

### **Board of Trustees Meeting Agenda**

Wednesday, April 23, 2025 1:00 P.M.

- I. Call to Order (Mr. Kelly Breland, Chair)
  - A. Invocation
  - B. Pledge of Allegiance
  - C. Approval of Agenda
  - **D.** <u>Approval of Minutes</u> February 26, 2025
- II. Report of Administrative Committee (Mr. Bill Benson)
  - A. <u>Certification of Board Election Results</u> -Retiree Representative
  - B. <u>Actuarial Experience Study</u>
  - C. Other
- III. Report of Legislative Committee (Mr. George Dale)
  - A. 2025 Legislative Update
  - B. Other
- IV. Report of Investment Committee (Dr. Randy McCoy)
  - A. <u>Global Manager Finalist Presentation</u>
  - B. Other
- V. Staff Reports
  - A. <u>Retiree Report</u>
  - B. Investment Report
- VI. Economic Interest Disclosures
- VII. Adjourn

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<b>O</b> PERS	Board of Trustees Meeting Agenda Wednesday, February 26, 2025			
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	L Call to Order (Mr. Kelly Breland, Chair) A. Invocation B. Pledge of Allegiance C. Approval of Agenda D. Approval of Minutes - February 5, 2025 E. Employee of Quarter- (April-June 2025)			
	II. Report of Administrative Committee (Mr. Bill Banson) A. Refiree Representative Board Election – Cartification of Ballot B. PERS Funding Policy Revisions C. Annual Crediting of Interest on Member Accounts D. Regulation 60: Contribution Rates E. Other			
	III. Report of Defined Contribution Committee (Dr. Brian Rutledge) A. Watchlist B. ORP Plan Document C. Other			
	IV. Report of Legislative Committee (Mr. George Dale) A. Update on 2025 Legislative Session B. Other			
	V. Report of Investment Committee (Dr. Randy McCoy) A. Pathway Capital Management – Private Equity Investments Fifth Series B. Other			
	VL Disability Appeals Committee			
	Staff Reports A. Retiree Report B. Investment Report			
	VIII. Economic Interest Disclosures			
	IX. Adjourn			
P11/				
Board Members:	Mr. Keily Breiand, Board Chair Dr. Randy McCoy   Mr. Bill Benson, Board Vice Chair State Treasurer David McRae   Mr. George Dale Dr. Brian Rutledge   Mr. Chris Graham Dr. Jay Smith   Ms. Kim Hanna Mr. Terrance Yarbrough			

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The Public Employees' Retirement System of Mississippi (PERS) Board of Trustees met Wednesday, February 26, 2025, at 429 Mississippi Street, Jackson, MS 39201. This meeting was duly announced to the public Tuesday, February 11, 2025, at 5:19 p.m., on the Public Meetings Notice website of the Mississippi Department of Finance and Administration, as well as was posted in the PERS lobby, on the PERS website, and on the PERS YouTube channel.

#### **BOARD MEMBER ATTENDEES**

In Person: Board Chair Mr. Kelly Breland, Mr. Bill Benson, Mr. George Dale, Mr. Chris Graham, Ms. Kimberly Hanna, Dr. Randy McCoy, and Dr. Brian Rutledge. Via Teleconference: None. Absent: State Treasurer David McRae, Dr. Jay Smith, and Mr. Terrance Yarbrough. Current Board Vacancies: None.

#### LEGISLATIVE LIAISON ATTENDEES

In Person: None.

#### STAFF ATTENDEES

In Person: Executive Director Ray Higgins; Chief Investment Officer Charles Nielsen; Counsel and Policy Advisor Davetta Lee; Member and Employer Services Deputy Director Mason Frantom; Benefit Services Deputy Director Lisa Green; Deputy Director Administrative Services Melanie Estridge; David DeGuire, Jason Clark, and Ryan Holliday, Investments; Chief Technology Officer Mike Lowry; Maurice Gilliam, Billy Means, Frank Giddens, Janet Mobley, Will Smith, Dedra Flowers, Christy McCombs, Chris Renfroe, Matt King, Alex Edmunds, Meaghan Humber, Ken Nason, Kevin Waite, and Eric Bennett, Information Technology; Comptroller Tracy Day; Barbara Lawson, Christy Smith, and Cindy Byars, Accounting; Employer Reporting Program Administrator Alisa Evans; Member Account Support Program Administrator Chris Hudson; and Communications Director Shelley Powers.

#### **GUEST ATTENDEES**

**In Person:** Assistant Attorney General Caroline Johnson; Ray Wright, Mississippi Joint Legislative Committee on Performance Evaluation; Ed Koebel, CavMac; Phil Sutphin, Retired Education Personnel of Mississippi; Allan Cooper, Mississippi Department of Finance and Administration; and Emily Tschiffely, Legislative Budget Office.

#### CALL TO ORDER

Board Chair Breland called the meeting to order at 1:01 p.m.

#### INVOCATION

McCoy gave the invocation.

#### PLEDGE OF ALLEGIANCE

McCoy led the Pledge of Allegiance.

#### AGENDA

- Motion: To approve the meeting agenda.
  - Made by: Dale.
  - Seconded by: Graham.
  - o Discussion: None.
  - Voting for: Benson, Breland, Dale, Graham, Hanna, McCoy, and Rutledge.
  - Voting against: None.
  - Absent: McRae, Smith, and Yarbrough.
  - Duly Passed.

#### MINUTES

- Motion: To approve the minutes of the February 5, 2025, PERS Board of Trustees' special called meeting.
  - Made by: Rutledge.
  - Seconded by: Hanna.
  - o **Discussion:** None.
  - Voting for: Benson, Breland, Dale, Graham, Hanna, McCoy, and Rutledge.
  - Voting against: None.
  - Absent: McRae, Smith, and Yarbrough.
  - Duly Passed.

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#### EMPLOYEE OF THE QUARTER

Breland presented the Employee of the Quarter for April through June 2025, to Eric Bennett, Information Technology.

#### **REPORT OF THE ADMINISTRATIVE COMMITTEE**

Committee Chair Benson reported that the Administrative Committee met the morning of February 26, 2025, and approved the following items for Board consideration.

#### **Retiree Representative Board Election – Certification of Ballot**

Benson presented the Board with the ballot and biographies for the retiree representative election for the term that runs from July 2025 to June 2031. The candidates for the election are as follows:

- Dr. Johnny L. Allen of Rienzi ...... Retired 2015
- Attorney Barbara M. Blackmon of Canton ...... Retired 2024
- Dr. Melody L. Fortune of Ridgeland......Retired 2023
- Dr. Randy McCoy of Tupelo (incumbent) ...... Retired 2009
- Mr. Fred Nelson, Jr. of Jackson......Retired 2015
- Dr. Sherry M. Ponder of Waveland......Retired 20210
- Motion: To certify the ballot for the retiree representative election for the term that runs from July 2025 to June 2031.
  - Made by: Benson.
    - Seconded by: Graham.
    - Discussion: None.
    - Voting for: Benson, Breland, Dale, Graham, Hanna, McCoy, and Rutledge.
    - Voting against: None.
    - **Absent:** McRae, Smith, and Yarbrough.
    - Duly Passed.

#### (Addendum A – Retiree Election Ballot and Biographies)

#### **PERS Funding Policy Revisions**

Benson presented the Board with recommended changes to the PERS Funding Policy that adopt the actuarially determined contribution (ADC) as policy, along with any financial assistance as necessary to incorporate recent changes in state law.

- Motion: To approve revisions to the PERS Funding Policy, as recommended to incorporate the actuarially determined contribution (ADC) as policy, along with any financial assistance as necessary to incorporate recent changes in state law.
  - Made by: Benson.
  - Seconded by: Rutledge.
  - Discussion: None.
  - Voting for: Benson, Breland, Dale, Graham, Hanna, McCoy, and Rutledge.
  - Voting against: None.
  - Absent: McRae, Smith, and Yarbrough.
  - Duly Passed.

(Addendum B – Funding Policy Revisions)

#### **Annual Crediting of Interest to Member Accounts**

Benson presented the Board with the 2025 Interest Rate for Member Accounts report, in accordance with Board Regulation 62, as follows:

In 2016, the PERS Board of Trustees approved the amendment of Regulation 62 to adjust the interest rate for member accumulation accounts. The interest rate is now calculated based on the money market rate as published by the Wall Street Journal on December 31 each year with a minimum rate of 1 percent and a maximum rate of 5 percent.

On December 31, 2024, the Money Market rate published in the Wall Street Journal was 0.42 percent; therefore, the interest rate paid shall remain set at the minimum rate of 1 percent as of July 1, 2025.

• **Motion:** To approve the 2025 Interest Rate for Member Accounts report presented by staff and to approve the interest rate for member accumulated accounts to remain set at the minimum rate of 1 percent as of July 1, 2025.

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- Made by: Benson. 0
- Seconded by: McCov. 0
- Discussion: None. 0
- Voting for: Benson, Breland, Dale, Graham, Hanna, McCov, and Rutledge, 0
- Voting against: None. 0
- Absent: McRae, Smith, and Yarbrough. 0
- Duly Passed. 0

#### **Regulation 60: Contribution Rates**

Benson presented the Board with the following staff-recommended changes to Regulation 60 (effective July 1, 2025) for initial approval:

Amend §§ 101 and 104 to update the employer contribution rate for the Public Employees' Retirement System and the Optional Retirement Program from 17.9 percent to 18.4 percent in accordance with Senate Bill 3231 as passed during the 2024 Legislative Session. In accordance with Miss. Code Ann. § 25-11-411, ORP employers shall contribute the same amount the employer would be required to contribute to PERS if the participant were a member.

- Motion: To provide initial approval of staff-recommended changes to Regulation 60 to update the employer . contribution rate for PERS and ORP from 17.9 percent to 18.4 percent, effective July 1, 2025, in accordance with Senate Bill 3231 as passed during the 2024 Legislative Session.
  - Made by: Benson. 0
  - Seconded by: Graham. 0
  - Discussion: None. 0
  - Voting for: Benson, Breland, Dale, Graham, Hanna, McCoy, and Rutledge. 0
  - Voting against: None. 0
  - Absent: McRae, Smith, and Yarbrough. 0
  - Duly Passed. 0

#### (Addendum C – Regulation 60)

#### **REPORT OF THE DEFINED CONTRIBUTION COMMITTEE**

Committee Chair Rutledge reported that the Defined Contribution Committee met February 25, 2025, and heard a market update and performance review from Callan on Mississippi Deferred Compensation and the Optional Retirement Plan. He also presented the Board with the following items for consideration.

#### Watchlist

Rutledge presented the Board with the staff recommendation to remove Wellington Small Cap from the Mississippi Deferred Compensation (MDC) Watchlist.

- Motion: To remove Wellington Small Cap from the Mississippi Deferred Compensation Watchlist, per staff recommendation.
  - Made by: Rutledge. 0
  - Seconded by: Benson. 0
  - o Discussion: None.
  - o Voting for: Benson, Breland, Dale, Graham, Hanna, McCoy, and Rutledge.
  - Voting against: None.
  - Absent: McRae, Smith, and Yarbrough. 0
  - 0 Duly Passed.

#### (Addendum D – MDC Watchlist)

#### **ORP Plan Document**

Rutledge presented the Board with the following staff-recommended routine changes to the Optional Retirement Plan for initial adoption, effective July 1, 2025.

Amend Section 4.1 Plan Contributions to update the employer contribution rate from 17.90 percent to 18.40 percent in accordance with Senate Bill 3231 as passed during the 2024 Legislative Session. In accordance with Miss. Code Ann. § 25-22-411, ORP employers shall contribute the same amount the employer would be required to contribute to PERS if the participant were a member.

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- Motion: To approve for initial adoption the Optional Retirement Plan Document routine amendments as recommended by staff effective July 1, 2025.
  - Made by: Rutledge. 0
    - Seconded by: Graham. 0
    - 0 Discussion: None.
  - Voting for: Benson, Breland, Dale, Graham, Hanna, McCoy, and Rutledge. 0
  - Voting against: None. 0
  - Absent: McRae, Smith, and Yarbrough. 0
  - Duly Passed. 0

#### (Addendum E – ORP Plan Document)

#### **REPORT OF THE LEGISLATIVE COMMITTEE**

Committee Chair Dale reported that the Legislative Committee met the morning of February 26, 2025, and heard an overview of pending legislation for the 2025 session and heard a lengthy discussion. No committee action was taken.

#### **REPORT OF THE INVESTMENT COMMITTEE**

Committee Chair McCoy reported that the Investment Committee met February 25, 2025. He said the committee heard a market update and performance review from Callan, a Capital Market Assumptions overview from Callan, an update on the Global Equity Manager Search Updates, updates from International Equity Investment managers Marathon, Arrowstreet, and Baillie Gifford, as well as heard two miscellaneous updates. No committee action was taken on those items. McCoy reported that cash from the assumptions held constantly at 3 percent; core fixed income went down from 5.25 to 4.75 percent; public equities were down a bit; and inflation held at 2.5 percent. Using those assumptions, a 10-year geometric return for PERS was projected to be 7.3 percent, just above the 7 percent PERS strives for each year. He also reported that the current PERS portfolio has a 53 percent probability of achieving the 7 percent discount rate and a low probability that it will ever have a negative return over the 10-year horizon reviewed. He said the PERS portfolio performance for the total fund was 3.8 percent fiscal year to date (as of December 31, 2024) and that PERS has out-performed its policy benchmarks over the past 5-, 7-, 10-, and 15-year periods. PERS' estimated fiscal year-to-date return as of February 24, 2025, was 6.6 percent, which, he said, is a good start toward our 7 percent over these next four months.

McCoy brought the following before the Board for consideration:

#### Pathway Capital Management – Private Equity Investments Fifth Series

McCoy presented the Board a recommendation for a continued partnership with a fifth commitment of \$720 million to a new Pathway 2025 Private Equity Fund Series.

- Motion: To approve, per staff recommendation, a continued partnership with Pathway Capital Management for a fifth • commitment of \$720 million to a new 2025 Private Equity Fund Series.
  - Made by: McCoy. 0
  - Seconded by: Benson. 0
  - 0 Discussion: None.
  - Voting for: Benson, Breland, Dale, Graham, Hanna, McCoy, and Rutledge. 0
  - Voting against: None. 0
  - Absent: McRae, Smith, and Yarbrough. 0
  - Duly Passed. 0

(Addendum F - Pathway Capital Management)

#### **REPORT OF THE DISABILITY APPEALS COMMITTEE**

Higgins presented the recommendations to the Board of the Disability Appeals Committee (DAC).

The DAC heard sworn testimony, received evidence, and gave due consideration to the applicable laws and regulations for the following case:

PERS No. 25-02 - This matter came on for hearing before the DAC January 27, 2025. The DAC submits to the Board of Trustees its Proposed Statement of Facts, Conclusions of Law, and Recommendation that the Claimant's request for nonduty-related disability benefits be approved.

Motion: To accept the findings of the DAC and approve the DAC recommendations.

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- Made by: Rutledge. 0
- Seconded by: Graham. 0
- Discussion: None. 0
- Voting for: Benson, Breland, Dale, Graham, Hanna, McCov, and Rutledge. 0
- Voting against: None. 0
- Absent: McRae, Smith, and Yarbrough. 0
- Duly Passed. 0

#### (Addendum G – Disability Appeals Summary)

#### **RETIREE REPORT**

Higgins presented the Retiree Report for the Board's approval.

- Motion: To approve the Retiree Report.
  - Made by: Benson. 0
  - Seconded by: Hanna. 0
  - Discussion: None. 0
  - Voting for: Benson, Breland, Dale, Graham, Hanna, McCoy, and Rutledge. 0
  - Voting against: None. 0
  - Absent: McRae, Smith, and Yarbrough. 0
  - 0 Duly Passed.

#### (Addendum H - Retiree Report)

#### **INVESTMENT REPORT**

Higgins presented the Investment Report. He requested board approval of this report, as well as of all trades and transactions performed by the PERS Investments division since the December 18, 2024, board meeting.

- Motion: To approve the Investment Report, as well as all trades and transactions performed by the PERS Investments division since the December 18, 2024, board meeting.
  - Made by: Benson. 0
  - Seconded by: McCoy. 0
  - Discussion: None. 0
  - Voting for: Benson, Breland, Dale, Graham, Hanna, McCoy, and Rutledge. 0
  - Voting against: None. 0
  - Absent: McRae, Smith, and Yarbrough. 0
  - 0 Duly Passed.

#### (Addendum I - Investment Report)

#### ECONOMIC INTEREST ETHICS DISLOSURE

Higgins advised the Board of the May 1, 2025, deadline for submission of their Economic Interests Ethics Disclosure.

#### **ADJOURN**

- Motion: To adjourn. .
  - Made by: McCoy.
  - Seconded by: Rutledge. 0
  - Discussion: None. 0
  - Voting for: Benson, Breland, Dale, Graham, Hanna, McCoy, and Rutledge. 0
  - Voting against: None. 0
  - 0 Absent: McRae, Smith, and Yarbrough.
  - **Duly Passed.** 0

Breland called the meeting adjourned at 1:17 p.m.

Respectfully Submitted,

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H. Ray Higgins, Jr. *Executive Director* Public Employees' Retirement System

HRH

Mr. Kelly Breland *Chair* PERS Board of Trustees



April 17, 2025

Public Employees Retirement System of Mississippi 429 Mississippi Street Jackson, MS 39201

Dear Davetta Lee:

The attached report contains the results from the election for the 2025 PERS of MS Retiree Election for the Public Employees Retirement System of Mississippi.

Thank you. It has been a pleasure working with you.

Sincerely yours,

Mi Bashit

Chris Backert CEO YesElections

1775 I St NW Suite 1150 Washington, DC 20006 155 Mineola Blvd. Suite 102 Mineola, NY 11501 4275 Executive Sq. Suite 200 San Diego, CA 92037

(866) 514-2995 YesElections.com 9/331



#### Results

Race	Candidate/Choice	Votes
Retiree Representative	Dr. Randy D. McCoy	11,949
Retiree Representative	Attorney Barbara M. Blackmon	4,914
Retiree Representative	Dr. Johnny L. Allen	2,583
Retiree Representative	Dr. Sherry M. Ponder	2,090
Retiree Representative	Dr. Melody L. Fortune	1,208
Retiree Representative	Mr. Fred Nelson, Jr.	1,123

1775 I St NW Suite 1150 Washington, DC 20006 155 Mineola Blvd. Suite 102 Mineola, NY 11501 4275 Executive Sq. Suite 200 San Diego, CA 92037

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Candidate	Votes	Percentage
МсСоу	11,949	50.06%
Blackmon	4,914	20.59%
Allen	2,583	10.82%
Ponder	2,090	8.76%
Fortune	1,208	5.06%
Nelson	1,123	4.71%
	23,867	100.00%

Half of Total Votes 11,933.50

**Review of Experience Study Findings** Study Period: Fiscal Years 2020 through 2024

## **Public Employees Retirement System of Mississippi**





## About CavMac



### Your CavMac Team



Ed Koebel EA, FCA, MAAA *Chief Executive Officer* 



Ben Mobley ASA, FCA, MAAA *Consulting Actuary* 



Darby Carraway Pursuing ASA *Consultant* 



Devon von Miller Pursuing ASA Senior Actuarial Analyst



Amara Conte Pursuing ASA *Actuarial Analyst* 



- Background information and purpose of the experience study
- Review of key experience study findings and recommended changes
- Cost impact of proposed changes



## **The Actuarial Model**







- Purpose: to review and evaluate all actuarial assumptions and methods used in the actuarial valuation process
  - How well did current assumptions model actual experience?
  - Should they continue to be used? If not, how should they be changed?
- Performed every two years for PERS but for a 4-year period
  - This study covers fiscal years 2020 through 2024 so includes Covid pandemic which must be considered in evaluating experience
  - New assumptions will be used in the upcoming June 30, 2025 actuarial valuations
- No "right" answer so professional judgment heavily drives recommendations, especially for smaller groups
- Guided by Actuarial Standards of Practice (ASOPs)

## Review of Actuarial Methods



	Current Method	Recommendation
Actuarial cost method	Entry Age Normal	No change
Asset smoothing method	5-year closed smoothing	No change
UAL Amortization Policy		
Amortization bases	New base established each year	No change
Amortization period	25-year period for all bases	No change
Payments	Level Percent of Payroll	No change

## **Actuarial Assumptions**



- Assumptions are forward looking
  - No "correct" assumptions, but a range of reasonable assumptions
  - Assumptions impact the cost pattern for contributions and funding metrics
  - More aggressive assumptions are likely to generate actuarial losses in future years; more conservative assumptions are likely to generate actuarial gains
- Assumptions are <u>long-term</u> estimates (30+ years)
  - Experience emerges and is measured short term
  - Year to year fluctuations are expected and reflected in the valuation process
- Assumptions do not affect the true cost of the System, i.e., the actual benefit payments
- Actuary makes recommendations, but the ultimate responsibility for the selection of assumptions resides with the Retirement Board



- Compare actual experience during study period with expected results, based on current assumptions, to evaluate whether to make changes
  - Key metric is A/E Ratio: Actual result/Expected result
- Past experience provides strong guidance for some assumptions (like mortality) and weak guidance for others (economic experience)

### • Both science and art

- Objective (science): number crunch of actual and expected numbers of members and rate of occurrence
- Subjective (art): interpreting the information, assigning credibility to the experience and deciding on appropriate changes. Involves professional judgment.





## Individual Impact of Assumption Changes



	Assumption Change	Usual Impact on Liabilities and Actuarial Contribution
E	conomic Assumptions	
•	Decrease investment return	Increase
•	Lower salary increases	Decrease
D	emographic Assumptions	
•	Decrease mortality (longer lifetime)	Increase
•	Earlier retirements	Increase
•	Increase termination rates	Decrease



- It is not uncommon to recommend changes to many assumptions as a result of an experience study, but the impact of the assumption changes varies
- Assumptions with largest cost impact for PERS
  - Investment return assumption
  - Mortality assumption
  - Retirement assumption
- Of all of these, the impact of the investment return assumption is most significant



- Price inflation represents annual increase in cost of living, measured by CPI
- Current assumption is 2.40%
- Indirectly impacts the valuation as a component of other economic assumptions
  - Investment return assumption
  - Individual salary increase assumption
- Inflation assumption must be consistent among all economic assumptions



Source	<b>Expected Inflation</b>
Callan	2.50%
2024 Horizon Survey (20 years)	2.44%
Bond market December 2024 (30 years)	2.30%
2024 Social Security report (75 years)	2.40%
Survey of Professional Forecasters (10 years)	2.23%
Other Public Plans	2.46%

- The current assumption of 2.40% is within the reasonable range of current inflation expectations.
- Based on the data, we recommend no change to the inflation assumption.



- Critical assumption in the valuation process
- Used to discount future benefit payments to "present value" (current lump sum value)
- Direct impact on the calculation of liabilities and costs
- Considerations in setting this assumption
  - System's asset allocation is key driver
  - Expected real rates of return on asset classes
  - Underlying inflation assumption
  - Industry trends note different plans have different asset allocations so not directly comparable

## CavMac's Forward-Looking Expectations



- Current assumption is 7.00%:
  - 2.40% inflation and 4.60% real rate of return

Source	Real Rate of Return	Inflation Assumption	Nominal Return
Callan CAPM	5.01%	2.40%	7.41%
Horizon Survey (10 years)	4.64%	2.40%	7.04%
Horizon Survey (20 years)	5.00%	2.40%	7.40%

### 2024 Peer Group Comparison





This graph shows that investment return assumptions for large US public retirement systems decreased significantly between 2011 and 2021.

The median return appears to have stabilized at 7.0%.

## Recommendation for Investment Return Assumption



- The outlook for investment return tends to vary dramatically with the point in time at which it is measured.
- In our professional opinion, the investment return assumption is reasonable and can be retained.

	Current	Proposed
Real Rate of Return	4.60%	4.60%
Assumed Inflation	<u>2.40%</u>	<u>2.40%</u>
Net investment return	7.00%	7.00%



- Current assumption varies with years of service, i.e., a service-based assumption
- Actual pay increases for employees over the past four years are well known in the State of Mississippi
  - System has experienced nearly \$1.5B in net losses due to higher salaries
- Actual/Expected (A/E) ratio is over 100% at all service levels
- However, we believe these salary increases may not be indicative of the expected long-term future rates
- Therefore, we recommend no change in the salary increase assumption at this time

# **PERS Plan**



## **Retiree Mortality Assumption**





Mississippi State Department of Health - Report Card 2023

Mortality varies by many factors including:

- Geography
- Marital Status
- Education
- Income
- Gender

## **Retiree Mortality Assumption**



- Current assumption uses the Pub-2010 Public Safety <u>Headcount</u> Weighted Below Median Mortality Tables
  - Further adjustments due to credible data analysis and Generational mortality projection using MP-2020 Scale
- The experience indicates that the post-retirement mortality rates were very close to anticipated for service and disabled retirees and higher than expected for contingent annuitants
- Recommend PERS adopt the Pub-2010 Public Safety <u>Benefit</u> Weighted Below Median Mortality tables with separate tables for service retirees and contingent annuitants
  - Further modifications in setbacks/set forwards and adjustments due to credible data analysis with Generational mortality projection using the updated MP-2021 Scale



Instead of relying entirely on the counts of deaths, we utilized a weighted experience approach which better reflects the impact demographic experience has on liability measures. We weight decrements from active service with the monthly salary of the individual members, and we weight the post-retirement mortality experience with the monthly retirement benefits of the individuals. We still review the actual counts of actual and expected decrements, but it is used for informational purposes only.

Mortality Headcount-Weighted Basis									
Exposures Actual Expected A/E Ratio									
Service Retirements									
Males	130,430	5,272	4,778	110%					
Females	248,213	6,863	6,259	110%					
Beneficiaries									
Males	11,845	480	354	136%					
Females	36,634	1,923	1,635	118%					
Disability Retirements	Disability Retirements								
Males	10,304	524	493	106%					
Females	14,965	617	539	114%					

Mortality Liability-Weighted Basis						
	Exposures	Actual	Expected	<u>A/E Ratio</u>		
Service Retirements						
Males	4,002,555	146,691	152,696	96%		
Females	6,304,884	152,750	149,689	102%		
Beneficiaries						
Males	172,205	8,017	6,076	132%		
Females	755,684	42,777	39,530	108%		
Disability Retirements						
Males	219,745	9,971	10,501	95%		
Females	300,043	11,242	10,479	107%		

Amounts in thousands

## **Retiree Mortality Assumption**









- Withdrawals include all nonvested and vested terminations
- Currently a select and ultimate age & service-based assumption
- Actual terminations show more withdrawals occurred on a headcount basis, however, less liabilities were released from the System than expected
- Recommend modifying the current assumption to better fit the actual experience (resulting A/E ratio is closer to 100%)



Withdrawal Headcount Basis						
	Exposures <u>Actual</u> Expected <u>A/E Ra</u>					
Males	177,824	22,735	21,196	107%		
Females	323,540	39,444	36,902	107%		

Withdrawal Liability-Weighted Basis (\$ in thousands)							
	<u> </u>	Exposures		<u>Actual</u>	<u>Ex</u>	<u>pected</u>	<u>A/E Ratio</u>
Males	\$	8,265,091	\$	807,833	\$	836,273	97%
Females	\$	13,403,084	\$	1,324,899	\$	1,329,848	100%




- Currently rates of retirement are assumed at every age and service combination
  - Frequently, what is happening in the economy has an impact on when retirements occur
- For retirements with less than 25 years of service:
  - Actual retirements less than anticipated for males,
  - Actual retirements more than anticipated for females
- For retirements with 25 or more years of service:
  - Actual retirements slightly less than anticipated for both males and females
- Recommend adjustment to the rates to reflect the experience as well as maintain a reasonable degree of margin

### Retirement from Active Employment



Retirements - Greater than 25 years of service Headcount Basis						
Exposures Actual Expected A/E Rat						
Males	15,560	3,335	3,409	98%		
Females	26,509	5,796	5,902	98%		

Retirements - Greater than 25 years of service Liability-Weighted Basis (\$ in thousands)							
	E	xposures		<u>Actual</u>	<u>E</u>	<u>xpected</u>	<u>A/E Ratio</u>
Males	\$	1,057,518	\$	222,448	\$	230,202	97%
Females	\$	1,489,291	\$	324,991	\$	325,415	100%



### Disability Retirement from Active Employment



- Currently rates of disability retirement are assumed at every age
- Actual rates of disability retirement were much less than expected for all age groups and for both males and females
- Recommend lowering the rates to reflect the experience

### Disability Retirement from Active Employment



Disability Headcount Basis					
Exposures <u>Actual Expected</u> <u>A/E Ratio</u>					
Males	209,951	270	320	84%	
Females	375,978	323	420	77%	

Disability Liability-Weighted Basis (\$ in thousands)						
Exposures <u>Actual Expected A/E Ratio</u>						
Males	\$ 10,106,881	\$	10,662	\$	16,001	67%
Females	\$ 15,946,817	\$	12,388	\$	18,096	68%



# **HSPRS Plan**

### Termination of Employment



- Currently an age-based assumption
- Actual terminations show more withdrawals occurred than anticipated
  - 64 actual terminations vs. 44 expected
  - A/E Ratio equal to nearly 150%
- Recommend increasing the current assumption to better fit the actual experience (resulting A/E ratio is closer to 100%)



CENTRAL	NUMBE	RAWALS	
AGE OF GROUP	Actual	Expected	Ratio of Actual to Expected
20	0	1	0.000
25	6	11	0.545
30	16	10	1.600
35	13	8	1.625
40	10	7	1.429
45	10	5	2.000
50	8	2	4.000
53 & over	1	0	0.000
TOTAL	64	44	1.455





- Currently rates of retirement are assumed at every service level
  - Frequently, what is happening in the economy or recent payroll increases has an impact on when retirements occur
- More retirements than expected occurred during the past four years
  - 98 actual retirements vs. 78 expected
- Recommend adjustment to the rates to reflect the experience as well as maintain a reasonable degree of margin

### Retirement from Active Employment



YEARS	NUMBER OF RETIREMENTS					
OF SERVICE	A ctual	Expected	Ratio of Actual to Expected			
Under 20	2	1	2.000			
20	1	4	0.250			
21	5	6	0.833			
22	7	4	1.750			
23	7	4	1.750			
24	11	6	1.833			
25	14	11	1.273			
26	8	9	0.889			
27	13	13	1.000			
28	9	6	1.500			
29	4	1	4.000			
30	5	2	2.500			
31	1	1	1.000			
32	2	2	1.000			
33	2	2	1.000			
34	2	2	1.000			
Subtotal	93	74	1.257			
35	1	1	1.000			
36	1	0	0.000			
37	0	0	0.000			
38	2	2	1.000			
39	0	0	0.000			
40 & over	1	1	1.000			
GRAND TOTAL	98	78	1.256			





- Current assumption varies with years of service, i.e., a servicebased assumption
- Actual pay increases for HSPRS officers over the past four years are not as high as PERS
  - System has only experienced \$32k in net losses due to higher salaries and only 2022 was more than expected
- We believe the current salary increases are indicative of the expected long-term future rates
- Therefore, we recommend no change in the salary increase assumption at this time

# **SLRP Plan**





- Currently an age-based assumption based on election years and non-election years
- Actual terminations show less withdrawals occurred than anticipated during election year and matched exactly for non-election years
  - It actual terminations vs. 15 expected during election years
- Recommend decreasing the current assumption during election years to better fit the actual experience (resulting A/E ratio is closer to 100%)

## Termination of Employment



CENTRAL	NUMBER OF WITHDRAWALS DURING ELECTION YEAR					
AGE OF GROUP	Actual	Expected	Ratio of Actual to Expected			
20	0	0	0.000			
25	0	0	0.000			
30	0	0	0.000			
35	0	1	0.000			
40	0	1	0.000			
45	5	4	1.250			
50	2	3	0.667			
53 & over	3	6	0.500			
TOTAL	10	15	0.667			

CENTRAL	NUMBER OF WITHDRAWALS DURING NON-ELECTION YEARS					
AGE OF GROUP	Actual	Expected	Ratio of Actual to Expected			
20	0	0	0.000			
25	0	0	0.000			
30	0	0	0.000			
35	0	0	0.000			
40	1	1	1.000			
45	2	1	2.000			
50	0	1	0.000			
53 & over	3	3	0.000			
TOTAL	6	6	1.000			



- Currently rates of retirement are assumed at every age level and during election years and non-election years
- Less retirements than expected occurred during the past four years
  - 17 actual retirements vs. 28 expected during election years
  - 5 actual retirements vs. 18 expected during non-election years
    - However, most of these expected are after age 80
- Recommend adjustment to the rates during election year to reflect the experience as well as maintain a reasonable degree of margin



	NUMBER OF RETIREMENTS DURING ELECTION YEAR				
AGE OF GROUP	Actual	Expected	Ratio of Actual to Expected		
50	1	1	1.000		
55	0	2	0.000		
60	6	5	1.200		
65	3	5	0.600		
70	3	4	0.750		
75	1	4	0.250		
Subtotal	14	21	0.667		
80 and Over	3	7	0.429		
GRAND TOTAL	17	28	0.607		

	NUMBE DURING N	R OF RETIRE	RETIREMENTS LECTION YEARS		
AGE OF GROUP	Actual	Expected	Ratio of Actual to Expected		
50	1	0	0.000		
55	0	0	0.000		
60	0	1	0.000		
65	3	2	1.500		
70	0	1	0.000		
75	1	1	1.000		
Subtotal	5	5	1.000		
80 and Over	0	13	0.000		
GRAND TOTAL	5	18	0.278		



- Current assumption varies with age, i.e., an age-based assumption
- Actual pay increases for legislators over the past four years were higher than anticipated due to longer legislative sessions
  - System has experienced \$1.2M in net losses due to the higher salaries, however, during the first year of the study (2021), the Plan experienced the highest increases
- We believe the current salary increase assumption is more indicative of the expected long-term future rates than what the Plan has experienced
- Therefore, we recommend no change in the salary increase assumption at this time

# **Summary and Financial Impact**





Economic Assumption	Current Assumption	CavMac Recommendation
Price inflation	2.40%	No Change
Real rate of return	4.60%	No Change
Nominal investment return	7.00%	No Change

#### Recommended Changes to Demographic Assumptions



Assumption	PERS	HSPRS	SLRP
Retirement	Minor adjustments	Minor adjustments	Decrease during election year
Termination	Decrease rates	Increase rates	Decrease during election year
Disability	Decrease rates	No change	No change
Salary Scale	No change	No change	No change
Mortality	Amount-Weighted Table with modifications and MP-2021 Projection Scale	Same as PERS	Same as PERS

### Cost Impact of Proposed Assumption Changes



PERS (\$in millions)	2024 Valuation	Mortality Change	Retirement Change	Withdrawal Change	Disability Change	After All Changes
2024 Valuation Unfunded Acccrued Liability (UAL)	\$26,498	\$28,156	\$26,256	\$26,185	\$26,183	\$26,184
2024 Funded Ratio	55.9%	54.4%	56.1%	56.2%	56.2%	56.2%
Actuarially Determined Contribution (ADC) Rate Normal Cost Accrued Liability Total	2.57% <u>23.35%</u> 25.92%	3.86% <u>24.77%</u> 28.63%	2.58% <u>23.14%</u> 25.72%	2.55% <u>23.08%</u> 25.63%	2.54% <u>23.08%</u> 25.62%	2.51% <u>23.08%</u> 25.59%
Funded Ratio in 2047	53.7%					55.4%

Based on the 6/30/2024 actuarial valuation. Actual impact on the 6/30/2025 valuation will differ.





HSPRS (\$ in thousands)	Before All Changes	After All Changes
2024 Valuation Unfunded Accrued Liability (UAL)	\$231,089	\$234,994
2024 Funded Ratio	65.5%	65.2%
2024 Actuarially Determined Employer Contribution (ADEC)	53.09%	52.87%
Projected Funding Ratio 2047*	80.5%	79.3%

Based on the 6/30/2024 actuarial valuation. Actual impact on the 6/30/2025 valuation will differ.



SLRP (\$ in thousands)	Before All Changes	After All Changes
2024 Valuation Unfunded Accrued Liability (UAL)	\$7,442	\$7,000
2024 Funded Ratio	74.7%	75.9%
2024 Actuarially Determined Employer Contribution (ADEC)	8.53%	8.18%
Projected Funding Ratio 2047*	86.9%	92.8%

Based on the 6/30/2024 actuarial valuation. Actual impact on the 6/30/2025 valuation will differ.



We, Ed Koebel, EA and Ben Mobley, ASA, are consulting actuaries with CavMac. We are members of the American Academy of Actuaries and meet the Qualification Standards of the American Academy of Actuaries to render the actuarial opinions contained herein. We are available to answer any questions or provide additional information as needed.

Ed Koebel, EA, FCA, MAAA Chief Executive Officer and Consulting Actuary

Ben Mobley, ASA, FCA, MAAA Consulting Actuary



## Appendix Supplemental Information



### Historical Inflation (Measured 6/30/2024)





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Period	Inflation
100 Years	2.96%
60 Years	3.94%
50 Years	3.79%
40 Years	2.81%
30 Years	2.54%
20 Years	2.55%
10 Years	2.80%

#### Distribution of Inflation Assumption (Public Plans)





#### From 2024 NASRA Public Fund Survey

#### Peer Group Return Assumptions





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The key takeaway from this graph is PERS' current assumption (7.00%) is in line with other public funds.

#### Distribution of Return Assumption (Public Plans)



#### Distribution of latest investment return assumptions



53 of the 131 Plans (40%) in the Survey use an investment return assumption equal to 7.0%, by far the most common assumption.

However, asset allocations vary which may impact the selection of the investment return assumption, along with the Board's risk perspective.





Note: Investment mixes may differ significantly between funds.

## Public Employees' Retirement System of Mississippi



Experience Study for the Four-Year Period Ending June 30, 2024

Prepared as of June 30, 2024



66/331



April 16, 2025

The Board of Trustees Public Employees' Retirement System of Mississippi 429 Mississippi Street Jackson, MS 39201

Members of the Board:

We are pleased to submit the results of an investigation of the economic and demographic experience for the Public Employees' Retirement System (PERS) and the Municipal Retirement Systems (MRS) for the four-year period from July 1, 2020 to June 30, 2024. The study was based on the data submitted by PERS for the annual valuation. In preparing this report, we relied, without audit, on the data provided.

The results of the experience study are the basis for recommended changes in the actuarial assumptions, which if adopted by the Board, will be first used for the June 30, 2025 valuation. With the Board's approval of the recommendations in the report, we believe the actuarial condition of the System will be more accurately portrayed. We would like to acknowledge the help in the preparation of the data for this investigation given by the PERS staff.

The purpose of the investigation was to assess the reasonability of the current PERS economic assumptions and demographic actuarial assumptions for each Retirement System. Actuarial assumptions are used to measure and budget future costs. Changing assumptions will not change the actual cost of future benefits. Once the assumptions have been adopted, the actuarial valuation measures the adequacy of the fixed contribution rate.

All recommended rates of separation, mortality and salary increase at each age or service level are shown in the attached tables in Appendix D of this report. In the actuary's judgment, the rates recommended are suitable for use until further experience indicates that modifications are desirable.

In order to prepare the measurement of the impact on liabilities in this report, we have utilized actuarial models that we developed to measure liabilities and develop actuarial costs. These models include tools that we have produced and tested, along with commercially available valuation software that we have reviewed to confirm the appropriateness and accuracy of the output. In utilizing these models, we develop and use input parameters and assumptions about future contingent events along with recognized actuarial approaches to develop the needed results.

We hereby certify that, to the best of our knowledge and belief, this report is complete and accurate and has been prepared in accordance with generally recognized and accepted actuarial principles and practices which are consistent with the principles prescribed by the Actuarial Standards Board (ASB) and the Code of Professional Conduct and Qualification Standards for Public Statements of Actuarial Opinion of the American Academy of Actuaries.



Board of Trustees April 16, 2025 Page 2

In particular, we have prepared the assumptions developed in this report in keeping with our understanding of Actuarial Standards of Practice No. 27 (Selection of Assumptions for Measuring Pension Obligations).

We note that as we prepare this report, the world has been in a pandemic during much of the experience study period. We have taken this into consideration as we reviewed the experience, particularly regarding mortality, retirement, termination and disability patterns. While we do not believe that there is yet sufficient data to warrant the significant modification of any of our assumptions specifically due to COVID-19, we will continue to monitor the situation and advise the Board in the future of any adjustments that we believe would be appropriate.

The experience investigation was performed by, and under the supervision of, independent actuaries who are members of the American Academy of Actuaries with experience in performing valuations for public retirement systems. The undersigned meet the Qualification Standards of the American Academy of Actuaries to render the actuarial opinion contained herein.

Respectfully submitted,

Edward J. Hockel

Edward J. Koebel, EA, FCA, MAAA Chief Executive Officer

Ben Moble

Ben Mobley, ASA, FCA, MAAA Consulting Actuary



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Public Employees' Retirement System of Mississippi July 1, 2020 Through June 30, 2024 Experience Study



#### SECTION I - EXECUTIVE SUMMARY

The purpose of an actuarial valuation is to provide a timely best estimate of the ultimate costs of a retirement system. Actuarial valuations of the Mississippi Public Employees' Retirement System (PERS) and the Mississippi Municipal Retirement System (MRS) are prepared annually to determine the actuarial contribution rate required to fund them on an actuarial reserve basis, (i.e. the current assets plus future contributions, along with investment earnings will be sufficient to provide the benefits promised by the System). The valuation requires the use of certain assumptions with respect to the occurrence of future events, such as rates of death, termination of employment, retirement age, and salary changes to estimate the obligations of the System.

The basic purpose of an experience study is to determine whether the actuarial assumptions currently in use have adequately anticipated the actual emerging experience. This information, along with the professional judgment of system personnel and advisors, is used to evaluate the appropriateness of continued use of the current actuarial assumptions. When analyzing experience and assumptions, it is important to recognize that actual experience is reported in the short-term while assumptions are intended to be long-term estimates of experience. Therefore, actual experience is expected to vary from study period to study period, without necessarily indicating a change in assumptions is needed.

Cavanaugh Macdonald Consulting, LLC (CavMac) has performed a study of the experience for PERS and MRS for the four-year period ending June 30, 2024. This report presents the results, analysis, and resulting recommendations of our study. It is anticipated that the changes, if approved, will first be reflected in the June 30, 2025 actuarial valuation.

These assumptions have been developed in accordance with generally recognized and accepted actuarial principles and practices that are consistent with the applicable Actuarial Standards of Practice adopted by the Actuarial Standards Board (ASB). While the recommended assumptions represent our best estimate of future experience, there are other reasonable assumption sets that could be supported by the results of this experience study. Those other sets of reasonable assumptions could produce liabilities and costs that are either higher or lower.

#### <u>Our Philosophy</u>

Similar to an actuarial valuation, the calculation of actual and expected experience is a fairly mechanical process, and differences between actuaries in this area are generally minor. However, the setting of assumptions differs, as it is more art than science. In this report, we have recommended changes to certain assumptions. To explain our thought process, we offer a brief summary of our philosophy:

• **Do Not Overreact**: When we see significant changes in experience, we generally do not adjust our rates to reflect the entire difference. We will typically recommend rates somewhere between the old rates and the new experience. If the experience during the next study period shows the same result, we will probably recognize the trend at that point in time or at least move further in the direction of the observed experience. On the other hand, if experience returns closer to its prior level, we will not have overreacted, possibly causing volatility in the actuarial contribution rates.





#### SECTION I - EXECUTIVE SUMMARY

- Anticipate Trends: If there is an identified trend that is expected to continue, we believe that this should be recognized. An example is the retiree mortality assumption. It is an established trend that people are living longer, outside of the recent pandemic. Therefore, we believe the best estimate of liabilities in the valuation should reflect the expected increase in life expectancy.
- **Simplify**: In general, we attempt to identify which factors are significant and eliminate or ignore the ones that do not materially improve the accuracy of the liability projections.

The following summarizes the findings and recommendations with regard to the assumptions utilized for PERS. Detailed explanations for the recommendations are found in the sections that follow.

#### Recommended Economic Assumption Changes

Economic assumptions are some of the most visible and significant assumptions used in the valuation process. The items in the broad economy modeled by these assumptions can be very volatile over short periods of time, as clearly seen in the economic recovery from the pandemic in 2021 followed by the downward trend in global markets in 2022. Our goal is to try to find the emerging long-term trends in the midst of this volatility so that we can then apply reasonable assumptions.

Most of the economic assumptions used by actuaries are developed through a building-block approach. For example, the expected return on assets is based on the expectation for inflation plus the expected real return on assets. At the core of the economic assumptions is the inflation assumption. As we discuss later in the report, although recently we have experienced higher inflation following the recovery from the pandemic, we believe that long-term inflation will settle back down in the 2.40% to 2.50% range. So therefore, we are recommending that the price inflation assumption remain at 2.40%.

We are also recommending that the long-term expected return on assets assumption remain at 7.00%, reflecting the 2.40% inflation assumption and a 4.60% real rate of return assumption. This will be discussed in detail later in this report, but a real rate of return of 4.60% is supported by the forecasting models developed using the Board's investment consultant's capital market assumptions and the Board's target asset allocation. Further analysis of the 42 sets of capital market assumptions included in the Horizon Actuarial Services, LLC. Survey conducted in 2024 and the Board's target asset allocation also support this recommendation.

Finally, we are recommending that the general wage inflation (payroll growth) assumption used as the underlying payroll growth for active members and used in the level percent of payroll amortization method remain at 2.65%.





#### SECTION I - EXECUTIVE SUMMARY

2.40%	2.40%
7.00%	7.00%
2.65%	2.65%
2	65%

The following table summarizes the current and proposed economic assumptions:

\* Net of investment expenses only.

We recognize there may be other sets of economic assumptions that are also reasonable for purposes of funding PERS. For example, we have typically reflected conservatism to the degree we would classify as moderate. Actuarial Standards of Practice allow for this difference in approaches and perspective, as long as the assumptions are reasonable and consistent.

Please note that for the Municipal Retirement System (MRS), we recommend continuation of the investment return assumption methodology that has been in place for the past two years. The calculation of the millage rates for each of the municipalities is determined by a projected cash flow analysis, using the current market value of assets as of each valuation date, an assumption that assessed property values remain level over time, and an assumption methodology on investment earnings. The current methodology utilizes a 1.50% differential between the current long-term investment return assumption used for PERS. The 5.50% assumption is 1.50% less than the current assumption used by PERS (7.00%). As MRS is closed to new members, we are assuming a more conservative assumption even though assets are commingled with PERS' assets.


# SECTION I - EXECUTIVE SUMMARY



#### **Recommended Demographic Assumption Changes**

In the experience study, actual experience for the study period is compared to that expected based on the current actuarial assumption. Comparing the actual incidence of the event to what was expected (called the Actual-to-Expected ratio, or A/E ratio) then provides the basis for our analysis.

The issue of future mortality improvement is one that the actuarial profession has become increasingly focused on studying in recent years. This has resulted in changes to the relevant Actuarial Standard of Practice, ASOP 27, *Selection of Assumptions for Measuring Pension Obligations*. This ASOP requires the pension actuary to make and disclose a specific recommendation with respect to future improvements in mortality after the valuation date. There have been significant improvements in longevity in the past, although there are different opinions about future expectations. We believe it is prudent to anticipate that the trend will continue to some degree in the future. Therefore, we believe it is appropriate to reflect future mortality improvement as part of the mortality assumption.

PERS currently uses a generational mortality approach that directly anticipates future improvements in mortality by using a different set of mortality rates for each year of birth, with the rates for later years of birth assuming lower mortality than the rates for earlier years of birth. The varying mortality rates by year of birth create a series of tables that contain "built-in" mortality improvements, e.g., a member who turns age 65 in 2055 has a longer life expectancy than a member who turns age 65 in 2025. When using generational mortality, the A/E ratios for the observed experience are set near 100% as future mortality improvements will be taken into account directly in the actuarial valuation process.

In this experience study, we also analyzed recent experience on a benefit-weighted basis where the exposures and deaths are multiplied by the monthly retirement benefit amount. This helps to reflect any differences that arise from better mortality experience among those with larger benefits. Because a valuation is designed to measure the amount and timing of future benefit payments (liability) rather than simply the number of retirees leaving pay status, this benefit-weighted approach is an important factor in valuing plan obligations. For mortality, the Actual to Expected Ratios on the benefit-weighted basis were much closer to 1.0 than the count basis over the past four years, which explains why the annual gain/loss experience over the past four valuations has shown very little volatility in the movement of the unfunded actuarial accrued liability. In this study, we have performed this benefit-weighted approach for all demographic assumptions for PERS.



PUBLIC EMPLOYEES' RETIREMENT SYSTEM OF MISSISSIPPI JULY 1, 2020 THROUGH JUNE 30, 2024 EXPERIENCE STUDY

# SECTION I - EXECUTIVE SUMMARY



The current post-retirement mortality assumption for healthy lives is a generational mortality approach using the Pub-2010 Mortality Tables. These tables, released in 2019, were developed using public pension plan mortality experience only. In the 2020 experience study, we adopted this family of mortality tables and the generational mortality approach and adjusted these tables to better match the mortality experience of the State of Mississippi and the membership of PERS. Over the past two valuations (2023 and 2024), PERS has experienced very minor gains in our valuation review of assumed to actual experience for post-retirement mortality and the actual to expected ratios have been very close to 100%. The number of deaths has been deemed credible enough to make a determination.

Mortality is typically the most significant demographic assumption. As we discuss in the report, we are recommending that PERS retain the Society of Actuaries Pub-2010 family of mortality tables issued in 2019 based on public retirement plan data. However, we note that we are recommending some slight adjustments in all four mortality tables, such as using the benefit-weighted tables rather than the headcount-weighted tables as prescribed by the Society of Actuaries. We do recommend the continued use of generational mortality, a technique in which mortality rates are assumed to improve slightly each year in the future.

More information will be discussed in the demographic section of this report.

The following is a general list of the other recommended changes to the demographic assumptions for PERS.

- Retirement: Recommend minor adjustments in the rates of retirement to better match experience of the System.
- Disability: Decrease rates of disability retirement at some ages to better match experience of the System.
- Withdrawal: Decrease rates of withdrawal that better match experience of the System based on an age by service matrix table broken down by tier.
- Merit Salary Scale: No change in the merit salary at this time.

Section IV of this report will provide more detail to these recommended demographic changes.





### Actuarial Methods

The basic actuarial methodologies used in the valuation process include the actuarial cost method, the asset valuation method and the unfunded actuarial accrued liability (UAAL) amortization methodology. Generally, these methods are:

- Cost Method Entry Age Normal
- Asset Valuation Five-year recognition of gains and losses with a 20% corridor
- Amortization method Layered bases with new experience bases amortized over a closed 25-year period as a level percentage of payroll.

