>90</b>   | <b>55</b>   | <b>66</b>   | <b>75</b>   | <b>34</b>   | <b>216</b>      | <b>29</b>  |
| <b>Surplus/(deficit)</b> |              |            |              |             |             |             |             |             |             |             |                 |            |
| <b>Surplus/(deficit)</b> | <b>(170)</b> | <b>(8)</b> | <b>(135)</b> | <b>(26)</b> | <b>(11)</b> | <b>(13)</b> | <b>(11)</b> | <b>(11)</b> | <b>(12)</b> | <b>(11)</b> | <b>(11)</b>     | <b>(2)</b> |
| <b>Funding level</b>     |              |            |              |             |             |             |             |             |             |             |                 |            |
| <b>Funding level</b>     | <b>88%</b>   | <b>82%</b> | <b>91%</b>   | <b>81%</b>  | <b>81%</b>  | <b>87%</b>  | <b>83%</b>  | <b>85%</b>  | <b>86%</b>  | <b>76%</b>  | <b>95%</b>      | <b>93%</b> |

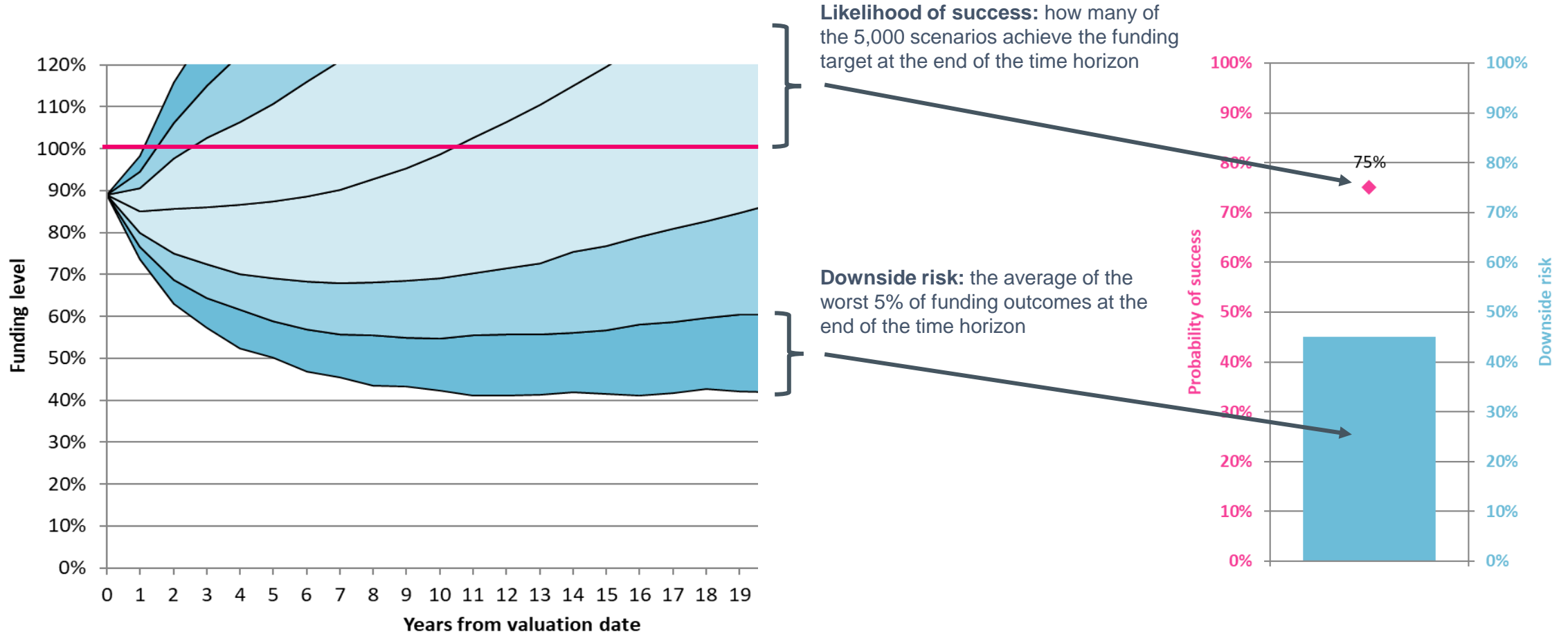
44

Figures may not sum exactly due to rounding.