Based on our review, discussed in full detail in Section III of this report, we recommend no changes in these actuarial methods at this time.

#### Other Assumptions

Another assumption that is included in the PERS valuation is the determination of administrative expense component that is added to the total normal cost each year. The current assumption is 0.26% of payroll. After reviewing the total amount of administrative expenses for the past four years and the percentage of payroll, we are recommending reducing this assumption to 0.25% of payroll. The following table shows actual percentages over the past four years:

Year Ending June 30	Administrative Expenses Annual Payroll		Percentage
2021	\$15,691	\$6,246,077	0.25%
2022	\$15,926	\$6,454,760	0.25%
2023	\$16,446	\$7,065,419	0.23%
2024	\$18,251	\$7,245,824	0.25%

(\$ in Thousands)







### Financial Impact

Although the assumption changes, if approved, will first be reflected in the 2025 valuations, we have provided the following table which highlights the impact of the recommended changes on the unfunded accrued liability (UAL), funded ratio, actuarially determined employer contribution (ADEC), and projected funding ratio on the 2024 valuation and projection results.

#### (\$ in Millions)

	Before All Changes	After All Changes
2024 Valuation Unfunded Accrued Liability (UAL)	\$26,498	\$26,184
2024 Funded Ratio	55.9%	56.2%
2024 Actuarially Determined Employer Contribution (ADEC)	25.92%	25.59%
Projected Funding Ratio 2047*	53.7%	55.4%

\* Statutory Contribution Rate (SCR) of 19.90% assumed.

It should be noted that since the recommended changes in the post-retirement mortality table are minor, the financial impact to the MRS valuation results will be minimal.







There are four economic assumptions used in the actuarial valuation performed for PERS. They are:

- Price Inflation
- Investment Return
- Wage Inflation
- Payroll Growth for Amortization Method

Note that future price inflation has an indirect impact on the results of the actuarial valuation through the development of the assumptions for investment return and wage inflation. However, it is not directly used in the valuation process.

Unlike demographic assumptions, economic assumptions do not lend themselves to analysis largely on the basis of internal historical patterns because economic assumptions are impacted by external forces in the economy. The investment return and general wage increase assumptions are selected on the basis of expectations in an inflation-free environment and then increased by the long-term expectation for inflation, called the "building block" approach.

Sources of data considered in the analysis and selection of the economic assumptions included:

- The 2024 Social Security Trustees Report
- Future expectations of PERS investment consultant, Callan
- Future expectations of other investment consultants (2024 Horizon Survey)
- U.S. Department of the Treasury bond rates
- Assumptions used by other large public retirement systems, based on the Public Fund Survey, published by the National Association of State Retirement Administrators (NASRA)
- Historical observations of price and wage growth statistics and investment returns

Guidance regarding the selection of economic assumptions for measuring pension obligations is provided by Actuarial Standard of Practice (ASOP) No. 27, *Selection of Assumptions for Measuring Pension Obligations*. Because no one knows what the future holds, the best an actuary can do is to use professional judgment to estimate possible future economic outcomes. These estimates are based on a mixture of past experience, future expectations, and professional judgment.

ASOP 27 requires the actuary to select a "reasonable" assumption. For this purpose, an assumption is reasonable if it has the following characteristics:

- It is appropriate for the purpose of the measurement;
- It reflects the actuary's professional judgment;
- It takes into account historical and current economic data that is relevant as of the measurement date;
- It reflects the actuary's estimate of future experience, the actuary's observation of the estimates inherent in market data, or a combination thereof; and
- It has no significant bias (i.e., it is not significantly optimistic or pessimistic), except when provisions for adverse deviation or plan provisions that are difficult to measure are included and disclosed, or when alternative assumptions are used for the assessment of risk.





# **SECTION II – ECONOMIC ASSUMPTIONS**

With respect to relevant data, the standard recommends the actuary review appropriate recent and longterm historical economic data but advises the actuary not to give undue weight to recent experience. Furthermore, it advises the actuary to consider that some historical economic data may not be appropriate for use in developing assumptions for future periods due to changes in the underlying environment. In addition, with respect to any particular valuation, each economic assumption should be consistent with all other economic assumptions over the measurement period.

ASOP 27 recognizes that economic data and analyses are available from a variety of sources, including representatives of the plan sponsor, investment advisors, economists, and other professionals. The actuary is permitted to incorporate the views of experts, but the selection or advice must reflect the actuary's professional judgment.

The standard also discusses a "range of reasonable assumptions" which in part states "the actuary should also recognize that different actuaries will apply professional judgment and may choose different reasonable assumptions. As a result, a range of reasonable assumptions may develop both for an individual actuary and across actuarial practice."

In our opinion, the economic assumptions recommended in this report have been developed in accordance with ASOP No. 27. The following table shows our recommendations followed by detailed discussions of each assumption.

ltem	Current Assumptions	Proposed Assumptions
Price Inflation	2.40%	2.40%
Real Rate of Return*	4.60	<u>4.60</u>
Investment Return	7.00%	7.00%
Price Inflation	2.40%	2.40%
Real Wage Growth	<u>0.25</u>	<u>0.25</u>
Wage Inflation	2.65%	2.65%
Payroll Growth	2.65%	2.65%

\* net of investment expenses.





### Price Inflation

#### Background

As can be seen from the table on the previous page, assumed price inflation is used as the basis for both the investment return assumption and the wage inflation assumption. These latter two assumptions will be discussed in detail in the following sections.

It is important that the price inflation assumption be consistently applied throughout the economic assumptions utilized in an actuarial valuation. This is called for in ASOP No. 27 and is also required to meet the parameters for determining pension liabilities and expense under Governmental Accounting Standards Board (GASB) Statements No. 67 and 68. The long-term relationship between price inflation and investment return has long been recognized by economists. The basic principle is that the investor demands a more or less level "real return" – the excess of actual investment return over price inflation. If inflation rates are expected to be high, investment return rates are also expected to be high, while low inflation rates are expected to result in lower expected investment returns, at least in the long run.

The current price inflation assumption is 2.40% per year, which was recommended and adopted in the last experience study.

### Past Experience

The Consumer Price Index, US City Average, All Urban Consumers, CPI (U), has been used as the basis for reviewing historical levels of price inflation. The table below provides historical annualized rates and annual standard deviation of the CPI-U over periods ending June 30th.

Period	Number of Years	Annualized Rate of Inflation	Annual Standard Deviation
1926 – 2024	98	2.96%	4.02%
1964 – 2024	60	3.94%	2.89%
1974 – 2024	50	3.79%	2.94%
1984 – 2024	40	2.81%	1.75%
1994 – 2024	30	2.54%	1.86%
2004 – 2024	20	2.55%	2.23%
2014 – 2024	10	2.80%	2.66%





### **SECTION II – ECONOMIC ASSUMPTIONS**

The following graph illustrates the historical levels of price inflation measured as of June 30th of each of the last 50 years and compared to the current 2.40% annual rate currently assumed.



### Annual Rate of CPI (U) Increases

As can be seen from the table on the previous page, over the last 30 years, the average annual rate of increase in the CPI-U has been just over 2.50%. The higher annual rates over the past few years have increased this average. In the last experience study in 2022, the 30-year average of price inflation was approximately 2.53%.

#### Forecasts

Additional information to consider in formulating this assumption is obtained from measuring the spread on Treasury Inflation Protected Securities (TIPS) and from the prevailing economic forecasts. The spread between the nominal yield on treasury securities (bonds) and the inflation indexed yield on TIPS of the same maturity is referred to as the "breakeven rate of inflation" and represents the bond market's expectation of inflation over the period to maturity.





### **SECTION II – ECONOMIC ASSUMPTIONS**

	Years to Maturity	Nominal Bond Yield	TIPS Yield	Breakeven Rate of Inflation
ſ	5	4.38%	2.00%	2.38%
	10	4.58	2.24	2.34
	20	4.86	2.41	2.45
	30	4.78	2.48	2.30

The table below provides the calculation of the breakeven rate of inflation as of December 31, 2024.

As this data indicates, the bond market is anticipating very low inflation of 2.3% to 2.5% for both the short and long term. The bond market expectations may be heavily influenced by the expectations of actions by the Federal Reserve Bank. Whether inflation returns to the higher rates observed historically remains to be seen. We note that measures can move fairly significantly over just a few months.

Based upon information contained in the "Survey of Professional Forecasters" for the fourth quarter of 2024 as published by the Philadelphia Federal Reserve Bank, the median expected annual rate of inflation for the next ten years is 2.23%. Although 10 years of future expectation is too short of a period for the basis of our inflation assumption, the information does provide some evidence that the consensus expectations of these experts are for rates of inflation very close to our current assumption of 2.40% for the near-term future.

PERS' investment consultant, Callan, also has an inflation forecast in their capital market assumptions. Their short-term assumption (10 years) is 2.50%. Horizon Actuarial Services surveys a significant portion of the major investment advisors and publishes their assumptions. For the 2024 study, the long-term inflation assumption was 2.44%.

### Social Security Administration

Although many economists forecast lower inflation than the assumption used by most retirement plans, they are generally looking at a shorter time horizon than is appropriate for a pension valuation. To consider a longer, similar time frame, we looked at the expected increase in the CPI by the Office of the Chief Actuary for the Social Security Administration. In the 2024 annual report, the projected ultimate average annual increase in the CPI over the next 75 years was estimated to be 2.40%, under the intermediate (best estimate) cost assumption. The range of inflation assumptions used in the Social Security 75-year modeling, which includes a low and high-cost scenario, in addition to the intermediate cost projection, was 1.80% to 3.00%. These rates remained unchanged from their 2022 annual report.







### Peer Comparison

While we do not recommend the selection of any assumption based on what other systems use, it does provide another set of relevant information to consider. Based on the Public Plan Database (a survey of over 125+ state and local retirement systems maintained by a collaboration between the Center for Retirement Research at Boston College, the Center for State and Local Government Excellence, and the National Association of State Retirement Administrators), the average inflation assumption for governmental plans is 2.46%. This data is largely based on actuarial valuations prepared with measurement dates in 2023. Based on our experience, we believe the inflation assumption has been steady for most systems over the last year.

#### Recommendation

It is difficult to predict inflation accurately. Inflation's short-term volatility is illustrated by comparing its average rate over the last 10, 30 and 50 year history. Although the 30-year average of 2.54% is closer to the System's assumed rate of 2.40%, the longer 50-year average of 3.79% is much higher and it includes the very high rates of inflation from the late 1970s and early 1980s. Those high rates will not be part of the 50-year average for much longer.

Although we have experienced higher inflation over the last few years following the recovery from the COVID-19 pandemic, current economic forecasts suggest annual inflation rates closer to 2.40% over the short-term and long-term, respectively. We concur with these forecasts and recommend maintaining the inflation assumption for PERS at 2.40%.







#### Investment Return

#### Background

The investment return assumption reflects anticipated returns on the current and future assets. The assumed investment return is one of the most significant assumptions in the annual actuarial valuation process as it is used to discount the expected benefit payments for all active, inactive and retired members. Minor changes in this assumption can have a major impact on valuation results. The investment return assumption should reflect the asset allocation target for the funds set by the Board of Trustees.

The current rate recommended by the actuary is 7.00%, consisting of a price inflation assumption of 2.40% and a real rate of return assumption of 4.60%.

#### Long Term Perspective

Because the economy is constantly changing, assumptions about what may occur in the near term are volatile. Asset managers and investment consultants usually focus on this near-term horizon in order to make prudent choices regarding how to invest the trust funds. For actuarial calculations, we typically consider very long periods of time. For example, a newly, hired employee in PERS who is 25 years old may work for 35 years, to age 60, and live another 30 years, to age 90 (or longer). The retirement system would receive contributions for the first 35 years and then pay out benefits for the next 30 years. During the entire 65-year period, the system is investing assets related to the member. For such a typical career employee, more than one-half of the investment income earned on assets accumulated to pay benefits is received <u>after</u> the employee retires. In addition, in an open, ongoing system like PERS, the stream of benefit payments is continually increasing as new hires replace current members who leave covered employment due to death, termination of employment, and retirement. This difference in the time horizon used by actuaries and investment consultants is frequently a source of debate and confusion when setting economic assumptions.





### Past Experience

One of the inherent problems with analyzing historical data is that the results can look significantly different depending on the timeframe used, especially if the year-to-year results vary widely. In addition, the asset allocation can also impact the investment returns so comparing results over long periods when different asset allocations were in place may not be meaningful.

The assets for PERS are valued using a widely accepted asset-smoothing methodology that fully recognizes the expected investment income and also recognizes 20% of each year's investment gain or loss (the difference between actual and expected investment income). The recent experience over the last five years is shown in the table below.

Year Ending 6/30	Actuarial Value	Market Value
2020	6.72%	3.11%
2021	12.47	32.17
2022	8.49	(8.64)
2023	6.85	7.43
2024	7.28	10.41
Geometric Average	8.34%	8.11%

While important to review and analyze, historical returns over such a short time period are not credible for the purpose of setting the long-term assumed future rate of return.

### Future Expectation Analysis

ASOP 27 provides that the actuary may rely on outside experts in setting economic assumptions. PERS utilizes the services of Callan to assist them in developing investment strategies and providing capital market assumptions for the PERS portfolio. As part of their duties, Callan periodically performs assetliability studies, along with comprehensive reviews of the expected return of the various asset classes in which the PERS portfolio is invested. We believe it is appropriate to consider the results of Callan's work as <u>one factor</u> in assessing expected future returns.

We also recognize that there can be differences of opinion among investment professionals regarding future return expectations. Horizon Actuarial Services prepares an annual study in which they survey various investment advisors (42 were included in the 2024 study with a 10-year horizon) and provide ranges of results as well as averages. This information provides an additional perspective on what a broad group of investment experts anticipate for future investment returns.





# **SECTION II – ECONOMIC ASSUMPTIONS**

Our forward-looking analysis used the real rates of return in Callan's capital market assumptions for 2025-2034 and PERS' target asset allocation. Using statistical projections that assume investment returns approximately follow a lognormal distribution with no correlation between years, produces an expected range of real rates of return over a 50-year time horizon. Looking at one year's results produces a mean real return of 5.77%, but also has a high standard deviation or measurement of volatility. By expanding the time horizon, the real return does not change, but the volatility declines significantly. The table below provides a summary of results.

Time	Mean	Standard	Real Returns by Percentile			centile	
Span in Years	Real Return	Deviation	5 <sup>th</sup>	25 <sup>th</sup>	50 <sup>th</sup>	75 <sup>th</sup>	95 <sup>th</sup>
1	5.77%	13.26%	-14.49%	-3.47%	5.01%	14.24%	28.96%
5	5.11%	5.88%	-4.21%	1.13%	5.01%	9.04%	15.12%
10	5.03%	4.15%	-1.59%	2.25%	5.01%	7.85%	12.06%
20	4.99%	2.93%	0.30%	3.05%	5.01%	7.01%	9.95%
30	4.97%	2.39%	1.14%	3.41%	5.01%	6.64%	9.02%
40	4.97%	2.07%	1.65%	3.62%	5.01%	6.42%	8.48%
50	4.96%	1.85%	2.00%	3.77%	5.01%	6.27%	8.11%

The percentile results are the percentages of random returns over the time span shown that are expected to be less than the amount indicated. For example, for the 10-year time span, 5% of the resulting real rates of return will be below -1.59% and 95% will be above that. As the time span increases, the results begin to converge. Over a 50-year time span, the results indicate there will be a 25% chance that real returns will be below 3.77% and a 25% chance they will be above 6.27%. In other words, there is a 50% chance the real returns will be between 3.77% and 6.27%.

For a broader view of expected returns, we also reviewed the 2024 Survey of Capital Market Assumptions produced by Horizon Actuarial Services, LLC to see what other investment professionals are currently using for capital market assumptions. The Horizon survey includes both 10-year horizon and 20-year horizon capital market assumptions. We applied the same statistical analysis to these survey results as we did the capital market assumption of PERS investment advisor with the following real return results for the <u>10-year horizon and 20-year horizon</u>:





## SECTION II – ECONOMIC ASSUMPTIONS

### Horizon Survey 10-year horizon

Time	Mean	Standard Deviation	Real Returns by			centile	
Span In Years	Real Return		5 <sup>th</sup>	25 <sup>th</sup>	50 <sup>th</sup>	75 <sup>th</sup>	95 <sup>th</sup>
1	5.40%	13.25%	-14.83%	-3.83%	4.64%	13.86%	28.57%
5	4.74%	5.87%	-4.565	0.77%	4.64%	8.67%	14.74%
10	4.66%	4.15%	-1.95%	1.89%	4.64%	7.48%	11.69%
20	4.62%	2.93%	-0.06%	2.69%	4.64%	6.64%	9.58%
30	4.61%	2.39%	0.78%	3.04%	4.64%	6.27%	8.65%
40	4.60%	2.07%	1.29%	3.26%	4.64%	6.05%	8.11%
50	4.60%	1.85%	1.64%	3.40%	4.64%	5.90%	7.74%

### Horizon Survey 20-year horizon

Time	Mean	Standard		Real Ret	urns by Per	centile	
Span in Years	Real Return	al Deviation	5 <sup>th</sup>	25 <sup>th</sup>	50 <sup>th</sup>	75 <sup>th</sup>	95 <sup>th</sup>
1	5.76%	13.25%	-14.48%	-3.47%	5.00%	14.22%	28.93%
5	5.10%	5.87%	-4.20%	1.13%	5.00%	9.03%	15.10%
10	5.02%	4.15%	-1.59%	2.25%	5.00%	7.84%	12.05%
20	4.98%	2.93%	0.29%	3.05%	5.00%	7.00%	9.94%
30	4.97%	2.39%	1.14%	3.40%	5.00%	6.63%	9.01%
40	4.96%	2.07%	1.65%	3.62%	5.00%	6.41%	8.47%
50	4.95%	1.85%	2.00%	3.76%	5.00%	6.26%	8.10%

As you can see from the two tables above, setting a real return assumption depends on the time horizon a plan seeks. The 20-year horizon is approximately 0.36% higher at all percentiles than the 10-year horizon. While PERS is a long-term vehicle expected to pay benefits to its retirees for many years in the future, a high percentage of the present value of the benefits is determined within the next ten to fifteen years, so the real return recommendation should fall near the 50<sup>th</sup> percentile columns in the three tables above.

Using a 2.40% inflation assumption, the current investment return assumption of 7.00% utilizes a 4.60% real rate of return (using the "building block" methodology). Based on the table directly above, 4.60% falls into the 42<sup>nd</sup> percentile. While it is slightly below thresholds that we recommend for a long-term assumption, it is still a reasonable assumption, as it falls within the 40-60<sup>th</sup> percentile range.







### Peer Comparison

Public retirement systems have historically compared their investment performance to their peer group. While we believe there is some merit in assessing the movement in the assumed rate of return for other systems, this is not an appropriate basis for setting this assumption in our opinion. For example, different plans have different plan dynamics, including varying asset allocations, which will impact their choice of the assumed investment return. This peer group information merely provides another set of relevant data to consider as long as we recognize that asset allocation varies from system to system.

The following chart shows the nominal investment return assumptions of 131 plans in the National Association of State Retirement Administrators (NASRA). The assumptions shown below are as of May 2024 and are updated frequently by the NASRA staff.





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The following chart shows the changes in expected investment return assumption from the NASRA public plan survey over the last 23 years from 2001.







#### Recommendation

By actuarial standards, we are required to maintain a long-term perspective in setting all assumptions, including the investment return assumption. Therefore, we believe we must be careful not to let recent experience or short-term expectations impact our judgment regarding the appropriateness of the current assumption over the long term.

Based on our analysis of Callan's capital market assumptions and the Horizon Survey capital market assumptions, we are recommending continuation of a real return assumption of 4.60%. We acknowledge that this real return assumption is just slightly below Horizon Survey's anticipated return over the next 10 years of 4.64%. Based on our recommended inflation assumption of 2.40% and real return assumption of 4.60%, we are recommending continuation of the 7.00% expected long term nominal rate of return assumption.

Investment Return Assumption				
	Current	Recommended		
Real Rate of Return*	4.60%	4.60%		
Inflation	2.40%	2.40%		
Net Investment Return	7.00%	7.00%		

\* net of investment expenses.





### Wage Inflation

#### Background

Wage inflation, thought of as the "across the board" rate of salary increases, is composed of the price inflation assumption combined with an assumption for the real rate of wage increases. In constructing the individual salary increase assumption, the wage inflation assumption is further combined with an assumption for age- or service-based salary increases (called a merit scale). The merit scale assumption is discussed later in this report.

Currently, the wage inflation assumption is 2.65%, which implies an assumed real rate of wage increase or real wage inflation of 0.25% (2.65% less the current inflation assumption of 2.40%). The excess of wage inflation over price inflation represents the increase in the standard of living, also called productivity growth. There has been debate on the issue of whether public sector employees will receive, over the long term, the same rewards for productivity as employees in the private sector, where productivity is more readily measurable. To our knowledge, no definitive research has been completed on this topic. Nevertheless, it is our opinion that public sector employees will eventually be rewarded with the same productivity increases as those participating in the remainder of the economy, even if there is a time lag.

#### Past Experience

The Social Security Administration publishes data on wage growth in the United States (see Appendix C). While this is the most comprehensive data available, it is based on all wage earners in the country so it can be influenced by the mix of jobs as well as by changes in certain sectors of the workforce that may not be seen by all segments.

As with our analysis of inflation, we provide below wage inflation and a comparison with price inflation over various time periods. Currently, this wage data is only available through calendar year 2023. We remove the rate of price inflation for each year from the data to result in the historical real rate of wage inflation.

Period	Wage Inflation	Price Inflation	Real Wage Growth
2013-2023	4.03%	2.79%	1.24%
2003-2023	3.41%	2.58%	0.83%
1993-2023	3.59%	2.51%	1.08%
1983-2023	3.76%	2.81%	0.95%
1973-2023	4.44%	3.86%	0.58%

Thus, over the last 50 years, annual real wage growth has averaged 0.58%.





### **SECTION II – ECONOMIC ASSUMPTIONS**



Similar information over rolling thirty-year periods is shown in the following graph:

### Public Sector Compensation and Wages

The Bureau of Labor Statistics publishes the Employment Cost Index, including detail for real (net of inflation) total compensation and wages and salaries. Further, this index is also broken down for state and local government workers. From 2005 through 2024, real compensation grew by at an annualized rate of 2.85%, while wages and salaries grew at a rate of 2.47%. This difference is a reflection that state and local government workers have had much of their compensation increase delivered through benefits rather than wages and salaries. While it is certainly reasonable to anticipate that total compensation will continue to increase faster than wages and salaries, it is also reasonable to anticipate that the difference between the two will moderate over time.



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### Recommendation

Based, on all the information discussed, we recommend that the plan maintain a 0.25% real wage growth inflation assumption and a total wage inflation growth of 2.65%.

	Wage Inflation Assumption	
	Current	Recommended
Price Inflation	2.40%	2.40%
Real Wage Growth	<u>0.25%</u>	<u>0.25%</u>
Wage Inflation	2.65%	2.65%



## **SECTION II – ECONOMIC ASSUMPTIONS**



#### Payroll Growth

#### Background

The assumed future rate of payroll growth increase in the total payroll of PERS' active members is an assumption used in the level percentage of payroll amortization method that affects the calculation of the amortization period required to fully amortize the unfunded actuarial accrued liability and the actuarially determined employer contribution. The total payroll growth is impacted by individual member's increases and population growth. The current assumption is 2.65% per year which is comprised of the inflation assumption of 2.40% and real wage growth of 0.25%.

#### Past Experience

Period	Number of Years	Annual Payroll Growth	Annual Active Membership Growth	Net Payroll Growth
2004 – 2024	20	2.28%	-0.35%	2.64%
2009 – 2024	15	1.46%	-0.90%	2.38%
2014 – 2024	10	2.19%	-1.01%	3.23%
2019 – 2024	5	3.35%	-0.65%	4.02%

The following table shows the actual PERS' payroll growth experienced over different time periods.

#### Recommendation

The table above shows annual payroll growth has been higher than assumed and the active membership growth has declined significantly since the financial crisis of 2008/2009. The net growth recently has been averaging above the current assumption of 2.65% but most of that is due to the larger than expected pay raises that were granted during the 2023 valuation. We anticipate the annual growth to come down to more normal levels in the future. Therefore, we are recommending we maintain the payroll growth assumption of 2.65%, which is equal to the recommended wage inflation assumption.







### ACTUARIAL COST METHOD

The systematic financing of a pension plan requires that contributions be made in an orderly fashion while a member is actively employed, so that the accumulation of these contributions, together with investment earnings should be sufficient to provide promised benefits and cover administration expenses. The actuarial valuation is the process used to determine when money should be contributed, i.e., as part of the budgeting process.

The actuarial valuation will not impact the amount of benefits paid or the actual cost of those benefits. In the long run, actuaries cannot change the costs of the pension plan, regardless of the funding method used or the assumptions selected. However, actuaries will influence the incidence of costs by their choice of methods and assumptions.

The valuation or determination of the present value of all future benefits to be paid by the funds reflects the assumptions that best describe anticipated future experience. The choice of a funding method does not impact the determination of the present value of future benefits. The funding method determines only the incidence of cost. In other words, the purpose of the funding method is to allocate the present value of future benefits determination into annual costs. In order to do this allocation, it is necessary for the funding method to "break down" the present value of future benefits into two components: (1) that which is attributable to the past, (2) and that which is attributable to the future. The excess of that portion attributable to the past over the plan assets is then amortized over a period of years. Actuarial terminology calls the present value of future benefits allocated to the future is commonly known as "the present value of future normal costs", with the specific piece of it allocated to the current year being called "the normal cost". The difference between the plan assets and actuarial accrued liability is called the "unfunded actuarial accrued liability".

Two key points should be noted. First, there is no single "correct" funding method, since different funding methods simply change the timing of the funding. Second, the allocation of the present value of future benefits and hence cost to the past for amortization and to the future for annual normal cost payments is not necessarily in a one-to-one relationship with service earned in the past and future service to be earned.

#### Entry Age Normal

There are various actuarial cost methods, each of which has different characteristics, advantages and disadvantages. However, Governmental Accounting Standard Board Statement Numbers 67 and 68 require that the Entry Age Normal cost method be used for financial reporting. Most retirement systems will not want to use a different actuarial cost method for funding and financial reporting. In addition, the Entry Age Normal method has been the most popular funding method for public systems for many years. This is the cost method currently used by PERS for all plans.



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# SECTION III - ACTUARIAL METHODS

The rationale of the entry age normal (EAN) funding method is that the cost of each member's benefit is determined to be a level percentage of salary from date of hire to the end of employment. This level percentage multiplied by the member's annual salary is referred to as the normal cost and is that portion of the total cost of the employee's benefit which is allocated to the current year. The portion of the present value of future benefits allocated to the future is determined by multiplying this percentage times the present value of the member's assumed earnings for all future years including the current year. The entry age normal actuarial accrued liability is then developed by subtracting from the present value of future benefits that portion of costs allocated to the future. To determine the unfunded actuarial accrued liability, the actuarial value of plan assets is subtracted from the entry age normal actuarial accrued liability. The current year's cost to amortize the unfunded actuarial accrued liability is developed by applying an amortization factor based on the funding policy.

It is to be expected that future events will not occur exactly as predicted by the actuarial assumptions in each year. Actuarial gains/losses from experience under this actuarial cost method can be directly calculated and are reflected as a decrease/increase in the unfunded actuarial accrued liability. Consequently, the gain/loss results in a decrease/increase in the amortization payment, and therefore the contribution rate or amount.

### Recommendation

Considering that the Entry Age Normal cost method is the most commonly used cost method by public plans, that it develops a normal cost rate that tends to be stable and is the required cost method under calculations required by Governmental Accounting Standard Numbers 67 and 68, we recommend the Entry Age Normal actuarial cost method be retained by PERS for all plans. Note that because of GASB 67 and 68 requirements, the Entry Age Normal method will also be used by the plans for accounting disclosures.







#### ACTUARIAL VALUE OF ASSETS

In preparing an actuarial valuation, the actuary must assign a value to the assets of the fund. An adjusted market value is often used to smooth out the volatility that is reflected in the market value of assets. This is because most employers would rather have annual costs remain relatively smooth, as a percentage of payroll or in actual dollars, as opposed to a cost pattern that is extremely volatile.

The actuary does not have complete freedom in assigning this value. The Actuarial Standards Board also has basic principles regarding the calculation of a smoothed asset value, Actuarial Standard of Practice No. 44 (ASOP 44), *Selection and Use of Asset Valuation Methods for Pension Valuations.* 

ASOP 44 provides that the asset valuation method should bear a reasonable relationship to the market value. Furthermore, the asset valuation method should be likely to satisfy both of the following:

- Produce values within a reasonable range around market value, AND
- Recognize differences from market value in a reasonable amount of time.

In lieu of both of the above, the standard will be met if <u>either</u> of the following requirements is satisfied:

- There is a sufficiently narrow range around the market value, OR
- The method recognizes differences from market value in a sufficiently short period.

These rules or principles prevent the asset valuation methodology from being used to manipulate annual funding patterns. No matter what asset valuation method is used, it is important to note that, like a cost method or actuarial assumptions, the asset valuation method does not affect the true cost of the plan; it only impacts the incidence of cost.

#### Recommendation

Currently, the actuarial value of assets recognizes a portion of the difference between the market value of assets and the expected market value of assets, based on the assumed valuation rate of return. The amount recognized each year is 20% of the difference between market value and expected market value. **We recommend no change in this methodology.** 



# SECTION III - ACTUARIAL METHODS



### AMORTIZATION OF THE UNFUNDED ACTUARIAL ACCRUED LIABILITY

The actuarial accrued liability is the portion of the actuarial present value of future benefits that are not included in future normal costs. Thus, it represents the liability that, in theory, should have been funded through normal costs for past service. Unfunded actuarial accrued liability (UAAL) exists when the actuarial accrued liability exceeds the actuarial value of plan assets. These deficiencies can result from:

- (i) plan improvements that have not been completely paid for,
- (ii) experience that is less favorable than expected,
- (iii) assumption changes that increase liabilities, or
- (iv) contributions that are less than the actuarial contribution rate.

There are a variety of different methods that can be used to amortize the UAAL. Each method results in a different payment stream and, therefore, has cost implications. For each methodology, there are three characteristics:

- The period over which the UAAL is amortized,
- The rate at which the amortization payment increases, and
- The number of components of UAAL (separate amortization bases).

<u>Amortization Period</u>: The amortization period can be either closed or open. If it is a closed amortization period, the number of years remaining in the amortization period declines by one in each future valuation. Alternatively, if the amortization period is an open or rolling period, the amortization period does not decline but is reset to the same number each year. This approach essentially "refinances" the System's debt (UAAL) every year.

<u>Amortization Payment:</u> The <u>level dollar</u> amortization method is similar to the method in which a homeowner pays off a mortgage. The liability, once calculated, is financed by a constant fixed dollar amount, based on the amortization period until the liability is extinguished. This results in the liability steadily decreasing while the payments, though remaining level in dollar terms, in all probability decrease as a percentage of payroll. (Even if a plan sponsor's population is not growing, inflationary salary increases will usually be sufficient to increase the aggregate covered payroll).

The rationale behind the <u>level percentage of payroll</u> amortization method is that since normal costs are calculated to be a constant percentage of pay, the unfunded actuarial accrued liability should be paid off in the same manner. When this method of amortizing the unfunded actuarial accrued liability is adopted, the initial amortization payments are lower than they would be under a level dollar amortization payment method, but the payments increase at a fixed rate each year so that ultimately the annual payment far exceeds the level dollar payment. The expectation is that total payroll will increase at the same rate so that the amortization payments will remain constant, as a percentage of payroll. In the initial years, the level percentage of payroll amortization payment is often less than the interest accruing on the unfunded actuarial accrued liability will grow (called negative amortization). This is particularly true if the plan sponsor is paying off the unfunded actuarial accrued liability over a long period, such as 20 or more years.





# SECTION III - ACTUARIAL METHODS

<u>Amortization Bases</u>: The UAAL can be amortized either as one single amount or as components or "layers", each with a separate amortization base, payment and period. If the UAAL is amortized as one amount, the UAAL is recalculated each year in the valuation and experience gains/losses or other changes in the UAAL are folded into the single UAAL amortization base. The amortization payment is then the total UAAL divided by an amortization factor for the applicable amortization period.

If separate amortization bases are maintained, the UAAL is composed of multiple amortization bases, each with its own payment schedule and remaining amortization period. In each valuation, the unexpected change in the UAAL is established as a new amortization base over the appropriate amortization period beginning on that valuation date. The UAAL is then the sum of all of the outstanding amortization bases on the valuation date and the UAAL payment is the sum of all of the amortization payments on the existing amortization bases. This approach provides transparency in that the current UAAL is paid off over a fixed period of time and the remaining components of the UAAL are clearly identified. Adjustments to the UAAL in future years are also separately identified in each future year. One downside of this approach is that it can create some discontinuities in contribution rates when UAAL layers/components are fully paid off. If this occurs, it likely would be far in the future, with adequate time to address any adjustments needed.

### Recommendation

In the current PERS Board funding policy, an actuarially determined employer contribution (ADEC) is calculated during each annual valuation and the ADEC is compared to the Fixed Contribution Rate adopted by the Board as one of its Signal Light metrics. The methodology in calculating the ADEC is as follows:

- Amortization Period Closed period with period of 25 years for new bases
- Amortization Payment Level Percentage of Payroll
- Amortization Bases Separate bases for all experience gains and losses, assumption changes or benefit changes

We recommend no changes in these methods.







Actuarial Standard of Practice (ASOP) No. 27 provides guidance to actuaries regarding the selection of demographic and other non-economic assumptions for measuring pension obligations. ASOP 27 states that the actuary should use professional judgment to estimate possible future outcomes based on past experience and future expectations, and select assumptions based upon application of that professional judgment. The actuary should select reasonable demographic assumptions in light of the particular characteristics of the defined benefit plan that is the subject of the measurement. A reasonable assumption is one that is expected to appropriately model the contingency being measured and is not anticipated to produce significant cumulative actuarial gains or losses over the measurement period.

Each individual demographic assumption should satisfy the criteria of ASOP 27. In selecting demographic assumptions, the actuary should also consider: the internal consistency between the assumptions, materiality, cost effectiveness, and the combined effect of all assumptions. At each measurement date, the actuary should consider whether the selected assumptions continue to be reasonable, but the actuary is not required to do a complete assumption study at each measurement date. In addition, the actuary should include a specific assumption with respect to expected mortality improvements after the measurement date. In our opinion, the demographic assumptions recommended in this report have been developed in accordance with ASOP 27.

#### **Overview of Analysis**

The purpose of a study of demographic experience is to compare what actually happened to the individual members of the System during the study period (July 1, 2020 through June 30, 2024) with what was expected to happen based on the actuarial assumptions.

Studies of demographic experience generally involve three steps:

- First, the number of members changing membership status, called decrements, during the study is tabulated by age, duration, gender, group, and membership class (active, retired, etc.).
- Next, the number of members expected to change status is calculated by multiplying certain membership statistics, called exposure, by the expected rates of decrement.
- Finally, the number of actual decrements is compared with the number of expected decrements. The comparison is called the Actual-to-Expected ratio (A/E Ratio) and is expressed as a percentage.

In general, if the actual experience differs significantly from the overall expected results, or if the pattern of actual decrements, or rates of decrement, by age, sex, or duration deviates significantly from the expected pattern, new assumptions are considered. Recommended revisions are normally not an exact representation of the experience during the observation period. Judgment is required to anticipate future experience from past trends and current evidence, including a determination of the amount of weight to assign to the most recent experience.





For most of the decrements we analyze the experience using a liability-weighted approach. This is approximated by using the member's compensation and years of service to estimate the member's benefit level. For retirees, the benefit is determined directly from the data. The exposure and actual occurrences are then multiplied by the benefit level to provide the liability-weighted experience. This approach is particularly insightful when analyzing experience from a non-homogenous group. While we reviewed experience on both a headcount and liability-weighted basis, we generally used the liability-weighted results to evaluate experience and develop new assumptions, if necessary.

Revised rates of decrement are tested by using them to recalculate the expected number of decrements during the study period, and the results are shown as revised Actual-to-Expected Ratios.

It takes a fair amount of data to perform a credible study of demographic assumptions. Because the membership or certain subsets of the membership are relatively small, some assumptions have been selected based more on our professional judgment of reasonable future outcomes than actual experience.

Because much of the past four years of experience overlapped the worldwide Covid pandemic, we recognize that the actual demographic experience captured in this study may be influenced by the presence of the disease, by decisions the various employers made to manage their workforces through this period, and by choices employees may have made in response to actual or perceived changes in the world around them. Further, it is possible that some of these changes will reflect a new reality and show up in future years, while other changes will likely revert back quickly to the previous norms. Consequently, we believe caution is warranted in this study before making significant changes based on the recent data only.





### RATES OF WITHDRAWAL

	Withdrawal Headcount Basis			
	<u>Exposures</u>	Actual	Expected	<u>A/E Ratio</u>
Males	177,824	22,735	21,196	107%
Females	323,540	39,444	36,902	107%

	Withdrawal Liability-Weighted Basis (\$ in thousands)			
	<u>Exposures</u>	<u>Actual</u>	Expected	<u>A/E Ratio</u>
Males	\$8,265,091	\$807,833	\$836,273	97%
Females	\$13,403,084	\$1,324,899	\$1,329,848	100%





The following graphs show a comparison of the present, actual and proposed rates of withdrawal.



### RATES OF WITHDRAWAL FOR ACTIVE MEMBERS



25

30

Actual Rate

PUBLIC EMPLOYEES' RETIREMENT SYSTEM OF MISSISSIPPI JULY 1, 2020 THROUGH JUNE 30, 2024 EXPERIENCE STUDY

35

40

Expected Rate Proposed Rate

CENTRAL AGE

45

50





The rates of withdrawal adopted by the Board are used to determine the expected number of separations from active service which will occur as a result of resignation or dismissal. The assumed rates of withdrawal include both those members leaving PERS and taking a refund and those who leave PERS but leave their employee contributions in the System and potentially will receive a pension in the future. A separate assumption is used to determine the percentage of vested employees who take a refund vs. leaving their money in PERS. See Section IV - Other Assumptions on page 54 for this explanation.

The results of our four-year study indicate that, in aggregate, the actual number of withdrawals on a headcount basis was 7% more than expected for both males and females. However, on a liability-weighted basis, the results showed that the actual amount of liability released due to withdrawals was slightly less than expected for both males and females but nearly perfect for females. And as you can see from the graphs, the actual and expected rates are very similar, in aggregate and follow a similar pattern. Therefore, we are only recommending fine-tuning the rates of withdrawal based on the liability-weighted amounts that will hopefully better match experience in the future. Please see Appendix D for a full listing of each rate of withdrawal by age and service.

The following tables show a comparison between the actual withdrawals and the proposed withdrawals.

		Withdrawal Headcount Ba	sis	
Malaa	Exposures	Actual	Proposed	A/E Ratio
Females	323,540	22,735 39,444	20,690 36,818	110% 107%
		Withdrawal	Pasia	
		(\$ in thousand	ls)	
	<u>Exposures</u>	<u>Actual</u>	<u>Proposed</u>	<u>A/E Ratio</u>
Males	\$8,265,091	\$807,833	\$820,393	98%
Females	\$13,403,084	\$1,324,899	\$1,330,221	100%





### RATES OF DISABILITY RETIREMENT

### COMPARISON OF ACTUAL AND EXPECTED DISABILITY RETIREMENTS

		Disability Headcount Bas	sis	
	<u>Exposures</u>	<u>Actual</u>	Expected	<u>A/E Ratio</u>
Males	209,951	270	320	84%
Females	375,978	323	420	77%

Disability Liability-Weighted Basis (\$ in thousands)				
	<b>Exposures</b>	Actual	Expected	<u>A/E Ratio</u>
Males	\$10,106,881	\$10,662	\$16,001	67%
Females	\$15,946,817	\$12,388	\$18,096	68%





The following graphs show a comparison of the present and actual rates of disability retirements.





PUBLIC EMPLOYEES' RETIREMENT SYSTEM OF MISSISSIPPI JULY 1, 2020 THROUGH JUNE 30, 2024 EXPERIENCE STUDY



As can be seen from the table and the graphs on the previous pages, the actual rates of disability retirement are less than expected for both males and females at all ages and for both a headcount and liability-weighted basis. The number of disabilities has significantly declined during the last four years of this study period. Therefore, we recommend a decrease in the rates of disability retirement to better match experience.

		Disability Headcount Bas	is	
	<u>Exposures</u>	<u>Actual</u>	Proposed	A/E Ratio
Males	209,951	270	270	100%
Females	375,978	323	370	87%

### COMPARISON OF ACTUAL AND PROPOSED DISABILITY RETIREMENTS

	Lia	Disability bility-Weighted (\$ in thousand	Basis is)	
			r	
	Exposures	<u>Actual</u>	<b>Proposed</b>	A/E Ratio
Males	\$10,106,881	\$10,662	\$13,528	79%
Females	\$15,946,817	\$12,388	\$16,052	77%





### RATES OF RETIREMENT

We separately analyzed the retirement rates for members with less than 25 years of service and those with greater than 25 years of service. The results are summarized below:

Retirement – Less than 25 years of Service Headcount Basis				
	<u>Exposures</u>	<u>Actual</u>	Expected	<u>A/E Ratio</u>
Males	16,567	3,083	3,176	97%
Females	25,929	5,266	4,970	106%

Retirement – Less than 25 years of Service Liability-Weighted Basis (\$ in thousands)				
	<u>Exposures</u>	<u>Actual</u>	Expected	<u>A/E Ratio</u>
Males	\$784,272	\$137,766	\$147,357	94%
Females	\$1,054,443	\$212,826	\$198,922	107%





	Retirement – Greater than or equal to 25 years of Service Headcount Basis				
	<u>Exposures</u>	<u>Actual</u>	Expected	<u>A/E Ratio</u>	
Males	15,560	3,335	3,409	98%	
Females	26,509	5,796	5,902	98%	

	Retirement – Greater than or equal to 25 years of Service Liability-Weighted Basis (\$ in thousands)				
	<u>Exposures</u>	Actual	<u>Expected</u>	<u>A/E Ratio</u>	
Males	\$1,057,518	\$222,448	\$230,202	97%	
Females	\$1,489,291	\$324,991	\$325,415	100%	




The following graphs show a comparison of the present, actual, and proposed rates of service retirements.



PUBLIC EMPLOYEES' RETIREMENT SYSTEM OF MISSISSIPPI

JULY 1, 2020 THROUGH JUNE 30, 2024 EXPERIENCE STUDY

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#### RATES OF RETIREMENT FOR ACTIVE MEMBERS WITH 25 OR MORE YEARS OF SERVICE



PUBLIC EMPLOYEES' RETIREMENT SYSTEM OF MISSISSIPPI JULY 1, 2020 THROUGH JUNE 30, 2024 EXPERIENCE STUDY



As can be seen from the previous 4 pages, the actual rates of service retirement, for both under 25 years of service and for 25 and over years of service are reasonably close to expected at most ages. In fact, the A/E Ratios are extremely close to 100% in aggregate on both a headcount and liability-weighted basis. The only group outside of a 5% range are females retiring with less than 25 years of service. We do note some movement up and down in the graphs at various ages and, therefore, recommend some slight adjustments in the rates of retirement, especially at the later ages, to better match anticipated experience going forward.

The following table shows a comparison between the present retirement rates and the proposed rates.



Retirement – Less than 25 years of Service Liability-Weighted Basis (\$ in thousands)				
	<u>Exposures</u>	<u>Actual</u>	Proposed	<u>A/E Ratio</u>
Males	\$784,272	\$137,766	\$146,148	94%
Females	\$1,054,443	\$212,826	\$209,162	102%





Retirement – Greater than or equal to 25 years of Service Headcount Basis				
	<u>Exposures</u>	<u>Actual</u>	Proposed	<u>A/E Ratio</u>
Males	15,560	3,335	3,370	99%
Females	26,509	5,796	5,891	98%

	Retirement – Greater than or equal to 25 years of Service Liability-Weighted Basis (\$ in thousands)				
	Exposures	Actual	Proposed	A/E Ratio	
Males	\$1,057,518	\$222,448	\$228,531	97%	
Females	\$1,489,291	\$324,991	\$325,802	100%	





#### RATES OF POST-RETIREMENT MORTALITY

One of the most important demographic assumptions in the valuation is mortality because it projects how long benefit payments will be made. The longer members live, the greater the true cost of future benefit obligations will be.

For many years, rates of mortality have been declining, meaning people, in general, are living longer. Consequently, we anticipate that mortality tables will need to be updated periodically. Because of potential differences in mortality, we break down our study by gender (males and females) and by status (healthy retirees, beneficiaries, disabled retirees, and active members).

Because of the substantial amount of data required to construct a mortality table, actuaries usually rely on standard tables published by the Society of Actuaries. Actuaries then use various adjustments such as age or scaling adjustments to the standard, published mortality tables in order to better match the observed mortality rates of a specific group.

The first of these adjustments is an age adjustment that can be either a "setback" or a "set forward". A oneyear age setback treats all members as if they were one year younger than they truly are when applying the rates in the mortality table. For example, a one year setback would treat a 61-year old retiree as if he will exhibit the mortality of a 60-year old in the standard mortality table.

The second adjustment that can be used to adjust the mortality rates in a standard table to better fit actual experience is to "scale" a mortality table by multiplying the probabilities of death by factors less than one (to reflect better mortality) or factors greater than one (to reflect poorer mortality). Scaling factors can be applied to an entire table or a portion of the table. Of course, if needed, actuaries may use both of these methods to develop an appropriate table to model the mortality of the specific plan population.

In 2019, the Society of Actuaries released a family of mortality tables named the Pub-2010 tables. While prior pension mortality tables have been based solely on private corporate and union retirement plans, these new tables are based entirely on public sector plan data. These tables are split by three membership types: Safety, Teachers, and General to reflect the observed differences in mortality patterns related to the three groups. Tables are further split for healthy retirees, disabled retirees, contingent beneficiaries, and employees. There are still other breakdowns in these tables for at, above or below median annuity values.







The issue of future mortality improvement is one that the actuarial profession has become increasingly focused on studying and monitoring. This has resulted in changes to the relevant Actuarial Standard of Practice, ASOP 27, *Selection of Assumptions for Measuring Pension Obligations*. This ASOP requires the pension actuary to make and disclose a specific recommendation with respect to future improvements in mortality after the valuation date, although it does not require that an actuary assume there will be future improvements. There have been significant improvements in longevity in the past, although there are different opinions about future expectations, and thus there is a subjective component in the estimation of future mortality improvement. We believe it is prudent to anticipate that the trend will continue to some degree in the future and that it is appropriate to reflect some future mortality improvement as part of the mortality assumption.

PERS currently uses generational mortality approach that directly anticipates future improvements in mortality by using a different set of mortality rates for each year of birth, with the rates for later years of birth assuming lower mortality than the rates for earlier years of birth. The varying mortality rates by year of birth create a series of tables that contain "built-in" mortality improvements, e.g., a member who turns age 65 in 2035 has a longer life expectancy than a member who turns age 65 in 2020. When using generational mortality, the A/E ratios for the observed experience are set near 100% as future mortality improvements will be taken into account directly in the actuarial valuation process.

The generational approach is our preferred method for recognizing future mortality improvements in the valuation process because it is more direct and results in longer life expectancy for members who are younger, consistent with what we believe is more likely to occur. Over the last ten to fifteen years, this method has become quite common as computing power has increased.

In this experience study, we also analyzed recent experience on a benefit-weighted basis where the exposures and deaths are multiplied by the monthly retirement benefit amount. This helps to reflect any differences that arise from better mortality experience among those with larger benefits. Because a valuation is designed to measure the amount and timing of future benefit payments (liability) rather than simply the number of retirees leaving pay status, this benefit-weighted approach is an important factor in valuing plan obligations. For mortality, the Actual to Expected Ratios on the benefit-weighted basis were much closer to 1.0 than the count basis over the past four years, which explains why the annual gain/loss experience over the past four valuations has shown very little volatility in the movement of the unfunded actuarial accrued liability.



PUBLIC EMPLOYEES' RETIREMENT SYSTEM OF MISSISSIPPI JULY 1, 2020 THROUGH JUNE 30, 2024 EXPERIENCE STUDY



#### COMPARISON OF ACTUAL AND EXPECTED CASES OF POST-RETIREMENT DEATHS

	Post-Retir Headc			
	<u>Exposures</u>	<u>Actual</u>	Expected	<u>A/E Ratio</u>
Service Retirements				
Males	130,430	5,272	4,778	110%
Females	248,213	6,863	6,259	110%
Beneficiaries				
Males	11,845	480	354	136%
Females	36,634	1,923	1,635	118%
Disability Retirements				
Males	10,304	524	493	106%
Females	14,965	617	539	114%

Post-Retirement Deaths Liability- Weighted Basis (\$ in thousands)

	Exposures	Actual	Expected	<u>A/E Ratio</u>
Service Retirements				
Males	\$4,002,555	\$146,691	\$152,696	96%
Females	\$6,304,884	\$152,750	\$149,689	102%
Beneficiaries				
Males	\$172,205	\$8,017	\$6,076	132%
Females	\$755,684	\$42,777	\$39,530	108%
<b>Disability Retirements</b>				
Males	\$219,745	\$9,971	\$10,501	95%
Females	\$300,043	\$11,242	\$10,479	107%

The following graphs show a comparison of the present, actual and proposed number of post-retirement deaths.



Public Employees' Retirement System of Mississippi July 1, 2020 Through June 30, 2024 Experience Study



#### POST-RETIREMENT DEATHS SERVICE RETIREMENTS





PUBLIC EMPLOYEES' RETIREMENT SYSTEM OF MISSISSIPPI JULY 1, 2020 THROUGH JUNE 30, 2024 EXPERIENCE STUDY





#### POST-RETIREMENT DEATHS BENEFICIARIES





PUBLIC EMPLOYEES' RETIREMENT SYSTEM OF MISSISSIPPI JULY 1, 2020 THROUGH JUNE 30, 2024 EXPERIENCE STUDY



#### POST-RETIREMENT DEATHS DISABILITY RETIREMENTS





PUBLIC EMPLOYEES' RETIREMENT SYSTEM OF MISSISSIPPI JULY 1, 2020 THROUGH JUNE 30, 2024 EXPERIENCE STUDY





The actuarial gain/loss analysis performed during the 2023 and 2024 valuations for PERS has indicated that the current mortality table that was adopted after the last experience study fits nicely into the actual mortality experience of PERS' service retirees, beneficiaries, and disabled retirees. The ratio of actual to expected experience on a benefit-weighted basis shown on page 46 and the actuarial gain/loss analysis performed during the past four valuations for PERS has indicated more deaths are occurring than expected, especially for beneficiaries (also called Contingent Annuitants).

Therefore, we have decided to change the membership table to the Pub-2010 Public Safety Amount-Weighted Mortality Tables. We are also recommending similar adjustments or refinements for service retirees and beneficiaries from the current table and an update to the most recent projection scale, MP-2021.

Service Retirees (Pr	oposed Table)		
Membership Table	<u>Set Forward (+)/</u> Setback (-)	Adjustment to Rates	Projection Scale
PubS-2010(B) Retiree	None	Male: 107% for all ages Female: 97% up to age 82, 100% for ages 83 to 87, and 110% for ages above 87	MP-2021
Contingent Annuitar	nts (Proposed Table	<u>y</u>	
Membership Table	<u>Set Forward</u> <u>Setback (-</u>	(+)/ Adjustment to Rates	Projection Scale
PubS-2010(B) Contingent Annuitant	Male: Set forward Female: Set forward	2 years None d 3 years	MP-2021
Disabled Retirees (P	Proposed Table)		
<u>Membership Table</u>	<u>Set Forward</u> <u>Setback (-</u>	(+)/ <u>Adjustment to Rates</u>	Projection Scale
PubG.H-2010 Disabled	Male: Set forward Female: Set forward	1 yearMale: 134% for all agesd 2 yearsFemale: 125% for all ages	MP-2021





#### COMPARISON OF ACTUAL AND PROPOSED CASES OF POST-RETIREMENT DEATHS

	Post-Retir Headc			
	<u>Exposures</u>	<u>Actual</u>	<u>Proposed</u>	<u>A/E Ratio</u>
Service Retirements				
Males	130,430	5,272	4,642	114%
Females	248,213	6,863	6,391	107%
Beneficiaries				
Males	11,845	480	464	103%
Females	36,634	1,923	1,745	110%
Disability Retirements				
Males	10,304	524	471	111%
Females	14,965	617	580	106%

#### Post-Retirement Deaths Liability- Weighted Basis (\$ in thousands)

	Exposures	<u>Actual</u>	<u>Proposed</u>	<u>A/E Ratio</u>
Service Retirements				
Males	\$4,002,555	\$146,691	\$148,633	99%
Females	\$6,304,884	\$152,750	\$152,664	100%
Beneficiaries				
Males	\$172,205	\$8,017	\$8,005	100%
Females	\$755,684	\$42,777	\$42,292	101%
Disability Retirements				
Males	\$219,745	\$9,971	\$10,050	99%
Females	\$300,043	\$11,242	\$11,237	100%





\$10,106,881

\$15,946,817

#### **RATES OF PRE-RETIREMENT MORTALITY**

The active member mortality assumption models eligibility for death benefits prior to retirement. Therefore, it has a much smaller impact on the valuation results than the post-retirement mortality assumption.

It is difficult to isolate the mortality for active members as it may be impacted by active members first terminating or moving to disabled status before death. The data collection methods used in this study do not fully capture known deaths, and so sometimes this can be misleading. Finally, the probability of active death is very small so volatility is not uncommon. Consequently, we prefer to set this assumption by utilizing the more reliable analysis performed on the retiree data.

#### COMPARISON OF ACTUAL AND EXPECTED PRE-RETIREMENT DEATHS

Pre-Retirement Deaths Headcount Basis				
	<u>Exposures</u>	Actual Ex	<u>kpected</u>	<u>A/E Ratio</u>
Males	209,951	698	518	135%
Females	375,978	573	365	157%
			~	
	Pre- Liabi	-Retirement Death ility-Weighted Bas \$ in thousands)	s is	
	Exposures	Actual Ex	rpected	A/E Ratio

The following graphs show a comparison of the present, actual, and proposed rates of pre-retirement mortality.

\$29,567

\$21,566

\$24,722

\$15,346

120%

140%



Males

Females

PUBLIC EMPLOYEES' RETIREMENT SYSTEM OF MISSISSIPPI JULY 1, 2020 THROUGH JUNE 30, 2024 EXPERIENCE STUDY







Public Employees' Retirement System of Mississippi July 1, 2020 Through June 30, 2024 Experience Study



As can be seen from the table and graphs on the previous pages, the number of actual pre-retirement deaths was higher than expected on both a headcount and liability-weighted basis. When we break down the 4-year period, we find that the number of pre-retirement deaths are fairly uniform over the 4-year period and just slightly weighted more during the first two years of the study period, which were more of the pandemic years.

Therefore, we recommend slight change in the current pre-retirement mortality table at this time to match the post-retirement experience.

Membership Table	<u>Set Forward (+)/</u> <u>Setback (-)</u>	Adjustment to Rates	Projection Scale
	Male: Set forward	Male: 75% up to age 47, 100% for ages 48	
PubS-2010(B)	2 years	to 57, and 120% for ages above 58	MD 2021
Employee	Female: Set	Female: 75% up to age 47, 100% for ages	IVIF-2021
	forward 1 year	48 to 52, and 110% for ages above 53	

#### COMPARISON OF ACTUAL AND PROPOSED PRE-RETIREMENT DEATHS

Pre-Retirement Deaths Headcount Basis				
	Exposures	<u>Actual</u>	<u>Proposed</u>	<u>A/E Ratio</u>
Males	209,951	698	584	120%
Females	375,978	573	507	113%

	Pro Lial	e-Retirement D bility-Weighted (\$ in thousand	eaths Basis Is)	
	<u>Exposures</u>	<u>Actual</u>	<u>Proposed</u>	<u>A/E Ratio</u>
Males	\$10,106,881	\$29,567	\$27,722	107%
Females	\$15,946,817	\$21,566	\$21,171	102%





#### RATES OF SALARY INCREASE

#### COMPARISON OF ACTUAL AND EXPECTED SALARIES OF ACTIVE MEMBERS

SERVICE	SALARIES A	T END OF YEAR (	\$ in Millions)
	Actual	Expected	Ratio of Actual to Expected
Less than 5	5,923	5,763	102.8%
5-9	5,216	5,048	103.3%
10-14	4,179	4,064	102.8%
15-19	3,947	3,857	102.3%
20-24	3,115	3,053	102.0%
25 & Over	2,085	2,046	101.9%
TOTAL	24,465	23,831	102.7%

As can be seen from the table above, actual rates of salary increase has been more than expected at all service breakdowns. However, if we break down the four year-periods and remove the second and third years of the period (2021-2023), which experienced much higher than expected salary increases and resulted in an actuarial losses in the 2022 valuation and 2023 valuation of \$377 million and \$935 million, respectively, then the actual to expected ratio drops from 1.027 to 1.005 and all service breakdowns are within 1% of expected. We believe these two years of the study are skewing the results and is not a full representation of actual salary increases going forward. Therefore, we recommend no change in the merit salary scale at this time.





#### **OTHER ASSUMPTIONS**

**DEFERRED VESTEDS:** Currently, the valuation assumes 65% of participants that leave the System as deferred vested will receive a deferred benefit upon attaining the eligibility requirements for retirement. During the last two investigation periods, the plan actually experienced an estimated 65% and 66% of participants receiving a deferred benefit, respectively. **Therefore, we recommend no change in our assumption at this time.** 

**LINE OF DUTY DEATH ASSUMPTION:** Currently, it is assumed that 4% of active member deaths are in the line of duty and 96% of active member deaths are not in the line of duty. For the past six years, approximately 2.2% of active member deaths were in the line of duty. There has definitely been a downward trend for this assumption. **Therefore, we recommend a decrease in the assumption from 4% to 2%.** 

LINE OF DUTY DISABILITY ASSUMPTION: Currently, it is assumed that 12% of active member disabilities are in the line of duty and 88% of active member disabilities are not in the line of duty. During the experience investigation period, an average of about 10% of disabilities each year were in the line of duty. During the last experience study, the average for the period was 13%. Therefore, we recommend that the assumption be maintained at 12% of active member disabilities are assumed to be in the line of duty.

**PERCENT MARRIED:** Currently, 85% of active members are assumed to be married and elect a joint & survivor payment form. We are not provided with marital status on the census data. However, we believe the current assumption is fairly conservative and recommend no change at this time.

**SPOUSE AGE DIFFERENCE:** Currently, for married members, it is assumed a male is two years older than his spouse. We have reviewed this assumption during this experience period and found that the age difference between males and females in PERS is about 2.2 years. In the previous study period, the age difference was about 2.3 years. **Therefore, we recommend no change in this assumption.** 

**UNUSED LEAVE:** Currently, we assume that participants will have on average 0.55 years of unused leave (sick and personal) at retirement. We reviewed this assumption for those participants who retired during this four-year period and the average number of years of unused leave was 0.57 years. In the last experience study, the average was 0.67 years. The average settled back to our expectations from the last study. Therefore, we recommend no change in this assumption at this time.



PUBLIC EMPLOYEES' RETIREMENT SYSTEM OF MISSISSIPPI JULY 1, 2020 THROUGH JUNE 30, 2024 EXPERIENCE STUDY





**FINAL AVERAGE COMPENSATION:** We compared the actual final average compensation used to determine retiree benefits with the compensation predicted by our pension software. Based on our findings, we recommend a continuation of the 0.25% load on the final average compensation produced by our valuation software.

**MILITARY SERVICE:** Currently, we assume that participants will have on average 0.20 years of military service at retirement. We reviewed this assumption for those participants who retired during this four-year period and the average number of years of military service was 0.21 years. In the last experience study, the average was 0.21 years. **Therefore, we recommend no change in this assumption at this time.** 

**ASSUMED INTEREST RATE ON EMPLOYEE CONTRIBUTIONS:** This assumption is adopted by the Board each year, but **2.00% remains a reasonable assumption at this time.** 

**OTHER ASSUMPTION LOADS:** Varying loads for pre-retirement dependent children option and for disability dependent child's options are made to the liabilities to account for the number of children possibly covered. We recommend no change at this time in these loads.

**OPTION FACTORS:** The option factors, currently in use by all of the Retirement Systems, are based on the mortality table and investment rate of return (discount rate) used in the valuation. We will review the changes in the mortality table as discussed earlier and determined in a change in the factors is needed at this time.





#### **MUNICIPAL RETIREMENT SYSTEMS**

#### SUMMARY OF RESULTS

Since this is a closed System with only retired members remaining, the only demographic assumption to review is post-retirement mortality. Over the period of this investigation, we have found the following observations:

Since the MRS does not have enough mortality data by itself to warrant credible data, we recommend that each of the Systems have the same mortality table. As mentioned in the PERS section of this report, we recommend that the rates of mortality for post-retirements be unchanged as outlined below:

Service Retirees (Pro	oposed Table <u>)</u>		
<u>Membership Table</u>	<u>Set Forward (+)/</u> Setback (-)	Adjustment to Rates	Projection Scale
PubS-2010(B) Retiree	None	Male: 107% for all ages Female: 97% up to age 82, 100% for ages 83 to 87, and 110% for ages above 87	MP-2021
Contingent Annuitar	nts (Proposed Table	<u>)</u>	
Membership Table	<u>Set Forward</u> <u>Setback (-</u>	(+)/ Adjustment to Rates	Projection Scale
PubS-2010(B) Contingent Annuitant	Male: Set forward Female: Set forward	2 years None d 3 years	MP-2021
Disabled Retirees (P	roposed Table)		
<u>Membership Table</u>	<u>Set Forward</u> <u>Setback (-</u>	(+)/ Adjustment to Rates	Projection Scale
PubG.H-2010 Disabled	Male: Set forward Female: Set forward	I 1 yearMale: 134% for all agesd 2 yearsFemale: 125% for all ages	MP-2021





# APPENDIX A – HISTORICAL JUNE CPI (U) INDEX

Year	CPI (U)	Year	CPI (U)
1963	30.6	1994	148.0
1964	31.0	1995	152.5
1965	31.6	1996	156.7
1966	32.4	1997	160.3
1967	33.3	1998	163.0
1968	35.7	1999	166.2
1969	34.7	2000	172.4
1970	38.8	2001	178.0
1971	40.6	2002	179.9
1972	41.7	2003	183.7
1973	44.2	2004	189.7
1974	49.0	2005	194.5
1975	53.6	2006	202.9
1976	56.8	2007	208.352
1977	60.7	2008	218.815
1978	65.2	2009	215.693
1979	72.3	2010	217.965
1980	82.7	2011	225.722
1981	90.6	2012	229.478
1982	97.0	2013	233.504
1983	99.5	2014	238.343
1984	103.7	2015	238.638
1985	107.6	2016	241.018
1986	109.5	2017	244.955
1987	113.5	2018	251.989
1988	118.0	2019	256.143
1989	124.1	2020	257.797
1990	129.9	2021	271.696
1991	136.0	2022	296.311
1992	140.2	2023	305.109
1993	144.4	2024	314.069





# Callan's Capital Market Assumptions and PERS' Board of Trustees Target Asset Allocation

#### Geometric Real Rates of Return and Standard Deviations by Asset Class

Asset Class	Expected Real Rate of Return	Standard Deviation
Domestic Equity	4.75%	17.00%
International Equity	4.75	20.15
Global Equity	4.95	21.25
Fixed Income	2.25	4.40
Real Estate	3.75	14.00
Private Equity	6.00	27.60
Cash Equivalents	0.50	0.90

#### Asset Allocation Targets

Asset Class	Asset Allocation
Domestic Equity	27.00%
International Equity	20.00
Global Equity	12.00
Fixed Income	20.00
Real Estate	10.00
Private Equity	10.00
Cash Equivalents	1.00





# APPENDIX C – SOCIAL SECURITY ADMINISTRATION WAGE INDEX

Year	Wage Index	Annual Increase	Year	Wage Index	Annual Increase
1962	\$4,291.40	5.01%	1993	\$23,132.67	0.86%
1963	4,396.64	2.45	1994	23,753.53	2.68
1964	4,576.32	4.09	1995	24,705.66	4.01
1965	4,658.72	1.80	1996	25,913.90	4.89
1966	4,938.36	6.00	1997	27,426.00	5.84
1967	5,213.44	5.57	1998	28,861.44	5.23
1968	5,571.76	6.87	1999	30,469.84	5.57
1969	5,893.76	5.78	2000	32,154.82	5.53
1970	6,186.24	4.96	2001	32,921.92	2.39
1971	6,497.08	5.02	2002	33,252.09	1.00
1972	7,133.80	9.80	2003	34,064.95	2.44
1973	7,580.16	6.26	2004	35,648.55	4.65
1974	8,030.76	5.94	2005	36,952.94	3.66
1975	8,630.92	7.47	2006	38,651.41	4.60
1976	9,226.48	6.90	2007	40,405.48	4.54
1977	9,779.44	5.99	2008	41,334.97	2.30
1978	10,556.03	7.94	2009	40,711.61	-1.51
1979	11,479.46	8.75	2010	41,673.83	2.36
1980	12,513.46	9.01	2011	42,979.61	3.13
1981	13,773.10	10.07	2012	44,321.67	3.12
1982	14,531.34	5.51	2013	44,888.16	1.28
1983	15,239.24	4.87	2014	46,481.52	3.55
1984	16,135.07	5.88	2015	48,098.63	3.48
1985	16,822.51	4.26	2016	48,642.15	1.13
1986	17,321.82	2.97	2017	50,321.89	3.45
1987	18,426.51	6.38	2018	52,145.80	3.62
1988	19,334.04	4.93	2019	54,099.99	3.75
1989	20,099.55	3.96	2020	55,628.60	2.83
1990	21,027.98	4.62	2021	60,575.07	8.89
1991	21,811.60	3.73	2022	63,795.13	5.31
1992	22,935.42	5.15	2023	66,621.80	4.43





### **APPENDIX D – RECOMMENDED RATES**

			RATES OF F	REHREMENT
AGE	RATES OF DEATH*	RATES OF DISABILITY	LESS THAN 25 YRS OF SERVICE**	25 OR MORE YEARS OF SERVICE**
20	0.000360	0.00020		SERVICE
21	0.000368	0.00020		
22	0.000368	0.00020		
23	0.000375	0.00020		
24	0.000383	0.00020		
25	0.000390	0.00020		
26	0.000398	0.00020		
27	0.000405	0.00020		
28	0.000413	0.00020		
29	0.000420	0.00020		
30	0.000428	0.00020		
31	0.000443	0.00020		
32	0.000450	0.00020		
33	0.000465	0.00020		
34	0.000480	0.00020		
35	0.000503	0.00020		
36	0.000525	0.00028		
37	0.000555	0.00036		
38	0.000585	0.00044		
39	0.000623	0.00052		0.2800
40	0.000660	0.00060		0.2800
41	0.000713	0.00070		0.2800
42	0.000738	0.00080		0.2800
43	0.000818	0.00100		0.2800
44	0.000878	0.00110		0.2800
46	0.001020	0.00124		0.2800
40	0.001020	0.00138		0.3200
48	0.001590	0.00152		0 1950
49	0.001720	0.00166		0.1800
50	0.001850	0.00180		0.2050
51	0.002000	0.00200		0.1800
52	0.002160	0.00220		0.2100
53	0.002330	0.00240		0.1850
54	0.002520	0.00260		0.1850
55	0.002730	0.00280		0.2000
56	0.002960	0.00268	v v	0.1900
57	0.003230	0.00256		0.1900
58	0.004212	0.00244		0.1900
59	0.004596	0.00232		0.1950
60	0.005016	0.00220	0.1175	0.1950
61	0.005484	0.00216	0.1250	0.2300
62	0.005988	0.00212	0.1850	0.2500
63	0.006540	0.00208	0.1650	0.2300
64	0.007404	0.00204	0.1575	0.2300
65	0.008400	0.00200	0.2600	0.3000
66	0.009516	0.00200	0.2500	0.3300
67	0.010776	0.00200	0.2400	0.2200
68	0.012216	0.00200	0.2050	0.2600
69	0.013848	0.00200	0.1600	0.2300
70	0.015684	0.00200	0.2100	0.2200
71	0.01///2	0.00200	0.1800	0.2200
73	0.020148	0.00200	0.1950	0.1900
74	0.022824	0.00200	0.1900	0.2000
75	0.0238/2	0.00200	0.1850	0.1950
76	0.029316	0.00200	0.1850	0.1500
77	0.037644	0.00200	0 1800	0.1500
78	0.042660	0.00200	0 1400	0.1200
79	0.078576	0.00200	0.1800	0.2200
80	0.087648	0.00200	1 0000	1 0000

 TABLE 1(a)

 RATES OF SEPARATION FROM ACTIVE SERVICE – MALES

\* Adjusted Base rates

\*\*For Tier 4 members, 30 years of service.



Public Employees' Retirement System of Mississippi July 1, 2020 Through June 30, 2024 Experience Study



### **APPENDIX D – RECOMMENDED RATES**

# TABLE 1(b) RATES OF SEPARATION FROM ACTIVE SERVICE – MALES (continued)

												Rates	of With	drawal -	Males											
AGE													SER	VICE				<u>^</u>					<i>•</i>			
	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25+
15	0.4000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
16	0.4000	0.3300	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
17	0.4000	0.3300	0.2600	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
18	0.4000	0.3300	0.2600	0.1800	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
19	0.4000	0.3300	0.2600	0.1800	0.1500	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
20	0.4000	0.3300	0.2600	0.1800	0.1500	0.1250	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
21	0.4000	0.3300	0.2600	0.1800	0.1500	0.1250	0.1200	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
22	0.4000	0.3300	0.2600	0.1800	0.1500	0.1250	0.1200	0.0800	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
23	0.3300	0.2700	0.2100	0.1750	0.1500	0.1250	0.1200	0.0800	0.0825	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
24	0.3300	0.2700	0.2100	0.1750	0.1500	0.1250	0.1200	0.0800	0.0825	0.0850	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
25	0.3300	0.2700	0.2100	0.1750	0.1500	0.1250	0.1200	0.0800	0.0825	0.0850	0.0650	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
26	0.3300	0.2700	0.2100	0.1750	0.1500	0.1250	0.1200	0.0800	0.0825	0.0850	0.0650	0.0600	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
27	0.3300	0.2700	0.2100	0.1750	0.1500	0.1250	0.1200	0.0800	0.0825	0.0850	0.0650	0.0600	0.0600	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
28	0.3300	0.2600	0.2100	0.1600	0.1400	0.1250	0.1000	0.0800	0.0825	0.0850	0.0650	0.0600	0.0600	0.0550	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
29	0.3300	0.2600	0.2100	0.1600	0.1400	0.1250	0.1000	0.0800	0.0825	0.0850	0.0650	0.0600	0.0600	0.0550	0.0400	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
30	0.3300	0.2600	0.2100	0.1600	0.1400	0.1250	0.1000	0.0800	0.0825	0.0850	0.0650	0.0600	0.0600	0.0550	0.0400	0.0350	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
31	0.3300	0.2600	0.2100	0.1600	0.1400	0.1250	0.1000	0.0800	0.0825	0.0850	0.0650	0.0600	0.0600	0.0550	0.0400	0.0350	0.0350	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
32	0.3300	0.2600	0.2100	0.1600	0.1400	0.1250	0.1000	0.0800	0.0825	0.0850	0.0650	0.0600	0.0600	0.0550	0.0400	0.0350	0.0350	0.0275	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
33	0.3300	0.2400	0.1750	0.1600	0.1400	0.1200	0.1000	0.0800	0.0850	0.0700	0.0600	0.0600	0.0550	0.0450	0.0400	0.0350	0.0350	0.0275	0.0250	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
34	0.3300	0.2400	0.1750	0.1600	0.1400	0.1200	0.1000	0.0800	0.0850	0.0700	0.0600	0.0600	0.0550	0.0450	0.0400	0.0350	0.0350	0.0275	0.0250	0.0250	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
35	0.3300	0.2400	0.1750	0.1600	0.1400	0.1200	0.1000	0.0800	0.0850	0.0700	0.0600	0.0600	0.0550	0.0450	0.0400	0.0350	0.0350	0.0275	0.0250	0.0250	0.0400	0.0000	0.0000	0.0000	0.0000	0.0000
36	0.3300	0.2400	0.1750	0.1600	0.1400	0.1200	0.1000	0.0800	0.0850	0.0700	0.0600	0.0600	0.0550	0.0450	0.0400	0.0350	0.0350	0.0275	0.0250	0.0250	0.0400	0.0400	0.0000	0.0000	0.0000	0.0000
37	0.3300	0.2400	0.1750	0.1600	0.1400	0.1200	0.1000	0.0800	0.0850	0.0700	0.0600	0.0600	0.0550	0.0450	0.0400	0.0350	0.0350	0.0275	0.0250	0.0250	0.0400	0.0400	0.0400	0.0000	0.0000	0.0000
38	0.3200	0.2350	0.1600	0.1450	0.1150	0.1050	0.0850	0.0825	0.0750	0.0750	0.0600	0.0550	0.0475	0.0550	0.0400	0.0350	0.0325	0.0275	0.0250	0.0250	0.0400	0.0400	0.0400	0.0400	0.0400	0.0000
39	0.3200	0.2350	0.1600	0.1450	0.1150	0.1050	0.0850	0.0825	0.0750	0.0750	0.0600	0.0550	0.0475	0.0550	0.0400	0.0350	0.0325	0.0275	0.0250	0.0250	0.0400	0.0400	0.0400	0.0400	0.0400	0.0000
40	0.3200	0.2350	0.1600	0.1450	0.1150	0.1050	0.0850	0.0825	0.0750	0.0750	0.0600	0.0550	0.0475	0.0550	0.0400	0.0350	0.0325	0.0275	0.0250	0.0250	0.0400	0.0400	0.0400	0.0400	0.0400	0.0000
41	0.3200	0.2350	0.1600	0.1450	0.1150	0.1050	0.0850	0.0825	0.0750	0.0750	0.0600	0.0550	0.0475	0.0550	0.0400	0.0350	0.0325	0.0275	0.0250	0.0250	0.0400	0.0400	0.0400	0.0400	0.0400	0.0000
42	0.3200	0.2350	0.1600	0.1450	0.1150	0.1050	0.0850	0.0825	0.0750	0.0750	0.0600	0.0550	0.0475	0.0550	0.0400	0.0350	0.0325	0.0275	0.0250	0.0250	0.0400	0.0400	0.0400	0.0400	0.0400	0.0000
43 - 47	0.3200	0.2100	0.1500	0.1225	0.1150	0.1050	0.0750	0.0850	0.0750	0.0750	0.0600	0.0525	0.0475	0.0425	0.0400	0.0350	0.0325	0.0275	0.0250	0.0250	0.0400	0.0400	0.0400	0.0400	0.0400	0.0000
48 - 52	0.2700	0.1900	0.1600	0.1150	0.1050	0.0900	0.0700	0.0850	0.0600	0.0600	0.0650	0.0525	0.0475	0.0425	0.0400	0.0350	0.0325	0.0300	0.0250	0.0250	0.0400	0.0400	0.0400	0.0400	0.0400	0.0000
53 - 79	0.2300	0.1800	0.1300	0.1250	0.1100	0.0850	0.0700	0.0800	0.0650	0.0600	0.0600	0.0500	0.0500	0.0450	0.0400	0.0350	0.0325	0.0300	0.0250	0.0250	0.0400	0.0400	0.0400	0.0400	0.0400	0.0000
80+	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

\*Rates stop at eligibility for retirement. For Tier 4, rates at 24 years of service are extended out to 29 years of service.



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### **APPENDIX D – RECOMMENDED RATES**

105		RATES OF	RATES OF RETIREMENT		
AGE	RATES OF DEATH*	DISABILITY	LESS THAN 25 YRS OF SERVICE**	25 OR MORE	
20	0.000150	0.00020		TEARO OF	
21	0.000158	0.00020			
22	0.000173	0.00020			
23	0.000188	0.00020			
24	0.000195	0.00020			
25	0.000210	0.00020			
26	0.000225	0.00020			
27	0.000240	0.00020			
28	0.000255	0.00020			
29	0.000270	0.00020			
30	0.000285	0.00020			
31	0.000308	0.00020			
32	0.000323	0.00020			
33	0.000345	0.00020			
34	0.000368	0.00020			
35	0.000390	0.00020			
36	0.000413	0.00026			
37	0.000443	0.00032			
38	0.000465	0.00038			
39	0.000495	0.00044			
40	0.000533	0.00050		0 2275	
41	0.000563	0.00054		0.2275	
42	0.000600	0.00058		0.2275	
43	0.000638	0.00062		0.2275	
40	0.000675	0.00066		0.2275	
45	0.000720	0.00070		0.2275	
46	0.000720	0.00070		0.2270	
40	0.000703	0.00100		0.2330	
47	0.000010	0.00100		0.1700	
40	0.001130	0.00113		0.1475	
49 50	0.001230	0.00130		0.1650	
51	0.001310	0.00145		0.1050	
52	0.001390	0.00150		0.1950	
53	0.001480	0.00178		0.1850	
54	0.001727	0.00170		0.1000	
55	0.001047	0.00109		0.1900	
56	0.001947	0.00200		0.2225	
57	0.002075	0.00190		0.2030	
50	0.002211	0.00192		0.2025	
50	0.002343	0.00184		0.2020	
60	0.002497	0.00104	0 1/75	0.2200	
61	0.002031	0.00100	0.14/0	0.2200	
62	0.002021	0.00100	0.1323	0.2400	
62	0.003003	0.00100	0.1000	0.2775	
64	0.003190	0.00180	0.1020	0.2475	
04 6F	0.003300	0.00100	0.2000	0.3050	
60	0.003894	0.00180	0.3000	0.3950	
67	0.004400	0.00100	0.3050	0.3000	
69	0.005120	0.00180	0.2050	0.3200	
60	0.005885	0.00180	0.2250	0.3000	
09	0.000754	0.00180	0.2400	0.2700	
70	0.007744	0.00180	0.2450	0.2650	
71	0.008888	0.00180	0.2300	0.2100	
72	0.010197	0.00180	0.2200	0.2600	
73	0.011704	0.00180	0.2500	0.2150	
14	0.013431	0.00180	0.2100	0.1750	
/5	0.015411	0.00180	0.2500	0.2100	
/6	0.017688	0.00180	0.3000	0.2500	
77	0.020295	0.00180	0.2550	0.3000	
/8	0.023298	0.00180	0.2100	0.2500	
79	0.026730	0.00180	0.3000	0.3000	
80	0.052041	0.00180	1.0000	1.0000	

# TABLE 2(a) RATES OF SEPARATION FROM ACTIVE SERVICE – FEMALES

\*Adjusted Base Rates

\*\*For Tier 4 members, 30 years of service.



PUBLIC EMPLOYEES' RETIREMENT SYSTEM OF MISSISSIPPI JULY 1, 2020 THROUGH JUNE 30, 2024 EXPERIENCE STUDY



# TABLE 2(b) RATES OF SEPARATION FROM ACTIVE SERVICE – FEMALES (Continued)

												Rates o	f Withd	rawal - I	Females	s										
AGE													SEF	RVICE												
	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25+
15	0.4550	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
16	0.4550	0.4000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
17	0.4550	0.4000	0.3200	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
18	0.4550	0.4000	0.3200	0.2700	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
19	0.4550	0.4000	0.3200	0.2700	0.1800	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
20	0.4550	0.4000	0.3200	0.2700	0.1800	0.1350	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
21	0.4550	0.4000	0.3200	0.2700	0.1800	0.1350	0.1000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
22	0.4550	0.4000	0.3200	0.2700	0.1800	0.1350	0.1000	0.0900	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
23	0.3500	0.2700	0.2300	0.1800	0.1550	0.1350	0.1000	0.0900	0.0900	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
24	0.3500	0.2700	0.2300	0.1800	0.1550	0.1350	0.1000	0.0900	0.0900	0.0800	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
25	0.3500	0.2700	0.2300	0.1800	0.1550	0.1350	0.1000	0.0900	0.0900	0.0800	0.0700	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
26	0.3500	0.2700	0.2300	0.1800	0.1550	0.1350	0.1000	0.0900	0.0900	0.0800	0.0700	0.0600	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
27	0.3500	0.2700	0.2300	0.1800	0.1550	0.1350	0.1000	0.0900	0.0900	0.0800	0.0700	0.0600	0.0600	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
28	0.3400	0.2675	0.2150	0.1700	0.1450	0.1250	0.1000	0.0825	0.0850	0.0750	0.0700	0.0600	0.0600	0.0525	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
29	0.3400	0.2675	0.2150	0.1700	0.1450	0.1250	0.1000	0.0825	0.0850	0.0750	0.0700	0.0600	0.0600	0.0525	0.0450	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
30	0.3400	0.2675	0.2150	0.1700	0.1450	0.1250	0.1000	0.0825	0.0850	0.0750	0.0700	0.0600	0.0600	0.0525	0.0450	0.0400	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
31	0.3400	0.2675	0.2150	0.1700	0.1450	0.1250	0.1000	0.0825	0.0850	0.0750	0.0700	0.0600	0.0600	0.0525	0.0450	0.0400	0.0350	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
32	0.3400	0.2675	0.2150	0.1700	0.1450	0.1250	0.1000	0.0825	0.0850	0.0750	0.0700	0.0600	0.0600	0.0525	0.0450	0.0400	0.0350	0.0250	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
33	0.2950	0.2200	0.1850	0.1450	0.1300	0.1200	0.0950	0.0800	0.0775	0.0750	0.0600	0.0600	0.0500	0.0425	0.0450	0.0400	0.0350	0.0250	0.0300	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
34	0.2950	0.2200	0.1850	0.1450	0.1300	0.1200	0.0950	0.0800	0.0775	0.0750	0.0600	0.0600	0.0500	0.0425	0.0450	0.0400	0.0350	0.0250	0.0300	0.0300	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
35	0.2950	0.2200	0.1850	0.1450	0.1300	0.1200	0.0950	0.0800	0.0775	0.0750	0.0600	0.0600	0.0500	0.0425	0.0450	0.0400	0.0350	0.0250	0.0300	0.0300	0.0250	0.0000	0.0000	0.0000	0.0000	0.0000
36	0.2950	0.2200	0.1850	0.1450	0.1300	0.1200	0.0950	0.0800	0.0775	0.0750	0.0600	0.0600	0.0500	0.0425	0.0450	0.0400	0.0350	0.0250	0.0300	0.0300	0.0250	0.0250	0.0000	0.0000	0.0000	0.0000
37	0.2950	0.2200	0.1850	0.1450	0.1300	0.1200	0.0950	0.0800	0.0775	0.0750	0.0600	0.0600	0.0500	0.0425	0.0450	0.0400	0.0350	0.0250	0.0300	0.0300	0.0250	0.0250	0.0250	0.0000	0.0000	0.0000
38	0.2750	0.2200	0.1750	0.1450	0.1150	0.0950	0.0925	0.0775	0.0850	0.0750	0.0600	0.0600	0.0500	0.0450	0.0450	0.0400	0.0350	0.0250	0.0300	0.0300	0.0250	0.0250	0.0250	0.0250	0.0000	0.0000
39	0.2750	0.2200	0.1750	0.1450	0.1150	0.0950	0.0925	0.0775	0.0850	0.0750	0.0600	0.0600	0.0500	0.0450	0.0450	0.0400	0.0350	0.0250	0.0300	0.0300	0.0250	0.0250	0.0250	0.0250	0.0250	0.0000
40	0.2750	0.2200	0.1750	0.1450	0.1150	0.0950	0.0925	0.0775	0.0850	0.0750	0.0600	0.0600	0.0500	0.0450	0.0450	0.0400	0.0350	0.0250	0.0300	0.0300	0.0250	0.0250	0.0250	0.0250	0.0250	0.0000
41	0.2750	0.2200	0.1750	0.1450	0.1150	0.0950	0.0925	0.0775	0.0850	0.0750	0.0600	0.0600	0.0500	0.0450	0.0450	0.0400	0.0350	0.0250	0.0300	0.0300	0.0250	0.0250	0.0250	0.0250	0.0250	0.0000
42	0.2750	0.2200	0.1750	0.1450	0.1150	0.0950	0.0925	0.0775	0.0850	0.0750	0.0600	0.0600	0.0500	0.0450	0.0450	0.0400	0.0350	0.0250	0.0300	0.0300	0.0250	0.0250	0.0250	0.0250	0.0250	0.0000
43 - 47	0.2600	0.2100	0.1500	0.1275	0.1050	0.0875	0.0875	0.0725	0.0750	0.0675	0.0600	0.0600	0.0500	0.0500	0.0450	0.0400	0.0350	0.0325	0.0300	0.0300	0.0300	0.0300	0.0300	0.0300	0.0300	0.0000
48 - 52	0.2600	0.2000	0.1450	0.1275	0.1100	0.0950	0.0825	0.0800	0.0750	0.0675	0.0600	0.0600	0.0500	0.0500	0.0450	0.0400	0.0350	0.0300	0.0300	0.0300	0.0400	0.0400	0.0400	0.0400	0.0400	0.0000
53 - 79	0.2300	0.1900	0.1450	0.1325	0.1100	0.0949	0.0825	0.0900	0.0700	0.0700	0.0600	0.0600	0.0650	0.0500	0.0400	0.0400	0.0350	0.0350	0.0350	0.0350	0.0450	0.0450	0.0450	0.0450	0.0450	0.0000
80+	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

\*Rates stop at eligibility for retirement. For Tier 4, rates at 24 years of service are extended out to 29 years of service.



PUBLIC EMPLOYEES' RETIREMENT SYSTEM OF MISSISSIPPI JULY 1, 2020 THROUGH JUNE 30, 2024 EXPERIENCE STUDY

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## **APPENDIX D – RECOMMENDED RATES**



	(For Both Male	es and Females
	SERVICE	
	0	0.1790
	1	0.0790
	2	0.0540
	3	0.0440
	4	0.0390
	5	0.0340
	6	0.0340
	7	0.0340
	8	0.0290
	9	0.0290
	10	0.0290
	11	0.0290
	12	0.0290
	13	0.0290
	14	0.0290
	15	0.0290
	16	0.0290
	17	0.0290
	18	0.0290
	19	0.0290
	20	0.0290
	21	0.0290
	22	0.0290
	23	0.0290
	24	0.0290
	25	0.0290
	20	0.0290
	28	0.0265
	29	0.0265
	30	0.0265
	31	0.0265
	32	0.0265
7	33	0.0265
	34	0.0265
	35	0.0265
	36	0.0265
	37	0.0265
	38	0.0265
	39	0.0265
	40	0.0265

#### TABLE 3 RATES OF ANTICIPATED SALARY INCREASES\* (For Both Males and Females)

40 0.0265 \* Includes wage inflation of 2.65%



Public Employees' Retirement System of Mississippi July 1, 2020 Through June 30, 2024 Experience Study



### **APPENDIX D – RECOMMENDED RATES**

 TABLE 4

 BASE RATES OF MORTALITY FOR MEMBERS RETIRED ON ACCOUNT OF SERVICE\*

AGE	MALES	FEMALES	AGE	MALES	FEMALES
19	0.000449	0.000155	71	0.023315	0.015384
20	0.000482	0.000175	72	0.026022	0.017169
21	0.000503	0.000194	73	0.029051	0.019148
22	0.000514	0.000204	74	0.032432	0.021359
23	0.000524	0.000223	75	0.036198	0.023823
24	0.000524	0.000243	76	0.040414	0.026578
25	0.000535	0.000252	77	0.045111	0.029643
26	0.000546	0.000272	78	0.050365	0.033067
27	0.000556	0.000291	79	0.056229	0.036879
28	0.000567	0.000310	80	0.062777	0.041138
29	0.000578	0.000330	81	0.070064	0.045891
30	0.000589	0.000349	82	0.078153	0.051187
31	0.000599	0.000369	83	0.087087	0.058860
32	0.000610	0.000398	84	0.096931	0.065660
32	0.000631	0.000378	85	0.107728	0.073240
34	0.000642	0.000417	86	0.119562	0.081690
35	0.000663	0.000440	87	0.132509	0.001000
35	0.000685	0.000475	88	0.132303	0.11120
30	0.000085	0.000504	00	0.140034	0.124719
37	0.000717	0.000534	89	0.162103	0.124/18
38	0.000749	0.000372	90	0.178947	0.139117
39	0.000792	0.000601	91	0.193949	0.1540//
40	0.000835	0.000640	92	0.212470	0.169103
41	0.000888	0.000689	93	0.228295	0.184085
42	0.000942	0.000728	94	0.243607	0.199133
43	0.001017	0.000776	95	0.258780	0.214566
44	0.001081	0.000825	96	0.274348	0.230791
45	0.002547	0.000902	97	0.290847	0.248193
46	0.002739	0.000999	98	0.308684	0.267113
47	0.002953	0.001116	99	0.328083	0.287672
48	0.003178	0.001251	100	0.348916	0.309760
49	0.003413	0.001387	101	0.370605	0.332915
50	0.003670	0.001552	102	0.392048	0.356202
51	0.003948	0.001727	103	0.413063	0.379434
52	0.004248	0.001930	104	0.433478	0.402391
53	0.004569	0.002153	105	0.453166	0.424875
54	0.004922	0.002406	106	0.472009	0.446699
55	0.005307	0.002677	107	0.489910	0.467709
56	0.005725	0.002988	108	0.506795	0.487751
57	0.006195	0.003337	109	0.522620	0.506737
58	0.006709	0.003715	110	0.535000	0.524590
59	0.007287	0.004152	111	0.535000	0.541255
60	0.007918	0.004627	112	0.535000	0.550000
61	0.008624	0.005160	113	0.535000	0.550000
62	0.009395	0.005752	114	0.535000	0.550000
63	0.010240	0.006421	115	0.535000	0.550000
64	0.011171	0.007159	116	0.535000	0.550000
65	0.012187	0.007993	117	0.535000	0.550000
66	0.013546	0.008914	118	0.535000	0.550000
67	0.015076	0.009943	119	0.535000	0.550000
68	0.016799	0.011087	120	1.000000	1.000000
69	0.018725	0.012368			
70	0.020886	0.013793			
70	0.020000	0.013775			

\*Adjusted Base Rates



Public Employees' Retirement System of Mississippi July 1, 2020 Through June 30, 2024 Experience Study



### **APPENDIX D – RECOMMENDED RATES**

AGE	MALES	FEMALES	AGE	MALES	FEMALES
19	0.000480	0.000200	71	0.035160	0.022750
20	0.000490	0.000210	72	0.038360	0.024760
21	0.000490	0.000230	73	0.041830	0.026990
22	0.000500	0.000250	74	0.045590	0.029460
23	0.000510	0.000260	75	0.049710	0.032200
24	0.000520	0.000280	76	0.054240	0.035270
25	0.000530	0.000300	77	0.059260	0.038700
26	0.000540	0.000320	78	0.064860	0.042580
27	0.000550	0.000340	79	0.071100	0.046980
28	0.000560	0.000360	80	0.078020	0.051970
29	0.000570	0.000380	81	0.085690	0.057620
30	0.000590	0.000410	82	0.094140	0.064020
31	0.000600	0.000430	83	0.103440	0.071270
32	0.000620	0.000460	84	0.113610	0.079450
33	0.000640	0.000490	85	0.124680	0.088570
34	0.000670	0.000520	86	0.136760	0.098570
35	0.000700	0.000550	87	0.151110	0.109330
36	0.000740	0.000590	88	0.166730	0.120640
37	0.000780	0.000620	89	0.183000	0.132580
38	0.000830	0.000660	90	0.199560	0.145230
39	0.000880	0.000710	91	0.216290	0.158700
40	0.000950	0.000750	92	0.233230	0.173100
41	0.001010	0.000800	93	0.250530	0.188520
42	0.007330	0.000850	94	0.268370	0.205030
43	0.007600	0.004640	95	0.286890	0.222660
44	0.007880	0.004790	96	0.306160	0.241380
45	0.008160	0.004930	97	0.326090	0.261090
46	0.008450	0.005080	98	0.346360	0.281600
47	0.009110	0.005230	99	0.366400	0.302650
48	0.009350	0.005370	100	0.386040	0.323820
49	0.009600	0.005670	101	0.405120	0.344940
50	0.009850	0.005990	102	0.423520	0.365810
51	0.010120	0.006320	103	0.441130	0.386250
52	0.010420	0.006670	104	0.457860	0.406090
53	0.010730	0.007040	105	0.473640	0.425190
54	0.011080	0.007420	106	0.488430	0.443410
55	0.011470	0.007820	107	0.500000	0.460670
56	0.011920	0.008250	108	0.500000	0.476900
57	0.012430	0.008710	109	0.500000	0.492050
58	0.013020	0.009210	110	0.500000	0.500000
59	0.013710	0.009750	111	0.500000	0.500000
60	0.014500	0.010340	112	0.500000	0.500000
61	0.015430	0.010980	113	0.500000	0.500000
62	0.016500	0.011680	114	0.500000	0.500000
63	0.017760	0.012430	115	0.500000	0.500000
64	0.019210	0.013320	116	0.500000	0.500000
65	0.020860	0.014290	117	1.000000	0.500000
66	0.022710	0.015350	118	1.000000	1.000000
67	0.024760	0.016530	119	1.000000	1.000000
68	0.027030	0.017840	120	1.000000	1.000000
69	0.029500	0.019310			
70	0.032210	0.020940			1

TABLE 5 BASE RATES OF MORTALITY FOR BENEFICIARIES OF DECEASED MEMBERS\*

\*Adjusted Base Rates



Public Employees' Retirement System of Mississippi July 1, 2020 Through June 30, 2024 Experience Study



### **APPENDIX D – RECOMMENDED RATES**

 TABLE 6

 BASE RATES OF MORTALITY FOR MEMBERS RETIRED ON ACCOUNT OF DISABILITY\*

AGE	MALES	FEMALES	AGE	MALES	FEMALES
19	0.005521	0.002688	71	0.058210	0.043300
20	0.005172	0.002425	72	0.061627	0.046475
21	0.004717	0.002200	73	0.065392	0.050038
22	0.004234	0.002050	74	0.069573	0.054025
23	0.003873	0.002050	75	0.074196	0.058475
24	0.003725	0.002238	76	0.079341	0.063438
25	0.003913	0.002450	77	0.085050	0.068963
26	0.004100	0.002688	78	0.091415	0.075088
27	0.004301	0.002938	79	0.098463	0.081875
28	0.004516	0.003212	80	0.106249	0.089375
29	0.004744	0.003513	81	0 114771	0.097638
30	0.004985	0.003837	82	0.124071	0.106700
31	0.005239	0.004200	83	0.121071	0.116638
32	0.005507	0.004200	84	0.134134	0.127038
32	0.005816	0.004588	85	0.156485	0.127675
33	0.005310	0.005475	86	0.150485	0.137075
35	0.006512	0.005475	87	0 182280	0.150462
35	0.006041	0.00550	88	0 100127	0.159402
30	0.000941	0.000330	80	0.17710	0.170012
37	0.007437	0.007175	89	0.217790	0.182/15
38	0.008000	0.007803	90	0.236923	0.195458
39	0.008643	0.008613	91	0.256288	0.209250
40	0.009380	0.009423	92	0.273879	0.224437
41	0.010224	0.010313	93	0.295845	0.241225
42	0.011176	0.011275	94	0.316468	0.259800
43	0.012274	0.012312	95	0.338028	0.280550
44	0.013494	0.013413	96	0.360782	0.302825
45	0.014861	0.014588	97	0.384888	0.326688
46	0.016361	0.015838	98	0.410362	0.352000
47	0.017983	0.017162	99	0.436961	0.378312
48	0.019698	0.018538	100	0.464122	0.404775
49	0.021507	0.019188	101	0.490976	0.431175
50	0.022941	0.019837	102	0.517294	0.457263
51	0.024361	0.020500	103	0.542861	0.482813
52	0.025741	0.021150	104	0.567517	0.507613
53	0.02/068	0.021775	105	0.591114	0.531488
54	0.028328	0.022363	106	0.613532	0.554263
55	0.029493	0.022913	107	0.634678	0.575838
56	0.030552	0.023425	108	0.654496	0.596125
57	0.031557	0.023925	109	0.670000	0.615063
58	0.032535	0.024450	110	0.670000	0.625000
59	0.033540	0.025000	111	0.670000	0.625000
60	0.034626	0.025638	112	0.670000	0.625000
61	0.035872	0.026375	113	0.670000	0.625000
62	0.037319	0.027225	114	0.670000	0.625000
63	0.038967	0.028200	115	0.670000	0.625000
64	0.040790	0.029325	116	0.670000	0.625000
65	0.042786	0.030625	117	0.670000	0.625000
66	0.044930	0.032113	118	0.670000	1.000000
67	0.047222	0.033825	119	1.000000	1.000000
68	0.049660	0.035775	120	1.000000	1.000000
69	0.052273	0.037988			
70	0.055114	0.040488			

\*Adjusted Base Rates



Public Employees' Retirement System of Mississippi July 1, 2020 Through June 30, 2024 Experience Study Mississippi Highway Safety Patrol Retirement System



Experience Study for the Four-Year Period Ending June 30, 2024

Prepared as of June 30, 2024



139/331



April 14, 2025

The Board of Trustees Public Employees' Retirement System of Mississippi The Administrative Board of the Highway Safety Patrol 429 Mississippi Street Jackson, MS 39201

Members of the Board:

We are pleased to submit the results of an investigation of the economic and demographic experience for the Mississippi Highway Safety Patrol Retirement System (HSPRS) for the four-year period from July 1, 2020 to June 30, 2024. The study was based on the data submitted by the Public Employees' Retirement System (PERS) for the annual valuation. In preparing this report, we relied, without audit, on the data provided.

The results of the experience study are the basis for recommended changes in the actuarial assumptions, which if adopted by the Board, will be first used for the June 30, 2025 valuation. With the Board's approval of the recommendations in the report, we believe the actuarial condition of the System will be more accurately portrayed. We would like to acknowledge the help in the preparation of the data for this investigation given by the PERS staff.

The purpose of the investigation was to assess the reasonability of the current HSPRS economic assumptions and demographic actuarial assumptions for each Retirement System. Actuarial assumptions are used to measure and budget future costs. Changing assumptions will not change the actual cost of future benefits. Once the assumptions have been adopted, the actuarial valuation measures the adequacy of the fixed contribution rate.

All recommended rates of separation, mortality and salary increase at each age or service level are shown in the attached tables in Appendix D of this report. In the actuary's judgment, the rates recommended are suitable for use until further experience indicates that modifications are desirable.

In order to prepare the measurement of the impact on liabilities in this report, we have utilized actuarial models that we developed to measure liabilities and develop actuarial costs. These models include tools that we have produced and tested, along with commercially available valuation software that we have reviewed to confirm the appropriateness and accuracy of the output. In utilizing these models, we develop and use input parameters and assumptions about future contingent events along with recognized actuarial approaches to develop the needed results.

We hereby certify that, to the best of our knowledge and belief, this report is complete and accurate and has been prepared in accordance with generally recognized and accepted actuarial principles and practices which are consistent with the principles prescribed by the Actuarial Standards Board (ASB) and the Code of Professional Conduct and Qualification Standards for Public Statements of Actuarial Opinion of the American Academy of Actuaries.



April 14, 2025 Board of Trustees Page 2

In particular, we have prepared the assumptions developed in this report in keeping with our understanding of Actuarial Standards of Practice No. 27 (Selection of Assumptions for Measuring Pension Obligations).

We note that as we prepare this report, the world has been in a pandemic during much of the experience study period. We have taken this into consideration as we reviewed the experience, particularly regarding mortality, retirement, termination and disability patterns. While we do not believe that there is yet sufficient data to warrant the significant modification of any of our assumptions specifically due to COVID-19, we will continue to monitor the situation and advise the Board in the future of any adjustments that we believe would be appropriate.

The experience investigation was performed by, and under the supervision of, independent actuaries who are members of the American Academy of Actuaries with experience in performing valuations for public retirement systems. The undersigned meet the Qualification Standards of the American Academy of Actuaries to render the actuarial opinion contained herein.

Respectfully submitted,

Eduard J. Hockel

Edward J. Koebel, EA, FCA, MAAA Chief Executive Officer

Ben Moble

Ben Mobley, ASA, FCA, MAAA Consulting Actuary



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MISSISSIPPI HIGHWAY SAFETY PATROL RETIREMENT SYSTEM JULY 1, 2020 THROUGH JUNE 30, 2024 EXPERIENCE STUDY



# SECTION I - EXECUTIVE SUMMARY

The purpose of an actuarial valuation is to provide a timely best estimate of the ultimate costs of a retirement system. Actuarial valuations of the Mississippi Highway Safety Patrol Retirement System (HSPRS) are prepared annually to determine the actuarial contribution rate required to fund them on an actuarial reserve basis, (i.e. the current assets plus future contributions, along with investment earnings will be sufficient to provide the benefits promised by the System). The valuation requires the use of certain assumptions with respect to the occurrence of future events, such as rates of death, termination of employment, retirement age, and salary changes to estimate the obligations of the System.

The basic purpose of an experience study is to determine whether the actuarial assumptions currently in use have adequately anticipated the actual emerging experience. This information, along with the professional judgment of system personnel and advisors, is used to evaluate the appropriateness of continued use of the current actuarial assumptions. When analyzing experience and assumptions, it is important to recognize that actual experience is reported in the short-term while assumptions are intended to be long-term estimates of experience. Therefore, actual experience is expected to vary from study period to study period, without necessarily indicating a change in assumptions is needed.