# Methodology

- This modelling is a form of asset-liability modelling (“ALM”).
- Assets are projected forward from 31 March 2021 using membership data at that date under 5,000 different outcomes for future market and economic conditions. See “Reliances, limitations and additional details” appendix for details of the expected return on assets, economic conditions and the associated volatilities.
- For each outcome (5,000 per scenario), we calculate the funding position annually throughout the projection period.
- The funding position uses the same methodology as at the 2019 formal valuation.
- We then rank the 5,000 outcomes from best to worst and we plot the outcomes graphically (as shown in the following two pages).
- We can then compare the range of outcomes with other scenarios.
- Please note the following likelihoods are adopted for each graph (please see the key on the following page for further details)
  - Lightest coloured ranges represent middle 2/3rds of the outcomes
  - The range above and below this shows 1 in 6 outcomes each
  - This range is further split into 1 in 10 for the next lightest range and 1 in 20 for the darkest range of outcomes
  - The best and worst 1% of outcomes are not shown on the graphs

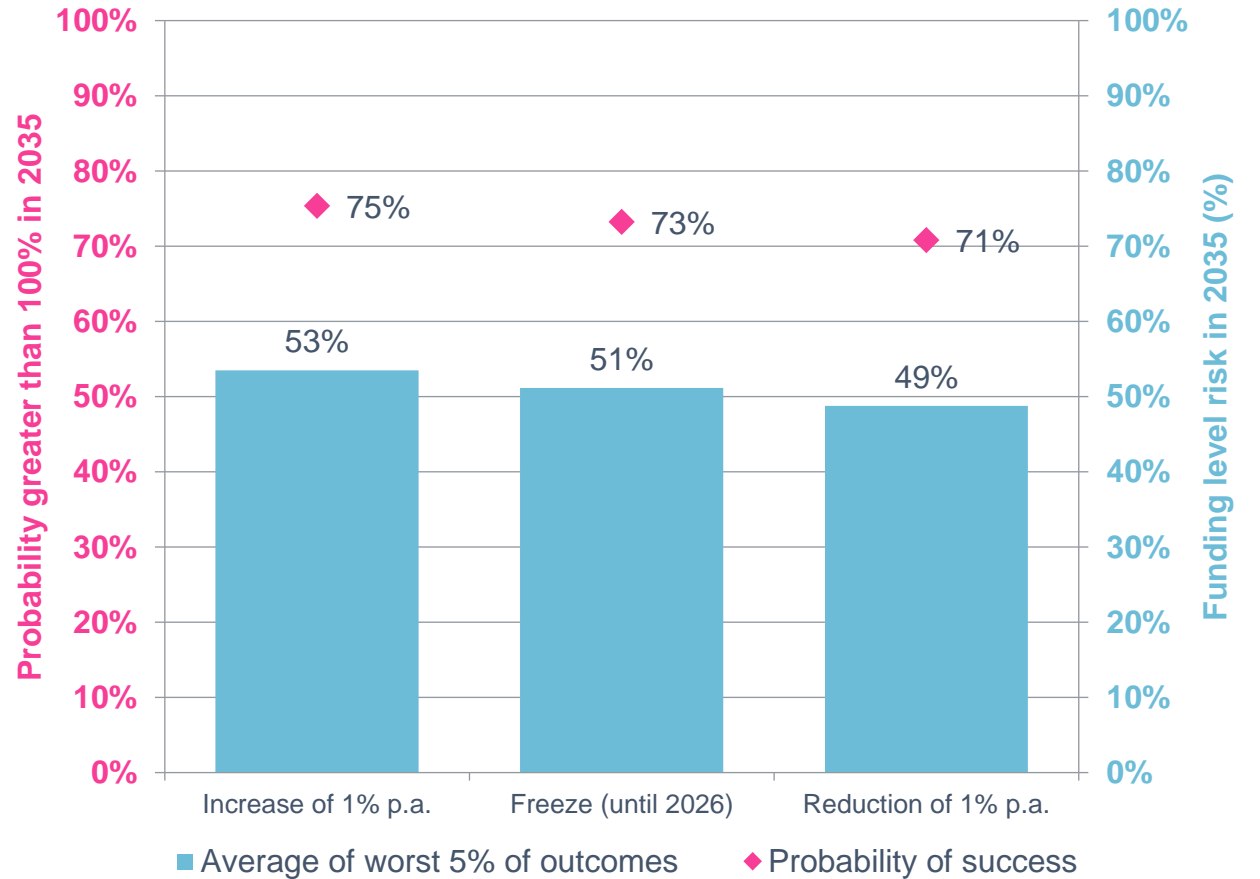
# Method: Understanding and comparing risk