Cavanaugh Macdonald Consulting, LLC (CavMac) has performed a study of the experience for HSPRS for the four-year period ending June 30, 2024. This report presents the results, analysis, and resulting recommendations of our study. It is anticipated that the changes, if approved, will first be reflected in the June 30, 2025 actuarial valuation.

These assumptions have been developed in accordance with generally recognized and accepted actuarial principles and practices that are consistent with the applicable Actuarial Standards of Practice adopted by the Actuarial Standards Board (ASB). While the recommended assumptions represent our best estimate of future experience, there are other reasonable assumption sets that could be supported by the results of this experience study. Those other sets of reasonable assumptions could produce liabilities and costs that are either higher or lower.

#### <u>Our Philosophy</u>

Similar to an actuarial valuation, the calculation of actual and expected experience is a fairly mechanical process, and differences between actuaries in this area are generally minor. However, the setting of assumptions differs, as it is more art than science. In this report, we have recommended changes to certain assumptions. To explain our thought process, we offer a brief summary of our philosophy:

• **Do Not Overreact**: When we see significant changes in experience, we generally do not adjust our rates to reflect the entire difference. We will typically recommend rates somewhere between the old rates and the new experience. If the experience during the next study period shows the same result, we will probably recognize the trend at that point in time or at least move further in the direction of the observed experience. On the other hand, if experience returns closer to its prior level, we will not have overreacted, possibly causing volatility in the actuarial contribution rates.





## SECTION I - EXECUTIVE SUMMARY

- Anticipate Trends: If there is an identified trend that is expected to continue, we believe that this should be recognized. An example is the retiree mortality assumption. It is an established trend that people are living longer, outside of the recent pandemic. Therefore, we believe the best estimate of liabilities in the valuation should reflect the expected increase in life expectancy.
- **Simplify**: In general, we attempt to identify which factors are significant and eliminate or ignore the ones that do not materially improve the accuracy of the liability projections.

The following summarizes the findings and recommendations with regard to the assumptions utilized for HSPRS. Detailed explanations for the recommendations are found in the sections that follow.

#### Recommended Economic Assumption Changes

Economic assumptions are some of the most visible and significant assumptions used in the valuation process. The items in the broad economy modeled by these assumptions can be very volatile over short periods of time, as clearly seen in the economic recovery from the pandemic in 2021 followed by the downward trend in global markets in 2022. Our goal is to try to find the emerging long-term trends in the midst of this volatility so that we can then apply reasonable assumptions.

Most of the economic assumptions used by actuaries are developed through a building-block approach. For example, the expected return on assets is based on the expectation for inflation plus the expected real return on assets. At the core of the economic assumptions is the inflation assumption. As we discuss later in the report, although recently we have experienced higher inflation following the recovery from the pandemic, we believe that long-term inflation will settle back down in the 2.40% to 2.50% range. So therefore, we are recommending that the price inflation assumption remain at 2.40%.

We are also recommending that the long-term expected return on assets assumption remain at 7.00%, reflecting the 2.40% inflation assumption and a 4.60% real rate of return assumption. This will be discussed in detail later in this report, but a real rate of return of 4.60% is supported by the forecasting models developed using the Board's investment consultant's capital market assumptions and the Board's target asset allocation. Further analysis of the 42 sets of capital market assumptions included in the Horizon Actuarial Services, LLC. Survey conducted in 2024 and the Board's target asset allocation also support this recommendation.

Finally, we are recommending that the general wage inflation (payroll growth) assumption used as the underlying payroll growth for active members and used in the level percent of payroll amortization method remain at 2.65%.




# SECTION I - EXECUTIVE SUMMARY

The following table summarizes the current and proposed economic assumptions:

Item	Current	Proposed
Price Inflation	2.40%	2.40%
Investment Return*	7.00%	7.00%
Wage Inflation (Payroll Growth)	2.65%	2.65%

\* Net of investment expenses only.

We recognize there may be other sets of economic assumptions that are also reasonable for purposes of funding HSPRS. For example, we have typically reflected conservatism to the degree we would classify as moderate. Actuarial Standards of Practice allow for this difference in approaches and perspective, as long as the assumptions are reasonable and consistent.



# SECTION I - EXECUTIVE SUMMARY



#### **Recommended Demographic Assumption Changes**

In the experience study, actual experience for the study period is compared to that expected based on the current actuarial assumption. Comparing the actual incidence of the event to what was expected (called the Actual-to-Expected ratio, or A/E ratio) then provides the basis for our analysis.

The major demographic assumptions include mortality, retirement, disability, terminations, and salary merit increases. There are some additional minor assumptions that are required as well. For each of these assumptions, we considered the observed behavior patterns during the study period to determine what adjustments might be appropriate. We note that the study period overlapped substantially with the onset of and then recovery from the Covid-19 pandemic, and so we are intentionally cautious in making changes based on the study period alone.

Mortality is typically the most significant demographic assumption. As we discuss in the report, we are recommending that HSPRS retain the Society of Actuaries Pub-2010 family of mortality tables issued in 2019 based on public retirement plan data. However, we note that we are recommending some slight adjustments in all four mortality tables. We do recommend the continued use of generational mortality, a technique in which mortality rates are assumed to improve slightly each year in the future.

More information will be discussed in the demographic section of this report.

The following is a general list of the other recommended changes to the demographic assumptions for HSPRS.

- Retirement: Recommend minor adjustments in the rates of retirement to better match experience of the System.
- Disability: No change to rates of disability at this time.
- Withdrawal: Increase the rates of withdrawal at most service levels to better match the experience of the System.
- Merit Salary Scale: No change in the merit salary at this time.

Section IV of this report will provide more detail to these recommended demographic changes.





### Actuarial Methods

The basic actuarial methodologies used in the valuation process include the actuarial cost method, the asset valuation method and the unfunded actuarial accrued liability (UAAL) amortization methodology. Generally, these methods are:

- Cost Method Entry Age Normal
- Asset Valuation Five-year recognition of gains and losses with a 20% corridor
- Amortization method Layered bases with new experience bases amortized over a closed 25-year period as a level percentage of payroll.

Based on our review, discussed in full detail in Section III of this report, we recommend no changes in these actuarial methods at this time.

### Other Assumptions

Another assumption that is included in the HSPRS valuation is the determination of administrative expense component that is added to the total normal cost each year. The current assumption is 1.00% of payroll. After reviewing the total amount of administrative expenses for the past four years and the percentage of payroll, we are recommending continuation of the current assumption. The following table shows actual percentages over the past four years:

Year Ending June 30	Administrative Expenses	Annual Payroll	Percentage
2021	\$320,000	\$31,012,146	1.03%
2022	\$319,000	\$33,581,298	0.95%
2023	\$359,000	\$34,748,851	1.03%
2024	\$350,000	\$34,573,388	1.01%





## Financial Impact

Although the assumption changes, if approved, will first be reflected in the 2025 valuations, we have provided the following table which highlights the impact of the recommended changes on the unfunded accrued liability (UAL), funded ratio, actuarially determined employer contribution (ADEC), and projected funding ratio on the 2024 valuation and projection results.

(\$	in	Thousands)
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	Before All Changes	After All Changes
2024 Valuation Unfunded Accrued Liability (UAL)	\$231,089	\$233,561
2024 Funded Ratio	65.5%	65.3%
2024 Actuarially Determined Employer Contribution (ADEC)	53.09%	52.43%
Projected Funding Ratio 2047*	80.5%	80.4%

\* Statutory Contribution Rate (SCR) of 49.08% assumed.







There are four economic assumptions used in the actuarial valuation performed for HSPRS. They are:

- Price Inflation
- Investment Return
- Wage Inflation
- Payroll Growth for Amortization Method

Note that future price inflation has an indirect impact on the results of the actuarial valuation through the development of the assumptions for investment return and wage inflation. However, it is not directly used in the valuation process.

Unlike demographic assumptions, economic assumptions do not lend themselves to analysis largely on the basis of internal historical patterns because economic assumptions are impacted by external forces in the economy. The investment return and general wage increase assumptions are selected on the basis of expectations in an inflation-free environment and then increased by the long-term expectation for inflation, called the "building block" approach.

Sources of data considered in the analysis and selection of the economic assumptions included:

- The 2024 Social Security Trustees Report
- Future expectations of PERS investment consultant, Callan
- Future expectations of other investment consultants (2024 Horizon Survey)
- U.S. Department of the Treasury bond rates
- Assumptions used by other large public retirement systems, based on the Public Fund Survey, published by the National Association of State Retirement Administrators (NASRA)
- Historical observations of price and wage growth statistics and investment returns

Guidance regarding the selection of economic assumptions for measuring pension obligations is provided by Actuarial Standard of Practice (ASOP) No. 27, *Selection of Assumptions for Measuring Pension Obligations*. Because no one knows what the future holds, the best an actuary can do is to use professional judgment to estimate possible future economic outcomes. These estimates are based on a mixture of past experience, future expectations, and professional judgment.

ASOP 27 requires the actuary to select a "reasonable" assumption. For this purpose, an assumption is reasonable if it has the following characteristics:

- It is appropriate for the purpose of the measurement;
- It reflects the actuary's professional judgment;
- It takes into account historical and current economic data that is relevant as of the measurement date;
- It reflects the actuary's estimate of future experience, the actuary's observation of the estimates inherent in market data, or a combination thereof; and
- It has no significant bias (i.e., it is not significantly optimistic or pessimistic), except when provisions for adverse deviation or plan provisions that are difficult to measure are included and disclosed, or when alternative assumptions are used for the assessment of risk.





# **SECTION II – ECONOMIC ASSUMPTIONS**

With respect to relevant data, the standard recommends the actuary review appropriate recent and longterm historical economic data but advises the actuary not to give undue weight to recent experience. Furthermore, it advises the actuary to consider that some historical economic data may not be appropriate for use in developing assumptions for future periods due to changes in the underlying environment. In addition, with respect to any particular valuation, each economic assumption should be consistent with all other economic assumptions over the measurement period.

ASOP 27 recognizes that economic data and analyses are available from a variety of sources, including representatives of the plan sponsor, investment advisors, economists, and other professionals. The actuary is permitted to incorporate the views of experts, but the selection or advice must reflect the actuary's professional judgment.

The standard also discusses a "range of reasonable assumptions" which in part states "the actuary should also recognize that different actuaries will apply professional judgment and may choose different reasonable assumptions." As a result, a range of reasonable assumptions may develop both for an individual actuary and across actuarial practice.

In our opinion, the economic assumptions recommended in this report have been developed in accordance with ASOP No. 27. The following table shows our recommendations followed by detailed discussions of each assumption.

ltem	Current Assumptions	Proposed Assumptions
Price Inflation	2.40%	2.40%
Real Rate of Return*	<u>4.60</u>	<u>4.60</u>
Investment Return	7.00%	7.00%
Price Inflation	2.40%	2.40%
Real Wage Growth	<u>0.25</u>	<u>0.25</u>
Wage Inflation	2.65%	2.65%
Payroll Growth	2.65%	2.65%

\* net of investment expenses.





### Price Inflation

#### Background

As can be seen from the table on the previous page, assumed price inflation is used as the basis for both the investment return assumption and the wage inflation assumption. These latter two assumptions will be discussed in detail in the following sections.

It is important that the price inflation assumption be consistently applied throughout the economic assumptions utilized in an actuarial valuation. This is called for in ASOP No. 27 and is also required to meet the parameters for determining pension liabilities and expense under Governmental Accounting Standards Board (GASB) Statements No. 67 and 68. The long-term relationship between price inflation and investment return has long been recognized by economists. The basic principle is that the investor demands a more or less level "real return" – the excess of actual investment return over price inflation. If inflation rates are expected to be high, investment return rates are also expected to be high, while low inflation rates are expected to result in lower expected investment returns, at least in the long run.

The current price inflation assumption is 2.40% per year, which was recommended and adopted in the last experience study.

#### Past Experience

The Consumer Price Index, US City Average, All Urban Consumers, CPI (U), has been used as the basis for reviewing historical levels of price inflation. The table below provides historical annualized rates and annual standard deviation of the CPI-U over periods ending June 30th.

Period	Number of Years	Annualized Rate of Inflation	Annual Standard Deviation
1926 – 2024	98	2.96%	4.02%
1964 – 2024	60	3.94%	2.89%
1974 – 2024	50	3.79%	2.94%
1984 – 2024	40	2.81%	1.75%
1994 – 2024	30	2.54%	1.86%
2004 – 2024	20	2.55%	2.23%
2014 – 2024	10	2.80%	2.66%





## **SECTION II – ECONOMIC ASSUMPTIONS**

The following graph illustrates the historical levels of price inflation measured as of June 30th of each of the last 50 years and compared to the current 2.40% annual rate currently assumed.



### Annual Rate of CPI (U) Increases

As can be seen from the table on the previous page, over the last 30 years, the average annual rate of increase in the CPI-U has been just over 2.50%. The higher annual rates over the past few years have increased this average. In the last experience study in 2022, the 30-year average of price inflation was approximately 2.53%.

### Forecasts

Additional information to consider in formulating this assumption is obtained from measuring the spread on Treasury Inflation Protected Securities (TIPS) and from the prevailing economic forecasts. The spread between the nominal yield on treasury securities (bonds) and the inflation indexed yield on TIPS of the same maturity is referred to as the "breakeven rate of inflation" and represents the bond market's expectation of inflation over the period to maturity.





## **SECTION II – ECONOMIC ASSUMPTIONS**

Years to Maturity	Nominal Bond Yield	TIPS Yield	Breakeven Rate of Inflation
5	4.38%	2.00%	2.38%
10	4.58	2.24	2.34
20	4.86	2.41	2.45
30	4.78	2.48	2.30

The table below provides the calculation of the breakeven rate of inflation as of December 31, 2024.

As this data indicates, the bond market is anticipating very low inflation of 2.3% to 2.5% for both the short and long term. The bond market expectations may be heavily influenced by the expectations of actions by the Federal Reserve Bank. Whether inflation returns to the higher rates observed historically remains to be seen. We note that measures can move fairly significantly over just a few months.

Based upon information contained in the "Survey of Professional Forecasters" for the fourth quarter of 2024 as published by the Philadelphia Federal Reserve Bank, the median expected annual rate of inflation for the next ten years is 2.23%. Although 10 years of future expectation is too short of a period for the basis of our inflation assumption, the information does provide some evidence that the consensus expectations of these experts are for rates of inflation very close to our current assumption of 2.40% for the near-term future.

PERS' investment consultant, Callan, also has an inflation forecast in their capital market assumptions. Their short-term assumption (10 years) is 2.50%. Horizon Actuarial Services surveys a significant portion of the major investment advisors and publishes their assumptions. For the 2024 study, the long-term inflation assumption was 2.44%.

## Social Security Administration

Although many economists forecast lower inflation than the assumption used by most retirement plans, they are generally looking at a shorter time horizon than is appropriate for a pension valuation. To consider a longer, similar time frame, we looked at the expected increase in the CPI by the Office of the Chief Actuary for the Social Security Administration. In the 2024 annual report, the projected ultimate average annual increase in the CPI over the next 75 years was estimated to be 2.40%, under the intermediate (best estimate) cost assumption. The range of inflation assumptions used in the Social Security 75-year modeling, which includes a low and high-cost scenario, in addition to the intermediate cost projection, was 1.80% to 3.00%. These rates remained unchanged from their 2022 annual report.







### Peer Comparison

While we do not recommend the selection of any assumption based on what other systems use, it does provide another set of relevant information to consider. Based on the Public Plan Database (a survey of over 125+ state and local retirement systems maintained by a collaboration between the Center for Retirement Research at Boston College, the Center for State and Local Government Excellence, and the National Association of State Retirement Administrators), the average inflation assumption for governmental plans is 2.46%. This data is largely based on actuarial valuations prepared with measurement dates in 2023. Based on our experience, we believe the inflation assumption has been steady for most systems over the last year.

#### Recommendation

It is difficult to predict inflation accurately. Inflation's short-term volatility is illustrated by comparing its average rate over the last 10, 30 and 50 year history. Although the 30-year average of 2.54% is closer to the System's assumed rate of 2.40%, the longer 50-year average of 3.79% is much higher and it includes the very high rates of inflation from the late 1970s and early 1980s. Those high rates will not be part of the 50-year average for much longer.

Although we have experienced higher inflation over the last few years following the recovery from the COVID-19 pandemic, current economic forecasts suggest annual inflation rates closer to 2.40% over the short-term and long-term, respectively. We concur with these forecasts and recommend maintaining the inflation assumption for HSPRS at 2.40%.







#### Investment Return

#### Background

The investment return assumption reflects anticipated returns on the current and future assets. The assumed investment return is one of the most significant assumptions in the annual actuarial valuation process as it is used to discount the expected benefit payments for all active, inactive and retired members. Minor changes in this assumption can have a major impact on valuation results. The investment return assumption should reflect the asset allocation target for the funds set by the Board of Trustees.

The current rate recommended by the actuary is 7.00%, consisting of a price inflation assumption of 2.40% and a real rate of return assumption of 4.60%.

#### Long Term Perspective

Because the economy is constantly changing, assumptions about what may occur in the near term are volatile. Asset managers and investment consultants usually focus on this near-term horizon in order to make prudent choices regarding how to invest the trust funds. For actuarial calculations, we typically consider very long periods of time. For example, a newly, hired employee in HSPRS who is 25 years old may work for 30 years, to age 55, and live another 30 years, to age 85 (or longer). The retirement system would receive contributions for the first 30 years and then pay out benefits for the next 30 years. During the entire 60-year period, the system is investing assets related to the member. For such a typical career employee, more than one-half of the investment income earned on assets accumulated to pay benefits is received <u>after</u> the employee retires. In addition, in an open, ongoing system like HSPRS, the stream of benefit payments is continually increasing as new hires replace current members who leave covered employment due to death, termination of employment, and retirement. This difference in the time horizon used by actuaries and investment consultants is frequently a source of debate and confusion when setting economic assumptions.





### Past Experience

One of the inherent problems with analyzing historical data is that the results can look significantly different depending on the timeframe used, especially if the year-to-year results vary widely. In addition, the asset allocation can also impact the investment returns so comparing results over long periods when different asset allocations were in place may not be meaningful.

The assets for HSPRS are valued using a widely accepted asset-smoothing methodology that fully recognizes the expected investment income and also recognizes 20% of each year's investment gain or loss (the difference between actual and expected investment income). The recent experience over the last five years is shown in the table below.

Year Ending 6/30	Actuarial Value	Market Value
2020	6.72%	3.11%
2021	12.47	32.17
2022	8.49	(8.64)
2023	6.85	7.43
2024	7.28	10.41
Geometric Average	8.34%	8.11%

While important to review and analyze, historical returns over such a short time period are not credible for the purpose of setting the long-term assumed future rate of return.

### Future Expectation Analysis

ASOP 27 provides that the actuary may rely on outside experts in setting economic assumptions. PERS utilizes the services of Callan to assist them in developing investment strategies and providing capital market assumptions for the PERS portfolio. As part of their duties, Callan periodically performs assetliability studies, along with comprehensive reviews of the expected return of the various asset classes in which the PERS portfolio is invested. We believe it is appropriate to consider the results of Callan's work as <u>one factor</u> in assessing expected future returns.

We also recognize that there can be differences of opinion among investment professionals regarding future return expectations. Horizon Actuarial Services prepares an annual study in which they survey various investment advisors (42 were included in the 2024 study with a 10-year horizon) and provide ranges of results as well as averages. This information provides an additional perspective on what a broad group of investment experts anticipate for future investment returns.





# **SECTION II – ECONOMIC ASSUMPTIONS**

Our forward-looking analysis used the real rates of return in Callan's capital market assumptions for 2025-2034 and PERS' target asset allocation. Using statistical projections that assume investment returns approximately follow a lognormal distribution with no correlation between years, produces an expected range of real rates of return over a 50-year time horizon. Looking at one year's results produces a mean real return of 5.77%, but also has a high standard deviation or measurement of volatility. By expanding the time horizon, the real return does not change, but the volatility declines significantly. The table below provides a summary of results.

Time	Mean	Standard	Real Returns by Percentile			centile		
Span In Years	Real Return	Deviation	5 <sup>th</sup>	25 <sup>th</sup>	50 <sup>th</sup>	75 <sup>th</sup>	95 <sup>th</sup>	
1	5.77%	13.26%	-14.49%	-3.47%	5.01%	14.24%	28.96%	
5	5.11%	5.88%	-4.21%	1.13%	5.01%	9.04%	15.12%	
10	5.03%	4.15%	-1.59%	2.25%	5.01%	7.85%	12.06%	
20	4.99%	2.93%	0.30%	3.05%	5.01%	7.01%	9.95%	
30	4.97%	2.39%	1.14%	3.41%	5.01%	6.64%	9.02%	
40	4.97%	2.07%	1.65%	3.62%	5.01%	6.42%	8.48%	
50	4.96%	1.85%	2.00%	3.77%	5.01%	6.27%	8.11%	

The percentile results are the percentages of random returns over the time span shown that are expected to be less than the amount indicated. For example, for the 10-year time span, 5% of the resulting real rates of return will be below -1.59% and 95% will be above that. As the time span increases, the results begin to converge. Over a 50-year time span, the results indicate there will be a 25% chance that real returns will be below 3.77% and a 25% chance they will be above 6.27%. In other words, there is a 50% chance the real returns will be between 3.77% and 6.27%.

For a broader view of expected returns, we also reviewed the 2024 Survey of Capital Market Assumptions produced by Horizon Actuarial Services, LLC to see what other investment professionals are currently using for capital market assumptions. The Horizon survey includes both 10-year horizon and 20-year horizon capital market assumptions. We applied the same statistical analysis to these survey results as we did the capital market assumption of PERS investment advisor with the following real return results for the <u>10-year horizon and 20-year horizon</u>:





# SECTION II – ECONOMIC ASSUMPTIONS

### Horizon Survey 10-year horizon

Time	Mean	Standard	Real Returns by Percentile				
Span In Years	Real Return	Deviation	5 <sup>th</sup>	25 <sup>th</sup>	50 <sup>th</sup>	75 <sup>th</sup>	95 <sup>th</sup>
1	5.40%	13.25%	-14.83%	-3.83%	4.64%	13.86%	28.57%
5	4.74%	5.87%	-4.565	0.77%	4.64%	8.67%	14.74%
10	4.66%	4.15%	-1.95%	1.89%	4.64%	7.48%	11.69%
20	4.62%	2.93%	-0.06%	2.69%	4.64%	6.64%	9.58%
30	4.61%	2.39%	0.78%	3.04%	4.64%	6.27%	8.65%
40	4.60%	2.07%	1.29%	3.26%	4.64%	6.05%	8.11%
50	4.60%	1.85%	1.64%	3.40%	4.64%	5.90%	7.74%

### Horizon Survey 20-year horizon

Time	Mean	Standard		Real Ret	urns by Per	centile	
Span In Years	Real Return	Deviation	5 <sup>th</sup>	25 <sup>th</sup>	50 <sup>th</sup>	75 <sup>th</sup>	95 <sup>th</sup>
1	5.76%	13.25%	-14.48%	-3.47%	5.00%	14.22%	28.93%
5	5.10%	5.87%	-4.20%	1.13%	5.00%	9.03%	15.10%
10	5.02%	4.15%	-1.59%	2.25%	5.00%	7.84%	12.05%
20	4.98%	2.93%	0.29%	3.05%	5.00%	7.00%	9.94%
30	4.97%	2.39%	1.14%	3.40%	5.00%	6.63%	9.01%
40	4.96%	2.07%	1.65%	3.62%	5.00%	6.41%	8.47%
50	4.95%	1.85%	2.00%	3.76%	5.00%	6.26%	8.10%

As you can see from the two tables above, setting a real return assumption depends on the time horizon a plan seeks. The 20-year horizon is approximately 0.36% higher at all percentiles than the 10-year horizon. While PERS is a long-term vehicle expected to pay benefits to its retirees for many years in the future, a high percentage of the present value of the benefits is determined within the next ten to fifteen years, so the real return recommendation should fall near the 50<sup>th</sup> percentile columns in the three tables above.

Using a 2.40% inflation assumption, the current investment return assumption of 7.00% utilizes a 4.60% real rate of return (using the "building block" methodology). Based on the table directly above, 4.60% falls into the 42<sup>nd</sup> percentile. While it is slightly below thresholds that we recommend for a long-term assumption, it is still a reasonable assumption, as it falls within the 40-60<sup>th</sup> percentile range.







#### Peer Comparison

Public retirement systems have historically compared their investment performance to their peer group. While we believe there is some merit in assessing the movement in the assumed rate of return for other systems, this is not an appropriate basis for setting this assumption in our opinion. For example, different plans have different plan dynamics, including varying asset allocations, which will impact their choice of the assumed investment return. This peer group information merely provides another set of relevant data to consider as long as we recognize that asset allocation varies from system to system.

The following chart shows the nominal investment return assumptions of 131 plans in the National Association of State Retirement Administrators (NASRA). The assumptions shown below are as of May 2024 and are updated frequently by the NASRA staff.









The following chart shows the changes in expected investment return assumption from the NASRA public plan survey over the last 23 years from 2001.







#### Recommendation

By actuarial standards, we are required to maintain a long-term perspective in setting all assumptions, including the investment return assumption. Therefore, we believe we must be careful not to let recent experience or short-term expectations impact our judgment regarding the appropriateness of the current assumption over the long term.

Based on our analysis of Callan's capital market assumptions and the Horizon Survey capital market assumptions, we are recommending continuation of a real return assumption of 4.60%. We acknowledge that this real return assumption is just slightly below Horizon Survey's anticipated return over the next 10 years of 4.64%. Based on our recommended inflation assumption of 2.40% and real return assumption of 4.60%, we are recommending continuation of the 7.00% expected long term nominal rate of return assumption.

Investment Return Assumption						
Current						
Real Rate of Return*	4.60%	4.60%				
Inflation	2.40%	2.40%				
Net Investment Return	7.00%	7.00%				

\* net of investment expenses.





#### Wage Inflation

#### Background

Wage inflation, thought of as the "across the board" rate of salary increases, is composed of the price inflation assumption combined with an assumption for the real rate of wage increases. In constructing the individual salary increase assumption, the wage inflation assumption is further combined with an assumption for age- or service-based salary increases (called a merit scale). The merit scale assumption is discussed later in this report.

Currently, the wage inflation assumption is 2.65%, which implies an assumed real rate of wage increase or real wage inflation of 0.25% (2.65% less the current inflation assumption of 2.40%). The excess of wage inflation over price inflation represents the increase in the standard of living, also called productivity growth. There has been debate on the issue of whether public sector employees will receive, over the long term, the same rewards for productivity as employees in the private sector, where productivity is more readily measurable. To our knowledge, no definitive research has been completed on this topic. Nevertheless, it is our opinion that public sector employees will eventually be rewarded with the same productivity increases as those participating in the remainder of the economy, even if there is a time lag.

#### Past Experience

The Social Security Administration publishes data on wage growth in the United States (see Appendix C). While this is the most comprehensive data available, it is based on all wage earners in the country so it can be influenced by the mix of jobs as well as by changes in certain sectors of the workforce that may not be seen by all segments.

As with our analysis of inflation, we provide below wage inflation and a comparison with price inflation over various time periods. Currently, this wage data is only available through calendar year 2023. We remove the rate of price inflation for each year from the data to result in the historical real rate of wage inflation.

Period	Wage Inflation	Price Inflation	Real Wage Growth
2013-2023	4.03%	2.79%	1.24%
2003-2023	3.41%	2.58%	0.83%
1993-2023	3.59%	2.51%	1.08%
1983-2023	3.76%	2.81%	0.95%
1973-2023	4.44%	3.86%	0.58%

Thus, over the last 50 years, annual real wage growth has averaged 0.58%.





## **SECTION II – ECONOMIC ASSUMPTIONS**



Similar information over rolling thirty-year periods is shown in the following graph:

### Public Sector Compensation and Wages

The Bureau of Labor Statistics publishes the Employment Cost Index, including detail for real (net of inflation) total compensation and wages and salaries. Further, this index is also broken down for state and local government workers. From 2005 through 2024, real compensation grew by at an annualized rate of 2.85%, while wages and salaries grew at a rate of 2.47%. This difference is a reflection that state and local government workers have had much of their compensation increase delivered through benefits rather than wages and salaries. While it is certainly reasonable to anticipate that total compensation will continue to increase faster than wages and salaries, it is also reasonable to anticipate that the difference between the two will moderate over time.





### Recommendation

Based, on all the information discussed, we recommend that the plan maintain a 0.25% real wage growth inflation assumption and a total wage inflation growth of 2.65%.

	Wage Inflation Assumption	
	Current	Recommended
Price Inflation	2.40%	2.40%
Real Wage Growth	<u>0.25%</u>	<u>0.25%</u>
Wage Inflation	2.65%	2.65%



## **SECTION II – ECONOMIC ASSUMPTIONS**



### Payroll Growth

#### Background

The assumed future rate of payroll growth increase in the total payroll of HSPRS' active members is an assumption used in the level percentage of payroll amortization method that affects the calculation of the amortization period required to fully amortize the unfunded actuarial accrued liability and the actuarially determined employer contribution. The total payroll growth is impacted by individual member's increases and population growth. The current assumption is 2.65% per year which is comprised of the inflation assumption of 2.40% and real wage growth of 0.25%.

#### Recommendation

As we did for PERS, we are recommending we maintain the payroll growth assumption of 2.65%, which is equal to the recommended wage inflation assumption.







#### ACTUARIAL COST METHOD

The systematic financing of a pension plan requires that contributions be made in an orderly fashion while a member is actively employed, so that the accumulation of these contributions, together with investment earnings should be sufficient to provide promised benefits and cover administration expenses. The actuarial valuation is the process used to determine when money should be contributed, i.e., as part of the budgeting process.

The actuarial valuation will not impact the amount of benefits paid or the actual cost of those benefits. In the long run, actuaries cannot change the costs of the pension plan, regardless of the funding method used or the assumptions selected. However, actuaries will influence the incidence of costs by their choice of methods and assumptions.

The valuation or determination of the present value of all future benefits to be paid by the funds reflects the assumptions that best describe anticipated future experience. The choice of a funding method does not impact the determination of the present value of future benefits. The funding method determines only the incidence of cost. In other words, the purpose of the funding method is to allocate the present value of future benefits determination into annual costs. In order to do this allocation, it is necessary for the funding method to "break down" the present value of future benefits into two components: (1) that which is attributable to the past, (2) and that which is attributable to the future. The excess of that portion attributable to the past over the plan assets is then amortized over a period of years. Actuarial terminology calls the present value of future benefits allocated to the future is commonly known as "the present value of future normal costs", with the specific piece of it allocated to the current year being called "the normal cost". The difference between the plan assets and actuarial accrued liability is called the "unfunded actuarial accrued liability".

Two key points should be noted. First, there is no single "correct" funding method since different funding methods simply change the timing of the funding. Second, the allocation of the present value of future benefits and hence cost to the past for amortization and to the future for annual normal cost payments is not necessarily in a one-to-one relationship with service earned in the past and future service to be earned.

#### Entry Age Normal

There are various actuarial cost methods, each of which has different characteristics, advantages and disadvantages. However, Governmental Accounting Standard Board Statement Numbers 67 and 68 require that the Entry Age Normal cost method be used for financial reporting. Most retirement systems will not want to use a different actuarial cost method for funding and financial reporting. In addition, the Entry Age Normal method has been the most popular funding method for public systems for many years. This is the cost method currently used by PERS for all plans.





# SECTION III – ACTUARIAL METHODS

The rationale of the entry age normal (EAN) funding method is that the cost of each member's benefit is determined to be a level percentage of salary from date of hire to the end of employment. This level percentage multiplied by the member's annual salary is referred to as the normal cost and is that portion of the total cost of the employee's benefit which is allocated to the current year. The portion of the present value of future benefits allocated to the future is determined by multiplying this percentage times the present value of the member's assumed earnings for all future years including the current year. The entry age normal actuarial accrued liability is then developed by subtracting from the present value of future benefits that portion of costs allocated to the future. To determine the unfunded actuarial accrued liability, the actuarial value of plan assets is subtracted from the entry age normal actuarial accrued liability. The current year's cost to amortize the unfunded actuarial accrued liability is developed by applying an amortization factor based on the funding policy.

It is to be expected that future events will not occur exactly as predicted by the actuarial assumptions in each year. Actuarial gains/losses from experience under this actuarial cost method can be directly calculated and are reflected as a decrease/increase in the unfunded actuarial accrued liability. Consequently, the gain/loss results in a decrease/increase in the amortization payment, and therefore the contribution rate or amount.

#### Recommendation

Considering that the Entry Age Normal cost method is the most commonly used cost method by public plans, that it develops a normal cost rate that tends to be stable and is the required cost method under calculations required by Governmental Accounting Standard Numbers 67 and 68, we recommend the Entry Age Normal actuarial cost method be retained by PERS for all plans. Note that because of GASB 67 and 68 requirements, the Entry Age Normal method will also be used by the plans for accounting disclosures.







#### ACTUARIAL VALUE OF ASSETS

In preparing an actuarial valuation, the actuary must assign a value to the assets of the fund. An adjusted market value is often used to smooth out the volatility that is reflected in the market value of assets. This is because most employers would rather have annual costs remain relatively smooth, as a percentage of payroll or in actual dollars, as opposed to a cost pattern that is extremely volatile.

The actuary does not have complete freedom in assigning this value. The Actuarial Standards Board also has basic principles regarding the calculation of a smoothed asset value, Actuarial Standard of Practice No. 44 (ASOP 44), *Selection and Use of Asset Valuation Methods for Pension Valuations.* 

ASOP 44 provides that the asset valuation method should bear a reasonable relationship to the market value. Furthermore, the asset valuation method should be likely to satisfy both of the following:

- Produce values within a reasonable range around market value, AND
- Recognize differences from market value in a reasonable amount of time.

In lieu of both of the above, the standard will be met if <u>either</u> of the following requirements is satisfied:

- There is a sufficiently narrow range around the market value, OR
- The method recognizes differences from market value in a sufficiently short period.

These rules or principles prevent the asset valuation methodology from being used to manipulate annual funding patterns. No matter what asset valuation method is used, it is important to note that, like a cost method or actuarial assumptions, the asset valuation method does not affect the true cost of the plan; it only impacts the incidence of cost.

#### Recommendation

Currently, the actuarial value of assets recognizes a portion of the difference between the market value of assets and the expected market value of assets, based on the assumed valuation rate of return. The amount recognized each year is 20% of the difference between market value and expected market value. **We recommend no change in this methodology.** 



# SECTION III – ACTUARIAL METHODS



### AMORTIZATION OF THE UNFUNDED ACTUARIAL ACCRUED LIABILITY

The actuarial accrued liability is the portion of the actuarial present value of future benefits that are not included in future normal costs. Thus, it represents the liability that, in theory, should have been funded through normal costs for past service. Unfunded actuarial accrued liability (UAAL) exists when the actuarial accrued liability exceeds the actuarial value of plan assets. These deficiencies can result from:

- (i) plan improvements that have not been completely paid for,
- (ii) experience that is less favorable than expected,
- (iii) assumption changes that increase liabilities, or
- (iv) contributions that are less than the actuarial contribution rate.

There are a variety of different methods that can be used to amortize the UAAL. Each method results in a different payment stream and, therefore, has cost implications. For each methodology, there are three characteristics:

- The period over which the UAAL is amortized,
- The rate at which the amortization payment increases, and
- The number of components of UAAL (separate amortization bases).

<u>Amortization Period</u>: The amortization period can be either closed or open. If it is a closed amortization period, the number of years remaining in the amortization period declines by one in each future valuation. Alternatively, if the amortization period is an open or rolling period, the amortization period does not decline but is reset to the same number each year. This approach essentially "refinances" the System's debt (UAAL) every year.

<u>Amortization Payment:</u> The <u>level dollar</u> amortization method is similar to the method in which a homeowner pays off a mortgage. The liability, once calculated, is financed by a constant fixed dollar amount, based on the amortization period until the liability is extinguished. This results in the liability steadily decreasing while the payments, though remaining level in dollar terms, in all probability decrease as a percentage of payroll. (Even if a plan sponsor's population is not growing, inflationary salary increases will usually be sufficient to increase the aggregate covered payroll).

The rationale behind the <u>level percentage of payroll</u> amortization method is that since normal costs are calculated to be a constant percentage of pay, the unfunded actuarial accrued liability should be paid off in the same manner. When this method of amortizing the unfunded actuarial accrued liability is adopted, the initial amortization payments are lower than they would be under a level dollar amortization payment method, but the payments increase at a fixed rate each year so that ultimately the annual payment far exceeds the level dollar payment. The expectation is that total payroll will increase at the same rate so that the amortization payments will remain constant, as a percentage of payroll. In the initial years, the level percentage of payroll amortization payment is often less than the interest accruing on the unfunded actuarial accrued liability will grow (called negative amortization). This is particularly true if the plan sponsor is paying off the unfunded actuarial accrued liability over a long period, such as 20 or more years.





# SECTION III - ACTUARIAL METHODS

<u>Amortization Bases</u>: The UAAL can be amortized either as one single amount or as components or "layers", each with a separate amortization base, payment and period. If the UAAL is amortized as one amount, the UAAL is recalculated each year in the valuation and experience gains/losses or other changes in the UAAL are folded into the single UAAL amortization base. The amortization payment is then the total UAAL divided by an amortization factor for the applicable amortization period.

If separate amortization bases are maintained, the UAAL is composed of multiple amortization bases, each with its own payment schedule and remaining amortization period. In each valuation, the unexpected change in the UAAL is established as a new amortization base over the appropriate amortization period beginning on that valuation date. The UAAL is then the sum of all of the outstanding amortization bases on the valuation date and the UAAL payment is the sum of all of the amortization payments on the existing amortization bases. This approach provides transparency in that the current UAAL is paid off over a fixed period of time and the remaining components of the UAAL are clearly identified. Adjustments to the UAAL in future years are also separately identified in each future year. One downside of this approach is that it can create some discontinuities in contribution rates when UAAL layers/components are fully paid off. If this occurs, it likely would be far in the future, with adequate time to address any adjustments needed.

### Recommendation

In the current HSPRS Board funding policy, an actuarially determined employer contribution (ADEC) is calculated during each annual valuation and the ADEC is compared to the Fixed Contribution Rate adopted by the Board as one of its Signal Light metrics. The methodology in calculating the ADEC is as follows:

- Amortization Period Closed period with period of 25 years for new bases
- Amortization Payment Level Percentage of Payroll
- Amortization Bases Separate bases for all experience gains and losses, assumption changes or benefit changes

### We recommend no changes in these methods.







Actuarial Standard of Practice (ASOP) No. 27 provides guidance to actuaries regarding the selection of demographic and other non-economic assumptions for measuring pension obligations. ASOP 27 states that the actuary should use professional judgment to estimate possible future outcomes based on past experience and future expectations, and select assumptions based upon application of that professional judgment. The actuary should select reasonable demographic assumptions in light of the particular characteristics of the defined benefit plan that is the subject of the measurement. A reasonable assumption is one that is expected to appropriately model the contingency being measured and is not anticipated to produce significant cumulative actuarial gains or losses over the measurement period.

Each individual demographic assumption should satisfy the criteria of ASOP 27. In selecting demographic assumptions, the actuary should also consider: the internal consistency between the assumptions, materiality, cost effectiveness, and the combined effect of all assumptions. At each measurement date, the actuary should consider whether the selected assumptions continue to be reasonable, but the actuary is not required to do a complete assumption study at each measurement date. In addition, the actuary should include a specific assumption with respect to expected mortality improvements after the measurement date. In our opinion, the demographic assumptions recommended in this report have been developed in accordance with ASOP 27.

### **Overview of Analysis**

The purpose of a study of demographic experience is to compare what actually happened to the individual members of the System during the study period (July 1, 2020 through June 30, 2024) with what was expected to happen based on the actuarial assumptions.

Studies of demographic experience generally involve three steps:

- First, the number of members changing membership status, called decrements, during the study is tabulated by age, duration, gender, group, and membership class (active, retired, etc.).
- Next, the number of members expected to change status is calculated by multiplying certain membership statistics, called exposure, by the expected rates of decrement.
- Finally, the number of actual decrements is compared with the number of expected decrements. The comparison is called the Actual-to-Expected ratio (A/E Ratio) and is expressed as a percentage.

In general, if the actual experience differs significantly from the overall expected results, or if the pattern of actual decrements, or rates of decrement, by age, sex, or duration deviates significantly from the expected pattern, new assumptions are considered. Recommended revisions are normally not an exact representation of the experience during the observation period. Judgment is required to anticipate future experience from past trends and current evidence, including a determination of the amount of weight to assign to the most recent experience.





Revised rates of decrement are tested by using them to recalculate the expected number of decrements during the study period, and the results are shown as revised Actual-to-Expected Ratios.

It takes a fair amount of data to perform a credible study of demographic assumptions. Because the membership or certain subsets of the membership are relatively small, some assumptions have been selected based more on our professional judgment of reasonable future outcomes than actual experience.

Because much of the past four years of experience overlapped the worldwide Covid pandemic, we recognize that the actual demographic experience captured in this study may be influenced by the presence of the disease, by decisions the various employers made to manage their workforces through this period, and by choices employees may have made in response to actual or perceived changes in the world around them. Further, it is possible that some of these changes will reflect a new reality and show up in future years, while other changes will likely revert back quickly to the previous norms. Consequently, we believe caution is warranted in this study before making significant changes based on the recent data only.





## **RATES OF WITHDRAWAL**

### COMPARISON OF ACTUAL AND EXPECTED WITHDRAWALS FROM ACTIVE SERVICE

CENTRAL AGE OF GROUP	NUMBER OF WITHDRAWALSActualRatio of Actual to Expected		
20	0	1	0.000
25	6	11	0.545
30	16	10	1.600
35	13	8	1.625
40	10	7	1.429
45	10	5	2.000
50	8	2	4.000
53 & over	1	0	0.000
TOTAL	64	44	1.455





The following graph shows a comparison of the present, actual and proposed rates of withdrawal.



### RATES OF WITHDRAWAL FOR ACTIVE MEMBERS





The rates of withdrawal adopted by the Board are used to determine the expected number of separations from active service which will occur as a result of resignation or dismissal. The results of our four-year study indicate that, in aggregate, the actual number of withdrawals was significantly more than expected.

As seen on the table on page 31, there were 64 actual withdrawals versus 44 expected withdrawals over the four-year period of this investigation. As seen on the graph on the previous page, significant differences between actual and expected rates were seen at most ages. During the current investigation period, there were larger than expected numbers of withdrawals at every age group greater than or equal to 30. **Therefore, at this time, we recommend changes in the rates of withdrawal that recognize the upward trend of withdrawal rates and will hopefully better match experience in the future.** 

The following tables show a comparison between the current withdrawal rates and a sample of the proposed withdrawal rates.

CENTRAL AGE	Current	Proposed
25	0.0700	0.0600
30	0.0400	0.0550
35	0.0275	0.0375
40	0.0200	0.0300
45	0.0200	0.0275
50	0.0200	0.0275
53 & over	0.0000	0.0000

### **COMPARATIVE RATES OF WITHDRAWAL**





## COMPARISON OF ACTUAL AND EXPECTED WITHDRAWALS FROM ACTIVE SERVICE BASED ON PROPOSED RATES

CENTRAL	NUMBER OF WITHDRAWALS		
AGE OF GROUP	Actual	Expected	Ratio of Actual to Expected
20	0	0	0.000
25	6	11	0.545
30	16	14	1.143
35	13	11	1.182
40	10	10	1.000
45	10	7	1.429
50	8	4	2.000
53 & over	1	1	0.000
TOTAL	64	58	1.103





### RATES OF DISABILITY RETIREMENT

There was only one disability retirement over the four-year period of this investigation or the prior study period. In fact, this Plan has only had 2 disability retirement in the past 14 years. Since the rates of disability retirement were lowered in the last experience study, **we recommend no change in the rates of disability at this time.** 







## RATES OF RETIREMENT

#### COMPARISON OF ACTUAL AND EXPECTED RETIREMENTS

YEARS	NUMBER OF RETIREMENTS		
OF SERVICE	Actual	Expected	Ratio of Actual to Expected
Under 20	2	1	2.000
20	1	4	0.250
21	5	6	0.833
22	7	4	1.750
23	7	4	1.750
24	11	6	1.833
25	14	11	1.273
26	8	9	0.889
27	13	13	1.000
28	9	6	1.500
29	4	1	4.000
30	5	2	2.500
31	1	1	1.000
32	2	2	1.000
33	2	2	1.000
34	2	2	1.000
Subtotal	93	74	1.257
25	4		1 000
30			1.000
30	1	0	0.000
37	0	0	0.000
38	2	2	1.000
39	0	0	0.000
40 & over	1	1	1.000
GRAND TOTAL	98	78	1.256





The following graph shows a comparison of the present, actual, and proposed rates of service retirements.



As you can see from the table on page 36, in aggregate, there were 98 actual retirements versus 78 expected retirements over the four-year period of this investigation. Reviewing the retirement experience, we see that more actual retirements than expected occurred at years of service from 22 to 25 (39 vs. 25) and at years of service from 28 to 30 (18 vs. 9).

Therefore, we recommend a change in the rates of retirement to better match experience by lowering the rate at 20 years of service and raising rates at years of service from 22 to 25 and again from 28 to 30.

The following table shows a comparison between the present retirement rates and the proposed rates.





Service	Current Rates of Retirement*	Proposed Rates of Retirement*
5	0.075	0.075
6	0.075	0.075
7	0.075	0.075
8	0.075	0.075
9	0.075	0.075
10	0.075	0.075
11	0.075	0.075
12	0.075	0.075
13	0.075	0.075
14	0.075	0.075
15	0.075	0.075
16	0.075	0.075
17	0.075	0.075
18	0.075	0.075
19	0.075	0.075
20	0.090	0.080
-21	0.120	0.120
22	0.075	0.100
23	0.075	0.100
24	0.120	0.140
25	0.240	0.250
26	0.180	0.180
27	0.250	0.250
28	0.250	0.350
29	0.100	0.250
30	0.250	0.300
31	0.275	0.300
32	0.350	0.350
33	0.350	0.350
34	0.350	0.350
35	0.350	0.350
36	0.350	0.350
37	0.350	0.350
38	0.500	0.500
39	0.500	0.500
40+	1.000	1.000

\* The annual rate of service retirement is 100% at age 63




YEARS	NUMBE	MENTS	
OF SERVICE	Actual	Expected	Ratio of Actual to Expected
Under 20	2	1	2.000
20	1	3	0.333
21	5	6	0.833
22	7	6	1.167
23	7	6	1.167
24	11	7	1.571
25	14	12	1.167
26	8	9	0.889
27	13	13	1.000
28	9	9	1.000
29	4	3	1.333
30	5	3	1.667
31	1	1	1.000
32	2	2	1.000
33	2	2	1.000
34	2	2	1.000
Subtotal	93	85	1.094
05	1		1 000
35	1	1	1.000
36	1	0	0.000
3/	0	0	0.000
38	2	2	1.000
39	0	0	0.000
40 & over	1	1	1.000
TOTAL	98	89	1.101

### COMPARISON OF ACTUAL AND EXPECTED RETIREMENTS BASED ON PROPOSED RATES





### RATES OF POST-RETIREMENT MORTALITY

One of the most important demographic assumptions in the valuation is mortality because it projects how long benefit payments will be made. The longer members live, the greater the true cost of future benefit obligations will be.

For many years, rates of mortality have been declining, meaning people, in general, are living longer. Consequently, we anticipate that mortality tables will need to be updated periodically. Because of potential differences in mortality, we break down our study by gender (males and females) and by status (healthy retirees, beneficiaries, disabled retirees, and active members).

Because of the substantial amount of data required to construct a mortality table, actuaries usually rely on standard tables published by the Society of Actuaries. Actuaries then use various adjustments such as age or scaling adjustments to the standard, published mortality tables in order to better match the observed mortality rates of a specific group.

The first of these adjustments is an age adjustment that can be either a "setback" or a "set forward". A oneyear age setback treats all members as if they were one year younger than they truly are when applying the rates in the mortality table. For example, a one year setback would treat a 61-year old retiree as if he will exhibit the mortality of a 60-year old in the standard mortality table.

The second adjustment that can be used to adjust the mortality rates in a standard table to better fit actual experience is to "scale" a mortality table by multiplying the probabilities of death by factors less than one (to reflect better mortality) or factors greater than one (to reflect poorer mortality). Scaling factors can be applied to an entire table or a portion of the table. Of course, if needed, actuaries may use both of these methods to develop an appropriate table to model the mortality of the specific plan population.

In 2019, the Society of Actuaries released a family of mortality tables named the Pub-2010 tables. While prior pension mortality tables have been based solely on private corporate and union retirement plans, these new tables are based entirely on public sector plan data. These tables are split by three membership types: Safety, Teachers, and General to reflect the observed differences in mortality patterns related to the three groups. Tables are further split for healthy retirees, disabled retirees, contingent beneficiaries, and employees. There are still other breakdowns in these tables for at, above or below median annuity values.







The issue of future mortality improvement is one that the actuarial profession has become increasingly focused on studying and monitoring. This has resulted in changes to the relevant Actuarial Standard of Practice, ASOP 27, *Selection of Assumptions for Measuring Pension Obligations*. This ASOP requires the pension actuary to make and disclose a specific recommendation with respect to future improvements in mortality after the valuation date, although it does not require that an actuary assume there will be future improvements. There have been significant improvements in longevity in the past, although there are different opinions about future expectations, and thus there is a subjective component in the estimation of future mortality improvement. We believe it is prudent to anticipate that the trend will continue to some degree in the future and that it is appropriate to reflect some future mortality improvement as part of the mortality assumption.

PERS currently uses generational mortality approach that directly anticipates future improvements in mortality by using a different set of mortality rates for each year of birth, with the rates for later years of birth assuming lower mortality than the rates for earlier years of birth. The varying mortality rates by year of birth create a series of tables that contain "built-in" mortality improvements, e.g., a member who turns age 65 in 2045 has a longer life expectancy than a member who turns age 65 in 2025. When using generational mortality, the A/E ratios for the observed experience are set near 100% as future mortality improvements will be taken into account directly in the actuarial valuation process.

The generational approach is our preferred method for recognizing future mortality improvements in the valuation process because it is more direct and results in longer life expectancy for members who are younger, consistent with what we believe is more likely to occur. Over the last ten to fifteen years, this method has become quite common as computing power has increased.





### COMPARISON OF ACTUAL AND EXPECTED CASES OF POST-RETIREMENT DEATHS

	NUMBER OF POST-RETIREMENT DEATHS						
	MALES AND FEMALES						
GROUP	Actual	Expected	Ratio of Actual to Expected				
	SERVICE	RETIREMENTS					
57 & Under	0	1	0.000				
60	7	3	2.229				
65	6	7	0.861				
70	8	9	0.939				
75	10	12	0.820				
80	10	13	0.784				
85	17	10	1.655				
90	7	6	1.176				
93 & Over	4	2	2.105				
Total	69	63	1.095				
	SUF	RVIVORS					
57 & Under	1	0	3.571				
60	0	0	0.000				
65	0	0	0.000				
70	2	1	1.351				
75	1	4	0.267				
80	10	6	1.626				
85	6	8	0.770				
90	11	9	1.275				
93 & Over	12	10	1.245				
Total	43	38	1.123				





As can be seen from the table on the previous page, the number of actual post-retirement deaths was fairly close to the expected number during the last four-year period. However, the HSPRS does not have enough mortality data by itself to warrant credible data.

Therefore, we recommend that the rates of mortality for post-retirements match the PERS mortality tables which we recommended a change to the amount-weighted mortality tables for all three post-retirement mortality tables (from the headcount-weighted), adjustments or refinements for service retirees and beneficiaries from the current table, and an update to the most recent MP-2021 projection scale from the MP-2020 scale.

Service Retirees (Pr	oposed Table)			
Membership Table	Set Forward (+)/ Setback (-)	<u>A</u>	<u>djustment to Rates</u>	Projection Scale
PubS-2010(B) Retiree	None	Ma Female: 979 83 to 87, a	ale: 107% for all ages % up to age 82, 100% for ages and 110% for ages above 87	MP-2021
Contingent Annuitar	nts (Proposed Table	e)		
Membership Table	<u>Set Forward</u> <u>Setback (</u> -	<u>(+)/</u> -)	Adjustment to Rates	Projection Scale
PubS-2010(B) Contingent Annuitant	Male: Set forward Female: Set forwar	2 years d 3 years	None	MP-2021
Disabled Retirees (F	Proposed Table)			
<u>Membership Table</u>	<u>Set Forward</u> <u>Setback (-</u>	<u>(+)/</u> .)	Adjustment to Rates	Projection Scale
PubG.H-2010 Disabled	Male: Set forward Female: Set forwar	d 1 year rd 2 years	Male: 134% for all ages Female: 125% for all ages	MP-2021





#### RATES OF PRE-RETIREMENT MORTALITY

The active member mortality assumption models eligibility for death benefits prior to retirement. Therefore, it has a much smaller impact on the valuation results than the post-retirement mortality assumption.

It is difficult to isolate the mortality for active members as it may be impacted by active members first terminating or moving to disabled status before death. The data collection methods used in this study do not fully capture known deaths, and so sometimes this can be misleading. Finally, the probability of active death is very small so volatility is not uncommon.

For the four-year period ending June 30, 2024, there were 3 active deaths and these all took place during the 2020/2021 fiscal year. Obviously, the lack of data makes this set not credible so we prefer to set this assumption by utilizing the more reliable analysis performed on the PERS data.

To be consistent with PERS and similar to the post-retirement mortality recommendations, we recommend a change to the amount-weighted mortality tables for the pre-retirement mortality table (from the headcount-weighted), an adjustment in the current pre-retirement mortality table at this time to a set forward of 1 year on rates and the change to the most updated projection scale table, MP-2021.

<u>Membership Table</u>	<u>Set Forward (+)/</u> <u>Setback (-)</u>	Adjustment to Rates	Projection Scale
	Male: Set forward	Male: 75% up to age 47, 100% for ages 48	
PubS-2010(B)	2 years	to 57, and 120% for ages above 58	
Employee	Female: Set	Female: 75% up to age 47, 100% for ages	MP-2021
	forward 1 year	48 to 52, and 110% for ages above 53	





### RATES OF SALARY INCREASE

#### COMPARISON OF ACTUAL AND EXPECTED SALARIES OF ACTIVE MEMBERS

	SALARIES AT END OF YEAR						
Samilaa	MALES AND FEMALES						
Service	Actual	Expected	Ratio of Actual to Expected				
< 1	\$6,695,758	\$6,396,993	1.047				
1	6,668,106	6,612,697	1.008				
2	6,786,937	6,816,652	0.996				
3	5,535,969	5,355,471	1.034				
4	5,187,978	4,953,432	1.047				
5	4,362,634	4,365,020	0.999				
6	2,100,071	2,106,441	0.997				
7	2,220,834	2,086,797	1.064				
8	3,765,079	3,723,628	1.011				
9	2,224,675	2,261,444	0.984				
10	2,612,061	2,358,426	1.108				
11	2,611,874	2,661,043	0.982				
12	2,496,629	2,504,581	0.997				
13	5,868,173	5,866,769	1.000				
14	7,990,415	7,834,569	1.020				
15	8,095,071	7,801,465	1.038				
16	7,319,792	7,217,657	1.014				
17	3,865,958	3,798,428	1.018				
18	2,067,973	1,994,719	1.037				
19	4,188,157	4,350,135	0.963				
20	4,178,729	4,043,554	1.033				
21	4,781,701	4,746,255	1.007				
22	4,423,716	4,397,794	1.006				
23	3,265,727	3,308,658	0.987				
24	2,793,024	2,751,784	1.015				
25+	9,646,865	9,688,714	0.996				
TOTAL	\$121,753,906	\$120,003,126	1.015				





Actual rates of salary increase were within 5% of expected at all service levels except for 7 years of service over the four-year period. Additionally, in the aggregate, salaries were within 1.5% of expected which is a slight improvement over the prior experience investigation even though it includes the period 2021 to 2023 which experienced much higher than expected salary increases. Since the 2024 salary increases returned to match our expectations, we recommend no change to the salary increase rates at this time.

See Appendix D for the full set of rates of salary increases.







#### **OTHER ASSUMPTIONS**

**PERCENT MARRIED:** Currently, 100% of active members are assumed to be married and elect a joint & survivor payment form. We are not provided with marital status on the census data. **However, we believe the current assumption is fairly conservative and recommend no change at this time.** 

**SPOUSE AGE DIFFERENCE:** Currently, for married members, it is assumed a male is three years older than his spouse. We have reviewed this assumption and recommend no change at this time.

**UNUSED LEAVE AND MILITARY SERVICE:** Currently, we assume that participants will have on average 2.25 total years of unused leave (sick and personal) and military service at retirement. We reviewed this assumption for retired participants for each of the past four years and the average number of years of unused leave is 1.78 years and the average number of military years is 0.61 years. There has definitely been an increase in these service amounts at retirement during this period. **Therefore, we recommend increasing this assumption to 2.50 years.** 

Year	Military Service	Unused Leave	Total
2021	0.57	1.64	2.21
2022	0.60	1.75	2.35
2023	0.63	1.82	2.45
2024	0.65	1.89	2.54
Average	0.61	1.78	2.39

**OPTION FACTORS:** The option factors, currently in use by all of the Retirement Systems, are based on the mortality table and investment rate of return (discount rate) used in the valuation. We will review our recommend change in the mortality tables and projection scale and determine if a change in the factors is needed at this time.





# APPENDIX A – HISTORICAL JUNE CPI (U) INDEX

Year	CPI (U)	Year	CPI (U)
1963	30.6	1994	148.0
1964	31.0	1995	152.5
1965	31.6	1996	156.7
1966	32.4	1997	160.3
1967	33.3	1998	163.0
1968	35.7	1999	166.2
1969	34.7	2000	172.4
1970	38.8	2001	178.0
1971	40.6	2002	179.9
1972	41.7	2003	183.7
1973	44.2	2004	189.7
1974	49.0	2005	194.5
1975	53.6	2006	202.9
1976	56.8	2007	208.352
1977	60.7	2008	218.815
1978	65.2	2009	215.693
1979	72.3	2010	217.965
1980	82.7	2011	225.722
1981	90.6	2012	229.478
1982	97.0	2013	233.504
1983	99.5	2014	238.343
1984	103.7	2015	238.638
1985	107.6	2016	241.018
1986	109.5	2017	244.955
1987	113.5	2018	251.989
1988	118.0	2019	256.143
1989	124.1	2020	257.797
1990	129.9	2021	271.696
1991	136.0	2022	296.311
1992	140.2	2023	305.109
1993	144.4	2024	314.069





# Callan's Capital Market Assumptions and PERS' Board of Trustees Target Asset Allocation

### Geometric Real Rates of Return and Standard Deviations by Asset Class

Asset Class	Expected Real Rate of Return	Standard Deviation
Domestic Equity	4.75%	17.00%
International Equity	4.75	20.15
Global Equity	4.95	21.25
Fixed Income	2.25	4.40
Real Estate	3.75	14.00
Private Equity	6.00	27.60
Cash Equivalents	0.50	0.90

### Asset Allocation Targets

Asset Class	Asset Allocation
Domestic Equity	27.00%
International Equity	20.00
Global Equity	12.00
Fixed Income	20.00
Real Estate	10.00
Private Equity	10.00
Cash Equivalents	1.00





# APPENDIX C – SOCIAL SECURITY ADMINISTRATION WAGE INDEX

Year	Wage Index	Annual Increase	Year	Wage Index	Annual Increase
1962	\$4,291.40	5.01%	1993	\$23,132.67	0.86%
1963	4,396.64	2.45	1994	23,753.53	2.68
1964	4,576.32	4.09	1995	24,705.66	4.01
1965	4,658.72	1.80	1996	25,913.90	4.89
1966	4,938.36	6.00	1997	27,426.00	5.84
1967	5,213.44	5.57	1998	28,861.44	5.23
1968	5,571.76	6.87	1999	30,469.84	5.57
1969	5,893.76	5.78	2000	32,154.82	5.53
1970	6,186.24	4.96	2001	32,921.92	2.39
1971	6,497.08	5.02	2002	33,252.09	1.00
1972	7,133.80	9.80	2003	34,064.95	2.44
1973	7,580.16	6.26	2004	35,648.55	4.65
1974	8,030.76	5.94	2005	36,952.94	3.66
1975	8,630.92	7.47	2006	38,651.41	4.60
1976	9,226.48	6.90	2007	40,405.48	4.54
1977	9,779.44	5.99	2008	41,334.97	2.30
1978	10,556.03	7.94	2009	40,711.61	-1.51
1979	11,479.46	8.75	2010	41,673.83	2.36
1980	12,513.46	9.01	2011	42,979.61	3.13
1981	13,773.10	10.07	2012	44,321.67	3.12
1982	14,531.34	5.51	2013	44,888.16	1.28
1983	15,239.24	4.87	2014	46,481.52	3.55
1984	16,135.07	5.88	2015	48,098.63	3.48
1985	16,822.51	4.26	2016	48,642.15	1.13
1986	17,321.82	2.97	2017	50,321.89	3.45
1987	18,426.51	6.38	2018	52,145.80	3.62
1988	19,334.04	4.93	2019	54,099.99	3.75
1989	20,099.55	3.96	2020	55,628.60	2.83
1990	21,027.98	4.62	2021	60,575.07	8.89
1991	21,811.60	3.73	2022	63,795.13	5.31
1992	22,935.42	5.15	2023	66,621.80	4.43





	RATE	S OF							
	WITHD	RAWAL	RATES OF	RATES OF	PATES OF PATES O		RATES OF		
AGE	Less than	20 or More	DEATH*	DEATH*			SERVICE	RETIREMENT**	
	20 Years of	Years of	MALES	FEMALES					
	Service	Service							
20	0.06000	0.03000	0.000360	0.000150	0.000169		0	0.000	
21	0.06000	0.03000	0.000368	0.000158	0.000169		1	0.000	
22	0.06000	0.03000	0.000368	0.000173	0.000169		2	0.000	
23	0.06000	0.03000	0.000375	0.000188	0.000191		3	0.000	
24	0.06000	0.03000	0.000383	0.000195	0.000191		4	0.000	
25	0.06000	0.03000	0.000390	0.000210	0.000191		5	0.075	
26	0.06000	0.03000	0.000398	0.000225	0.000191		6	0.075	
27	0.06000	0.03000	0.000405	0.000240	0.000225		7	0.075	
28	0.06000	0.03000	0.000413	0.000255	0.000225		8	0.075	
29	0.05750	0.02875	0.000420	0.000270	0.000236		9	0.075	
30	0.05500	0.02750	0.000428	0.000285	0.000259		10	0.075	
31	0.05500	0.02750	0.000443	0.000308	0.000270	Ľ	11	0.075	
32	0.05000	0.02500	0.000450	0.000323	0.000304		12	0.075	
33	0.04750	0.02375	0.000465	0.000345	0.000338		13	0.075	
34	0.04000	0.02000	0.000480	0.000368	0.000349		14	0.075	
35	0.03750	0.01875	0.000503	0.000390	0.000383		15	0.075	
36	0.03500	0.01750	0.000525	0.000413	0.000394		16	0.075	
37	0.03250	0.01625	0.000555	0.000443	0.000428		17	0.075	
38	0.03000	0.01500	0.000585	0.000465	0.000450		18	0.075	
39	0.03000	0.01500	0.000623	0.000495	0.000473		19	0.075	
40	0.03000	0.01500	0.000660	0.000533	0.000506		20	0.080	
41	0.02750	0.01375	0.000713	0.000563	0.000529		21	0.120	
42	0.02750	0.01375	0.000758	0.000600	0.000574		22	0.100	
43	0.02750	0.01375	0.000818	0.000638	0.000596		23	0.100	
44	0.02750	0.01375	0.000878	0.000675	0.000641		24	0.140	
45	0.02750	0.01375	0.000945	0.000720	0.000675		25	0.250	
46	0.02750	0.01375	0.001020	0.000765	0.000743		26	0.180	
47	0.02750	0.01375	0.001103	0.000818	0.000810		27	0.250	
48	0.02750	0.01375	0.001590	0.001150	0.000866		28	0.350	
49	0.02750	0.01375	0.001720	0.001230	0.000956		29	0.250	
50	0.02750	0.01375	0.001850	0.001310	0.001035		30	0.300	
51	0.02750	0.01375	0.002000	0.001390	0.001136		31	0.300	
52	0.02750	0.01375	0.002160	0.001480	0.001260		32	0.350	
53	0.02750	0.01375	0.002330	0.001727	0.001406		33	0.350	
54	0.02750	0.01375	0.002520	0.001837	0.001541		34	0.350	
55	0.00000	0.00000	0.002730	0.001947	0.001744		35	0.350	
56			0.002960	0.002079	0.002003		36	0.350	
57			0.003230	0.002211	0.002250		37	0.350	
58			0.004212	0.002343	0.002543		38	0.500	
59			0.004596	0.002497	0.002914		39	0.500	
60			0.005016	0.002651	0.002914		40+	1.000	
61			0.005484	0.002827	0.000000				

TABLE 1RATES OF SEPARATION FROM ACTIVE SERVICE

\* Adjusted Base rates

\*\* The annual rate of service is 100% at age 63.







SERVICE	RATE	
0	0.0500	
1	0.0500	
2	0.0500	
3	0.0500	
4	0.0500	
5	0.0475	
6	0.0475	
7	0.0475	
8	0.0425	
9	0.0425	
10	0.0425	
11	0.0425	
12	0.0425	
13	0.0425	
14	0.0400	
15	0.0400	
16	0.0400	
17	0.0400	
18	0.0400	
19	0.0400	
20	0.0400	
21	0.0375	
22	0.0375	
23	0.0375	
24	0.0375	
25	0.0350	

### TABLE 2 RATES OF ANTICIPATED SALARY INCREASES\* (For Both Males and Females)





AGE	MALES	FEMALES	AGE	MALES	FEMALES
19	0.000449	0.000155	71	0.023315	0.015384
20	0.000482	0.000175	72	0.026022	0.017169
21	0.000503	0.000194	73	0.029051	0.019148
22	0.000514	0.000204	74	0.032432	0.021359
23	0.000524	0.000223	75	0.036198	0.023823
24	0.000524	0.000243	76	0.040414	0.026578
25	0.000535	0.000252	77	0.045111	0.029643
26	0.000546	0.000272	78	0.050365	0.033067
27	0.000556	0.000291	79	0.056229	0.036879
28	0.000567	0.000310	80	0.062777	0.041138
29	0.000578	0.000330	81	0.070064	0.045891
30	0.000589	0.000349	82	0.078153	0.051187
31	0.000599	0.000369	83	0.087087	0.058860
32	0.000610	0.000398	84	0.096931	0.065660
33	0.000631	0.000417	85	0 107728	0.073240
34	0.000642	0.000446	86	0.107720	0.081690
35	0.000663	0.000440	87	0 132509	0.091120
36	0.000685	0.000473	88	0.146654	0.001120
37	0.000717	0.000534	80	0.140004	0.124718
38	0.000717	0.000572	90	0.178947	0.124710
30	0.000743	0.0006012	91	0.175949	0.154077
40	0.000732	0.000640	02	0.100040	0.169103
40	0.000888	0.000689	03	0.212470	0.184085
42	0.000000	0.000000	94	0.223202	0.104000
43	0.000042	0.000720	95	0.258780	0.100100
40	0.001081	0.000825	96	0 274348	0.230791
45	0.002547	0.000902	97	0.290847	0.248193
46	0.002739	0.000999	98	0.308684	0.240100
47	0.002953	0.001116	99	0.328083	0.287672
48	0.003178	0.001251	100	0.348916	0.309760
49	0.003413	0.001387	101	0.370605	0.332915
50	0.003670	0.001552	102	0.392048	0.356202
51	0.003948	0.001727	103	0.413063	0.379434
52	0.004248	0.001930	104	0.433478	0.402391
53	0.004569	0.002153	105	0.453166	0.424875
54	0.004922	0.002406	106	0.472009	0.446699
55	0.005307	0.002677	107	0.489910	0.467709
56	0.005725	0.002988	108	0.506795	0.487751
57	0.006195	0.003337	109	0.522620	0.506737
58	0.006709	0.003715	110	0.535000	0.524590
59	0.007287	0.004152	111	0.535000	0.541255
60	0.007918	0.004627	112	0.535000	0.550000
61	0.008624	0.005160	113	0.535000	0.550000
62	0.009395	0.005752	114	0.535000	0.550000
63	0.010240	0.006421	115	0.535000	0.550000
64	0.011171	0.007159	116	0.535000	0.550000
65	0.012187	0.007993	117	0.535000	0.550000
66	0.013546	0.008914	118	0.535000	0.550000
67	0.015076	0.009943	119	0.535000	0.550000
68	0.016799	0.011087	120	1.000000	1.000000
69	0.018725	0.012368			
70	0.020886	0.013793			

TABLE 3 BASE RATES OF MORTALITY FOR MEMBERS RETIRED ON ACCOUNT OF SERVICE\*

\* Adjusted Base Rates





BAGE RAT		EIT I OK BEN		DEGEAGED	
AGE	MALES	FEMALES	AGE	MALES	FEMALES
19	0.000480	0.000200	71	0.035160	0.022750
20	0.000490	0.000210	72	0.038360	0.024760
21	0.000490	0.000230	73	0.041830	0.026990
22	0.000500	0.000250	74	0.045590	0 029460
23	0.000510	0.000260	75	0.049710	0.032200
24	0.000520	0.000280	76	0.054240	0.035270
25	0.000530	0.000200	70	0.059260	0.038700
26	0.000540	0.000320	78	0.064860	0.030700
20	0.000550	0.000320	70	0.004000	0.042300
27	0.000550	0.000340	79 80	0.071100	0.040980
20	0.000570	0.000300	00	0.076020	0.051970
29	0.000570	0.000360	01	0.000090	0.057020
30	0.000590	0.000410	02	0.094140	0.064020
31	0.000000	0.000430	03	0.103440	0.071270
32	0.000620	0.000460	84	0.113610	0.079450
33	0.000640	0.000490	85	0.124680	0.088570
34	0.000670	0.000520	86	0.136760	0.098570
35	0.000700	0.000550	87	0.151110	0.109330
36	0.000740	0.000590	88	0.166730	0.120640
37	0.000780	0.000620	89	0.183000	0.132580
38	0.000830	0.000660	90	0.199560	0.145230
39	0.000880	0.000710	91	0.216290	0.158700
40	0.000950	0.000750	92	0.233230	0.173100
41	0.001010	0.000800	93	0.250530	0.188520
42	0.007330	0.000850	94	0.268370	0.205030
43	0.007600	0.004640	95	0.286890	0.222660
44	0.007880	0.004790	96	0.306160	0.241380
45	0.008160	0.004930	97	0.326090	0.261090
46	0.008450	0.005080	98	0.346360	0.281600
47	0.009110	0.005230	99	0.366400	0.302650
48	0.009350	0.005370	100	0.386040	0.323820
49	0.009600	0.005670	101	0.405120	0.344940
50	0.009850	0.005990	102	0.423520	0.365810
51	0.010120	0.006320	103	0.441130	0.386250
52	0.010420	0.006670	104	0.457860	0.406090
53	0.010730	0.007040	105	0.473640	0.425190
54	0.011080	0.007420	106	0.488430	0.443410
55	0.011470	0.007820	107	0.500000	0.460670
56	0.011920	0.008250	108	0.500000	0.476900
57	0.012430	0.008710	109	0.500000	0.492050
58	0.013020	0.009210	110	0.500000	0.500000
59	0.013710	0.009750	111	0.500000	0.500000
60	0.014500	0.010340	112	0.500000	0.500000
61	0.015430	0.010980	113	0.500000	0.500000
62	0.016500	0.011680	114	0.500000	0.500000
63	0.017760	0.012430	115	0.500000	0.500000
64	0.019210	0.013320	116	0.500000	0.500000
65	0.020860	0.014290	117	1.000000	0.500000
66	0.022710	0.015350	118	1.000000	1.000000
67	0.024760	0.016530	119	1.000000	1.000000
68	0.027030	0.017840	120	1.000000	1.000000
69	0.029500	0.019310			
70	0.032210	0.020940			

TABLE 4 BASE RATES OF MORTALITY FOR BENEFICIARIES OF DECEASED MEMBERS\*

\* Adjusted Base Rates





BASE RATES	JF WORTALIT		KS RETIRED U	N ACCOUNT O	F DISABILIT
AGE	MALES	FEMALES	AGE	MALES	FEMALES
19	0.000480	0.000200	71	0.035160	0.022750
20	0.000490	0.000210	72	0.038360	0.024760
21	0.000490	0.000230	73	0.041830	0.026990
22	0.000500	0.000250	74	0.045590	0.029460
23	0.000510	0.000260	75	0.049710	0.032200
24	0.000520	0.000280	76	0.054240	0.035270
25	0.000530	0.000300	77	0.059260	0.038700
26	0.000540	0.000320	78	0.064860	0.042580
27	0.000550	0.000340	79	0.071100	0.046980
28	0.000560	0.000360	80	0.078020	0.051970
29	0.000570	0.000380	81	0.085690	0.057620
30	0.000590	0.000410	82	0.094140	0.064020
31	0.000600	0.000430	83	0.103440	0.071270
32	0.000620	0.000460	84	0.113610	0.079450
33	0.000640	0.000490	85	0.124680	0.088570
34	0.000670	0.000520	86	0.136760	0.098570
35	0.000700	0.000550	87	0.151110	0.109330
36	0.000740	0.000590	88	0.166730	0.120640
37	0.000780	0.000620	89	0.183000	0.132580
38	0.000830	0.000660	90	0.199560	0.145230
39	0.000880	0.000710	91	0.216290	0.158700
40	0.000950	0.000750	92	0.233230	0.173100
41	0.001010	0.000800	93	0.250530	0.188520
42	0.007330	0.000850	94	0.268370	0.205030
43	0.007600	0.004640	95	0.286890	0.222660
44	0.007880	0.004790	96	0.306160	0.241380
45	0.008160	0.004930	97	0.326090	0.261090
46	0.008450	0.005080	98	0.346360	0.281600
47	0.009110	0.005230	99	0.366400	0.302650
48	0.009350	0.005370	100	0.386040	0.323820
49	0.009600	0.005670	101	0.405120	0.344940
50	0.009850	0.005990	102	0.423520	0.365810
51	0.010120	0.006320	103	0.441130	0.386250
52	0.010420	0.006670	104	0.457860	0.406090
53	0.010730	0.007040	105	0.473640	0.425190
54	0.011080	0.007420	106	0.488430	0.443410
55	0.011470	0.007820	107	0.500000	0.460670
56	0.011920	0.008250	108	0.500000	0.476900
57	0.012430	0.008710	109	0.500000	0.492050
58	0.013020	0.009210	110	0.500000	0.500000
59	0.013710	0.009750	111	0.500000	0.500000
60	0.014500	0.010340	112	0.500000	0.500000
61	0.015430	0.010980	113	0.500000	0.500000
62	0.016500	0.011680	114	0.500000	0.500000
63	0.017760	0.012430	115	0.500000	0.500000
64	0.019210	0.013320	116	0.500000	0.500000
65	0.020860	0.014290	117	1.000000	0.500000
66	0.022710	0.015350	118	1.000000	1.000000
67	0.024760	0.016530	119	1.000000	1.000000
68	0.027030	0.017840	120	1.000000	1.000000
69	0.029500	0.019310	-		
70	0.032210	0.020940			

TABLE 5 - - . - - - . . . . . . 

\* Adjusted Base Rates



Supplemental Legislative Retirement Plan of Mississippi

Experience Study for the Four-Year Period Ending June 30, 2024

Prepared as of June 30, 2024





April 13, 2025

The Board of Trustees Public Employees' Retirement System of Mississippi 429 Mississippi Street Jackson, MS 39201

Members of the Board:

We are pleased to submit the results of an investigation of the economic and demographic experience for the Supplemental Legislative Retirement Plan for Mississippi (SLRP) for the four-year period from July 1, 2020 to June 30, 2024. The study was based on the data submitted by the Public Employees' Retirement System (PERS) for the annual valuation. In preparing this report, we relied, without audit, on the data provided.

The results of the experience study are the basis for recommended changes in the actuarial assumptions, which if adopted by the Board, will be first used for the June 30, 2025 valuation. With the Board's approval of the recommendations in the report, we believe the actuarial condition of the System will be more accurately portrayed. We would like to acknowledge the help in the preparation of the data for this investigation given by the PERS staff.

The purpose of the investigation was to assess the reasonability of the current SLRP economic assumptions and demographic actuarial assumptions for each Retirement System. Actuarial assumptions are used to measure and budget future costs. Changing assumptions will not change the actual cost of future benefits. Once the assumptions have been adopted, the actuarial valuation measures the adequacy of the fixed contribution rate.

All recommended rates of separation, mortality and salary increase at each age or service level are shown in the attached tables in Appendix D of this report. In the actuary's judgment, the rates recommended are suitable for use until further experience indicates that modifications are desirable.

In order to prepare the measurement of the impact on liabilities in this report, we have utilized actuarial models that we developed to measure liabilities and develop actuarial costs. These models include tools that we have produced and tested, along with commercially available valuation software that we have reviewed to confirm the appropriateness and accuracy of the output. In utilizing these models, we develop and use input parameters and assumptions about future contingent events along with recognized actuarial approaches to develop the needed results.

We hereby certify that, to the best of our knowledge and belief, this report is complete and accurate and has been prepared in accordance with generally recognized and accepted actuarial principles and practices which are consistent with the principles prescribed by the Actuarial Standards Board (ASB) and the Code of Professional Conduct and Qualification Standards for Public Statements of Actuarial Opinion of the American Academy of Actuaries.



April 13, 2025 Board of Trustees Page 2

In particular, we have prepared the assumptions developed in this report in keeping with our understanding of Actuarial Standards of Practice No. 27 (Selection of Assumptions for Measuring Pension Obligations).

We note that as we prepare this report, the world has been in a pandemic during much of the experience study period. We have taken this into consideration as we reviewed the experience, particularly regarding mortality, retirement, termination and disability patterns. While we do not believe that there is yet sufficient data to warrant the significant modification of any of our assumptions specifically due to COVID-19, we will continue to monitor the situation and advise the Board in the future of any adjustments that we believe would be appropriate.

The experience investigation was performed by, and under the supervision of, independent actuaries who are members of the American Academy of Actuaries with experience in performing valuations for public retirement systems. The undersigned meet the Qualification Standards of the American Academy of Actuaries to render the actuarial opinion contained herein.

Respectfully submitted,

Edward J. Hockel

Edward J. Koebel, EA, FCA, MAAA Chief Executive Officer

Ben moble

Ben Mobley, ASA, FCA, MAAA Consulting Actuary



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SUPPLEMENTAL LEGISLATIVE RETIREMENT PLAN OF MISSISSIPPI JULY 1, 2020 THROUGH JUNE 30, 2024 EXPERIENCE STUDY



The purpose of an actuarial valuation is to provide a timely best estimate of the ultimate costs of a retirement system. Actuarial valuations of the Supplemental Legislative Retirement Plan for Mississippi (SLRP) are prepared annually to determine the actuarial contribution rate required to fund them on an actuarial reserve basis, (i.e. the current assets plus future contributions, along with investment earnings will be sufficient to provide the benefits promised by the system). The valuation requires the use of certain assumptions with respect to the occurrence of future events, such as rates of death, termination of employment, retirement age, and salary changes to estimate the obligations of the system.

The basic purpose of an experience study is to determine whether the actuarial assumptions currently in use have adequately anticipated the actual emerging experience. This information, along with the professional judgment of system personnel and advisors, is used to evaluate the appropriateness of continued use of the current actuarial assumptions. When analyzing experience and assumptions, it is important to recognize that actual experience is reported in the short-term while assumptions are intended to be long-term estimates of experience. Therefore, actual experience is expected to vary from study period to study period, without necessarily indicating a change in assumptions is needed.

Cavanaugh Macdonald Consulting, LLC (CavMac) has performed a study of the experience for SLRP for the four-year period ending June 30, 2024. This report presents the results, analysis, and resulting recommendations of our study. It is anticipated that the changes, if approved, will first be reflected in the June 30, 2025 actuarial valuation.

These assumptions have been developed in accordance with generally recognized and accepted actuarial principles and practices that are consistent with the applicable Actuarial Standards of Practice adopted by the Actuarial Standards Board (ASB). While the recommended assumptions represent our best estimate of future experience, there are other reasonable assumption sets that could be supported by the results of this experience study. Those other sets of reasonable assumptions could produce liabilities and costs that are either higher or lower.

### <u>Our Philosophy</u>

Similar to an actuarial valuation, the calculation of actual and expected experience is a fairly mechanical process, and differences between actuaries in this area are generally minor. However, the setting of assumptions differs, as it is more art than science. In this report, we have recommended changes to certain assumptions. To explain our thought process, we offer a brief summary of our philosophy:

• **Do Not Overreact**: When we see significant changes in experience, we generally do not adjust our rates to reflect the entire difference. We will typically recommend rates somewhere between the old rates and the new experience. If the experience during the next study period shows the same result, we will probably recognize the trend at that point in time or at least move further in the direction of the observed experience. On the other hand, if experience returns closer to its prior level, we will not have overreacted, possibly causing volatility in the actuarial contribution rates.





- Anticipate Trends: If there is an identified trend that is expected to continue, we believe that this should be recognized. An example is the retiree mortality assumption. It is an established trend that people are living longer, outside of the recent pandemic. Therefore, we believe the best estimate of liabilities in the valuation should reflect the expected increase in life expectancy.
- **Simplify**: In general, we attempt to identify which factors are significant and eliminate or ignore the ones that do not materially improve the accuracy of the liability projections.

The following summarizes the findings and recommendations with regard to the assumptions utilized for SLRP. Detailed explanations for the recommendations are found in the sections that follow.

#### Recommended Economic Assumption Changes

Economic assumptions are some of the most visible and significant assumptions used in the valuation process. The items in the broad economy modeled by these assumptions can be very volatile over short periods of time, as clearly seen in the economic recovery from the pandemic in 2021 followed by the downward trend in global markets in 2022. Our goal is to try to find the emerging long-term trends in the midst of this volatility so that we can then apply reasonable assumptions.

Most of the economic assumptions used by actuaries are developed through a building-block approach. For example, the expected return on assets is based on the expectation for inflation plus the expected real return on assets. At the core of the economic assumptions is the inflation assumption. As we discuss later in the report, although recently we have experienced higher inflation following the recovery from the pandemic, we believe that long-term inflation will settle back down in the 2.40% to 2.50% range. So therefore, we are recommending that the price inflation assumption remain at 2.40%.

We are also recommending that the long-term expected return on assets assumption remain at 7.00%, reflecting the 2.40% inflation assumption and a 4.60% real rate of return assumption. This will be discussed in detail later in this report, but a real rate of return of 4.60% is supported by the forecasting models developed using the Board's investment consultant's capital market assumptions and the Board's target asset allocation. Further analysis of the 42 sets of capital market assumptions included in the Horizon Actuarial Services, LLC. Survey conducted in 2024 and the Board's target asset allocation also support this recommendation.

Finally, we are recommending that the general wage inflation (payroll growth) assumption used as the underlying payroll growth for active members and used in the level percent of payroll amortization method remain at 2.65%.





The following table summarizes the current and proposed economic assumptions:

Item	Current	Proposed
Price Inflation	2.40%	2.40%
Investment Return*	7.00%	7.00%
Wage Inflation (Payroll Growth)	2.65%	2.65%
* Net of investment expenses only.		

We recognize there may be other sets of economic assumptions that are also reasonable for purposes of funding SLRP. For example, we have typically reflected conservatism to the degree we would classify as moderate. Actuarial Standards of Practice allow for this difference in approaches and perspective, as long as the assumptions are reasonable and consistent.



SUPPLEMENTAL LEGISLATIVE RETIREMENT PLAN OF MISSISSIPPI JULY 1, 2020 THROUGH JUNE 30, 2024 EXPERIENCE STUDY



#### **Recommended Demographic Assumption Changes**

In the experience study, actual experience for the study period is compared to that expected based on the current actuarial assumption. Comparing the actual incidence of the event to what was expected (called the Actual-to-Expected ratio, or A/E ratio) then provides the basis for our analysis.

The major demographic assumptions include mortality, retirement, disability, terminations, and salary merit increases. There are some additional minor assumptions that are required as well. For each of these assumptions, we considered the observed behavior patterns during the study period to determine what adjustments might be appropriate. We note that the study period overlapped substantially with the onset of and then recovery from the Covid-19 pandemic, and so we are intentionally cautious in making changes based on the study period alone.

Mortality is typically the most significant demographic assumption. As we discuss in the report, we are recommending that SLRP retain the Society of Actuaries Pub-2010 family of mortality tables issued in 2019 based on public retirement plan data. However, we note that we are recommending some slight adjustments in all four mortality tables. We do recommend the continued use of generational mortality, a technique in which mortality rates are assumed to improve slightly each year in the future.

More information will be discussed in the demographic section of this report.

The following is a general list of the other recommended changes to the demographic assumptions for SLRP.

- Retirement: Recommend lowering the rates of retirement during election years to better match experience of the System.
- Disability: No change to rates of disability at this time.
- Withdrawal: Recommend decreasing rates of withdrawal during election years that better match experience of the System.
- Merit Salary Scale: No change in the merit salary at this time.

Section IV of this report will provide more detail to these recommended demographic changes.





### Actuarial Methods

The basic actuarial methodologies used in the valuation process include the actuarial cost method, the asset valuation method and the unfunded actuarial accrued liability (UAAL) amortization methodology. Generally, these methods are:

- Cost Method Entry Age Normal
- Asset Valuation Five-year recognition of gains and losses with a 20% corridor
- Amortization method Layered bases with new experience bases amortized over a closed 25-year period as a level percentage of payroll.

Based on our review, discussed in full detail in Section III of this report, we recommend no changes in these actuarial methods at this time.

#### **Other Assumptions**

Another assumption that is included in the SLRP valuation is the determination of administrative expense component that is added to the total normal cost each year. The current assumption is 0.15% of payroll. After reviewing the total amount of administrative expenses for the past four years and the percentage of payroll, we are recommending continuation of the current assumption. The following table shows actual percentages over the past four years:

Year Ending June 30	Administrative Expenses	Annual Payroll	Percentage
2021	\$12,000	\$8,029,670	0.15%
2022	\$12,000	\$8,179,673	0.15%
2023	\$13,000	\$8,425,049	0.15%
2024	\$13,000	\$9,090,777	0.14%







### Financial Impact

Although the assumption changes, if approved, will first be reflected in the 2025 valuations, we have provided the following table which highlights the impact of the recommended changes on the unfunded accrued liability (UAL), funded ratio, actuarially determined employer contribution (ADEC), and projected funding ratio on the 2024 valuation and projection results.

#### (\$ in Thousands)

	Before All Changes	After All Changes
2024 Valuation Unfunded Accrued Liability (UAL)	\$7,442	\$7,000
2024 Funded Ratio	74.7%	75.9%
2024 Actuarially Determined Employer Contribution (ADEC)	8.53%	8.18%
Projected Funded Ratio 2047*	86.9%	92.8%

\* Assumes that the Statutory Contribution Rate (SCR) of 8.40% is continued and that the Plan is still open to new members.







There are four economic assumptions used in the actuarial valuation performed for SLRP. They are:

- Price Inflation
- Investment Return
- Wage Inflation
- Payroll Growth for Amortization Method

Note that future price inflation has an indirect impact on the results of the actuarial valuation through the development of the assumptions for investment return and wage inflation. However, it is not directly used in the valuation process.

Unlike demographic assumptions, economic assumptions do not lend themselves to analysis largely on the basis of internal historical patterns because economic assumptions are impacted by external forces in the economy. The investment return and general wage increase assumptions are selected on the basis of expectations in an inflation-free environment and then increased by the long-term expectation for inflation, called the "building block" approach.

Sources of data considered in the analysis and selection of the economic assumptions included:

- The 2024 Social Security Trustees Report
- Future expectations of PERS investment consultant, Callan
- Future expectations of other investment consultants (2024 Horizon Survey)
- U.S. Department of the Treasury bond rates
- Assumptions used by other large public retirement systems, based on the Public Fund Survey, published by the National Association of State Retirement Administrators (NASRA)
- Historical observations of price and wage growth statistics and investment returns

Guidance regarding the selection of economic assumptions for measuring pension obligations is provided by Actuarial Standard of Practice (ASOP) No. 27, *Selection of Assumptions for Measuring Pension Obligations*. Because no one knows what the future holds, the best an actuary can do is to use professional judgment to estimate possible future economic outcomes. These estimates are based on a mixture of past experience, future expectations, and professional judgment.

ASOP 27 requires the actuary to select a "reasonable" assumption. For this purpose, an assumption is reasonable if it has the following characteristics:

- It is appropriate for the purpose of the measurement;
- It reflects the actuary's professional judgment;
- It takes into account historical and current economic data that is relevant as of the measurement date;
- It reflects the actuary's estimate of future experience, the actuary's observation of the estimates inherent in market data, or a combination thereof; and
- It has no significant bias (i.e., it is not significantly optimistic or pessimistic), except when provisions for adverse deviation or plan provisions that are difficult to measure are included and disclosed, or when alternative assumptions are used for the assessment of risk.





# **SECTION II – ECONOMIC ASSUMPTIONS**

With respect to relevant data, the standard recommends the actuary review appropriate recent and longterm historical economic data but advises the actuary not to give undue weight to recent experience. Furthermore, it advises the actuary to consider that some historical economic data may not be appropriate for use in developing assumptions for future periods due to changes in the underlying environment. In addition, with respect to any particular valuation, each economic assumption should be consistent with all other economic assumptions over the measurement period.

ASOP 27 recognizes that economic data and analyses are available from a variety of sources, including representatives of the plan sponsor, investment advisors, economists, and other professionals. The actuary is permitted to incorporate the views of experts, but the selection or advice must reflect the actuary's professional judgment.

The standard also discusses a "range of reasonable assumptions" which in part states "the actuary should also recognize that different actuaries will apply professional judgment and may choose different reasonable assumptions." As a result, a range of reasonable assumptions may develop both for an individual actuary and across actuarial practice.

In our opinion, the economic assumptions recommended in this report have been developed in accordance with ASOP No. 27. The following table shows our recommendations followed by detailed discussions of each assumption.

ltem	Current	Proposed Assumptions
	Assumptions	Assumptions
Price Inflation	2.40%	2.40%
Real Rate of Return*	<u>4.60</u>	<u>4.60</u>
Investment Return	7.00%	7.00%
Price Inflation	2.40%	2.40%
Real Wage Growth	<u>0.25</u>	<u>0.25</u>
Wage Inflation	2.65%	2.65%
Payroll Growth	2.65%	2.65%

\* net of investment expenses.





#### Price Inflation

#### Background

As can be seen from the table on the previous page, assumed price inflation is used as the basis for both the investment return assumption and the wage inflation assumption. These latter two assumptions will be discussed in detail in the following sections.

It is important that the price inflation assumption be consistently applied throughout the economic assumptions utilized in an actuarial valuation. This is called for in ASOP No. 27 and is also required to meet the parameters for determining pension liabilities and expense under Governmental Accounting Standards Board (GASB) Statements No. 67 and 68. The long-term relationship between price inflation and investment return has long been recognized by economists. The basic principle is that the investor demands a more or less level "real return" – the excess of actual investment return over price inflation. If inflation rates are expected to be high, investment return rates are also expected to be high, while low inflation rates are expected to result in lower expected investment returns, at least in the long run.

The current price inflation assumption is 2.40% per year, which was recommended and adopted in the last experience study.

#### Past Experience

The Consumer Price Index, US City Average, All Urban Consumers, CPI (U), has been used as the basis for reviewing historical levels of price inflation. The table below provides historical annualized rates and annual standard deviation of the CPI-U over periods ending June 30th.

Period	Number of Years	Annualized Rate of Inflation	Annual Standard Deviation
1926 – 2024	98	2.96%	4.02%
1964 – 2024	60	3.94%	2.89%
1974 – 2024	50	3.79%	2.94%
1984 – 2024	40	2.81%	1.75%
1994 – 2024	30	2.54%	1.86%
2004 – 2024	20	2.55%	2.23%
2014 – 2024	10	2.80%	2.66%



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### **SECTION II – ECONOMIC ASSUMPTIONS**

The following graph illustrates the historical levels of price inflation measured as of June 30th of each of the last 50 years and compared to the current 2.40% annual rate currently assumed.



### Annual Rate of CPI (U) Increases

As can be seen from the table on the previous page, over the last 30 years, the average annual rate of increase in the CPI-U has been just over 2.50%. The higher annual rates over the past few years have increased this average. In the last experience study in 2022, the 30-year average of price inflation was approximately 2.53%.

### Forecasts

Additional information to consider in formulating this assumption is obtained from measuring the spread on Treasury Inflation Protected Securities (TIPS) and from the prevailing economic forecasts. The spread between the nominal yield on treasury securities (bonds) and the inflation indexed yield on TIPS of the same maturity is referred to as the "breakeven rate of inflation" and represents the bond market's expectation of inflation over the period to maturity.



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### **SECTION II – ECONOMIC ASSUMPTIONS**

Years to Maturity	Nominal Bond Yield	TIPS Yield	Breakeven Rate of Inflation
5	4.38%	2.00%	2.38%
10	4.58	2.24	2.34
20	4.86	2.41	2.45
30	4.78	2.48	2.30

The table below provides the calculation of the breakeven rate of inflation as of December 31, 2024.

As this data indicates, the bond market is anticipating very low inflation of 2.3% to 2.5% for both the short and long term. The bond market expectations may be heavily influenced by the expectations of actions by the Federal Reserve Bank. Whether inflation returns to the higher rates observed historically remains to be seen. We note that measures can move fairly significantly over just a few months.

Based upon information contained in the "Survey of Professional Forecasters" for the fourth quarter of 2024 as published by the Philadelphia Federal Reserve Bank, the median expected annual rate of inflation for the next ten years is 2.23%. Although 10 years of future expectation is too short of a period for the basis of our inflation assumption, the information does provide some evidence that the consensus expectations of these experts are for rates of inflation very close to our current assumption of 2.40% for the near-term future.

PERS' investment consultant, Callan, also has an inflation forecast in their capital market assumptions. Their short-term assumption (10 years) is 2.50%. Horizon Actuarial Services surveys a significant portion of the major investment advisors and publishes their assumptions. For the 2024 study, the long-term inflation assumption was 2.44%.

### Social Security Administration

Although many economists forecast lower inflation than the assumption used by most retirement plans, they are generally looking at a shorter time horizon than is appropriate for a pension valuation. To consider a longer, similar time frame, we looked at the expected increase in the CPI by the Office of the Chief Actuary for the Social Security Administration. In the 2024 annual report, the projected ultimate average annual increase in the CPI over the next 75 years was estimated to be 2.40%, under the intermediate (best estimate) cost assumption. The range of inflation assumptions used in the Social Security 75-year modeling, which includes a low and high-cost scenario, in addition to the intermediate cost projection, was 1.80% to 3.00%. These rates remained unchanged from their 2022 annual report.







#### Peer Comparison

While we do not recommend the selection of any assumption based on what other systems use, it does provide another set of relevant information to consider. Based on the Public Plan Database (a survey of over 125+ state and local retirement systems maintained by a collaboration between the Center for Retirement Research at Boston College, the Center for State and Local Government Excellence, and the National Association of State Retirement Administrators), the average inflation assumption for governmental plans is 2.46%. This data is largely based on actuarial valuations prepared with measurement dates in 2023. Based on our experience, we believe the inflation assumption has been steady for most systems over the last year.

#### Recommendation

It is difficult to predict inflation accurately. Inflation's short-term volatility is illustrated by comparing its average rate over the last 10, 30 and 50 year history. Although the 30-year average of 2.54% is closer to the System's assumed rate of 2.40%, the longer 50-year average of 3.79% is much higher and it includes the very high rates of inflation from the late 1970s and early 1980s. Those high rates will not be part of the 50-year average for much longer.

Although we have experienced higher inflation over the last few years following the recovery from the COVID-19 pandemic, current economic forecasts suggest annual inflation rates closer to 2.40% over the short-term and long-term, respectively. We concur with these forecasts and recommend maintaining the inflation assumption for SLRP at 2.40%.







#### Investment Return

#### Background

The investment return assumption reflects anticipated returns on the current and future assets. The assumed investment return is one of the most significant assumptions in the annual actuarial valuation process as it is used to discount the expected benefit payments for all active, inactive and retired members. Minor changes in this assumption can have a major impact on valuation results. The investment return assumption should reflect the asset allocation target for the funds set by the Board of Trustees.

The current rate recommended by the actuary is 7.00%, consisting of a price inflation assumption of 2.40% and a real rate of return assumption of 4.60%.

#### Long Term Perspective

Because the economy is constantly changing, assumptions about what may occur in the near term are volatile. Asset managers and investment consultants usually focus on this near-term horizon in order to make prudent choices regarding how to invest the trust funds. For actuarial calculations, we typically consider very long periods of time. For example, a newly, hired employee in SLRP who is 25 years old may work for 30 years, to age 55, and live another 30 years, to age 85 (or longer). The retirement system would receive contributions for the first 30 years and then pay out benefits for the next 30 years. During the entire 60-year period, the system is investing assets related to the member. For such a typical career employee, more than one-half of the investment income earned on assets accumulated to pay benefits is received <u>after</u> the employee retires. In addition, in an open, ongoing system like SLRP, the stream of benefit payments is continually increasing as new hires replace current members who leave covered employment due to death, termination of employment, and retirement. This difference in the time horizon used by actuaries and investment consultants is frequently a source of debate and confusion when setting economic assumptions.



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#### Past Experience

One of the inherent problems with analyzing historical data is that the results can look significantly different depending on the timeframe used, especially if the year-to-year results vary widely. In addition, the asset allocation can also impact the investment returns so comparing results over long periods when different asset allocations were in place may not be meaningful.

The assets for SLRP are valued using a widely accepted asset-smoothing methodology that fully recognizes the expected investment income and also recognizes 20% of each year's investment gain or loss (the difference between actual and expected investment income). The recent experience over the last five years is shown in the table below.

Year Ending 6/30	Actuarial Value	Market Value
2020	6.72%	3.11%
2021	12.47	32.17
2022	8.49	(8.64)
2023	6.85	7.43
2024	7.28	10.41
Geometric Average	8.34%	8.11%

While important to review and analyze, historical returns over such a short time period are not credible for the purpose of setting the long-term assumed future rate of return.

### Future Expectation Analysis

ASOP 27 provides that the actuary may rely on outside experts in setting economic assumptions. PERS utilizes the services of Callan to assist them in developing investment strategies and providing capital market assumptions for the PERS portfolio. As part of their duties, Callan periodically performs assetliability studies, along with comprehensive reviews of the expected return of the various asset classes in which the PERS portfolio is invested. We believe it is appropriate to consider the results of Callan's work as <u>one factor</u> in assessing expected future returns.

We also recognize that there can be differences of opinion among investment professionals regarding future return expectations. Horizon Actuarial Services prepares an annual study in which they survey various investment advisors (42 were included in the 2024 study with a 10-year horizon) and provide ranges of results as well as averages. This information provides an additional perspective on what a broad group of investment experts anticipate for future investment returns.





# **SECTION II – ECONOMIC ASSUMPTIONS**

Our forward-looking analysis used the real rates of return in Callan's capital market assumptions for 2025-2034 and PERS' target asset allocation. Using statistical projections that assume investment returns approximately follow a lognormal distribution with no correlation between years, produces an expected range of real rates of return over a 50-year time horizon. Looking at one year's results produces a mean real return of 5.77%, but also has a high standard deviation or measurement of volatility. By expanding the time horizon, the real return does not change, but the volatility declines significantly. The table below provides a summary of results.

Time	Mean	Standard		Real Returns by Percentile			
Span In Years	Real Return	Deviation	5 <sup>th</sup>	25 <sup>th</sup>	50 <sup>th</sup>	75 <sup>th</sup>	95 <sup>th</sup>
1	5.77%	13.26%	-14.49%	-3.47%	5.01%	14.24%	28.96%
5	5.11%	5.88%	-4.21%	1.13%	5.01%	9.04%	15.12%
10	5.03%	4.15%	-1.59%	2.25%	5.01%	7.85%	12.06%
20	4.99%	2.93%	0.30%	3.05%	5.01%	7.01%	9.95%
30	4.97%	2.39%	1.14%	3.41%	5.01%	6.64%	9.02%
40	4.97%	2.07%	1.65%	3.62%	5.01%	6.42%	8.48%
50	4.96%	1.85%	2.00%	3.77%	5.01%	6.27%	8.11%

The percentile results are the percentages of random returns over the time span shown that are expected to be less than the amount indicated. For example, for the 10-year time span, 5% of the resulting real rates of return will be below -1.59% and 95% will be above that. As the time span increases, the results begin to converge. Over a 50-year time span, the results indicate there will be a 25% chance that real returns will be below 3.77% and a 25% chance they will be above 6.27%. In other words, there is a 50% chance the real returns will be between 3.77% and 6.27%.