Compare and contrast the outcomes (risk measures) for different contribution and investment strategies

# Example of modelling results: Leicestershire County Council

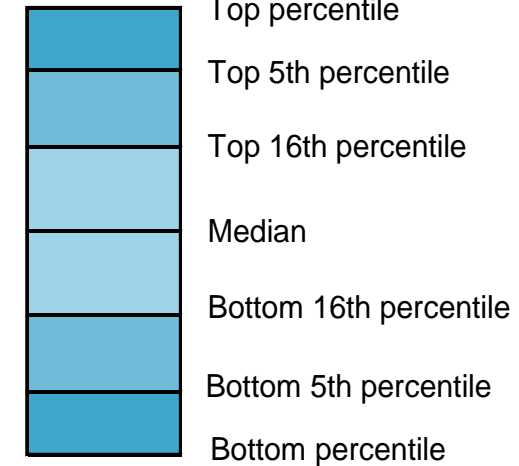
- At a high level, results look positive in all scenarios
- However, a strategy of freezing or reducing contribution rates over the next 3 years falls below the minimum likelihood target of 75%
- Increasing contributions by 1% p.a. for the next 3 years meets the minimum likelihood target and will provide the Fund with protection against future risks (e.g. fall in assets).



# Appendix B - Technical & Professional Notes

# Reliances, limitations and additional details (1)

- We undertake 5,000 simulations of the future for each scenario. The outcomes of the simulations are ranked from “best” to “worst”. The spread of outcomes at a given point in time for a given strategy can be illustrated in charts as follows.
- The “median” funding level can be considered to be the average outcome. It should be noted that this is not the same as saying this is the most likely outcome, rather it represents the value with which we would expect all outcomes to have a 50% chance of being above and a 50% chance of being below.
- The bottom 16th percentile – approximately 1 outcome in 6 is worse than this level.
- The top 16th percentile – approximately 5 outcomes in 6 would be expected to be below this level.
- The bottom 5th percentile can be considered a “bad” outcome – 1 outcome in 20 of the simulations is expected to be worse than this.
- The top 5th percentile can be considered a “good” outcome – 19 outcomes in 20 of the simulations are expected to be below this level.
- The bottom percentile can be considered an “extremely bad” outcome, which occurs with a probability of 1 in 100.
- The top percentile can be considered an “extremely good” outcome, which occurs with a probability of 1 in 100.
- When plotting the distribution of contribution rates, rather than funding levels, the description of any outcome as ‘bad’ or ‘good’ is reversed.
- In all the charts we consider, there will be some outcomes above and below the highest and lowest levels shown.



# Reliances, limitations and additional details (2)

## Data – Cashflows

In projecting forward the evolution of the Fund, we have used the assets from HEAT as at 31 March 2021.

## Data – ESS

The distributions of outcomes depend significantly on the Economic Scenario Service (ESS), our (proprietary) stochastic asset model. This type of model is known as an economic scenario generator and uses probability distributions to project a range of possible outcomes for the future behaviour of asset returns and economic variables. Some of the parameters of the model are dependent on the current state of financial markets and are updated each month (for example, the current level of equity market volatility) while other more subjective parameters do not change with different calibrations of the model.

Key subjective assumptions are the average excess equity return over the risk free asset (tending to approximately 3% p.a. as the investment horizon is increased), the volatility of equity returns (approximately 18% p.a. over the long term) and the level and volatility of yields, credit spreads, inflation and expected (breakeven) inflation, which affect the projected value placed on the liabilities and bond returns. The market for CPI linked instruments is not well developed and our model for expected CPI in particular may be subject to additional model uncertainty as a consequence. The output of the model is also affected by other more subtle effects, such as the correlations between economic and financial variables.

Our expectation (i.e. the average outcome) is that long term real interest rates will gradually rise from their current low levels. Higher long-term yields in the future will mean a lower value placed on liabilities and therefore our median projection will show, all other things being equal, an improvement in the current funding position (because of the mismatch between assets and liabilities). The mean reversion in yields also affects expected bond returns.