For a broader view of expected returns, we also reviewed the 2024 Survey of Capital Market Assumptions produced by Horizon Actuarial Services, LLC to see what other investment professionals are currently using for capital market assumptions. The Horizon survey includes both 10-year horizon and 20-year horizon capital market assumptions. We applied the same statistical analysis to these survey results as we did the capital market assumption of PERS investment advisor with the following real return results for the <u>10-year horizon and 20-year horizon</u>:



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# SECTION II – ECONOMIC ASSUMPTIONS

## Horizon Survey 10-year horizon

Time	Mean	Standard	Real Returns by Percentile				
Span In Years	Real Return	Deviation	5 <sup>th</sup>	25 <sup>th</sup>	50 <sup>th</sup>	75 <sup>th</sup>	95 <sup>th</sup>
1	5.40%	13.25%	-14.83%	-3.83%	4.64%	13.86%	28.57%
5	4.74%	5.87%	-4.565	0.77%	4.64%	8.67%	14.74%
10	4.66%	4.15%	-1.95%	1.89%	4.64%	7.48%	11.69%
20	4.62%	2.93%	-0.06%	2.69%	4.64%	6.64%	9.58%
30	4.61%	2.39%	0.78%	3.04%	4.64%	6.27%	8.65%
40	4.60%	2.07%	1.29%	3.26%	4.64%	6.05%	8.11%
50	4.60%	1.85%	1.64%	3.40%	4.64%	5.90%	7.74%

## Horizon Survey 20-year horizon

Time	Mean	Standard		Real Returns by Percentile			
Span In Years	Real Return	Deviation	5 <sup>th</sup>	25 <sup>th</sup>	50 <sup>th</sup>	75 <sup>th</sup>	95 <sup>th</sup>
1	5.76%	13.25%	-14.48%	-3.47%	5.00%	14.22%	28.93%
5	5.10%	5.87%	-4.20%	1.13%	5.00%	9.03%	15.10%
10	5.02%	4.15%	-1.59%	2.25%	5.00%	7.84%	12.05%
20	4.98%	2.93%	0.29%	3.05%	5.00%	7.00%	9.94%
30	4.97%	2.39%	1.14%	3.40%	5.00%	6.63%	9.01%
40	4.96%	2.07%	1.65%	3.62%	5.00%	6.41%	8.47%
50	4.95%	1.85%	2.00%	3.76%	5.00%	6.26%	8.10%

As you can see from the two tables above, setting a real return assumption depends on the time horizon a plan seeks. The 20-year horizon is approximately 0.36% higher at all percentiles than the 10-year horizon. While PERS is a long-term vehicle expected to pay benefits to its retirees for many years in the future, a high percentage of the present value of the benefits is determined within the next ten to fifteen years, so the real return recommendation should fall near the 50<sup>th</sup> percentile columns in the three tables above.

Using a 2.40% inflation assumption, the current investment return assumption of 7.00% utilizes a 4.60% real rate of return (using the "building block" methodology). Based on the table directly above, 4.60% falls into the 42<sup>nd</sup> percentile. While it is slightly below thresholds that we recommend for a long-term assumption, it is still a reasonable assumption, as it falls within the 40-60<sup>th</sup> percentile range.







## Peer Comparison

Public retirement systems have historically compared their investment performance to their peer group. While we believe there is some merit in assessing the movement in the assumed rate of return for other systems, this is not an appropriate basis for setting this assumption in our opinion. For example, different plans have different plan dynamics, including varying asset allocations, which will impact their choice of the assumed investment return. This peer group information merely provides another set of relevant data to consider as long as we recognize that asset allocation varies from system to system.

The following chart shows the nominal investment return assumptions of 131 plans in the National Association of State Retirement Administrators (NASRA). The assumptions shown below are as of May 2024 and are updated frequently by the NASRA staff.









The following chart shows the changes in expected investment return assumption from the NASRA public plan survey over the last 23 years from 2001.







## Recommendation

By actuarial standards, we are required to maintain a long-term perspective in setting all assumptions, including the investment return assumption. Therefore, we believe we must be careful not to let recent experience or short-term expectations impact our judgment regarding the appropriateness of the current assumption over the long term.

Based on our analysis of Callan's capital market assumptions and the Horizon Survey capital market assumptions, we are recommending continuation of a real return assumption of 4.60%. We acknowledge that this real return assumption is just slightly below Horizon Survey's anticipated return over the next 10 years of 4.64%. Based on our recommended inflation assumption of 2.40% and real return assumption of 4.60%, we are recommending continuation of the 7.00% expected long term nominal rate of return assumption.

Investment Return Assumption					
	Current	Recommended			
Real Rate of Return*	4.60%	4.60%			
Inflation	2.40%	2.40%			
Net Investment Return	7.00%	7.00%			

\* net of investment expenses.





## Wage Inflation

## Background

Wage inflation, thought of as the "across the board" rate of salary increases, is composed of the price inflation assumption combined with an assumption for the real rate of wage increases. In constructing the individual salary increase assumption, the wage inflation assumption is further combined with an assumption for age- or service-based salary increases (called a merit scale). The merit scale assumption is discussed later in this report.

Currently, the wage inflation assumption is 2.65%, which implies an assumed real rate of wage increase or real wage inflation of 0.25% (2.65% less the current inflation assumption of 2.40%). The excess of wage inflation over price inflation represents the increase in the standard of living, also called productivity growth. There has been debate on the issue of whether public sector employees will receive, over the long term, the same rewards for productivity as employees in the private sector, where productivity is more readily measurable. To our knowledge, no definitive research has been completed on this topic. Nevertheless, it is our opinion that public sector employees will eventually be rewarded with the same productivity increases as those participating in the remainder of the economy, even if there is a time lag.

#### Past Experience

The Social Security Administration publishes data on wage growth in the United States (see Appendix C). While this is the most comprehensive data available, it is based on all wage earners in the country so it can be influenced by the mix of jobs as well as by changes in certain sectors of the workforce that may not be seen by all segments.

As with our analysis of inflation, we provide below wage inflation and a comparison with price inflation over various time periods. Currently, this wage data is only available through calendar year 2023. We remove the rate of price inflation for each year from the data to result in the historical real rate of wage inflation.

Period	Wage Inflation	Price Inflation	Real Wage Growth
2013-2023	4.03%	2.79%	1.24%
2003-2023	3.41%	2.58%	0.83%
1993-2023	3.59%	2.51%	1.08%
1983-2023	3.76%	2.81%	0.95%
1973-2023	4.44%	3.86%	0.58%

Thus, over the last 50 years, annual real wage growth has averaged 0.58%.





# **SECTION II – ECONOMIC ASSUMPTIONS**



Similar information over rolling thirty-year periods is shown in the following graph:

## Public Sector Compensation and Wages

The Bureau of Labor Statistics publishes the Employment Cost Index, including detail for real (net of inflation) total compensation and wages and salaries. Further, this index is also broken down for state and local government workers. From 2005 through 2024, real compensation grew by at an annualized rate of 2.85%, while wages and salaries grew at a rate of 2.47%. This difference is a reflection that state and local government workers have had much of their compensation increase delivered through benefits rather than wages and salaries. While it is certainly reasonable to anticipate that total compensation will continue to increase faster than wages and salaries, it is also reasonable to anticipate that the difference between the two will moderate over time.



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## Recommendation

Based, on all the information discussed, we recommend that the plan maintain a 0.25% real wage growth inflation assumption and a total wage inflation growth of 2.65%.

	Wage Inflation Assumption	
	Current	Recommended
Price Inflation	2.40%	2.40%
Real Wage Growth	<u>0.25%</u>	<u>0.25%</u>
Wage Inflation	2.65%	2.65%



# **SECTION II – ECONOMIC ASSUMPTIONS**



## Payroll Growth

## Background

The assumed future rate of payroll growth increase in the total payroll of SLRP' active members is an assumption used in the level percentage of payroll amortization method that affects the calculation of the amortization period required to fully amortize the unfunded actuarial accrued liability and the actuarially determined employer contribution. The total payroll growth is impacted by individual member's increases and population growth. The current assumption is 2.65% per year which is comprised of the inflation assumption of 2.40% and real wage growth of 0.25%.

#### Recommendation

As we did for PERS, we are recommending we maintain the payroll growth assumption of 2.65%, which is equal to the recommended wage inflation assumption.







## ACTUARIAL COST METHOD

The systematic financing of a pension plan requires that contributions be made in an orderly fashion while a member is actively employed, so that the accumulation of these contributions, together with investment earnings should be sufficient to provide promised benefits and cover administration expenses. The actuarial valuation is the process used to determine when money should be contributed, i.e., as part of the budgeting process.

The actuarial valuation will not impact the amount of benefits paid or the actual cost of those benefits. In the long run, actuaries cannot change the costs of the pension plan, regardless of the funding method used or the assumptions selected. However, actuaries will influence the incidence of costs by their choice of methods and assumptions.

The valuation or determination of the present value of all future benefits to be paid by the funds reflects the assumptions that best describe anticipated future experience. The choice of a funding method does not impact the determination of the present value of future benefits. The funding method determines only the incidence of cost. In other words, the purpose of the funding method is to allocate the present value of future benefits determination into annual costs. In order to do this allocation, it is necessary for the funding method to "break down" the present value of future benefits into two components: (1) that which is attributable to the past, (2) and that which is attributable to the future. The excess of that portion attributable to the past over the plan assets is then amortized over a period of years. Actuarial terminology calls the present value of future benefits allocated to the future is commonly known as "the present value of future normal costs", with the specific piece of it allocated to the current year being called "the normal cost". The difference between the plan assets and actuarial accrued liability is called the "unfunded actuarial accrued liability".

Two key points should be noted. First, there is no single "correct" funding method since different funding methods simply change the timing of the funding. Second, the allocation of the present value of future benefits and hence cost to the past for amortization and to the future for annual normal cost payments is not necessarily in a one-to-one relationship with service earned in the past and future service to be earned.

#### Entry Age Normal

There are various actuarial cost methods, each of which has different characteristics, advantages and disadvantages. However, Governmental Accounting Standard Board Statement Numbers 67 and 68 require that the Entry Age Normal cost method be used for financial reporting. Most retirement systems will not want to use a different actuarial cost method for funding and financial reporting. In addition, the Entry Age Normal method has been the most popular funding method for public systems for many years. This is the cost method currently used by PERS for all plans.



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# SECTION III - ACTUARIAL METHODS

The rationale of the entry age normal (EAN) funding method is that the cost of each member's benefit is determined to be a level percentage of salary from date of hire to the end of employment. This level percentage multiplied by the member's annual salary is referred to as the normal cost and is that portion of the total cost of the employee's benefit which is allocated to the current year. The portion of the present value of future benefits allocated to the future is determined by multiplying this percentage times the present value of the member's assumed earnings for all future years including the current year. The entry age normal actuarial accrued liability is then developed by subtracting from the present value of future benefits that portion of costs allocated to the future. To determine the unfunded actuarial accrued liability, the actuarial value of plan assets is subtracted from the entry age normal actuarial accrued liability. The current year's cost to amortize the unfunded actuarial accrued liability is developed by applying an amortization factor based on the funding policy.

It is to be expected that future events will not occur exactly as predicted by the actuarial assumptions in each year. Actuarial gains/losses from experience under this actuarial cost method can be directly calculated and are reflected as a decrease/increase in the unfunded actuarial accrued liability. Consequently, the gain/loss results in a decrease/increase in the amortization payment, and therefore the contribution rate or amount.

#### Recommendation

Considering that the Entry Age Normal cost method is the most commonly used cost method by public plans, that it develops a normal cost rate that tends to be stable and is the required cost method under calculations required by Governmental Accounting Standard Numbers 67 and 68, we recommend the Entry Age Normal actuarial cost method be retained by PERS for all plans. Note that because of GASB 67 and 68 requirements, the Entry Age Normal method will also be used by the plans for accounting disclosures.







## ACTUARIAL VALUE OF ASSETS

In preparing an actuarial valuation, the actuary must assign a value to the assets of the fund. An adjusted market value is often used to smooth out the volatility that is reflected in the market value of assets. This is because most employers would rather have annual costs remain relatively smooth, as a percentage of payroll or in actual dollars, as opposed to a cost pattern that is extremely volatile.

The actuary does not have complete freedom in assigning this value. The Actuarial Standards Board also has basic principles regarding the calculation of a smoothed asset value, Actuarial Standard of Practice No. 44 (ASOP 44), *Selection and Use of Asset Valuation Methods for Pension Valuations.* 

ASOP 44 provides that the asset valuation method should bear a reasonable relationship to the market value. Furthermore, the asset valuation method should be likely to satisfy both of the following:

- Produce values within a reasonable range around market value, AND
- Recognize differences from market value in a reasonable amount of time.

In lieu of both of the above, the standard will be met if <u>either</u> of the following requirements is satisfied:

- There is a sufficiently narrow range around the market value, OR
- The method recognizes differences from market value in a sufficiently short period.

These rules or principles prevent the asset valuation methodology from being used to manipulate annual funding patterns. No matter what asset valuation method is used, it is important to note that, like a cost method or actuarial assumptions, the asset valuation method does not affect the true cost of the plan; it only impacts the incidence of cost.

#### Recommendation

Currently, the actuarial value of assets recognizes a portion of the difference between the market value of assets and the expected market value of assets, based on the assumed valuation rate of return. The amount recognized each year is 20% of the difference between market value and expected market value. **We recommend no change in this methodology.** 



# SECTION III - ACTUARIAL METHODS



## AMORTIZATION OF THE UNFUNDED ACTUARIAL ACCRUED LIABILITY

The actuarial accrued liability is the portion of the actuarial present value of future benefits that are not included in future normal costs. Thus, it represents the liability that, in theory, should have been funded through normal costs for past service. Unfunded actuarial accrued liability (UAAL) exists when the actuarial accrued liability exceeds the actuarial value of plan assets. These deficiencies can result from:

- (i) plan improvements that have not been completely paid for,
- (ii) experience that is less favorable than expected,
- (iii) assumption changes that increase liabilities, or
- (iv) contributions that are less than the actuarial contribution rate.

There are a variety of different methods that can be used to amortize the UAAL. Each method results in a different payment stream and, therefore, has cost implications. For each methodology, there are three characteristics:

- The period over which the UAAL is amortized,
- The rate at which the amortization payment increases, and
- The number of components of UAAL (separate amortization bases).

<u>Amortization Period</u>: The amortization period can be either closed or open. If it is a closed amortization period, the number of years remaining in the amortization period declines by one in each future valuation. Alternatively, if the amortization period is an open or rolling period, the amortization period does not decline but is reset to the same number each year. This approach essentially "refinances" the System's debt (UAAL) every year.

<u>Amortization Payment:</u> The <u>level dollar</u> amortization method is similar to the method in which a homeowner pays off a mortgage. The liability, once calculated, is financed by a constant fixed dollar amount, based on the amortization period until the liability is extinguished. This results in the liability steadily decreasing while the payments, though remaining level in dollar terms, in all probability decrease as a percentage of payroll. (Even if a plan sponsor's population is not growing, inflationary salary increases will usually be sufficient to increase the aggregate covered payroll).

The rationale behind the <u>level percentage of payroll</u> amortization method is that since normal costs are calculated to be a constant percentage of pay, the unfunded actuarial accrued liability should be paid off in the same manner. When this method of amortizing the unfunded actuarial accrued liability is adopted, the initial amortization payments are lower than they would be under a level dollar amortization payment method, but the payments increase at a fixed rate each year so that ultimately the annual payment far exceeds the level dollar payment. The expectation is that total payroll will increase at the same rate so that the amortization payments will remain constant, as a percentage of payroll. In the initial years, the level percentage of payroll amortization payment is often less than the interest accruing on the unfunded actuarial accrued liability will grow (called negative amortization). This is particularly true if the plan sponsor is paying off the unfunded actuarial accrued liability over a long period, such as 20 or more years.





# SECTION III - ACTUARIAL METHODS

<u>Amortization Bases</u>: The UAAL can be amortized either as one single amount or as components or "layers", each with a separate amortization base, payment and period. If the UAAL is amortized as one amount, the UAAL is recalculated each year in the valuation and experience gains/losses or other changes in the UAAL are folded into the single UAAL amortization base. The amortization payment is then the total UAAL divided by an amortization factor for the applicable amortization period.

If separate amortization bases are maintained, the UAAL is composed of multiple amortization bases, each with its own payment schedule and remaining amortization period. In each valuation, the unexpected change in the UAAL is established as a new amortization base over the appropriate amortization period beginning on that valuation date. The UAAL is then the sum of all of the outstanding amortization bases on the valuation date and the UAAL payment is the sum of all of the amortization payments on the existing amortization bases. This approach provides transparency in that the current UAAL is paid off over a fixed period of time and the remaining components of the UAAL are clearly identified. Adjustments to the UAAL in future years are also separately identified in each future year. One downside of this approach is that it can create some discontinuities in contribution rates when UAAL layers/components are fully paid off. If this occurs, it likely would be far in the future, with adequate time to address any adjustments needed.

## Recommendation

In the current SLRP Board funding policy, an actuarially determined employer contribution (ADEC) is calculated during each annual valuation and the ADEC is compared to the Fixed Contribution Rate adopted by the Board as one of its Signal Light metrics. The methodology in calculating the ADEC is as follows:

- Amortization Period Closed period with period of 25 years for new bases
- Amortization Payment Level Percentage of Payroll
- Amortization Bases Separate bases for all experience gains and losses, assumption changes or benefit changes

We recommend no changes in these methods.







Actuarial Standard of Practice (ASOP) No. 27 provides guidance to actuaries regarding the selection of demographic and other non-economic assumptions for measuring pension obligations. ASOP 27 states that the actuary should use professional judgment to estimate possible future outcomes based on past experience and future expectations, and select assumptions based upon application of that professional judgment. The actuary should select reasonable demographic assumptions in light of the particular characteristics of the defined benefit plan that is the subject of the measurement. A reasonable assumption is one that is expected to appropriately model the contingency being measured and is not anticipated to produce significant cumulative actuarial gains or losses over the measurement period.

Each individual demographic assumption should satisfy the criteria of ASOP 27. In selecting demographic assumptions, the actuary should also consider: the internal consistency between the assumptions, materiality, cost effectiveness, and the combined effect of all assumptions. At each measurement date, the actuary should consider whether the selected assumptions continue to be reasonable, but the actuary is not required to do a complete assumption study at each measurement date. In addition, the actuary should include a specific assumption with respect to expected mortality improvements after the measurement date. In our opinion, the demographic assumptions recommended in this report have been developed in accordance with ASOP 27.

## **Overview of Analysis**

The purpose of a study of demographic experience is to compare what actually happened to the individual members of the System during the study period (July 1, 2020 through June 30, 2024) with what was expected to happen based on the actuarial assumptions.

Studies of demographic experience generally involve three steps:

- First, the number of members changing membership status, called decrements, during the study is tabulated by age, duration, gender, group, and membership class (active, retired, etc.).
- Next, the number of members expected to change status is calculated by multiplying certain membership statistics, called exposure, by the expected rates of decrement.
- Finally, the number of actual decrements is compared with the number of expected decrements. The comparison is called the Actual-to-Expected ratio (A/E Ratio) and is expressed as a percentage.

In general, if the actual experience differs significantly from the overall expected results, or if the pattern of actual decrements, or rates of decrement, by age, sex, or duration deviates significantly from the expected pattern, new assumptions are considered. Recommended revisions are normally not an exact representation of the experience during the observation period. Judgment is required to anticipate future experience from past trends and current evidence, including a determination of the amount of weight to assign to the most recent experience.





Revised rates of decrement are tested by using them to recalculate the expected number of decrements during the study period, and the results are shown as revised Actual-to-Expected Ratios.

It takes a fair amount of data to perform a credible study of demographic assumptions. Because the membership or certain subsets of the membership are relatively small, some assumptions have been selected based more on our professional judgment of reasonable future outcomes than actual experience.

Because much of the past four years of experience overlapped the worldwide Covid pandemic, we recognize that the actual demographic experience captured in this study may be influenced by the presence of the disease, by decisions the various employers made to manage their workforces through this period, and by choices employees may have made in response to actual or perceived changes in the world around them. Further, it is possible that some of these changes will reflect a new reality and show up in future years, while other changes will likely revert back quickly to the previous norms. Consequently, we believe caution is warranted in this study before making significant changes based on the recent data only.





## **RATES OF WITHDRAWAL**

## COMPARISON OF ACTUAL AND EXPECTED WITHDRAWALS FROM ACTIVE SERVICE

CENTRAL	NUMBER OF WITHDRAWALS DURING NON-ELECTION YEARS			
AGE OF GROUP	Actual	Expected	Ratio of Actual to Expected	
20	0	0	0.000	
25	0	0	0.000	
30	0	0	0.000	
35	0	0	0.000	
40	1	1	1.000	
45	2	1	2.000	
50	0	1	0.000	
53 & over	3	3	0.000	
TOTAL	6	6	1.000	

CENTRAL	NUMBER OF WITHDRAWALS DURING ELECTION YEAR			
AGE OF GROUP	Actual	Expected	Ratio of Actual to Expected	
20	0	0	0.000	
25	0	0	0.000	
30	0	0	0.000	
35	0	1	0.000	
40	0	1	0.000	
45	5	4	1.250	
50	2	3	0.667	
53 & over	3	6	0.500	
TOTAL	10	15	0.667	





The following graphs show a comparison of the present, actual and proposed rates of withdrawal.



## RATES OF WITHDRAWAL FOR ACTIVE MEMBERS







The rates of withdrawal adopted by the Board are used to determine the expected number of separations from active service which will occur as a result of resignation or dismissal. The results of our four-year study indicate that, in aggregate, the actual number of withdrawals was just slightly less than expected during election years.

As seen on the table on page 31, there were 16 actual withdrawals versus 21 expected withdrawals over the four-year period of this investigation. This period included one election year and three non-election year. In the prior investigation period, we noted that the actual withdrawals were very close to expected. During the current investigation period, there was a slightly larger difference between actual and expected. The entirety of this difference was due to the election year. **Therefore, we recommend a reduction in the rates of withdrawal for legislative years that will hopefully better match experience in the future. We recommend no change in rates of withdrawal for non-election years.** 

The following tables show a comparison between the current withdrawal rates and a sample of the proposed withdrawal rates.

AGE	Current	Proposed
20	0.1500	0.1250
25	0.1500	0.1250
30	0.1500	0.1250
35	0.1500	0.1250
40	0.1500	0.1250
45	0.1500	0.1250
50	0.1500	0.1250
53 & over	0.1500	0.1250

## COMPARATIVE RATES OF WITHDRAWAL DURING ELECTION YEAR



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## COMPARISON OF ACTUAL AND EXPECTED WITHDRAWALS FROM ACTIVE SERVICE BASED ON PROPOSED RATES

CENTRAL	NUMBE DURING N	R OF WITHD	RAWALS ON YEARS
AGE OF GROUP	Actual	Expected	Ratio of Actual to Expected
20	0	0	0
25	0	0	0
30	0	0	0
35	0	0	0
40	1	1	1
45	2	1	2
50	0	1	0
53 & over	3	3	0
TOTAL	6	6	1.000

CENTRAL	NUMBE DURIN	R OF WITHDI G ELECTION	RAWALS NYEAR
AGE OF GROUP	Actual	Expected	Ratio of Actual to Expected
20	0	0	0.000
25	0	0	0.000
30	0	0	0.000
35	0	1	0.000
40	0	1	0.000
45	5	3	1.667
50	2	2	1.000
53 & over	3	5	0.600
TOTAL	10	12	0.833





## RATES OF DISABILITY RETIREMENT

There were no disability retirements over the four-year period of this investigation or the prior study period. In fact, this Plan has not had a disability retirement in the past 14 years. Since the rates of disability retirement were lowered in the last experience study, **we recommend no change in the rates of disability at this time.** 







## RATES OF RETIREMENT

## COMPARISON OF ACTUAL AND EXPECTED RETIREMENTS

	NUMBE DURING N	R OF RETIRE	EMENTS ON YEARS
GROUP	Actual	Expected	Ratio of Actual to Expected
50	1	0	0.000
55	0	0	0.000
60	0	1	0.000
65	3	2	1.500
70	0	1	0.000
75	1	1	1.000
Subtotal	5	5	1.000
80 and Over	0	13	0.000
GRAND			
TOTAL	5	18	0.278

	NUMBER OF RETIREMENTS DURING ELECTION YEAR			
GROUP	Actual	Expected	Ratio of Actual to Expected	
50	1	1	1.000	
55	0	2	0.000	
60	6	5	1.200	
65	3	5	0.600	
70	3	4	0.750	
75	1	4	0.250	
Subtotal	14	21	0.667	
80 and Over	3	7	0.429	
GRAND TOTAL	17	28	0.607	





As you can see from the table on the previous page, during non-election years, there were 5 actual retirements versus 18 expected retirements over the four-year period of this investigation. However, this aggregate result is deceiving as the actual number of retirements before the age of 80 was exactly as expected.

During the election year, there were 17 actual retirements, which was less than expected (28 retirements). This result was close for all ages but we believe we should lower the rates of retirements during election years since this is the 2<sup>nd</sup> election year with similar experience.

Therefore, we only recommend a decrease in the election year retirement rates from 30% to 25% for ages before age 80 to better match experience.





## COMPARISON OF ACTUAL AND EXPECTED RETIREMENTS BASED ON PROPOSED RATES

	NUMBER OF RETIREMENTS DURING NON-ELECTION YEARS				
GROUP	Actual	Ratio of Actual to Expected			
50	1	0	0.000		
55	0	0	0.000		
60	0	1	0.000		
65	3	2	1.500		
70	0	1	0.000		
75	1	1	1.000		
Subtotal	5	5	1.000		
80 and Over	0	13	0.000		
GRAND					
TOTAL	5	18	0.278		

	NUMBER OF RETIREMENTS DURING ELECTION YEAR			
GROUP	Actual	Expected	Ratio of Actual to Expected	
50	1	1	1.000	
55	0	1	0.000	
60	6	4	1.500	
65	3	4	0.750	
70	3	3	1.000	
75	1	4	0.250	
Subtotal	14	17	0.824	
80 and Over	3	7	0.429	
TOTAL	17	24	0.708	





## RATES OF POST-RETIREMENT MORTALITY

One of the most important demographic assumptions in the valuation is mortality because it projects how long benefit payments will be made. The longer members live, the greater the true cost of future benefit obligations will be.

For many years, rates of mortality have been declining, meaning people, in general, are living longer. Consequently, we anticipate that mortality tables will need to be updated periodically. Because of potential differences in mortality, we break down our study by gender (males and females) and by status (healthy retirees, beneficiaries, disabled retirees, and active members).

Because of the substantial amount of data required to construct a mortality table, actuaries usually rely on standard tables published by the Society of Actuaries. Actuaries then use various adjustments such as age or scaling adjustments to the standard, published mortality tables in order to better match the observed mortality rates of a specific group.

The first of these adjustments is an age adjustment that can be either a "setback" or a "set forward". A oneyear age setback treats all members as if they were one year younger than they truly are when applying the rates in the mortality table. For example, a one year setback would treat a 61-year old retiree as if he will exhibit the mortality of a 60-year old in the standard mortality table.

The second adjustment that can be used to adjust the mortality rates in a standard table to better fit actual experience is to "scale" a mortality table by multiplying the probabilities of death by factors less than one (to reflect better mortality) or factors greater than one (to reflect poorer mortality). Scaling factors can be applied to an entire table or a portion of the table. Of course, if needed, actuaries may use both of these methods to develop an appropriate table to model the mortality of the specific plan population.

In 2019, the Society of Actuaries released a family of mortality tables named the Pub-2010 tables. While prior pension mortality tables have been based solely on private corporate and union retirement plans, these new tables are based entirely on public sector plan data. These tables are split by three membership types: Safety, Teachers, and General to reflect the observed differences in mortality patterns related to the three groups. Tables are further split for healthy retirees, disabled retirees, contingent beneficiaries, and employees. There are still other breakdowns in these tables for at, above or below median annuity values.







The issue of future mortality improvement is one that the actuarial profession has become increasingly focused on studying and monitoring. This has resulted in changes to the relevant Actuarial Standard of Practice, ASOP 27, *Selection of Assumptions for Measuring Pension Obligations*. This ASOP requires the pension actuary to make and disclose a specific recommendation with respect to future improvements in mortality after the valuation date, although it does not require that an actuary assume there will be future improvements. There have been significant improvements in longevity in the past, although there are different opinions about future expectations, and thus there is a subjective component in the estimation of future mortality improvement. We believe it is prudent to anticipate that the trend will continue to some degree in the future and that it is appropriate to reflect some future mortality improvement as part of the mortality assumption.

PERS currently uses generational mortality approach that directly anticipates future improvements in mortality by using a different set of mortality rates for each year of birth, with the rates for later years of birth assuming lower mortality than the rates for earlier years of birth. The varying mortality rates by year of birth create a series of tables that contain "built-in" mortality improvements, e.g., a member who turns age 65 in 2035 has a longer life expectancy than a member who turns age 65 in 2020. When using generational mortality, the A/E ratios for the observed experience are set near 100% as future mortality improvements will be taken into account directly in the actuarial valuation process.

The generational approach is our preferred method for recognizing future mortality improvements in the valuation process because it is more direct and results in longer life expectancy for members who are younger, consistent with what we believe is more likely to occur. Over the last ten to fifteen years, this method has become quite common as computing power has increased.





## COMPARISON OF ACTUAL AND EXPECTED CASES OF POST-RETIREMENT DEATHS

	NUMBER OF POST-RETIREMENT DEATHS				
	MALES AND FEMALES				
GROUP	Actual	Expected	Ratio of Actual to Expected		
	SERVICE	RETIREMENTS			
57 & Under	0	0	0.000		
60	0	0	0.000		
65	1	2	0.625		
70	1	3	0.294		
75	6	6	1.091		
80	5	6	0.821		
85	9	7	1.343		
90	4	4	0.895		
93 & Over	2	3	0.712		
Total	28	31	0.904		
	SUF	RVIVORS			
57 & Under	0	0	0.000		
60	0	0	0.000		
65	0	0	0.000		
70	0	0	0.000		
75		1	1.000		
80	1	2	0.500		
85	1	2	0.500		
90	7	3	2.333		
93 & Over	0	0	0.000		
Total	10	8	1.250		





As can be seen from the table on the previous page, the number of actual post-retirement deaths was fairly close to the expected number during the last four-year period. However, the SLRP does not have enough mortality data by itself to warrant credible data.

Therefore, we recommend that the rates of mortality for post-retirements match the PERS mortality tables which we recommended a change to the amount-weighted mortality tables for all three post-retirement mortality tables (from the headcount-weighted), adjustments or refinements for service retirees and beneficiaries from the current table, and an update to the most recent MP-2021 projection scale from the MP-2020 scale.

<u>Service Retirees (Pr</u>	oposed Table)		
Membership Table	<u>Set Forward (+)/</u> Setback (-)	Adjustment to Rates	Projection Scale
PubS-2010(B) Retiree	None	Male: 107% for all ages Female: 97% up to age 82, 100% for ages 83 to 87, and 110% for ages above 87	MP-2021
Contingent Annuitar	nts (Proposed Table	<u>ə)</u>	
Membership Table	<u>Set Forward</u> <u>Setback (-</u>	(+)/ <u>Adjustment to Rates</u>	Projection Scale
PubS-2010(B) Contingent Annuitant	Male: Set forward Female: Set forwar	2 years rd 3 years None	MP-2021
<u>Disabled Retirees (P</u>	Proposed Table) Set Forward	(+)/	
<u>Membership Table</u>	<u>Setback (-</u>	Adjustment to Rates	Projection Scale
PubG.H-2010 Disabled	Male: Set forward Female: Set forwar	d 1 year Male: 134% for all ages rd 2 years Female: 125% for all ages	MP-2021





## **RATES OF PRE-RETIREMENT MORTALITY**

The active member mortality assumption models eligibility for death benefits prior to retirement. Therefore, it has a much smaller impact on the valuation results than the post-retirement mortality assumption.

It is difficult to isolate the mortality for active members as it may be impacted by active members first terminating or moving to disabled status before death. The data collection methods used in this study do not fully capture known deaths, and so sometimes this can be misleading. Finally, the probability of active death is very small so volatility is not uncommon.

For the four-year period ending June 30, 2024, there were 2 active deaths. Obviously, the lack of data makes this set not credible so we prefer to set this assumption by utilizing the more reliable analysis performed on the PERS data.

To be consistent with PERS and similar to the post-retirement mortality recommendations, we recommend a change to the amount-weighted mortality tables for the pre-retirement mortality table (from the headcount-weighted), an adjustment in the current pre-retirement mortality table at this time to a set forward of 1 year on rates and the change to the most updated projection scale table, MP-2021.

Membership Table	<u>Set Forward (+)/</u> <u>Setback (-)</u>	Adjustment to Rates	Projection Scale
PubS-2010(B)	Male: Set forward 2 years Female: Set	Male: 75% up to age 47, 100% for ages 48 to 57, and 120% for ages above 58 Female: 75% up to age 47, 100% for ages	MP-2021
Linployee	forward 1 year	48 to 52, and 110% for ages above 53	





## RATES OF SALARY INCREASE

## COMPARISON OF ACTUAL AND EXPECTED SALARIES OF ACTIVE MEMBERS

	SALARIES AT END OF YEAR				
Age of	MA	MALES AND FEMALES			
Group	Actual	Expected	Ratio of Actual to Expected		
20	\$0	\$0	0.000		
25	182,264	174,179	1.046		
30	986,385	951,838	1.036		
35	837,439	816,094	1.026		
40	2,519,913	2,431,791	1.036		
45	4,104,496	3,957,063	1.037		
50	4,727,170	4,487,075	1.054		
55	5,262,925	5,070,777	1.038		
60	4,543,179	4,395,465	1.034		
65	3,151,537	3,044,284	1.035		
68 & Over	5,270,927	5,105,520	1.032		
TOTAL	\$31,586,235	\$30,434,086	1.038		

Actual rates of salary increase, in aggregate, were higher than expected over the four-year period by approximately 3.8%. In the prior investigation, they were more than we expected by approximately 2.3% in aggregate. In this Plan, salaries are determined by the number of days spent in legislative session and in 2021 (1<sup>st</sup> year of this study period), the number of hours was much higher than in other years and provided the members with significantly higher salary increases during that year. We do not foresee an increase like that in the future, therefore, we recommend no change in the merit salary scale at this time.



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## **OTHER ASSUMPTIONS**

**PERCENT MARRIED:** Currently, 100% of active members are assumed to be married and elect a joint & survivor payment form. We are not provided with marital status on the census data. **However, we believe the current assumption is fairly conservative and recommend no change at this time.** 

**SPOUSE AGE DIFFERENCE:** Currently, for married members, it is assumed a male is three years older than his spouse. We have reviewed this assumption and recommend no change at this time.

**OPTION FACTORS:** The option factors, currently in use by all of the Retirement Systems, are based on the mortality table and investment rate of return (discount rate) used in the valuation. We will review our recommend change in the mortality projection scale and determine if a change in the factors is needed at this time.







# APPENDIX A – HISTORICAL JUNE CPI (U) INDEX

Year	CPI (U)	Year	CPI (U)
1963	30.6	1994	148.0
1964	31.0	1995	152.5
1965	31.6	1996	156.7
1966	32.4	1997	160.3
1967	33.3	1998	163.0
1968	35.7	1999	166.2
1969	34.7	2000	172.4
1970	38.8	2001	178.0
1971	40.6	2002	179.9
1972	41.7	2003	183.7
1973	44.2	2004	189.7
1974	49.0	2005	194.5
1975	53.6	2006	202.9
1976	56.8	2007	208.352
1977	60.7	2008	218.815
1978	65.2	2009	215.693
1979	72.3	2010	217.965
1980	82.7	2011	225.722
1981	90.6	2012	229.478
1982	97.0	2013	233.504
1983	99.5	2014	238.343
1984	103.7	2015	238.638
1985	107.6	2016	241.018
1986	109.5	2017	244.955
1987	113.5	2018	251.989
1988	118.0	2019	256.143
1989	124.1	2020	257.797
1990	129.9	2021	271.696
1991	136.0	2022	296.311
1992	140.2	2023	305.109
1993	144.4	2024	314.069





# Callan's Capital Market Assumptions and PERS' Board of Trustees Target Asset Allocation

## Geometric Real Rates of Return and Standard Deviations by Asset Class

Asset Class	Expected Real Rate of Return	Standard Deviation
Domestic Equity	4.75%	17.00%
International Equity	4.75	20.15
Global Equity	4.95	21.25
Fixed Income	2.25	4.40
Real Estate	3.75	14.00
Private Equity	6.00	27.60
Cash Equivalents	0.50	0.90

## Asset Allocation Targets

Asset Class	Asset Allocation
Domestic Equity	27.00%
International Equity	20.00
Global Equity	12.00
Fixed Income	20.00
Real Estate	10.00
Private Equity	10.00
Cash Equivalents	1.00





# APPENDIX C – SOCIAL SECURITY ADMINISTRATION WAGE INDEX

Year	Wage Index	Annual Increase	Year	Wage Index	Annual Increase
1962	\$4,291.40	5.01%	1993	\$23,132.67	0.86%
1963	4,396.64	2.45	1994	23,753.53	2.68
1964	4,576.32	4.09	1995	24,705.66	4.01
1965	4,658.72	1.80	1996	25,913.90	4.89
1966	4,938.36	6.00	1997	27,426.00	5.84
1967	5,213.44	5.57	1998	28,861.44	5.23
1968	5,571.76	6.87	1999	30,469.84	5.57
1969	5,893.76	5.78	2000	32,154.82	5.53
1970	6,186.24	4.96	2001	32,921.92	2.39
1971	6,497.08	5.02	2002	33,252.09	1.00
1972	7,133.80	9.80	2003	34,064.95	2.44
1973	7,580.16	6.26	2004	35,648.55	4.65
1974	8,030.76	5.94	2005	36,952.94	3.66
1975	8,630.92	7.47	2006	38,651.41	4.60
1976	9,226.48	6.90	2007	40,405.48	4.54
1977	9,779.44	5.99	2008	41,334.97	2.30
1978	10,556.03	7.94	2009	40,711.61	-1.51
1979	11,479.46	8.75	2010	41,673.83	2.36
1980	12,513.46	9.01	2011	42,979.61	3.13
1981	13,773.10	10.07	2012	44,321.67	3.12
1982	14,531.34	5.51	2013	44,888.16	1.28
1983	15,239.24	4.87	2014	46,481.52	3.55
1984	16,135.07	5.88	2015	48,098.63	3.48
1985	16,822.51	4.26	2016	48,642.15	1.13
1986	17,321.82	2.97	2017	50,321.89	3.45
1987	18,426.51	6.38	2018	52,145.80	3.62
1988	19,334.04	4.93	2019	54,099.99	3.75
1989	20,099.55	3.96	2020	55,628.60	2.83
1990	21,027.98	4.62	2021	60,575.07	8.89
1991	21,811.60	3.73	2022	63,795.13	5.31
1992	22,935.42	5.15	2023	66,621.80	4.43



# **APPENDIX D – RECOMMENDED RATES**



	ACE	ADJUSTED BASE RATES OF DEATH		RATES OF	
	AGE	MALES	FEMALES	DISABILITY	
	20	0.000360	0.000150	0.000169	
	21	0.000368	0.000158	0.000169	
	22	0.000368	0.000173	0.000169	
	23	0.000375	0.000188	0.000191	
	24	0.000383	0.000195	0.000191	
	25	0.000390	0.000210	0.000191	
	26	0.000398	0.000225	0.000191	
	27	0.000405	0.000240	0.000225	
	28	0.000413	0.000255	0.000225	
	29	0.000420	0.000270	0.000236	
	30	0.000428	0.000285	0.000259	
	31	0.000443	0.000308	0.000270	
	32	0.000450	0.000323	0.000304	
	33	0.000465	0.000345	0.000338	
	34	0.000480	0.000368	0.000349	
	35	0.000503	0.000390	0.000383	
	36	0.000525	0.000413	0.000394	
	37	0.000555	0.000443	0.000428	
	38	0.000585	0.000465	0.000450	
	39	0.000623	0.000495	0.000473	
	40	0.000660	0.000533	0.000506	
_	41	0.000713	0.000563	0.000529	
	42	0.000758	0.000600	0.000574	
	43	0.000818	0.000638	0.000596	
	44	0.000878	0.000675	0.000641	
	45	0.000945	0.000720	0.000675	
	46	0.001020	0.000765	0.000743	
	47	0.001103	0.000818	0.000810	
	48	0.001590	0.001150	0.000866	
	49	0.001720	0.001230	0.000956	
	50	0.001850	0.001310	0.001035	
	51	0.002000	0.001390	0.001136	
	52	0.002160	0.001480	0.001260	
	53	0.002330	0.001727	0.001406	
	54	0.002520	0.001837	0.001541	
	55	0.002730	0.001947	0.001744	
	56	0.002960	0.002079	0.002003	
	57	0.003230	0.002211	0.002250	
	58	0.004212	0.002343	0.002543	
	59	0.004596	0.002497	0.002914	
	60	0.005016	0.002651	0.002914	
	61	0.005484	0.002827	0.000000	

# TABLE 1 RATES OF SEPARATION\* FROM ACTIVE SERVICE

\* Withdrawal and Vesting: 12.5% in an election year, 2% in a non-election year.

\* Service Retirement: 25% in an election year, 3.5% in a non-election year. All members assumed to retire no later than age 80.







SERVICE	RATE	
0	0.0500	
1	0.0500	
2	0.0500	
3	0.0500	
4	0.0500	
5	0.0475	
6	0.0475	
7	0.0475	
8	0.0425	
9	0.0425	
10	0.0425	
11	0.0425	
12	0.0425	
13	0.0425	
14	0.0400	
15	0.0400	
16	0.0400	
17	0.0400	
18	0.0400	
19	0.0400	
20	0.0400	
21	0.0375	
22	0.0375	
23	0.0375	
24	0.0375	
25	0.0350	

## TABLE 2 RATES OF ANTICIPATED SALARY INCREASES\* (For Both Males and Females)

\* Includes wage inflation of 2.65%





# **APPENDIX D – RECOMMENDED RATES**

AGE	MALES	FEMALES	AGE	MALES	FEMALES
19	0.000449	0.000155	71	0.023315	0.015384
20	0.000482	0.000175	72	0.026022	0.017169
21	0.000503	0.000194	73	0.029051	0.019148
22	0.000514	0.000204	74	0.032432	0.021359
23	0.000524	0.000223	75	0.036198	0.023823
24	0.000524	0.000243	76	0.040414	0.026578
25	0.000535	0.000252	77	0.045111	0.029643
26	0.000546	0.000272	78	0.050365	0.033067
27	0.000556	0.000291	79	0.056229	0.036879
28	0.000567	0.000310	80	0.062777	0.041138
29	0.000578	0.000330	81	0.070064	0.045891
30	0.000589	0.000349	82	0.078153	0.051187
31	0.000599	0.000369	83	0.087087	0.058860
32	0.000610	0.000398	84	0.096931	0.065660
33	0.000631	0.000417	85	0.107728	0.073240
34	0.000642	0.000446	86	0.119562	0.081690
35	0.000663	0.000475	87	0.132509	0.091120
36	0.000685	0.000504	88	0.146654	0.111804
37	0.000717	0.000534	89	0.162105	0.124718
38	0.000749	0.000572	90	0.178947	0.139117
39	0.000792	0.000601	91	0.195949	0.154077
40	0.000835	0.000640	92	0.212470	0.169103
41	0.000888	0.000689	93	0.228295	0.184085
42	0.000942	0.000728	94	0.243607	0.199133
43	0.001017	0.000776	95	0.258780	0.214566
44	0.001081	0.000825	96	0.274348	0.230791
45	0.002547	0.000902	97	0.290847	0.248193
46	0.002739	0.000999	98	0.308684	0.267113
47	0.002953	0.001116	99	0.328083	0.287672
48	0.003178	0.001251	100	0.348916	0.309760
49	0.003413	0.001387	101	0.370605	0.332915
50	0.003670	0.001552	102	0.392048	0.356202
51	0.003948	0.001727	103	0.413063	0.379434
52	0.004248	0.001930	104	0.433478	0.402391
53	0.004569	0.002153	105	0.453166	0.424875
54	0.004922	0.002406	106	0.472009	0.446699
55	0.005307	0.002677	107	0.489910	0.467709
56	0.005725	0.002988	108	0.506795	0.487751
57	0.006195	0.003337	109	0.522620	0.506737
58	0.006709	0.003715	110	0.535000	0.524590
59	0.007287	0.004152	111	0.535000	0.541255
60	0.007918	0.004627	112	0.535000	0.550000
61	0.008624	0.005160	113	0.535000	0.550000
62	0.009395	0.005752	114	0.535000	0.550000
63	0.010240	0.006421	115	0.535000	0.550000
64	0.011171	0.007159	116	0.535000	0.550000
65	0.012187	0.007993	117	0.535000	0.550000
66	0.013546	0.008914	118	0.535000	0.550000
67	0.015076	0.009943	119	0.535000	0.550000
68	0.016799	0.011087	120	1.000000	1.000000
69	0.018725	0.012368			
70	0.020886	0.013793			

TABLE 3 BASE RATES OF MORTALITY FOR MEMBERS RETIRED ON ACCOUNT OF SERVICE\*

\* Adjusted Base Rates




### **APPENDIX D – RECOMMENDED RATES**

AGE	MALES	FEMALES	AGE	MALES	FEMALES
19	0.000480	0.000200	71	0.035160	0.022750
20	0.000490	0.000210	72	0.038360	0.024760
21	0.000490	0.000230	73	0.041830	0.026990
22	0.000500	0.000250	74	0.045590	0.029460
23	0.000510	0.000260	75	0.049710	0.032200
24	0.000520	0.000280	76	0.054240	0.035270
25	0.000530	0.000300	77	0.059260	0.038700
26	0.000540	0.000320	78	0.064860	0.042580
27	0.000550	0.000340	79	0.071100	0.046980
28	0.000560	0.000360	80	0.078020	0.051970
29	0.000570	0.000380	81	0.085690	0.057620
30	0.000590	0.000410	82	0.094140	0.064020
31	0.000600	0.000430	83	0.103440	0.071270
32	0.000620	0.000460	84	0.113610	0.079450
33	0.000640	0.000490	85	0.124680	0.088570
34	0.000670	0.000520	86	0.136760	0.098570
35	0.000700	0.000550	87	0.151110	0.109330
36	0.000740	0.000590	88	0.166730	0.120640
37	0.000780	0.000620	89	0.183000	0.132580
38	0.000830	0.000660	90	0.199560	0.145230
39	0.000880	0.000710	91	0.216290	0.158700
40	0.000950	0.000750	92	0.233230	0.173100
41	0.001010	0.000800	93	0.250530	0.188520
42	0.007330	0.000850	94	0.268370	0.205030
43	0.007600	0.004640	95	0.286890	0.222660
44	0.007880	0.004790	96	0.306160	0.241380
45	0.008160	0.004930	97	0.326090	0.261090
46	0.008450	0.005080	98	0.346360	0.281600
47	0.009110	0.005230	99	0.366400	0.302650
48	0.009350	0.005370	100	0.386040	0.323820
49	0.009600	0.005670	101	0.405120	0.344940
50	0.009850	0.005990	102	0.423520	0.365810
51	0.010120	0.006320	103	0.441130	0.386250
52	0.010420	0.006670	104	0.457860	0.406090
53	0.010730	0.007040	105	0.473640	0.425190
54	0.011080	0.007420	106	0.488430	0.443410
55	0.011470	0.007820	107	0.500000	0.460670
56	0.011920	0.008250	108	0.500000	0.476900
57	0.012430	0.008710	109	0.500000	0.492050
58	0.013020	0.009210	110	0.500000	0.500000
59	0.013710	0.009750	111	0.500000	0.500000
60	0.014500	0.010340	112	0.500000	0.500000
61	0.015430	0.010980	113	0.500000	0.500000
62	0.016500	0.011680	114	0.500000	0.500000
63	0.017760	0.012430	115	0.500000	0.500000
64	0.019210	0.013320	116	0.500000	0.500000
65	0.020860	0.014290	117	1.000000	0.500000
66	0.022710	0.015350	118	1.000000	1.000000
67	0.024760	0.016530	119	1.000000	1.000000
68	0.027030	0.017840	120	1.000000	1.000000
69	0.029500	0.019310			
70	0.032210	0.020940			

TABLE 4 BASE RATES OF MORTALITY FOR BENEFICIARIES OF DECEASED MEMBERS\*

\* Adjusted Base Rates



SUPPLEMENTAL LEGISLATIVE RETIREMENT PLAN OF MISSISSIPPI JULY 1, 2020 THROUGH JUNE 30, 2024 EXPERIENCE STUDY



### **APPENDIX D – RECOMMENDED RATES**

AGE	MALES	FEMALES	AGE	MALES	FEMALES
19	0.005521	0.002688	71	0.058210	0.043300
20	0.005172	0.002425	72	0.061627	0.046475
21	0.004717	0.002200	73	0.065392	0.050038
22	0.004234	0.002050	74	0.069573	0.054025
23	0.003873	0.002050	75	0.074196	0.058475
24	0.003725	0.002238	76	0.079341	0.063438
25	0.003913	0.002450	77	0.085050	0.068963
26	0.004100	0.002688	78	0.091415	0.075088
27	0.004301	0.002938	79	0.098463	0.081875
28	0.004516	0.003212	80	0.106249	0.089375
29	0.004744	0.003513	81	0.114771	0.097638
30	0.004985	0.003837	82	0.124071	0.106700
31	0.005239	0.004200	83	0.134134	0.116638
32	0.005507	0.004588	84	0.144921	0.127038
33	0.005816	0.005013	85	0.156485	0.137675
34	0.006137	0.005475	86	0.168907	0.148475
35	0.006512	0.005988	87	0.182280	0.159462
36	0.006941	0.006550	88	0.199137	0.170812
37	0.007437	0.007175	89	0.217790	0.182713
38	0.008000	0.007863	90	0.236925	0.195438
39	0.008643	0.008613	91	0.256288	0.209250
40	0.009380	0.009425	92	0.275879	0.224437
41	0.010224	0.010313	93	0.295845	0.241225
42	0.011176	0.011275	94	0.316468	0.259800
43	0.012274	0.012312	95	0.338028	0.280550
44	0.013494	0.013413	96	0.360782	0.302825
45	0.014861	0.014588	97	0.384888	0.326688
46	0.016361	0.015838	98	0.410362	0.352000
47	0.017983	0.017162	99	0.436961	0.378312
48	0.019698	0.018538	100	0.464122	0.404775
49	0.021507	0.019188	101	0.490976	0.431175
50	0.022941	0.019837	102	0.517294	0.457263
51	0.024361	0.020500	103	0.542861	0.482813
52	0.025741	0.021150	104	0.567517	0.507613
53	0.027068	0.021775	105	0.591114	0.531488
54	0.028328	0.022363	106	0.613532	0.554263
55	0.029493	0.022913	107	0.634678	0.575838
56	0.030552	0.023425	108	0.654496	0.596125
57	0.031557	0.023925	109	0.670000	0.615063
58	0.032535	0.024450	110	0.670000	0.625000
59	0.033540	0.025000	111	0.670000	0.625000
60	0.034626	0.025638	112	0.670000	0.625000
61	0.035872	0.026375	113	0.670000	0.625000
62	0.037319	0.027225	114	0.670000	0.625000
63	0.038967	0.028200	115	0.670000	0.625000
64	0.040790	0.029325	116	0.670000	0.625000
65	0.042786	0.030625	117	0.670000	0.625000
66	0.044930	0.032113	118	0.670000	1.000000
67	0.047222	0.033825	119	1.000000	1.000000
68	0.049660	0.035775	120	1.000000	1.000000
69	0.052273	0.037988			
70	0.055114	0.040488			

TABLE 5 BASE RATES OF MORTALITY FOR MEMBERS RETIRED ON ACCOUNT OF DISABILITY\*

\* Adjusted Base Rates



SUPPLEMENTAL LEGISLATIVE RETIREMENT PLAN OF MISSISSIPPI JULY 1, 2020 THROUGH JUNE 30, 2024 EXPERIENCE STUDY



House Bills								
BILL	AUTHOR	COMMITTEE	SYSTEM	DESCRIPTION	DETAILS	IMPACT	STATUS	
1	Trey Lamar	Ways & Means (H)	PERS, SLRP, ORP	"Build Up Mississippi Act"	Mississippi Tax Reform Legislation. Creates PERS Tier 5, a hybrid retirement plan, for those hired on or after March 1, 2026. Terminates SLRP for those newly elected on or after March 1, 2026. Reforms ORP by creating a 9% employer contribution for those entering ORP on or after July 1, 2025, and allocates all remaining employer contributions to PERS.	Closes PERS Tier 4 for new hires and creates a new offering of benefits. Also closes SLRP to new legislators and reforms ORP.	Approved by Governor March 27, 2025	
<u>1762</u>	Sam Mims	Appropriations D; Appropriations A	PERS	Appropriation; Public Employees' Retirement System	FY 2026 Appropriation	\$21,052,911 beginning July 1, 2025, and ending June 30, 2026, including \$300,000 for building maintenance and \$3,538,000 for computer expenses; 167 permanent positions.	Died in Conference March 29, 2025	

Senate Bills								
BILL	AUTHOR	COMMITTEE	SYSTEM	DESCRIPTION	DETAILS	IMPACT	STATUS	
<u>3095</u>	Harkins	Finance	PERS	Tax; cut income and grocery taxes, increase fuel excise tax, and adjust distribution of certain fuel and sales taxes.	Mississippi Tax Reform Legislation. The House version reallocated net proceeds of the lottery to PERS at \$100,000,000 per year until the system is funded at 80%.	Potential dedicated stream of revenue to PERS	Died in Conference March 29, 2025	



# PERS Tier 4 and Tier 5 Benefit Overview

	PERS Tier 4	PERS Tier 5
Entry Date	July 1, 2011 – February 28, 2026	March 1, 2026, forward
Type of Plan	Traditional Defined Benefit Pension	Hybrid of Defined Benefit Pension and Defined Contribution Plan
Employee Contribution Rate	9%	9% (4% into Defined Benefit, 5% into Defined Contribution)
Employer Contribution Rate effective July 1, 2025	18.40% to PERS	18.40% to PERS
Defined Contribution Plan Employer Match	N/A	None guaranteed. Employer may elect to contribute an additional amount
Defined Contribution Plan Vesting	N/A	Immediately
Defined Benefit Plan Vesting	8 years	8 years
Defined Benefit Retirement Eligibility	30 years of creditable service at any age or age 60 and vested	35 years of creditable service at any age or age 62 and vested
Defined Benefit Formula	2% of average compensation per year of creditable service for up to 30 years, plus 2.5% of average compensation per year for each year of creditable service over 30, with an actuarial reduction for each year of creditable service below 30 years or for each year in age below age 65, whichever is less	1% of average compensation for all years of service. If member reaches age 62 with less than 30 years of service, an actuarial reduction is made for each year of creditable service below 30 years or for each year in age below age 65, whichever is less
Average Compensation	4 highest fiscal or calendar years of earned compensation or last 48 months, whichever is greater	8 highest consecutive fiscal or calendar years of earned compensation or last 96 months, whichever is greater
Cost-of-Living Adjustments (COLA)	3% of annual base benefit for each full fiscal year of retirement to age 60, plus 3% compounded for each fiscal year thereafter	No guaranteed COLA; Legislature may provide an additional benefit for a specific year
Partial Lump Sum Eligibility	33 years of creditable service at any age	N/A
Unused Leave	Unused leave certified to PERS is computed to additional creditable service	No service credit shall be awarded for unused leave
Military Service	Up to 4 years of free creditable service for honorable military service; members may purchase additional military service credit under USERRA	Up to 4 years of free creditable service for honorable military service; members may purchase additional military service credit under USERRA
Early Withdrawals	No withdrawals before termination	Defined contribution plan allows hardship withdrawals
Service Purchase	Members may purchase certain out-of- state service, professional leave credit, and other non-covered public service credit	No service credit shall be purchased for out-of-state service, professional leave, or any other non-covered service
Refund Payback	Individuals reentering the system before March 1, 2026, are eligible to repurchase the withdrawn service credit	Individuals reentering the system on or after March 1, 2026, are ineligible to repurchase the withdrawn service credit

Memorandum from



CHARLES NIELSEN Chief Investment Officer

**To:** Investment Committee

**Date:** April 22, 2025

**Re:** Global Equity Search

In December of 2024 this Committee gave the Investments Department the approval to initiate a search to replace Epoch Investment Advisors as a Global Equity Manager. Over the past 3months we reviewed information on hundreds of available strategies. Through this process we narrowed it down to seven different asset managers to interview. All of the firms we met were extremely capable and could have adequately managed the assets for this mandate. After thorough evaluation we decided to bring PGIM Quantitative Solutions forward for your approval. PGIM's Quantitative strategies have demonstrated an ability to effectively attain strong absolute and risk adjusted returns through the application of their multi-factor quantitative model. This model focuses on guarding against taking on uncompensated risk, and to capture alpha through systematically gaining exposure to growth stocks in all market environments while avoiding concentration in growth themes.

PGIM's flexible investment process enabled them to provide PERS with customized solution to better meet our unique investment needs at an incredible price point.

It is my recommendation as Chief Investment Officer that the contract to replace Epoch's Global Equity mandate be awarded to PGIM Quantitative Solutions.

I have included on the following pages:

- Charts depicting the 5- and 10- year risk/reward for all the firms interviewed, and the benchmark net of fees.
- Charts depicting the 5- and 10- year Excess Returns Vs. Tracking Error for all the firms interviewed, and the benchmark net of fees.
- A list of advantages that quantitative investing can provide.

### **Risk/Reward**



#### Standard Deviation %



#### Standard Deviation %

### Excess Return Vs. Tracking Error of The MSCI ACWI



**Tracking Error %** 



**Tracking Error %** 

Quantitative investing is an investment strategy that relies on mathematical and statistical models to make investment decisions. It differs from other forms of active investing, such as fundamental analysis, which requires evaluating a company's financials, management, industry, and market conditions. Quantitative investing can provide several advantages (in certain markets) compared to traditional fundamental analysis.

- **Objective/Unbiased Approach**: Quantitative investing is data-driven, treating investing as a science, reducing the impact of emotional biases that can influence decision-making in traditional fundamental analysis.
- **Systematic and Repeatable**: Quantitative models are systematic and rules-based, allowing for consistent application across different securities and markets. This reduces the reliance on individual judgment and increases replicability. This is even more advantageous where traditional manager "Skill" is difficult to find.
- **Back-Testing**: Quantitative strategies can be tested on historical data to evaluate their past performance. This enables refinement and optimization before actual capital is utilized.
- **Scalability/Portability**: Quantitative strategies can be applied to a large number of securities simultaneously, making them suitable for managing portfolios with diverse holdings, across different asset classes and markets. This is especially valuable in markets like Small Cap International; a market that contains almost 2,400 companies representing approximately 14% of the market capitalization in each country represented in the index.
- **Velocity**: Advancements in technology enable quantitative models to process large amounts of data rapidly. This allows for the identification and exploitation of short-term market inefficiencies or arbitrage opportunities.
- **Risk Management**: Quantitative models often integrate risk management tools to limit exposure to specific risks or perfunctorily rebalance portfolios based on changing market environments.
- **Reduction of Behavioral Biases**: Quantitative models are designed to minimize behavioral biases, such as overconfidence and anchoring, which can often affect traditional investment strategies.
- **Multifactor Models**: Quantitative strategies can incorporate multiple factors and variables, such as value, momentum, quality, and size, to enhance performance.
- **Statistical Analysis**: Quantitative models employ rigorous statistical techniques to assess the significance of relationships between variables, leading to more data-driven decision-making.
- **Reliability**: Quantitative models apply the same criteria and rules consistently over time, resulting in more stable investment decisions.
- **Broad Coverage**: Quantitative models can scan and analyze a wide range of information sources, including financial statements, news, social media sentiment, and macroeconomic data, to inform investment decisions.
- **Automation**: Numerous properties of quantitative investing can be systematized, reducing the need for constant individual oversight, thus lowering operational costs.

# Callan

April 22, 2025

#### Public Employees' Retirement System of Mississippi

Investment Manager Search Global Growth Equity

John Jackson, CFA Senior Vice President

Alexander Ford Senior Vice President

Important Disclosures regarding the use of this document are included at the end of this document. These disclosures are an integral part of this document and should be considered by the user.

### **Investment Manager Search**

### Callan's multi-step approach

### **Manager Search Process**



### Manager candidates

	Investment Manager	Strategy
The following investment manager organizations have submitted information to Callan regarding their investment management capabilities. The information has been summarized in this report for the consideration of Public Employees' Retirement System of	Janus Henderson Investors	Global Research Growth Equity
Mississippi.	PGIM Quantitative Solutions	Global Growth Equity

### Candidate firm summary

	Janus Henderson Investors	PGIM Quantitative Solutions LLC
Headquarters	London, England	Newark, NJ
Ownership / Parent	Publicly Owned Janus Henderson Group plc	Subsidiary PGIM, Inc.
Total Firm Assets (\$mm)	378,699	111,322
Have any open regulatory exams/investigations been escalated to enforcement?	No	No
Date of Last SEC Exam	09/29/2023	03/01/2017
GIPS Compliant	Yes	Yes
E&O Insurance	Yes	Yes
Disaster Recovery Plan in Place	Yes	Yes

### Candidate product summary

	Janus Henderson Investors	PGIM Quantitative Solutions LLC				
Product Name	Global Research Growth Equity	(Simulated) Global Growth Equity				
Product Benchmark	MSCI:ACWI Growth	MSCI:ACWI IMI				
Proposed Vehicle	Sep Acc	Sep Acc				
Product / Vehicle Inception	2005 / 2005	2010 / 2010				
Total Product Assets (\$mm)	5,736	N/A				
Total Vehicle Assets (\$mm)	941	N/A				
Number of Holdings	104	428				
Annual Turnover	28%	217%				
Emerging Market Exposure*	4% (80th)	17% (9th)				
Combined Z-Score*	0.90 (20th)	0.30 (83rd)				
Weighted Median Market Cap*	797.91 (3rd)	44.41 (93rd)				
tesults reflect ranking vs. Callan Global All Country Growth Equity in parenthesis						

### **Manager Summary Matrix**

### Janus Henderson Investors

	Organization/Team	Strategy/Portfolio	Summary Opinion
Janus Henderson Investors Global Research Growth Equity	<ul> <li>Established as a result of the merger between Janus Capital Global and Henderson Global Investors in 2017.</li> <li>Publicly listed company on the NYSE Exchange under the symbol "JHG" and headquartered in London.</li> <li>The firm appointed Ali Dibadj as its new CEO in June 2022. Dibadj succeeded interim CEO, Roger Thompson, who has since returned to the firm's CFO position. Dibadj was previously the CFO and Head of Strategy at Alliance Bernstein.</li> <li>Research strategies led by co-PM John Jordan and co-PM Joshua Cummings since 1Q24, supported by 37 analysts organized into seven sector teams globally.</li> <li>Matt Peron stepped down as a co-PM of the Research strategies effective September 30, 2024. Peron remains at the firm as Global Head of Solutions and member of the Portfolio Oversight Team.</li> </ul>	<ul> <li>Deep fundamental, quality growth strategy that uses an analyst-driven, team-refined investment approach.</li> <li>Search for companies with compelling growth opportunities that arise from innovation, market share gains, and strong growth in their end markets.</li> <li>Seven global sector research teams with sector leaders, who are responsible for oversight within their respective sector portfolio. The sector teams provide coverage across market capitalizations, geographies, and styles.</li> <li>The portfolio managers ensure that the combination of sector sleeves meets overall portfolio objectives.</li> <li>Strategy intends to emphasize idiosyncratic risks and to minimize unintended systemic risks and exposures.</li> <li>Limit position sizes to within a +/-2% relative weight; the team is not making country and region-based decisions.</li> <li>Large cap, true growth strategy.</li> </ul>	<ul> <li>Firm cost-cutting and other market volatility driven changes initiated by Ali Dibadj in 2022 have since concluded; however, stability of investment teams and asset flows continue to be monitored.</li> <li>Good stability across sector team leads.</li> <li>Viable as a complement to a true value manager given the growth portfolio characteristics and risk/reward profile.</li> </ul>

Janus Henderson Investors – Global Research Growth Equity

### **Manager Summary Matrix**

### **PGIM** Quantitative Solutions

	Organization/Team	Strategy/Portfolio	Summary Opinion
PGIM Quantitative Solutions LLC (Simulated) Global Growth Equity	<ul> <li>Founded in 1975, PGIM Quantitative Solutions LLC (PGIM QS) is a limited liability company positioned as a business unit under the publicly traded company Prudential Financial (PGIM). PGIM QS operates as the PGIM quantitative subsidiary, offering a diverse set of quantitative strategies and vehicles.</li> <li>Head of Quantitative Equity Stacie Mintz leads the team of ~15 quantitative PM/analysts.</li> </ul>	<ul> <li>PGIM as an organization employs a quantitative approach using both bottom-up and top-down models to construct a multi-factor strategy based on fundamental insights that systematically adapts to changing growth rates and market conditions.</li> <li>Bottom-up stock selection generates 80% of expected alpha while top-down models account for 20%.</li> <li>This portfolio however, is focused on 'rapid growth' factors within their quantitative approach to create the global growth portfolio.</li> <li>These rapid growth factors are informed by information momentum (data &amp; correlation driven), estimate revisions, and technology driven insights (ex. NLP, linkages, etc.)</li> <li>In constructing the portfolio the team is balancing exposure to rapid growth while moderating tracking error.</li> <li>The simulated portfolio held 430 with +/-4% vs. index sector weights and country allocations are +/- 2.5% vs. MSCI ACWI Index.</li> <li>Mid/Large cap, core with a growth tilt strategy.</li> </ul>	<ul> <li>Stable organization.</li> <li>Team is stable and experienced.</li> <li>PGIM has an organization has had proven success in their quantitative approach.</li> <li>The focus on pure 'rapid growth' factors has not been tested and PGIM doesn't manage any live assets with this approach.</li> <li>Viable as a standalone or as a pair to relative value given the diversified, core with a growth tilt portfolio characteristics.</li> </ul>

PGIM Quantitative Solutions - Global Growth Equity

### Proposed vehicle information and fees

	Minimum Account Size (\$M)	Proposed Fee (%)*	Comments
Janus Henderson Investors Global Research Growth Equity (Separate Account)	25	0.24%	<ul> <li>Fee schedule:</li> <li>0.25% on first \$500M</li> <li>0.23% on next \$500M</li> <li>0.20% on remaining balance</li> </ul>
<b>PGIM Quantitative Solutions</b> <i>Global Growth Equity</i> (Separate Account)	50	0.065%	<ul> <li>Fee schedule:</li> <li>0.065% on first \$1B</li> <li>0.050% on next \$1B</li> <li>0.045% on remaining balance</li> </ul>

Note: proposed fees reflect "best and final offers" from the investment manager candidates.

\*Proposed fee is based on a \$1.0 billion mandate size. If the mandate size increases to \$1.4 billion, the all-in fees for both manager candidates go down (Janus = 0.23% and PGIM = 0.06%).

Returns and peer group rankings

#### Returns for Periods Ended December 31, 2024 Group: Callan Glbl AC Gr Eq (Percentile Rankings in Parentheses)

	Last Quarter	Last Year	Last 3 Years	Last 5 Years	Last 7 Years	Last 10 Years
Janus Henderson	1.85 (15)	27.86 (7)	8.07 (5)	14.43 (9)	13.82 (5)	12.58 (20)
PGIM (Simulated)	0.67 (28)	26.23 (11)	8.50 (3)	14.80 (5)	11.89 (33)	12.22 (28)
Acadian - Complement	2.74 (10)	23.36 (22)	9.33 (1)	14.56 (7)	11.49 (39)	10.78 (52)
Harding Loevner - Complement	<b>(0.85)</b> (52)	14.95 (64)	0.15 (78)	8.89 (71)	8.82 (84)	10.23 (70)
LSV - Complement	(3.71) (86)	11.17 (81)	6.24 (17)	8.28 (83)	<b>6.92</b> (95)	7.93 (97)
Callan Glbl AC Gr Eq*	(0.79)	18.78	2.86	10.16	10.61	10.86
MSCI:ACWI Growth	2.64 (10)	24.23 (19)	5.72 (20)	13.07 (19)	12.31 (22)	11.88 (31)
MSCI:ACWI	(0.99) (55)	17.49 (57)	5.44 (22)	10.06 (51)	9.21 (78)	9.23 (88)
MSCI:ACWI IMI	<b>(1.24)</b> (59)	<b>16.37</b> (62)	4.90 (29)	9.67 (53)	8.78 (85)	9.00 (91)

Note: Manager candidate performance is shown gross-of-fees unless otherwise noted.

\*Results reflect peer group median performance.

Calendar year - returns and peer group rankings

#### Returns for Periods Ended December 31, 2024

#### Group: Callan Glbl AC Gr Eq (Percentile Rankings in Parentheses)

	2024	2023	2022	2021	2020	2019	2018	2017	2016	2015
Janus Henderson	27.86 (7)	34.70 (11)	(26.72) (71)	19.47 (36)	30.13 (44)	33.77 (37)	(5.69) (37)	30.19 (61)	0.48 (82)	0.99 (73)
PGIM (Simulated)	26.23 (11)	23.56 (40)	(18.11) (13)	26.27 (5)	23.65 (72)	24.53 (95)	(11.57) (80)	32.22 (44)	7.76 (9)	1.23 (72)
Acadian - Complement	23.36 (22)	25.95 (33)	(15.88) (4)	26.69 (3)	19.19 (85)	21.76 (97)	(10.87) (76)	26.68 (86)	7.54 (10)	(4.54) (98)
Harding Loevner - Complement	14.95 (64)	23.33 (44)	(29.14) (80)	16.14 (60)	31.23 (41)	30.17 (73)	<b>(9.35)</b> (64)	33.26 ( <sup>39</sup> )	7.14 (11)	2.65 (52)
LSV - Complement	11.17 (81)	17.18 (75)	(7.96) (1)	21.83 (14)	1.89 (100)	23.90 (96)	(13.37) (89)	23.40 (92)	13.31 (1)	(3.98) (98)
Callan Glbl AC Gr Eq*	18.78	22.18	(24.34)	17.80	28.80	32.84	(7.74)	31.58	3.09	3.21
MSCI:ACWI Growth	24.23 (19)	33.22 (12)	(28.61) (76)	17.10 (54)	33.60 (33)	32.72 (51)	(8.13) (54)	30.00 (63)	3.27 (48)	<b>1.55</b> (71)
MSCI:ACWI	17.49 (57)	22.20 (50)	(18.36) (14)	18.54 (47)	16.25 (93)	26.60 (87)	<b>(9.41)</b> (65)	23.97 (91)	7.86 (9)	<b>(2.36)</b> (97)
MSCI:ACWI IMI	16.37 ( <sup>62</sup> )	21.58 (55)	(18.40) (15)	18.22 (48)	16.25 <sup>(93)</sup>	26.35 (90)	(10.08) (69)	23.95 (91)	8.36 (8)	(2.19) (97)

Note: Manager candidate performance is shown gross-of-fees unless otherwise noted.

\*Results reflect peer group median performance.

Rolling three-year periods – returns and peer group rankings

#### Returns for Rolling Three-Year Periods Ended December 31, 2024 Group: Callan Glbl AC Gr Eq (Percentile Rankings in Parentheses)

	Last 3 Yrs.	3 Yrs. Ending 12/31/23	3 Yrs. Ending 12/31/22	3 Yrs. Ending 12/31/21	3 Yrs. Ending 12/31/20
Janus Henderson	8.07 (5)	5.65 (18)	4.44 (50)	27.64 (34)	17.97 (31)
PGIM (simulated)	8.50 (3)	8.51 (3)	8.54 (6)	24.81 (70)	10.84 (88)
Acadian - Complement	9.33 (1)	10.31 (2)	8.30 (8)	22.50 (81)	8.95 (92)
Harding Loevner - Complement	0.15 (78)	0.49 (66)	2.59 (80)	25.65 (61)	<b>15.69</b> (63)
LSV - Complement	6.24 (17)	9.53 (2)	4.54 (49)	15.43 (98)	3.03 (100)
Callan Glbl AC Gr Eq*	2.86	2.01	4.47	26.19	16.67
MSCI:ACWI Growth	5.72 (20)	3.66 (32)	3.75 (61)	27.58 (34)	17.66 (38)
MSCI:ACWI	5.44 (22)	5.75 (17)	4.00 (56)	20.38 (92)	10.06 (90)
MSCI:ACWI IMI	4.90 (29)	5.46 (18)	3.89 (59)	20.20 (92)	9.72 (90)

Note: Manager candidate performance is shown gross-of-fees unless otherwise noted.

\*Results reflect peer group median performance.

Up-market and down-market capture statistics

Up Market Capture and Down Market Capture Relative to the MSCI:ACWI Growth for Five Years Ended December 31, 2024 Group: Callan Glbl AC Gr Eq (Percentile Rankings in Parentheses)

	Up Market Capture (%)	Down Market Capture (%)
Janus Henderson	106.65 (10)	98.38 (57)
PGIM (simulated)	103.70 (14)	93.98 (78)
Acadian - Complement	90.03 (32)	82.57 (100)
Harding Loevner - Complement	82.11 (55)	106.05 (22)
LSV - Complement	71.95 (80)	99.44 (53)
Callan Gibi AC Gr Eq*	83.33	99.93
MSCI:ACWI	77.91 (70)	95.79 (67)
MSCI:ACWI IMI	77.64 (70)	97.67 (58)

Note: Manager candidate performance is shown gross-of-fees unless otherwise noted.

\*Results reflect peer group median performance.

### Excess correlation table

#### Benchmark: MSCI ACWI (Net) for Five Years Ended December 31, 2024 1.00 Janus Henderson 0.34 1.00 PGIM (simulated) 0.19 0.54 1.00 Acadian - Complement 0.68 0.31 0.04 1.00 Harding Loevner - Complement LSV - Complement (0.80)(0.05)0.08 (0.68)1.00 Janus Henderson Harding Loevner -LSV - Complement

Note: Manager candidate performance is shown gross-of-fees unless otherwise noted.

PGIM's simulated Global Growth Equity Strategy was produced by leveraging the firm's existing alpha model and shifting the portfolio toward faster growing stocks within the portfolio construction process. The "live" Global All Country IMI Equity Strategy has an inception date of 7/1/2016 and has \$204.2 million in product assets as of March 31, 2025

PGIM (simulated)



Complement

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Acadian - Complement

### Risk/reward structure - return versus standard deviation

Risk/Reward for Five Years Ended December 31, 2024 Group: Callan Glbl AC Gr Eq (Ellipse with Median at Central Axis)



Note: Manager candidate performance is shown gross-of-fees unless otherwise noted.

**PGIM's** simulated Global Growth Equity Strategy was produced by leveraging the firm's existing alpha model and shifting the portfolio toward faster growing stocks within the portfolio construction process. The "live" Global All Country IMI Equity Strategy has an inception date of 7/1/2016 and has \$204.2 million in product assets as of March 31, 2025

Callan

### Excess return versus tracking error

Excess Return vs Tracking Error for Five Years Ended December 31, 2024 Benchmark: MSCI ACWI Growth (Net)

Group: Callan Glbl AC Gr Eq (Ellipse with Median at Central Axis)



Note: Manager candidate performance is shown gross-of-fees unless otherwise noted.

PGIM's simulated Global Growth Equity Strategy was produced by leveraging the firm's existing alpha model and shifting the portfolio toward faster growing stocks within the portfolio construction process. The "live" Global All Country IMI Equity Strategy has an inception date of 7/1/2016 and has \$204.2 million in product assets as of March 31, 2025

Callan

### 5-year risk statistics

#### Return-Based Risk Statistics Relative to MSCI:ACWI Growth for Five Years Ended December 31, 2024 Group: Callan Glbl AC Gr Eq (Percentile Ranking in Parentheses)

	Standard Deviation	Downside Risk	Sharpe Ratio	Information Ratio	Alpha	Beta	Correlation
Janus Henderson	21.78 (46)	1.05 (99)	0.55 (7)	0.56 (1)	1.32 (8)	0.99 (33)	0.99 (1)
PGIM (simulated)	21.83 (45)	4.99 (61)	0.57 (4)	0.30 (5)	2.27 (3)	0.95 (44)	0.94 (72)
Acadian - Complement	19.27 (86)	5.10 (59)	0.63 (1)	0.42 (1)	3.07 (1)	0.83 (92)	0.93 (83)
Harding Loevner - Complement	22.04 (43)	4.60 (78)	0.29 (78)	(0.78) (91)	(3.68) (83)	0.99 (34)	0.98 (9)
LSV - Complement	22.31 (41)	10.92 (1)	0.26 (83)	<b>(0.11)</b> (36)	(1.63) (49)	0.79 (96)	0.77 (99)
Callan Glbl AC Gr Eq*	21.44	5.49	0.37	(0.26)	(1.66)	0.94	0.95
MSCI:ACWI Growth	21.76 (46)	0.00 (99)	0.49 (14)	0.00 (20)	0.00 (20)	1.00 (32)	1.00 (1)
MSCI:ACWI	19.58 (78)	5.82 (44)	0.39 (42)	(0.20) (40)	(1.33) (43)	0.85 (80)	0.94 (63)
MSCI:ACWI IMI	20.10 (72)	6.18 (33)	0.36 (54)	(0.25) (48)	(1.78) (54)	0.87 (74)	0.94 (76)

Note: Manager candidate performance is shown gross-of-fees unless otherwise noted.

\*Results reflect peer group median performance.



Appendix

#### Style Map for Five Years Ended December 31, 2024



**PGIM's** simulated Global Growth Equity Strategy was produced by leveraging the firm's existing alpha model and shifting the portfolio toward faster growing stocks within the portfolio construction process. The "live" Global All Country IMI Equity Strategy has an inception date of 7/1/2016 and has \$204.2 million in product assets as of March 31, 2025

### **Investment Terms**

Alpha:	A measure of risk-adjusted return. It measures the excess return relative to the return expected from the portfolios beta to a given benchmark and attempts to capture the return coming from asset specific (or residual) risks like stock selection and sector selection.
► Beta:	Measures the sensitivity of portfolio returns to movements in the market index. A portfolio's beta measures the expected change in return per 1% change in the market return. If a beta of a portfolio is 1.5, a 1% increase in the return on the market will result, on average, in a 1.5% increase in the return on the portfolio.
Capitalization:	The capitalization for an individual stock is its stock price multiplied by the number of shares outstanding. The capitalization of an index reflects the capitalizations of the stocks contained in the index. While large cap stocks always represent the largest stocks in a universe there is no broadly accepted definition of how small the smallest large cap stock should be. Similarly, there is no broadly accepted definition of how large the largest small cap stock should be. Consequently, there is often capitalization overlap between indices.
Developed Markets:	Countries which have mature economies and long-established asset markets
Down Market Capture:	For a given evaluation horizon (10 years for example), isolates the periods where the benchmark had negative performance. Down market capture measures the ratio of the portfolio's cumulative returns in these periods to the benchmark's cumulative returns in the same periods.
Emerging Markets:	Countries which have economies which are developing rapidly and have relatively new asset markets
Economic Exposure:	An estimate of the regional allocation of a company based on the geographic distribution of its revenues rather than the country of domicile. Company-level economic exposures are aggregated to calculate a portfolio's overall economic exposure.

### **Investment Terms (Continued)**

Excess Return:	A manager's return in excess of the return of the manager's benchmark
Excess Return Ratio:	A measure of risk-adjusted return. This ratio captures the amount of active management performance (excess return) per unit of active management risk (tracking error).
Excess Return Correlation:	The correlation of one portfolio's excess return to another portfolio's excess return. Excess return is the portfolio's return minus its benchmark's return.
Information Ratio:	The information ratio measures and compares the <u>active return</u> of an investment (e.g., a security or portfolio) compared to a benchmark index relative to the volatility of the active return (also known as <u>active risk</u> or benchmark tracking risk).
Manager Return Composite:	Manager composites are the returns for the aggregate of each manager's client portfolios.
Maximum Drawdown:	The worst peak-to-trough decline in a portfolio's value over the specified evaluation period.
Sharpe Ratio:	A measure of risk-adjusted return. This ratio captures the amount of excess return over the risk-free rate (usually 3-month T-Bills) per unit of absolute risk (standard deviation).
Standard Deviation:	Standard deviation reflects the average deviation of the observations from their sample mean. In the case of portfolio performance, the standard deviation describes the average deviation of the portfolio returns from the mean portfolio return over a certain period of time. Standard deviation measures how wide this range of returns typically is. The wider the typical range of returns, the higher the standard deviation of returns, and the higher the portfolio risk. If returns are normally distributed (i.e., has a bell-shaped curve distribution), then approximately 2/3 of the returns would occur within plus or minus one standard deviation from the sample mean.
► Styles:	The three most common styles are growth, value and core. Growth stocks have relatively high growth in profits, sales and return on equity with relatively high prices to reflect these characteristics. Value stocks generally have low prices reflecting relatively low earnings growth but high dividend yields. Core stocks have characteristics which lie in between those of growth and value.

### **Investment Terms (Continued)**

Tracking Error: Tracking error is the volatility (as measured by standard deviation) of a portfolio's returns relative to its benchmark.
 Up Market Capture: For a given evaluation horizon (10 years for example), isolates the periods where the benchmark had positive performance. Up market capture measures the ratio of the portfolio's cumulative returns in these periods to the benchmark's cumulative returns in the same periods.

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# Public Employees' Retirement System of Mississippi

Global Growth Equity Strategy

April 22, 2025

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## **Presenters**





Stacie L. Mintz, CFA, is a Managing Director and Head of Quantitative Equity for PGIM Quantitative Solutions. She leads the portfolio managers on the Quantitative Equity team and is responsible for enhancements to the Quantitative Equity models and portfolio analytic tools. Prior to her current role, she served as the Head of Equity Portfolio Management for PGIM Quantitative Solutions. Stacie has over two decades of portfolio management experience, focusing on long-only and long-short equity investing for more than 15 years at PGIM. Prior to that, she managed strategic and tactical asset allocation for several institutional and retail funds at PGIM. During that time, she was also responsible for managing the overall asset allocation for the Prudential Pension Plan. She earned a BA in economics from Rutgers University and an MBA in finance from the New York University Stern School of Business.



Kevin O'Rourke, CFA, CAIA is a Managing Director and Head of East Coast Sales for PGIM Quantitative Solutions. In this capacity, he is responsible for institutional client relations and business development. Prior to joining PGIM Quantitative Solutions, he was a Managing Director at Turner Investments and was responsible for Business Development and Consultant Relations in the US and Canada. Previously, Kevin was employed at Walnut Asset Management and Wells Fargo/First Union. Kevin earned a BS in business administration at West Virginia University. He is a member of the CFA Institute and the CFA Society New York, as well as a member of the Chartered Alternative Investment Analyst Association.



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- 1. Firm Overview
- 2. Global Growth Equity Strategy Overview

### Appendix

- Additional Exhibits
- Notes to Disclosure

# THE POWER OF A MULTI-AFFILIATE MODEL





PGIM internal data as of December 31, 2024. All assets under management (AUM) are net unless otherwise noted. AUM totals may not sum due to rounding and double counting. Assets under management are based on company estimates and are subject to change. 1. AUM total includes \$11 billion in assets managed by PGIM Fixed Income for affiliated businesses, \$67 billion in PGIM Japan assets, and \$140 million of which is sub-advised by PGIM Private Capital. 2. AUM total includes equity \$172 billion, fixed income \$38 billion, and private credit and other alternatives \$404 million.

3. ÅUA/AUM total includes: assets managed by PGIM Quantitative Solutions, \$69 billion in directly managed mandates, \$39 billion of institutional and retail assets managed by various affiliated and third-party managers. The Net AUM is \$108.5 billion and the AUA is \$2.8 billion. 4. AUM/AUA total is reflected as gross and includes assets under administration. Gross is \$159 billion and AUA is \$47 billion. Net AUM is \$133 billion. 5. MCP AUM includes NAV plus unfunded commitments. As of 9/30/24. 6. PGIM Investments AUM as of 12/31/2024 includes U.S. mutual funds: \$145.5 (excluding money markets and funds of funds), closed-end funds: \$1.48, ETFs: \$12.3, UCITS funds: \$8.9B, PGIM Custom Harvest: \$5.2B, and Asia Local: \$21.2B. Asia Local AUM includes Everbright PGIM (a joint venture in China in which PGIM has a 45% ownership stake), PGIM SITE, and PGIM India. 7. PGIM Private Alternatives manages \$324 billion gross in private alternatives strategies across private credit, real estate, agriculture, sustainable investing, infrastructure and private equity. These strategies are managed by PGIM Real Estate (est. 1970), PGIM Private Capital (est. 1925) and Montana Capital Partners (est. 2011); underlying investment strategies and portfolio and originations teams remain distinct, with each affiliate maintaining its own governance. Note: AUM/AUA includes \$7.2B from Deerpath Capital, in which PGIM acquired a majority stake in late 2023. PGIM Real Estate net AUM is \$132.5B and AUA is \$47.3B **287/331** 

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## PGIM Quantitative Solutions Overview Global Experience Leads to Diversity of Thought



- > Headquartered in Newark, with offices in San Francisco\* and London
- Delivering asset management solutions for retail and institutional investors globally for 50 years
- > 193 employees representing 25+ countries, 11 PhDs and numerous CFAs and advanced degrees
- Investment team averages 15 years of investment experience and 11 years at PGIM Quantitative Solutions

#### **QUANTITATIVE EQUITY**

l <b>US Equity</b> US Large, Mid, SMID, Small, Micro Cap Core	\$23.3 B	
International and Global Equity Int'l Core, Int'l Opportunities, Int'l Small Cap, Int'l Micro Cap, Global	\$7.2 B	AUM/AUA <sup>1</sup> Multi Asset \$56 6 Billion (net)
Emerging Markets Equity EM Core, EM All Cap, EM Small Cap	\$2.2 B	\$30.0 Billion (net) \$83.3 Billion (gross) Quantitative Equity \$54.7 Billion
Nalue Equity Large, Mid, Small	\$1.0 B	
Equity Indexing	\$21.2 B	\$111.3B

#### As of 12/31/2024.

<sup>1</sup>Please read carefully the information about the pie chart included in this footnote. PGIM Quant provides model portfolios for certain accounts, the assets of which (Assets Under Administration) are included in the total AUM/AUA figure. The Net AUM is \$108.5 billion and the AUA is \$2.8 billion. PGIM Quant's Gross Multi-Asset AUM figure (\$83.3 billion) in the pie chart includes \$26.7 billion that PGIM Quant's Multi-Asset team directs to equity strategies advised directly by PGIM Quant. This \$26.7 billion amount is also included in the Quantitative Equity portion of the pie chart and counted twice. Please also note that AUM figures include both active equity and indexing strategies and may not sum due to rounding.

\*PGIM Quant maintains an office in San Francisco that is used periodically by PGIM Quant personnel fo page of statistic purposes (no investment advisory activities are conducted from this location).
# **Our Organization**



Linda Gibson Chair and Chief Executive Officer					
George Patterson, PhD Chief Investment Officer					
	<b>Quantitative Equity</b> Investment Team of 25			<b>Multi Asset</b> Investment Team of 19	
	Global Trading & Support Team of 7	Operations N Team	<b>lanagement<sup>1</sup></b> of 56	Investment Technology Team of 9	
	Global Distribution Team of 28	<b>Complianc</b> Team	<b>e &amp; Legal<sup>2</sup></b> of 10	Business Management <sup>3</sup> Team of 37	

As of 12/31/2024.

<sup>1</sup>Operations Management includes the following functions: Business Systems, Technology Infrastructure, Operations, Client Reporting & Performance, Operational Risk, Information Security and Market Data Services. <sup>2</sup>Compliance and Legal report independently to the Law Department of PFI. <sup>3</sup>Business Management includes Finance, Human Resources, Business Continuation and Administrative **28**(9)(331)



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- 1. Firm Overview
- 2. Global Growth Equity Strategy Overview

#### Appendix

- Additional Exhibits
- Notes to Disclosure

# **Global All Country IMI Equity Strategy**



#### Investment Objective<sup>1</sup>

Long-term MSCI ACWI IMI Index outperformance

#### **Key Features**

- · Global focused, systematic multi-factor approach grounded in fundamental and behavioral motivations
- A key differentiator is our approach to risk, we vigilantly focus on managing against uncompensated risk while dynamically capturing alpha without taking undue style bets

			Ann	ualized	
As of 3/31/2025	1 Year	3 Year	5 Year	7 Year	Since Inception <sup>2</sup>
Net of Fees (%)	6.26	8.86	17.12	9.20	11.12
Gross Return (%)	6.79	9.40	17.69	9.74	11.67
Benchmark Return (%)	6.30	6.31	15.02	8.67	10.26
Net Alpha (bps)	-4	+255	+210	+53	+86
Gross Alpha (bps)	+49	+309	+268	+107	+141
Gross Risk Statistics					
Information Ratio	0.26	1.17	0.96	0.42	0.60
Tracking Error	1.91	2.64	2.78	2.57	2.36

<sup>1</sup>There can be no guarantee that the objective will be achieved.

<sup>2</sup>Inception of the Global All Country IMI Equity Composite is 7/1/2016. The Global All Country IMI Equity Composite presently consists of a single client account and may also include accounts with client-provided restricted securities lists.

Source: PGIM Quant, MSCI. Benchmark: MSCI ACWI IMI Index.

Past performance is not a guarantee or a reliable indicator of future results. Performance results are stated gross and net of model fees. Gross performance has been calculated in US dollars and reflects the reinvestments of dividends and other earnings. Returns for each client will be reduced by such fees and expenses as described in their individual contract. Returns are shown net of non-reclaimable foreign withholding taxes, if any. Net returns are calculated by deducting the highest tier of the PGIM Quant fee schedule in effect for the respective time period from the monthly gross composite return. The returns provided above are time-weighted. The index is net of foreign withholding tax using the Luxembourg tax rate. Please see 'Notes to Disclosure' page for Important Information including risk factors and other disclosures. MSCI has not approved, reviewed or produced this report, makes no express or implied warranties or representations and is not liable whatsoever for any data in the report. You may not redistribute the MSCI data or use it as basis for other indices or investment products. Please see 'Notes to Disclosure' page for additional MSCI disclosures. **291/331** 

### **PGIM** QUANTITATIVE SOLUTIONS

# **Global All Country IMI Equity Return Profile**

As of 12/31/2024 (eVestment Universe: Global All Cap Equity vs. MSCI ACWI IMI Index)





	3 Years	Rank	5 Years	Rank	SI 8.5 Yrs.	Rank
5 <sup>th</sup> Percentile	1.21		0.98		0.79	
25 <sup>th</sup> Percentile	0.27		0.33		0.38	
Median	0.12		-0.03		0.00	
75 <sup>th</sup> Percentile	-0.57		-0.28		-0.23	
95 <sup>th</sup> Percentile	-1.25		-0.64		-0.60	
# of Observations	673		584		437	
<b>PGIM Quant</b>	1.11	6	0.97	5	0.62	10

From 7/1/2016 to 12/31/2024. Inception of the Global All Country IMI Equity Composite is 7/1/2016. Source: eVestment Alliance, LLC, PGIM Quant.

Past performance is not a guarantee or a reliable indicator of future results. Batting Average is the percentage of quarterly periods a product outperforms the benchmark (gross of fee). Shown for illustrative purposes only. eVestment Alliance is an outside vendor whose software has been used to create this exhibit. PGIM Quant pays a fee for this software. PGIM Quantitative Solutions has made efforts to confirm accuracy/reliability of the data provided by eVestment Alliance but we disclaim responsibility for its accuracy or completeness.

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### **Global All Country IMI Equity Return Profile**

As of 12/31/2024 (eVestment Universe: Global All Cap Equity vs. MSCI ACWI IMI Index)



From 7/1/2016 to 12/31/2024. Inception of the Global All Country IMI Equity Composite is 7/1/2016.

Source: eVestment Alliance, LLC, PGIM Quant.

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### Executive Summary: Global Growth Equity Strategy

#### Investment Objective<sup>1</sup>

Long-term MSCI ACWI IMI Index outperformance

#### **Key Features**

- · Global growth equity strategy driven by a systematic multi-factor approach grounded in fundamental and behavior motivations
- The Global Growth Equity Strategy was produced by leveraging our existing time proven alpha model and shifting the portfolio toward faster growing stocks within the portfolio construction process

#### The efficacy of the Global Growth Equity Strategy stems from:

- · Our proven track record of successfully managing other global equity strategies
- · The contextual modeling element of our alpha model, which evaluates growth companies thru the proper lens
- · Fundamentally based factors that are time proven across various market environments

Simulated Global Growth Equity		Annualized			
As of 3/31/2025	1 Year	3 Year	5 Year	10 Year	Since Inception <sup>2</sup>
Net of Fees (%)	7.59	9.63	20.22	11.47	12.29
Gross Return (%)	7.65	9.70	20.30	11.54	12.37
Benchmark Return (%)	6.30	6.31	15.02	8.55	8.88
Net Alpha (bps)	+128	+332	+521	+292	+341
Gross Alpha (bps)	+135	+339	+528	+299	+348
Gross Risk Statistics					
Information Ratio	0.41	0.84	1.30	0.86	1.12
Tracking Error	3.33	4.04	4.07	3.47	3.12

<sup>1</sup>There can be no guarantee that the objective will be achieved. <sup>2</sup>Inception of the Simulated Global Growth Equity Strategy is 1/1/2010.

Source: PGIM Quant, MSCI. Benchmark: MSCI ACWI IMI Index.

Past performance is not a guarantee or a reliable indicator of future results. The simulated results shown above do not represent the results of actual trading, but were achieved by retroactive application of a model designed with the benefit of hindsight. The simulations shown have significant inherent shortcomings and do not consider many real-world frictions such as cash balances, intra-month trades, and the ability to trade at various prices. Gross performance does not reflect the deduction of investment advisory fees and other expenses. Net performance reflect the deduction of the highest model fee for the strategy. The simulated results were derived using certain assumptions. The simulated performance of the strategy assumes monthly portfolio rebalancing, specific risk constraints relative to the benchmark of individual stock (+/- 1.50%), country exposure (+/- 2.5%), market cap bin (+/- 10.0%), beta exposure (+/- 0-10.0%), and costs are modelled using estimates for bid-ask spread and market impact (up to 20% turnover monthly). Please see 'Notes to Disclosure for Simulated Performance' pages for additional important information including risk factors, disclosures, and additional assumptions and portfolio construction details. MSCI has not approved, reviewed or produced this report, makes no express or implied warranties or representations and is not liable whatsoever for any data in the report. You may not redistribute the MSCI data or use it as basis for other indices or investment products. Please see 'Notes to Disclosure' page 4// @Bintheff and MSCI disclosures.

# Why PGIM Quantitative Equity?







Source: PGIM Quant

There can be no guarantee that the objective will be achieved. No investment strategy or risk management technique can guarantee returns or eliminate risk in any market environment. Please see "Notes to Disclosure" page for Important Information including risk factors and additional disclosures. 295/331

# **Quantitative Equity Investment Team**

	George Patterson, PhD
Chief Investment Officer	29 Years of Investment Experience, 7 Years at PGIM Quant

Portfolio Management	Investment Experience (Years)	Firm Tenure (Years)
Head of Quantitative Equity		
Stacie Mintz, CFA	31	32
Stephen Courtney	38	11
Shaun Daley	7	20
Ken D'Souza, CFA	15	10
Devang Gambhirwala	37	38
Harry Hinkel	21	24
Wen Jin, PhD, CFA	24	16
Christopher Lipari, CFA	6	14
Edward Lithgow, CFA	25	28
Chris Zani, CFA, FRM	20	<1

Supported by a team of 5 Associates

Global Trading	Investment Experience (Years)	Firm Tenure (Years)
Head of Global Trading		
Richard Crist	37	41
Joseph Lombardi	35	40
Wataru Yamaguchi	32	11

Supported by 4 Operations Associates

Research	Investment Experience (Years)	Firm Tenure (Years)
Head of Equity Research		
Gavin Smith, PhD	21	10
Adam M. Papallo, CFA	17	5
Patrick Pfeifer, CFA	12	19
Jyoti Singh, CFA	14	11
Sophia Zhang, PhD	12	8

#### Supported by 5 Associates

Governance	Experience (Years)	Firm Tenure (Years)
Donna Maggio, CPA	18	25
Nydia Montoya, JD	18	11
Investment Technology	Experience (Years)	Firm Tenure (Years)

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Aaditya Gorur Paniraj Supported by 8 Associates 6

### **Investment Process**



#### STOCK SELECTION

Evaluate stocks on metrics that matter

- Fundamental insights to formulate stock scores
- Adaptively utilize signals where most effective

# PORTFOLIO

Optimize portfolio to client-desired outcome

- Factor exposures optimized to maximize expected alpha
- · Focus on after cost alpha
- Apply sector, position, country and style risk parameters
- Control for uncompensated risk factors

#### PORTFOLIO REVIEW

Transparent portfolio outcomes

- Experienced portfolio manager oversight
- Carefully review and monitor trade lists
- Risk liquidity and cost oversight

### TRADE EXECUTION

Cost-effective trading

- Assess current market conditions ahead of trade execution
  - Experienced trader oversight and monitoring of all risk
- Systematic trading across multiple venues

### DIVERSIFIED PORTFOLIO



POST TRADE MONITORING -

• Analyze execution efficacy

• Return decomposition

### **Canvas the Global Stock Universe**



#### **INSIGHTS ON INVESTMENTS ACROSS ALL GLOBAL PUBLIC EQUITY MARKETS**

Daily analysis of 40,000+ Securities



### **Stock Selection Insights**





# **An Adaptive Factor Modeling Process**

- > The value of a company is the sum of its current earnings, and its future growth prospects
- > Our contextual modeling uses this concept to determine factor weights based on where a company is in its growth cycle
  - For slower growing, mature companies, emphasis is on the value of current operations
  - For faster growing companies, emphasis is on future growth prospects



**PGIM** QUANTITATIVE SOLUTIONS

### **Portfolio Construction and Risk Control**





Source: PGIM Quant.

Shown for illustrative purposes only. Portfolio construction parameters may vary without notice. No investment strategy or risk management technique can guarantee returns or eliminate risk in any market environment. Please see "Notes to Disclosure" page for Important Information including risk factors and additional disclaret 331

### **Exposure to Factor Components**

#### Exposure to Factors Relative to MSCI ACWI IMI Index

Five Years ending 3/31/2025



#### Source: PGIM Quant, using data provided by FactSet, MSCI.

Source: PGIM Quant, using data provided by FactSet, MSCI. Holdings-based analysis that is intended to illustrate significant performance drivers and is not intended shown in each chart to be a formal accounting of return. Holdings are subject to change. The simulated results shown above do not represent the results of actual trading, but were achieved by retroactive application of a model designed with the benefit of hindsight. The simulations shown have significant inherent shortcomings and do not consider many real-world frictions such as cash balances, intra-month trades, and the ability to trade at various prices. The simulated results were derived using certain assumptions. The simulated performance of the strategy assumes monthly portfolio rebalancing, specific risk constraints relative to the benchmark of individual stock (+/- 15.0%), country exposure (+/- 2.5%), market cap bin (+/- 10.0%), beta exposure (+/- 0.10.0%), and costs are modelled using estimates for bid-ask spread and market impact (up to 20% turnover monthly). Please see 'Notes to Disclosure' and 'Notes to Disclosure' and 'Notes to Disclosure' and 'Notes to Disclosure' and 'Notes to Disclosure' or any data in the report. You may not redistribute the MSCI data or use it as basis for other indices or investment products. Please see 'Notes to Disclosure' page for additional MSCI disclosures.

### **PGIM** QUANTITATIVE SOLUTIONS

1.9

1.8

MSCI ACWI IMI Index

### **Portfolio Characteristics**



Weighted Average Median



#### Weighted Average Median

#### As of 3/31/2025.

Source: PGIM Quant, FactSet, MSCI. Benchmark: MSCI ACWI IMI Index.

Forecasts may not be achieved and are not a guarantee or reliable indicator of future results. Representative characteristics are subject to change. The simulated results shown above do not represent the results of actual trading, but were achieved by retroactive application of a model designed with the benefit of hindsight. The simulations shown have significant inherent shortcomings and do not consider many real-world frictions such as cash balances, intra-month trades, and the ability to trade at various prices. The simulated results were derived using certain assumptions. The simulated performance of the strategy assumes monthly portfolio rebalancing, specific risk constraints relative to the benchmark of individual stock (+/- 1.50%), country exposure (+/- 2.5%), market cap bin (+/- 10.0%), beta exposure (+/- 0-10.0%), and costs are modelled using estimates for bid-ask spread and market impact (up to 20% turnover monthly). Please see 'Notes to Disclosure' and 'Notes to Disclosures, and additional assumptions and portfolio construction details. MSCI has not approved, reviewed or produced this report, makes no express or implied warranties or representations and is not liable whatsoever for any data in the report. You may not redistribute the MSCI data or use it **303/30** the rindices or investment products. Please see 'Notes to Disclosure' page for additional MSCI disclosures. 20

3.0 2.5

2.0

1.5

1.0

0.5

0.0

100%

Price/Sales

2.2

1.6

Simulated Global Growth



**Global All Country IMI** 

■ Weighted Average ■ Median

**Price/Sales** 

1.4

2.0



Positive Earnngs Revisions (% of Holdings)

# Simulated Global Growth Portfolio Characteristics

Summary of Holdings	Portfolio	Benchmark
# of Holdings	388	8,406
Portfolio Top 20 Holdings (%)	32.7	19.7
Top 10 Active Weights (%)	14.3	-
Beta (3 Year)	1.0	-

Market Cap (\$ Billion) <sup>1</sup>	Portfolio	Benchmark
Large > \$50B	51.6%	63.6%
Mid/Large \$10-50B	30.0%	22.3%
Mid/Small \$2-10B	16.7%	10.4%
Small < \$2B	1.7%	3.7%
Median Market Cap	\$12.5	\$2.4
Weighted Avg. Market Cap	\$475.4	\$526.4

**PGIM** QUANTITATIVE SOLUTIONS

As of 3/31/2025. <sup>1</sup>Market Capitalization is calculated based on total shares outstanding.