While the model allows for the possibility of scenarios that would be extreme by historical standards, including very significant downturns in equity markets, large systemic and structural dislocations are not captured by the model. Such events are unknowable in effect, magnitude and nature, meaning that the most extreme possibilities are not necessarily captured within the distributions of results.



## Reliances, limitations and additional details (3)

Given the context of this modelling, we have not undertaken any sensitivity analysis to assess how different the results might be with alternative calibrations of the economic scenario generator, or allowances for resource & environment constraints.

We would be happy to provide fuller information about the scenario generator, and the sensitivities of the results to some of the parameters, on request.

### Model

Except where stated, we do not allow for any variation in actual experience away from the demographic assumptions underlying the cash flows. Variations in demographic assumptions (and experience relative to those assumptions) can result in significant changes to the funding level and contribution rates. We allow for variations in inflation (RPI or CPI as appropriate), inflation expectations (RPI or CPI as appropriate), interest rates and asset class returns. Cash flows into and out of the Scheme are projected forward in annual increments, are assumed to occur in the middle of each Scheme year and do not allow for inflation lags. Investment strategies are assumed to be rebalanced annually.

Unless stated otherwise, we have assumed that all contributions are made and not varied throughout the period of projection irrespective of the funding position. In practice the contributions are likely to vary especially if the funding level changes significantly.

Investment strategy is also likely to change with significant changes in funding level, but unless stated otherwise we have not considered the impact of this.

The returns that could be achieved by investing in any of the asset classes will depend on the exact timing of any investment/disinvestment. In addition, there will be costs associated with buying or selling these assets. The model implicitly assumes that all returns are net of costs and that investment/disinvestment and rebalancing are achieved without market impact and without any attempt to 'time' entry or exit.

For the purposes of modelling very low investment risk strategies or matched bond portfolios, we have constructed an LBP (liability benchmark portfolio) that is a hypothetical portfolio that exactly matches the changes in value and cash flows of the liabilities (with a particular allowance for accrual) under all states of the world. It is generally not possible in practice to construct a portfolio with the same high quality of matching as the LBP but major financial and investment risks can be broadly quantified. However, a more detailed analysis is required to understand fully the implications and appropriate implementation of a very low risk or 'cash flow matched' strategy.

# Reliances, limitations and additional details (4)

## Assumptions

We have estimated future service benefit cash flows and projected salary roll for new entrants after the valuation date such that payroll remains constant in real terms (i.e. full replacement). There is a distribution of new entrants introduced at ages between 25 and 65, and the average age of the new entrants is assumed to be 40 years. All new entrants are assumed to join and then leave service at SPA, which is a much simplified set of assumptions compared with the modelling of existing members. The base mortality table used for the new entrants is an average of mortality across the LGPS and is not client specific, which is another simplification compared to the modelling of existing members. Nonetheless, we believe that these assumptions are reasonable for the purposes of the modelling given the highly significant uncertainty associated with the level of new entrants.

There are a number of different types of increases applied before and after retirement to benefits payable from the Fund. A judgement always has to be made as the most appropriate assets from the ESS to model the strategy under consideration. We have agreed this with yourselves during the scoping stage and further details are in the appendices.

## TAS Compliance

The models used to carry out this modelling, and this presentation, comply with Technical Actuarial Standards 100 (Principles for Technical Actuarial Work) and 300 (Pensions).

# Reliances, limitations and additional details (5)

31 March 2021 ESS calibration summary:

|          | Annualised total returns        |                             |                           |                |          |                      |                       |               |                                    |                                   | Inflation (RPI) | 17 year real yield (RPI) | Inflation (CPI) | 17 year real yield (CPI) | 17 year yield |      |
|----------|---------------------------------|-----------------------------|---------------------------|----------------|----------|----------------------|-----------------------|---------------|------------------------------------|-----------------------------------|-----------------|--------------------------|-----------------|--------------------------|---------------|------|
|          | Cash                            | Index Linked Gilts (medium) | Index Linked Gilts (long) | Private Equity | Property | Emerging Market Debt | Infrastructure Equity | Global Equity | Multi Asset Credit (sub inv grade) | Absolute Return Bonds (inv grade) |                 |                          |                 |                          |               |      |
| 5 years  | 16th %ile                       | -0.3%                       | -3.2%                     | -4.4%          | -7.1%    | -3.5%                | -3.3%                 | -5.0%         | -3.4%                              | 0.5%                              | 1.1%            | 2.0%                     | -2.4%           | 1.0%                     | -2.2%         | 0.8% |
|          | 50th %ile                       | 0.4%                        | -0.3%                     | -0.8%          | 5.1%     | 2.5%                 | 1.9%                  | 4.1%          | 4.5%                               | 3.3%                              | 2.0%            | 3.6%                     | -1.6%           | 2.6%                     | -1.4%         | 1.9% |
|          | 84th %ile                       | 1.2%                        | 2.6%                      | 2.9%           | 18.9%    | 8.8%                 | 7.2%                  | 14.1%         | 12.3%                              | 5.2%                              | 2.9%            | 5.2%                     | -0.7%           | 4.1%                     | -0.4%         | 3.1% |
| 10 years | 16th %ile                       | 0.1%                        | -2.5%                     | -3.7%          | -3.1%    | -1.3%                | -1.3%                 | -1.8%         | -0.8%                              | 1.8%                              | 1.3%            | 1.9%                     | -1.8%           | 1.0%                     | -1.7%         | 1.0% |
|          | 50th %ile                       | 1.1%                        | -0.5%                     | -1.4%          | 5.8%     | 3.2%                 | 2.6%                  | 4.9%          | 5.1%                               | 3.7%                              | 2.5%            | 3.5%                     | -0.5%           | 2.6%                     | -0.5%         | 2.4% |
|          | 84th %ile                       | 2.3%                        | 1.6%                      | 1.2%           | 15.6%    | 8.0%                 | 6.6%                  | 12.0%         | 10.7%                              | 5.3%                              | 3.7%            | 5.2%                     | 0.7%            | 4.3%                     | 0.7%          | 4.1% |
| 20 years | 16th %ile                       | 0.6%                        | -2.0%                     | -3.1%          | 0.4%     | 0.8%                 | 0.7%                  | 0.9%          | 1.6%                               | 3.0%                              | 2.2%            | 1.2%                     | -0.7%           | 0.8%                     | -0.7%         | 1.3% |
|          | 50th %ile                       | 2.0%                        | -0.3%                     | -1.4%          | 6.8%     | 4.2%                 | 3.7%                  | 5.9%          | 5.9%                               | 4.6%                              | 3.6%            | 2.8%                     | 1.0%            | 2.3%                     | 1.0%          | 3.2% |
|          | 84th %ile                       | 3.6%                        | 1.5%                      | 0.4%           | 13.6%    | 8.1%                 | 6.9%                  | 11.0%         | 10.3%                              | 6.3%                              | 5.1%            | 4.4%                     | 2.7%            | 3.9%                     | 2.7%          | 5.7% |
|          | <b>Volatility (Disp) (1 yr)</b> | 0%                          | 7%                        | 9%             | 28%      | 14%                  | 12%                   | 21%           | 17%                                | 6%                                | 2%              | 1%                       |                 | 1%                       |               |      |

53

This calibration of the model indicates that a period of outward yield movement is expected. For example, over the next 20 years our model expects the 17-year maturity annualised real (nominal) interest rate to rise from -2.3% (1.3%) to 1.0% (3.2%).

# Reliances, limitations and additional details (6)

Resulting increases in average volatility under climate change scenario modelling:

| Variable                 | Mean volatility in core ESS (p.a.) | Increase in mean volatility for climate scenarios (p.a.) |             |                  |
|--------------------------|------------------------------------|----------------------------------------------------------|-------------|------------------|
|                          |                                    | Moderate 60%ile                                          | High 75%ile | Very high 85%ile |
| Global equity returns    | 15.7%                              | 1.07%                                                    | 3.70%       | 6.08%            |
| CPI inflation            | 1.52%                              | 0.077%                                                   | 0.39%       | 0.69%            |
| Credit spreads           | 0.55%                              | 0.011%                                                   | 0.16%       | 0.30%            |
| Real yields (detrended*) | 0.31%                              | 0.014%                                                   | 0.08%       | 0.15%            |

- Volatilities vary slightly over the 20 year period – the above are averages
- \*Real yields have a definite pathway from now until year 20 so we look for high volatility after stripping out the trend

54

Volatility is defined as the sample standard deviation of the 5 values in each 5-year period. Mean volatility is the arithmetic (weighted) mean of these volatilities over all 5,000 trials.

# General risk warning

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