Source: PGIM Quant, FactSet, MSCI. Source of sector classification: S&P/MSCI. Benchmark: MSCI ACWI IMI Index.

Representative characteristics are subject to change. The simulated results shown above do not represent the results of actual trading, but were achieved by retroactive application of a model designed with the benefit of hindsight. The simulations shown have significant inherent shortcomings and do not consider many real-world frictions such as cash balances, intra-month trades, and the ability to trade at various prices. The simulated results were derived using certain assumptions. The simulated performance of the strategy assumes monthly portfolio rebalancing, specific risk constraints relative to the benchmark of individual stock (+/- 1.50%), country exposure (+/- 2.5%), market cap bin (+/- 10.0%), beta exposure (+/- 0-10.0%), and costs are modelled using estimates for bid-ask spread and market impact (up to 20% turnover monthly). Please see 'Notes to Disclosure' and 'Notes to Disclosure for Simulated Performance' pages for additional important information including risk factors, disclosures, and additional assumptions and portfolio construction details. MSCI has not approved, reviewed or produced this report, makes no express or implied warranties or representations and is not liable whatsoever for any data in the report. You may not redistribute the MSCI data or use it as basis for other indices or investment products. Please see 'Notes **A Disclosures**.

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# MSCI ACWI IMI vs. MSCI ACWI IMI Growth



Weights - Economic Sector				
	MSCI ACWI IMI	MSCI ACWI IMI Growth		
Communication Services	7.66	11.82		
Consumer Discretionary	10.83	14.03		
Consumer Staples	6.16	4.26		
Energy	4.17	0.84		
Financials	17.81	8.16		
Health Care	10.22	8.47		
Industrials	11.52	10.25		
Information Technology	22.03	38.59		
Materials	4.12	2.56		
Real Estate	2.76	0.51		
Utilities	2.72	0.51		

То	p 10 Positions	3
	MSCI ACWI IMI	MSCI ACWI IMI Growth
0 Highest	18.34	41.14
Apple Inc.	3.93	8.84
NVIDIA Corporation	3.12	7.02
Microsoft Corporation	3.12	7.01
Amazon.com, Inc.	2.12	4.76
Meta Platforms Inc Class A	1.48	3.32
Alphabet Inc. Class A	1.06	2.39
Alphabet Inc. Class C	0.92	2.06
Tesla, Inc.	0.88	1.98
Broadcom Inc.	0.88	1.97
Berkshire Hathaway Class B	0.83	-
Taiwan Semiconductor MFG	-	1.79

#### As of 3/31/2025.

Source: PGIM Quant, FactSet, MSCI.

References to specific securities and their issuers are for illustrative purposes only and are not intended and should not be interpreted as recommendations to purchase or sell such securities. The securities referenced may or may not be held in portfolios managed by PGIM Quant and, if such securities are held, no representation is being made that such securities will continue to be held. Please see 'Notes to Disclosure' page for Important Information including risk factors and disclosures. MSCI has not approved, reviewed or produced this report, makes no express or implied warranties or representations and is not liable whatsoever for any data in the report. You may not redistribute the MSCI data or use it as basis for other indices or investment products. Please for additional MSCI disclosures.

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# Style Map - Holdings Based vs. Global Equity Universe



#### Source: eVestment Alliance, LLC, PGIM Quant.

Shown for illustrative purposes only. The simulated results shown above do not represent the results of actual trading, but were achieved by retroactive application of a model designed with the benefit of hindsight. The simulations shown have significant inherent shortcomings and do not consider many real-world frictions such as cash balances, intra-month trades, and the ability to trade at various prices. The simulated results were derived using certain assumptions. The simulated performance of the strategy assumes monthly portfolio rebalancing, specific risk constraints relative to the benchmark of individual stock (+/- 1.50%), country exposure (+/- 2.5%), market cap bin (+/- 10.0%) beta exposure (+/- 0-10.0%), and costs are modelled using restimates for bid-ask spread and market impact (up to 20% turnover monthly). Please see 'Notes to Disclosure' and 'Notes to Disclosure' for Simulated Performance' pages for additional important information including risk factors, disclosures, and additional assumptions and portfolio construction details. eVestment Alliance is an outside vendor whose software has been used to create this exhibit. PGIM Quant pays a fee for this software. PGIM Quantitative Solutions has made efforts to confirm accuracy/reliability of the data provided by eVestment Distribution.



### Simulated Performance: Global Growth Equity Strategy

#### Simulated Global Growth Equity Strategy vs. MSCI ACWI IMI Index As of 3/31/2025

Year	Simulated Global Growth Equity (Net)	Simulated Global Growth Equity (Gross)	MSCI ACWI IMI Index	Net Alpha	Gross Alpha
2025 (1/1-3/31)	-1.99%	-1.98%	-1.61%	-39 bps	-37 bps
2024	26.15	26.23	16.37	+978	+986
2023	23.48	23.56	21.58	+190	+198
2022	-18.16	-18.11	-18.40	+24	+30
2021	26.19	26.27	18.22	+797	+805
2020	23.57	23.65	16.25	+732	+740
2019	24.45	24.53	26.35	-190	-182
2018	-11.63	-11.57	-10.08	-155	-149
2017	32.14	32.22	23.95	+819	+828
2016	7.69	7.76	8.36	-67	-60
2015	1.16	1.23	-2.19	+335	+341
2014	9.29	9.36	3.84	+546	+553
2013	25.63	25.71	23.55	+208	+216
2012	21.10	21.18	16.38	+472	+480
2011	-3.55	-3.49	-7.89	+434	+440
2010	18.57	18.64	14.35	+422	+430

Annualized	1 Year	3 Year	5 Year	10 Year	Since Inception <sup>^</sup>
Net Return (%)	7.59	9.63	20.22	11.47	12.29
Gross Return (%)	7.65	9.70	20.30	11.54	12.37
Benchmark Return (%)	6.30	6.31	15.02	8.55	8.88
Net Alpha (bps)	+128	+332	+521	+292	+341
Gross Alpha (bps)	+135	+339	+528	+299	+348
Gross Tracking Error (%)	3.33	4.04	4.07	3.47	3.12
Gross Information Ratio	0.41	0.84	1.30	0.86	1.12

Source: PGIM Quant, MSCI.

<sup>^</sup>Inception of the Simulated Global Growth Equity Strategy is 1/1/2010.

The simulated results shown above do not represent the results of actual trading, but were achieved by retroactive application of a model designed with the benefit of hindsight. The simulations shown have significant inherent shortcomings and do not consider many real-world frictions such as cash balances, intra-month trades, and the ability to trade at various prices. Gross performance does not reflect the deduction of investment advisory fees and other expenses. Net performance reflect the deduction of the highest model fee for the strategy. Results are not guaranteed. The simulated results were derived using certain assumptions. The simulated performance of the strategy assumes monthly portfolio rebalancing, specific risk constraints relative to the benchmark of individual stock (+/- 1.50%), country exposure (+/- 2.5%), market cap bin (+/- 10.0%), beta exposure (+/- 0.10.0%), and costs are modelled using estimates for bid-ask spread and market impact (up to 20% turnover monthly). Please see 'Notes to Disclosure' and 'Notes to Disclosure for Simulated Performance' pages for additional important information including risk factors, disclosures, and additional assumptions and portfolio construction details. MSCI has not approved, reviewed or produced this report, makes no express or implied warranties or representations and is not liable whatsoever for any data in the report. You may not redistribute the MSCI data or use it as basis for other indices or investment products. Please see 'Notes to Disclosure' page for additional MSCI disclosures. **307/331** 

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- > 50 years of experience in developing customized investment solutions
- Time-proven systematic approach that will continue to employ the latest investment techniques as new data becomes available
- Ability to further customize the mandate as investment needs and market exposures evolve over time
- Expansion of relationship with PGIM enables PERS of Mississippi to access a curated investment solution at a highly efficient investment management fee



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# **Global Growth Equity Fee Schedule**



**Global All Country IMI Equity** 

SEPARATE ACCOUNT – STANDARD BASED MANAGEMENT FEE SCHEDULE

50 basis points on first \$50 million

45 basis points on next \$50 million

40 basis points thereafter

Global Growth Equity for Public Employees' Retirement System of Mississippi SEPARATE ACCOUNT – PROPOSED ASSET BASED MANAGEMENT FEE SCHEDULE

6.5 basis points on first \$1 billion

5 basis points on next \$1 billion

4.5 basis points thereafter

### **Simulated Global Growth Sector Weights**



Portfolio Sector Active Weights

Sector	Portfolio	Benchmark	Difference
Financials	21.65%	17.81%	3.84%
Communication Services	10.27%	7.66%	2.61%
Information Technology	24.28%	22.03%	2.25%
Consumer Staples	7.06%	6.16%	0.90%
Health Care	11.12%	10.22%	0.90%
Real Estate	3.21%	2.76%	0.45%
Utilities	2.22%	2.72%	-0.49%
Energy	2.37%	4.17%	-1.80%
Materials	1.42%	4.12%	-2.70%
Consumer Discretionary	8.04%	10.83%	-2.79%
Industrials	8.35%	11.52%	-3.17%

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#### As of 3/31/2025.

Source: PGIM Quant, FactSet, MSCI. Source of sector classification: S&P/MSCI. Benchmark: MSCI ACWI IMI Index.

Excludes cash positions. Active weights are subject to change. The simulated results shown above do not represent the results of actual trading, but were achieved by retroactive application of a model designed with the benefit of hindsight. The simulations shown have significant inherent shortcomings and do not consider many real-world frictions such as cash balances, intra-month trades, and the ability to trade at various prices. The simulated results were derived using certain assumptions. The simulated performance of the strategy assumes monthly portfolio rebalancing, specific risk constraints relative to the benchmark of individual stock (+/- 1.50%), country exposure (+/- 2.5%), market cap bin (+/- 10.0%), beta exposure (+/- 0-10.0%), and costs are modelled using estimates for bid-ask spread and market impact (up to 20% turnover monthly). Please see 'Notes to Disclosure' and 'Notes to Disclosure for Simulated Performance' pages for additional important information including risk factors, disclosures, and additional assumptions and portfolio construction details. MSCI has not approved, reviewed or produced this report, makes no express or implied warranties or representations and is not liable whatsoever for any data in the report. You may not redistribute the MSCI data or use it **3 tais/ 3 the** first further Distribution

### **Simulated Global Growth Country Weights**

**PGIM** QUANTITATIVE SOLUTIONS



Portfolio Country Weights (%)									
Country	Portfolio	Benchmark	Difference						
Taiwan	3.35	1.84	1.51						
China	4.03	3.06	0.97						
United Kingdom	4.42	3.46	0.96						
Korea	1.91	0.99	0.91						
United Arab Emirates	0.99	0.15	0.84						
Italy	1.50	0.72	0.78						
Switzerland	2.90	2.14	0.77						
Brazil	0.84	0.47	0.37						
Austria	0.43	0.08	0.35						
Turkey	0.41	0.08	0.33						
India	2.38	2.12	0.26						
Spain	0.83	0.68	0.14						
Norway	0.33	0.20	0.13						
Thailand	0.27	0.15	0.13						
Singapore	0.53	0.42	0.11						
Ireland	0.17	0.07	0.10						
United States	63.22	63.17	0.05						
Poland	0.12	0.13	-0.00						
Egypt		0.01	-0.01						
Colombia		0.01	-0.01						
Czech Republic		0.02	-0.02						
Hungary		0.03	-0.03						
Peru		0.03	-0.03						
Qatar	0.05	0.08	-0.03						
Portugal		0.04	-0.04						
Belgium	0.20	0.25	-0.05						
New Zealand		0.05	-0.05						
Chile		0.06	-0.06						
Philippines		0.06	-0.06						
Greece		0.06	-0.06						
Kuwait		0.00	-0.09						
Indonesia	0.04	0.00	-0.10						
Israel	0.16	0.28	-0.12						
Finland	0.12	0.20	-0.12						
Sweden	0.79	0.92	-0.14						
Saudi Arabia	0.30	0.44	-0.14						
Malavsia		0.17	-0.17						
Mexico	_	0.17	-0.19						
South Africa	0.05	0.35	-0.30						
Hong Kong	0.00	0.00	-0.44						
Denmark	0.05	0.44	-0.49						
Netherlands	0.00	0.04	-0.40						
Canada	0. <del>11</del> 2.38	2 80	-0.50						
France	2.00 1 65	2.03	_0.77						
Germany	1.05	2.42	-0.87						
	0.68	2.15	-0.07						
	0.00	5.53	2.36						

#### As of 3/31/2025.

Source: PGIM Quant, FactSet, MSCI. Source of sector classification: S&P/MSCI. Benchmark: MSCI ACWI IMI Index.....

Excludes cash positions. Active weights are subject to charge. The simulated results shown above do not represent the results of actual trading, but were achieved by retroactive application of a model designed with the benefit of hindsight. The simulations shown have significant inherent shortcomings and do not consider many real-world frictions such as cash balances, intra-month trades, and the ability to trade at various prices. The simulated results were derived using certain assumptions. The simulated results were derived using certain assumptions. The simulated performance of the strategy assumes monthly portfolio rebalancing, specific risk constraints relative to the benchmark of individual stock (+/- 1.50%), country exposure (+/- 2.5%), market cap bin (+/- 10.0%), beta exposure (+/- 0-10.0%), and costs are modelled using estimates for bid-ask spread and market impact (up to 20% turnover monthly). Please see 'Notes to Disclosure' and 'Notes to Disclosure for Simulated Performance' pages for additional important information including risk factors, disclosures, and additional assumptions and portfolio construction details. MSCI has not approved, reviewed or produced this report, makes no express or implied warranties or representations and is not liable whatsoever for any data in the report. You may not redistribute the MSCI data or use it a data of the further Distribution

### **Research Process**



Our robust research is thoughtful, thoroughly tested, and seamlessly implemented. It continues to evolve as markets evolve.

#### IDEA GENERATION: SOURCES

- Investor / client needs
- Finance theory & academic papers
- New & alternative sources of data
- Market trends and portfolio attribution
- Internal discussions and seminars
- New technologies e.g. NLP



#### IMPLEMENTATION CRITERIA: CONSIDERATIONS

- Intuitive
- Incremental to existing factors
- Persistent validity
- Expected decay
- Trading costs

# Key Research



Research	Туре	Rationale	Paper
Cross Industry Information Diffusion	Linkages	Information that impacts a single stock in one industry, can ripple across and impact companies in other connected industries.	Link
Globalization of Information Momentum	Growth/ Alternative Data	Better identify information events in regions around the world.	Link
Board Centrality	Quality/ Alternative Data	Utilization of social network data to augment and enhance quality factor.	Link
Innovation Factor	Quality/ Natural Language Processing	Quantifies soft attributes of a firm, specifically its innovation attributes, and is particularly impactful for low quality firms.	Link
Dynamic Value	Value	Improvement of the efficacy of value factors by shifting emphasis of specific value factors based on market dynamics.	Link
Information Momentum	Growth/ Alternative Data	Quantification of the market's reaction to key events that reveal fundamental information about the growth prospects of a company.	Link
Top Down Insights	Top-Down	Macro insights that expand the breadth of alpha generation process.	Link
Industry Information Diffusion	Linkages	Information directly relevant to a single stock also indirectly impacts other companies. This indirect information diffuses at a slower rate, and therefore complements and strengthens existing growth insights.	<u>Link</u>
Country-Specific Stock Insights	Growth	Local analyst revisions that are blended with global analyst revisions to provide incremental information to our models.	Link



# **Global All Country IMI Equity Strategy**

Performance as of 3/31/2025

Year	Global All Country IMI Equity (Net)	Global All Country IMI Equity (Gross)	MSCI ACWI IMI Index	Net Alpha	Gross Alpha
2025 (1/1-3/31)	-2.50%	-2.38%	-1.61%	-90 bps	-77 bps
2024	21.91	22.51	16.37	+554	+614
2023	25.08	25.69	21.58	+350	+411
2022	-18.79	-18.38	-18.40	-39	+2
2021	23.23	23.83	18.22	+500	+561
2020	14.41	14.98	16.25	-184	-127
2019	24.32	24.93	26.35	-203	-142
2018	-12.86	-12.42	-10.08	-278	-234
2017	25.51	26.13	23.95	+156	+218
2016 (7/1-12/31)	8.72	8.99	6.91	+181	+208

Annualized	1 Year	3 Year	5 Year	7 Year	Since Inception <sup>1</sup>
Net Return (%)	6.26	8.86	17.12	9.20	11.12
Gross Return (%)	6.79	9.40	17.69	9.74	11.67
Benchmark Return (%)	6.30	6.31	15.02	8.67	10.26
Net Alpha (bps)	-4	+255	+210	+53	+86
Gross Alpha (bps)	+49	+309	+268	+107	+141
Gross Tracking Error (%)	1.91	2.64	2.78	2.57	2.36
Gross Information Ratio	0.26	1.17	0.96	0.42	0.60

<sup>1</sup>Inception of the Global All Country IMI Equity Composite is 7/1/2016. The Global All Country IMI Equity Composite presently consists of a single client account and may also include accounts with client-provided restricted securities lists.

Source: PGIM Quant, MSCI. Benchmark: MSCI ACWI IMI Index.

Past performance is not a guarantee or a reliable indicator of future results. Performance results are stated gross and net of model fees. Gross performance has been calculated in US dollars and reflects the reinvestments of dividends and other earnings. Returns for each client will be reduced by such fees and expenses as described in their individual contract. Returns are shown net of non-reclaimable foreign withholding taxes, if any. Net returns are calculated by deducting the highest tier of the PGIM Quant fee schedule in effect for the respective time period from the monthly gross composite return. The returns provided above are time-weighted. The index is net of foreign withholding tax using the Luxembourg tax rate. Please see 'Notes to Disclosure' page for Important Information including risk factors and other disclosures. MSCI has not approved, reviewed or produced this report, makes no express or implied warranties or representations and is not liable whatsoever for any data in the report. You may not redistribute the MSCI data or use it as basis for other indices or investment products. Please see 'Notes to Disclosure' page for additional MSCI disclosures. 315/331

### **Notes to Disclosure**



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# Notes to Disclosure for Simulated Performance



#### **Global Growth Equity Strategy**

This material has been provided as per your request. The simulated performance included in this presentation is for the purpose of illustrating the performance returns of a Global Growth Equity strategy for the period of January 1, 2010 through March 31, 2025. The information is for illustrative purposes only, does not constitute investment advice, and is not indicative or a guarantee of future results. The performance of the a Global Growth Equity strategy is simulated because there is no current PGIM Quant strategies using these portfolio constituents or benchmark.

The simulated results shown above do not represent the results of actual trading, but were achieved by retroactive application of a model designed with the benefit of hindsight. The simulations shown have significant inherent shortcomings and do not consider many real-world frictions such as cash balances, intra-month trades, and the ability to trade at various prices. Gross performance does not reflect the deduction of investment advisory fees and other expenses. Net performance reflect the deduction of the highest model fee for the strategy. Results are not guaranteed. The simulated results were derived using certain assumptions. The simulated results were derived using certain assumptions. The simulated performance of the strategy assumes monthly portfolio rebalancing, specific risk constraints relative to the benchmark of individual stock (+/- 1.50%), country exposure (+/- 2.5%), market cap bin (+/- 10.0%), beta exposure (+/- 0-10.0%), and costs are modelled using estimates for bid-ask spread and market impact (up to 20% turnover monthly).

The simulated results shown do not represent the results of actual trading, but were achieved by retroactive application of a model designed with the benefit of hindsight. The simulations shown have significant inherent shortcomings and do not consider many real-world frictions such as cash balances, intra-month trades, timing of the reinvestment of dividends and the ability to trade at various prices.

Future portfolio results may not be profitable and characteristics of our strategy may change in the future. There can be no assurance that the actual performance would achieve the results shown in the simulations.

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The MSCI ACWI Index captures large and mid cap representation across 23 Developed Markets (DM) and 24 Emerging Markets (EM) countries. With 2,650 constituents, the index is comprehensive, covering approximately 85% of the global equity investment opportunity set.

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MONTHLY TOTALS BY RETIREMENT TYPE AND BENEFIT AMOUNT													
ALL SYSTE	MS		SERVICE		DISABILITY		SURVIVOR	SUN	IMARY TOTAL				
MONTH	YEAR	#	\$	#	\$	#	\$	#	\$				
JULY	2024	110,928	\$200,366,848.93	7,157	\$9,489,766.91	3,731	\$3,513,795.28	121,816	\$213,370,411.12				
AUGUST	2024	111,073	\$200,814,873.23	7,149	\$9,475,745.05	3,727	\$3,514,935.06	121,949	\$213,805,553.34				
SEPTEMBER	2024	111,049	\$200,936,966.45	7,138	\$9,470,290.51	3,730	\$3,517,115.87	121,917	\$213,924,372.83				
OCTOBER	2024	111,058	\$201,042,668.00	7,131	\$9,460,167.16	3,726	\$3,520,034.14	121,915	\$214,022,869.30				
NOVEMBER	2024	111,050	\$201,052,695.09	7,137	\$9,475,019.63	3,678	\$3,499,404.43	121,865	\$214,027,119.15				
DECEMBER	2024	110,947	\$200,953,834.87	7,122	\$9,466,446.14	3,687	\$3,499,608.07	121,756	\$213,919,889.08				
DECEMBER 15	2024								\$884,796,679.82				
JANUARY	2025	111,107	\$201,503,044.79	7,114	\$9,478,948.72	3,688	\$3,502,317.85	121,909	\$214,484,311.36				
FEBRUARY	2025	111,043	\$201,491,373.69	7,093	\$9,444,300.94	3,687	\$3,502,766.10	121,823	\$214,438,440.73				
MARCH	2025	110,946	\$201,409,269.39	7,080	\$9,414,929.07	3,692	\$3,507,106.25	121,718	\$214,331,304.71				
APRIL	2025	110,911	\$201,447,067.48	7,075	\$9,405,484.53	3,636	\$3,491,273.74	121,622	\$214,343,825.75				
MAY	2025												
JUNE	2025												
YEAR-TO-DA	TE		\$2,011,018,641.92		\$ 94,581,098.66		\$ 35,068,356.79		\$3,025,464,777.19				

	MONTHLY TOTALS BY RETIREMENT PLAN AND BENEFIT AMOUNT											
ALL SYSTE	MS	PERS			SLRP		MHSP		MRS	SUM	IMARY TOTAL	
MONTH	YEAR	#	\$	#	\$	#	\$	#	\$	#	\$	
JULY	2024	119,422	\$208,584,512.63	245	\$115,546.65	811	\$2,565,734.74	1,338	\$2,104,617.10	121,816	\$213,370,411.12	
AUGUST	2024	119,558	\$208,995,702.18	244	\$115,448.98	815	\$2,592,886.18	1,332	\$2,101,516.00	121,949	\$213,805,553.34	
SEPTEMBER	2024	119,536	\$209,129,799.21	244	\$115,159.41	811	\$2,588,975.24	1,326	\$2,090,438.97	121,917	\$213,924,372.83	
OCTOBER	2024	119,542	\$209,239,351.50	244	\$115,165.30	810	\$2,589,214.69	1,319	\$2,079,137.81	121,915	\$214,022,869.30	
NOVEMBER	2024	119,494	\$209,245,348.67	244	\$115,165.30	807	\$2,581,758.48	1,320	\$2,084,846.70	121,865	\$214,027,119.15	
DECEMBER	2024	119,394	\$209,146,869.84	242	\$113,716.40	807	\$2,582,183.05	1,313	\$2,077,119.79	121,756	\$213,919,889.08	
DECEMBER 15	2024		\$870,317,391.26		\$430,056.98		\$10,754,880.52		\$3,294,351.06		\$884,796,679.82	
JANUARY	2025	119,552	\$209,700,038.87	242	\$113,126.06	807	\$2,577,385.84	1,308	\$2,093,760.59	121,909	\$214,484,311.36	
FEBRUARY	2025	119,473	\$209,663,915.19	242	\$113,126.06	806	\$2,574,251.98	1,302	\$2,087,147.50	121,823	\$214,438,440.73	
MARCH	2025	119,381	\$209,585,643.48	238	\$109,377.00	806	\$2,576,966.92	1,293	\$2,059,317.31	121,718	\$214,331,304.71	
APRIL	2025	119,288	\$209,596,954.75	238	\$109,377.00	807	\$2,581,250.18	1,289	\$2,056,243.82	121,622	\$214,343,825.75	
MAY	2025											
JUNE	2025											
YEAR-TO-DA	ATE		\$2,963,205,527.58		\$1,565,265.14		\$36,565,487.82		\$ 24,128,496.65		\$3,025,464,777.19	

	RECIPIENTS ADDED TO AND REMOVED FROM PAYROLL BY PLAN																				
ALL SYSTE	EMS		PE	RS			MHSP				SLRP MRS					SUMMARY TOTALS					
MONTH	YEAR	YTD	Added	Removed	Total	YTD	Added	Removed	Total	YTD	Added	Removed	Total	YTD	Added	Removed	Total	YTD	Added	Removed	Total
JULY	2024	118,453	1,381	412	119,422	811	4	4	811	245	-	-	245	1,344	4	10	1,338	120,853	1,389	426	121,816
AUGUST	2024	119,422	459	323	119,558	811	7	3	815	245	-	1	244	1,338	-	6	1,332	121,816	466	333	121,949
SEPTEMBER	2024	119,558	381	403	119,536	815	2	6	811	244	1	1	244	1,332	2	8	1,326	121,949	386	418	121,917
OCTOBER	2024	119,536	334	328	119,542	811	1	2	810	244	-	-	244	1,326	2	9	1,319	121,917	337	339	121,915
NOVEMBER	2024	119,542	289	337	119,494	810	2	5	807	244	-	-	244	1,319	7	6	1,320	121,915	298	348	121,865
DECEMBER	2024	119,494	287	387	119,394	807	1	1	807	244	-	2	242	1,320	2	9	1,313	121,865	290	399	121,756
JANUARY	2025	119,394	540	382	119,552	807	2	2	807	242	2	2	242	1,313	4	9	1,308	121,756	548	395	121,909
FEBRUARY	2025	119,552	346	425	119,473	807	3	4	806	242	-	-	242	1,308	1	7	1,302	121,909	350	436	121,823
MARCH	2025	119,473	276	368	119,381	806	3	3	806	242	-	4	238	1,302	-	9	1,293	121,823	279	384	121,718
APRIL	2025	119,381	320	413	119,288	806	1	_	807	238	1	1	238	1,293	1	5	1,289	121,718	323	419	121,622
MAY	2025																				
JUNE	2025																				

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#### Report to the Board of Trustees PERS of Mississippi

DAILY PAYROLL TOTALS BY PAYMENT TYPE											
ALL SYSTE	MS	PARTIAL LUMP SUMS	BENEFITS	REFUNDS	TOTAL						
MONTH	YEAR	\$\$		\$	\$						
JULY	2024	\$41,880,428.08	\$1,342,850.69	\$10,982,639.93	\$54,205,918.70						
AUGUST	2024	\$5,944,244.28	\$817,290.92	\$13,054,868.70	\$19,816,403.90						
SEPTEMBER	2024	\$3,349,084.98	\$594,832.24	\$12,048,530.67	\$15,992,447.89						
OCTOBER	2024	\$3,245,767.44	\$606,831.33	\$11,435,583.75	\$15,288,182.52						
NOVEMBER	2024	\$2,365,683.69	\$528,732.15	\$11,413,192.19	\$14,307,608.03						
DECEMBER	2024	\$2,326,708.08	\$1,286,785.92	\$10,375,450.34	\$13,988,944.34						
JANUARY	2025	\$15,732,837.05	\$1,397,196.37	\$9,429,624.43	\$26,559,657.85						
FEBRUARY	2025	\$4,818,674.88	\$509,553.39	\$7,803,162.56	\$13,131,390.83						
MARCH	2025	\$3,259,422.42	\$214,331,304.71	\$9,477,162.51	\$227,067,889.64						
APRIL	2025										
MAY	2025										
JUNE	2025										
YEAR-TO-D	ATE	\$82,922,850.90	\$221,415,377.72	\$96,020,21 <u>5.08</u>	\$400,358,443.70						

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#### Report to the Board of Trustees PERS of Mississippi

COMBINED DAILY AND MONTHLY RETIREE PAYROLL TOTALS					
ALL SYSTEMS		DAILY PAYROLL**	N		PAYROLL TOTALS
MONTH	YEAR	\$		\$	\$
JULY	2024	\$43,223,278.77		\$213,370,411.12	\$256,593,689.89
AUGUST	2024	\$6,761,535.20		\$213,805,553.34	\$220,567,088.54
SEPTEMBER	2024	\$3,943,917.22		\$213,924,372.83	\$217,868,290.05
OCTOBER	2024	\$3,852,598.77		\$214,022,869.30	\$217,875,468.07
NOVEMBER	2024	\$2,894,415.84		\$214,027,119.15	\$216,921,534.99
DECEMBER	2024	\$3,613,494.00		\$213,919,889.08	\$217,533,383.08
DECEMBER 15	2024	\$-		\$884,796,679.82	\$884,796,679.82
JANUARY	2025	\$17,130,033.42	\$	214,484,311.36	\$231,614,344.78
FEBRUARY	2025	\$5,328,228.27	\$	214,438,440.73	\$219,766,669.00
MARCH	2025	\$3,778,965.88	\$	214,331,304.71	\$218,110,270.59
APRIL	2025				
MAY	2025				
JUNE	2025				
YEAR-TO-DATE		\$90,526,467.37	\$	2,811,120,951.44	\$2,901,647,418.81

\*\*These amounts do not include refunds; they represent retiree payroll (partial lump sums and benefits) only.

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# Public Employees' Retirement System of Mississippi

**Report of Investments** 

March 31, 2025 (Unaudited)

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### **Consolidated Portfolio Summary**

3/31/2025

		% of Total Book		% of Total Market
	BOOK Value	value	Market Value	value
Domestic Equity	4,330,089,632.77	16.62%	8,143,543,422.39	24.05%
Fixed Income	7,320,519,160.22	28.10%	7,175,534,664.86	21.19%
International Equity	8,892,803,544.49	34.13%	10,641,575,853.63	31.43%
Real Estate	1,838,339,606.73	7.06%	2,803,243,133.25	8.28%
Private Equity	2,156,103,250.56	8.28%	3,658,793,269.60	10.81%
Private Credit	93,894,776.01	0.36%	96,933,729.01	0.29%
Cash & Cash Equivalent In-House	384,047,664.95	1.47%	384,047,664.95	1.13%
Cash & Cash Equivalent Manager	1,036,213,042.49	3.98%	956,954,381.31	2.83%
Total —	26 052 010 678 22	100 00%	33 860 626 119 00	100 00%
i otal	20,002,010,078.22	100.00%	33,000,020,119.00	100.00%

#### Manager Portfolio Summary 3/31/2025

Manager	Account #	Book Value	% of Asset Class (BV)	% of Portfolio (BV)	Market Value	% of Asset Class (MV)	% of Portfolio (MV)
Domestic Equity							
ARTISAN PARTNERS	MS6F10015002	420,494,159,61	3.11%	1.61%	505.534.137.46	2.65%	1.49%
DIMENSIONAL FUND ADVISORS	MS6F10014002	305,301,899.30	2.26%	1.17%	327,645,062.08	1.72%	0.97%
	MS6F10017002	661,843,270.31	4.90%	2.54%	898,230,321.16	4.71%	2.65%
VICTORY MID CAP VALUE	MS6F10019002 MS6F10021002	244,996,477.59 540 873 078 54	4.00%	2.08%	570 275 169 43	2.99%	0.89%
WELLINGTON SMALL CAP	MS6F10013102	<u>312,115,493.46</u>	2.31%	1.20%	335,306,457.97	1.76%	0.99%
Total Active		2,485,626,378.81	18.40%	9.54%	2,939,844,348.99	15.41%	8.68%
Passive							
NOR TR RSSLL 10000 V	MS6F10016102	35,192.41	0.00%	0.00%	35,192.41	0.00%	0.00%
NORTHERN TRUST- SP 500	MS6F10010002	<u>1,947,430,516.19</u>	14.41%	7.48%	5,306,666,335.63	27.82%	15.67%
Total Passive		1,947,465,708.60	14.41%	7.40%	5,306,701,528.04	21.82%	15.67%
Total Domestic Equity		4,433,092,087.41	32.81%	17.02%	8,246,545,877.03	43.23%	24.35%
Global Equity							
ACADIAN ASSET	MS6F30010002	913,549,301.48	6.76%	3.51%	1,001,499,009.31	5.25%	2.96%
EPOCH GLOBAL HARDING LOEVNER	MS6F30020002 MS6F30030002	800,872,220.23	5.93%	3.07%	908,552,413.96	4.76%	2.68%
LSV GLOBAL VALUE	MS6F30080002	886,474,266.27	6.56%	3.40%	1,048,382,686.09	5.50%	3.10%
Total Global Equity Managers		3,402,603,060.21	<u>25.19%</u>	<u>13.06%</u>	3,978,941,156.52	20.86%	11.75%
Total Global Equity Managers		3,402,603,060.21	25.19%	13.06%	3,978,941,156.52	20.86%	11.75%
International Equity Active							
ARROWSTREET CAPITAL	MS6F20020002	694,003,092.59	5.14%	2.66%	750,903,566.83	3.94%	2.22%
BAILLIE GIFFORD	MS6F20021002	619,769,801.85	4.59%	2.38%	751,022,664.83	3.94%	2.22%
MARATHON ASSET MGMT	MS6F20023002	761,167,466.31	5.63%	2.92%	886,377,239.04	4.65%	2.62%
NT INTL SMALL CAP	MS6F20025002	329,847,648.55	2.44%	1.27%	336,783,304.68	1.77%	0.99%
PRINCIPAL SC INTL	MS6F20019102	<u>313,940,971.13</u> 2 718 728 980 43	<u>2.32%</u> 20.12%	<u>1.21%</u>	<u>363,370,117.81</u>	<u>1.91%</u>	<u>1.07%</u>
		2,710,720,900.49	20.1276	10.44 /8	3,000,400,093.19	10.1376	5.12 /0
Passive NT MSCI WORLD EX US INDEX Total Passive	MS6F20024002	1,725,143,565.47 <b>1,725,143,565.47</b>	12.77% <b>12.77%</b>	6.62% <b>6.62%</b>	2,378,872,948.92 <b>2,378,872,948.92</b>	12.47% <b>12.47%</b>	7.03% <b>7.03%</b>
Regional/Emerging							
FISHER INVESTMENTS	MS6F20022002	553,308,554.19	4.10%	2.12%	686,153,107.03	3.60%	2.03%
Total Regional/Emerging	MS6F20011002	1,230,657,253.16	<u>5.01%</u> 9.11%	<u>2.60%</u> 4.72%	1,381,232,508.10	<u>3.64%</u> 7.24%	<u>2.05%</u> <b>4.08%</b>
Total International Equity		5,674,529,799.06	42.00%	21.78%	6,848,562,350.21	35.91%	20.23%
Total Equity		13,510,224,946.68	100.00%	51.86%	19,074,049,383.76	100.00%	56.33%
Fixed Income							
LOOMIS SAYLES	MS6F40016002	1,238,273,379.58	16.25%	4.75%	1,178,846,476.90	15.93%	3.48%
MANULIFE ASSET MGMT	MS6F40018002	724,529,414.58	9.51%	2.78%	693,893,588.91	9.38%	2.05%
PACIFIC INVESTMENTS MG1 PRUDENTIAL	MS6F40013002 MS6F40017002	731,732,466.41	9.60% 16.86%	2.81%	699,868,584.36	9.46% 16.45%	2.07%
SIT SHORT DURATION FIXED	MS6F40019002	1,260,409,848.70	<u>16.54%</u>	4.84%	1,263,831,360.69	17.08%	3.73%
Total Domestic Active		5,239,948,210.76	68.74%	20.11%	5,053,972,748.69	68.30%	14.93%
Global Active							
ALLIANCE BERNSTEIN GLOBAL	MS6F45010002	806,577,006.32	10.58%	3.10%	796,364,815.17	10.76%	2.35%
PIMCO GLOBAL Total Global Active	MS6F45011002	<u>814,449,077.49</u> 1 621 026 083 81	<u>10.68%</u> <b>21 27%</b>	<u>3.13%</u> 6.22%	<u>794,281,034.80</u> 1 590 645 849 97	<u>10.73%</u> 21 50%	<u>2.35%</u> 4 70%
		1,021,020,000.01	21.2770	0.22 /0	1,000,040,040.01	21.00 /0	4.1070
	M00550040000	701 470 404 00	0.00%	2.020/	755 004 770 04	10.010/	0.000/
Total International Active	MS6F50010002	761,476,121.69	9.99%	2.92%	755,334,773.81	10.21%	2.23%
Total Active		7,622,450,416.26	100.00%	29.26%	7,399,953,372.47	100.00%	21.85%
Total Fixed Income		7,622,450,416.26	100.00%	29.26%	7,399,953,372.47	100.00%	21.85%
Real Estate Managers							
	MEEFEOODOOO	004 040 450 77	10.070/	0.000/	400 400 070 00	6 440/	0 570/
JPM STRAT PROP FD	MS6F60030002 MS6F60021002	224,846,153.77 208 802 263 64	10.97%	0.80%	393 673 731 14	0.41% 13.06%	0.57%
PRINCIPAL COMMINGLED FUND	MS6F60010002	320,068,225.33	15.62%	1.23%	757,182,211.91	25.12%	2.24%
UBS TRUMBULL PROP FUND	MS6F60011002	189,394,185.24	9.24%	0.73%	363,853,813.44	12.07%	1.07%
Total Core Commingled	IVISOF00020002	1.045.168.853.50	<u>4.98%</u> 51.01%	<u>0.39%</u> 4.01%	<u>218,822,920.17</u> <b>1,926,722,649,65</b>	<u>7.26%</u> 63.93%	0.65% 5.69%
		,			, ,. ,		

#### Manager Portfolio Summary 3/31/2025

				% of			
Managor	Account #	Book Value	% of Asset Clas	s Portfolio	Markot Valuo	% of Asset	% of Portfolio
Manulife Timber	Account #	BOOK Value	(64)	(64)	Walket Value		(1414)
MANULIFE TIMBER FUND	MS6F60014002	24,644,531.65	<u>1.20%</u>	0.09%	34,848,198.65	<u>1.16%</u>	<u>0.10%</u>
Manulife Timber		24,644,531.65	1.20%	0.09%	34,848,198.65	1.16%	0.10%
REITS							
CENTERSQUARE INV	MS6F60027002	209,698,562.83	10.23%	0.80%	233,606,536.33	7.75%	0.69%
Total REITS	WIS01 000 10002	312,549,418.82	<u>15.25%</u>	1.20%	342,980,208.71	<u>11.38%</u>	<u>0.32 //</u> 1.01%
AEW PARTNERS IX LP	MS6F60028002	57,893,129.30	2.83%	0.22%	72,804,972.30	2.42%	0.22%
AEW PARTNERS VI LP	MS6F60017102	289,968.85	0.01%	0.00%	743,947.85	0.02%	0.00%
AEW PARTNERS VII LP AEW PARTNERS VIII LP	MS6F60017202 MS6F60017302	2,296,326.40	0.11%	0.01%	4,396,743.64	0.15%	0.01%
AEW PARTNERS X LP	MS6F60032002	7,060,226.86	0.34%	0.03%	7,060,226.86	0.23%	0.02%
AG CORE PLUS FD II	MS6F60015002	827.28	0.00%	0.00%	827.28	0.00%	0.00%
AG CORE PLUS FD IV	MS6F60025002	21,580,880.89	1.05%	0.08%	16,040,034.67	0.53%	0.05%
AG REALTY VALUE FUND X	MS6F60025102	44,620,060.18	2.18%	0.17%	48,149,584.41	1.60%	0.14%
HEITMAN V	MS6F60029002	24,035,756.62	3.10%	0.09%	65,035,158.98	2.16%	0.19%
HEITMAN VALUE PARTNERS III	MS6F60016102	414,084.79	0.02%	0.00%	414,084.79	0.01%	0.00%
HEITMAN VALUE PARTNERS IV LP HEITMAN VI	MS6F60016202 MS6F60034002	21,895,036.00	1.07%	0.08%	31,444,330.16	1.04%	0.09%
INVESCO VA FUND IV	MS6F60024002	1,775,382.43	0.09%	0.01%	1,890,014.60	0.06%	0.01%
INVESCO VA FUND V	MS6F60024102	58,593,284.18	2.86%	0.22%	57,225,353.18	1.90%	0.17%
TA REALTY X	MS6F60023002	815,202.97	0.04%	0.00%	815,202.97	0.03%	0.00%
TA REALTY XI	MS6F60023102	1,134,603.96	0.06%	0.00%	497,132.96	0.02%	0.00%
TA REALTY XII TA REALTY XIII	MS6F60023202 MS6F60023302	73,513,016.99	3.59% 3.07%	0.28%	84,253,554.99 59,966,898,40	2.80% 1.99%	0.25%
TA REALTY CORE PROPERTY FUND	MS6F60035002	100,000,000.00	4.88%	0.38%	100,433,559.03	3.33%	0.30%
WESTBROOK RE FUND XI	MS6F60026102	59,006,469.87	2.88%	0.23%	61,086,781.87	2.03%	0.18%
WESTBROOK REAL ESTATE FUND X	MS6F60026002	18,924,090.26	0.92%	0.07%	11,774,377.37	0.39%	0.03%
Total Value Added		666,693,168.41	32.54%	2.56%	709,399,149.78	23.54%	<u>2.10%</u>
Total Real Estate Managers		2,049,055,972.38	100.00%	7.87%	3,013,950,206.79	100.00%	8.90%
Private Equity Managers							
CFIG DIV PRTNR 14-1	MS6F70014002	153,913,020.09	6.51%	0.59%	574,410,695.49	14.86%	1.70%
GCM GROSVENOR 2018 1 SERIES GCM GROSVENOR 2019 1 SERIES	MS6F70014102 MS6F70011002	270,028,134.75	11.43%	1.04%	125,772,580.59	3.25%	0.37%
GCM GRSVNR PE 2024	MS6F70014202	10,006,078.34	0.42%	0.04%	12,209,947.34	0.32%	0.04%
PATHWAY PEF 2016 PATHWAY PEF SRS 2012	MS6F70013102 MS6F70013002	719,287,229.01 266 744 253 30	30.44% 11.29%	2.76%	1,327,765,774.95	34.35% 15.82%	3.92%
PATHWAY PEF SRS 2021	MS6F70013202	357,086,806.00	15.11%	1.37%	439,814,922.00	11.38%	1.30%
PATHWAY- PEF XXIII	MS6F70010002	<u>188,582,994.13</u>	<u>7.98%</u>	0.72%	<u>218,840,709.81</u>	<u>5.66%</u>	0.65%
Total Private Equity Managers		2,302,023,070.44	100.00%	9.07%	3,005,513,095.40	100.00%	11.42%
Private Credit Managers							
BLUE OWL LENDNG 2023	MS6F75000102	34,356,485.71	35.94%	0.13%	37,248,832.71	37.77%	0.11%
Total Private Credit Managers	W30F75000002	<u>95.593.856.02</u>	<u>04.06%</u> 100.00%	0.37%	98.632.809.02	<u>02.23%</u> 100.00%	0.18%
					,		
Terminated Managers	MOGEOOOA	4 400 050 00	0.00%	0.010/	4 000 074 57	0.400/	0.00%
DIMENSIONAL FUND ADV EAFE	MS6F20013002 MS6F20010002	1,439,656.20	6.22% 0.91%	0.01%	1,380,371.57 165,182,77	6.16% 0.74%	0.00%
INTL TRANSITION	MS6F20090002	3,788,940.89	16.36%	0.01%	3,522,110.68	15.72%	0.01%
JARISLOWSKY, FRASER LMT	MS6F20015002	411,892.60	1.78%	0.00%	323,743.83	1.45%	0.00%
MONDRIAN SMALL CAP	MS6F20018002	2,151,493.81	9.29%	0.01%	2,158,029.52	9.63%	0.01%
NEW STAR INSTITUTIONAL	MS6F20014002	130,711.96	0.56%	0.00%	102,565.97	0.46%	0.00%
NOR TR RSSEL MID CAP NORTHERN TRUST BB AGGREGATE	MS6F10010102 MS6F40014102	-0.36	0.00%	0.00%	20,963.46	0.00%	0.00%
NORTHERN TRUST EAFE	MS6F20013102	12,332,959.72	0.36%	0.05%	12,205,961.38	0.31%	0.04%
NORTHERN TRUST GLOBAL EQUITY INDEX	MS6F30060002 MS6F20019002	1,443,212.46	0.04%	0.01%	1,345,356.63 143 215 53	0.03%	0.00%
RREEF REIT	MS6F60012002	0.00	0.00%	0.00%	0.00	0.00%	0.00%
WELLINGTON MIDCAP	MS6F10013002	46,059.03	0.00%	0.00%	<u>46.059.03</u>	0.00%	0.00%
i otar reminateu Manayers		23,103,900.95	40.01%	0.05%	22,402,174.81	30.32%	0.07%
Transition Managers							
MSPRS NORTHERN TRST TRANSITION	MS6F30050002	4,650,764.54	0.14%	0.02%	<u>2,077,411.72</u>	0.05%	0.01%
		4,000, <i>1</i> 04.54	U.14%	0.02%	2,077,411.72	0.05%	0.01%
Short Term In-House							
PERS ADMINISTRATIVE SHORT TERM	MS6F80010002	384,047,664.95 384 047 664 95	100.00% 100.00%	1.47% <b>1.47%</b>	384,047,664.95 384 047 664 95	100.00%	1.13% <b>1.13%</b>
		<u></u>			<u></u>		
Grand Total		26,052,010,678.22		100.00%	33,860,626,119.00		100.00%

70 Portfolios 36 Managers

#### Securities Lending Management Summary As of March 2025

2024	1/2025	FAR	NINGS

	Gov.	Equity	Corp.	Int'l Fixed	Int'l Equities	Total
July	\$106,970	\$534,507	\$183,854	\$65,205	\$118,491	\$1,009,027
Aug	\$45,786	\$418,854	\$138,353	\$72,387	\$111,691	\$787,071
Sept	\$17,199	\$345,105	\$6,340	\$17,067	\$118,056	\$503,767
Oct ^	\$60,694	\$100,271	\$44,693	\$757	\$0	\$206,415
Nov	\$144,997	\$231,967	\$62,880	\$1,170	\$0	\$441,014
Dec	\$134,270	\$305,713	\$73,056	\$2,941	\$0	\$515,980
Jan	\$135,978	\$223,615	\$83,349	\$2,410	\$0	\$445,352
Feb	\$130,899	\$262,703	\$104,940	\$2,150	\$79	\$500,771
Mar	\$160,954	\$293,404	\$118,640	\$5,317	\$2,090	\$580,405
Apr						\$0
May						\$0
June						\$0
YTD	\$937,747	\$2,716,139	\$816,105	\$169,404	\$350,407	\$4,989,802
^ as of O	ctober Mitsubishi	UFJ Trust and	Banking Corpo	oration became	the Securities L	ender

Μ	arch 2025	
I. Earnings	This Month	Year-to-Date
Governments	\$160,954	\$937,747
Equity	\$293,404	\$2,716,139
Corporate	\$118,640	\$816,105
Int'l Fixed	\$5,317	\$169,404
Int'l Equities	\$2,090	\$350,407
Total	\$580,405	\$4,989,802
II. Monthly Performance Measures	Avg. Loan	Avg. Wgt.
	Volume (000's)	Spread (BP)
Governments	\$801,144	25
Equity	\$1,645,841	24
Corporate/Equities	\$351,458	44
Int'l Fixed	\$20,282	27
Int'l Equities	\$11,087	24
Total	\$2,829,812	26







Outstandings (000's) Gov. Equity Corp. Int'l Fixed Int'l Equities Total July \$335,947 \$289,121 \$1,030,113 \$331,065 \$217,466 \$2,203,712 Aug \$228,047 \$98,433 \$709,774 \$186,122 \$282,883 \$1,505,259 Sept \$69,669 \$36,131 \$16,896 \$55,895 \$39,995 \$218,586 Oct ^ \$264,706 \$489,476 \$78,969 \$2,474 \$0 \$835,625 Nov \$879,460 \$1,418,464 \$164,913 \$3,987 \$0 \$2,466,824 \$0 Dec \$966,776 \$2,099,278 \$198,643 \$9,960 \$3,274,657 Jan \$1,001,448 \$1,540,848 \$261,403 \$8,166 \$0 \$2,811,865 \$2,830,598 Feb \$823,207 \$1,659,245 \$343,167 \$4,874 \$105 Mar \$801,144 \$1,645,841 \$351,458 \$20,282 \$11,087 \$2,829,812 \$0 Apr May \$0 June \$0

AVG \$577,107 \$1,181,019 \$219,396 \$56,581 \$74,446 \$1,581,412 ^ as of October Mitsubishi UFJ Trust and Banking Corporation became the Securities Lender

SPREADS						
	Gov.	Equity	Corp	Int'l Fixed	Int'l Equities	Spread
July	51	71	76	41	49	58
Aug	61	79	84	53	55	71
Sept	35	39	53	44	31	38
Oct ^	29	27	73	38	0	32
Nov	22	22	50	39	0	27
Dec	18	19	47	38	0	20
Jan	17	18	41	38	0	25
Feb	23	22	51	42	21	25
Mar	25	24	44	27	24	26
Apr						
May						
June						
WHT AVG	31	36	58	40	20	36
^ as of Octobe	er Mitsubishi	UFJ Trust and	Banking Corp	oration became	the Securities Le	nder

## **Securities Lending Management Summary**

As of March

Fiscal Year	PI	ERS Earnings	Le	nding Agent Earnings	Т	otal Program Earnings
2011	\$	13,878,226	\$	2,449,099	\$	16,327,325
2012	\$	15,596,477	\$	2,752,319	\$	18,348,796
2013	\$	15,682,377	\$	2,767,478	\$	18,449,855
2014	\$	15,401,726	\$	2,717,952	\$	18,119,678
2015	\$	15,094,878	\$	2,663,802	\$	17,758,681
2016	\$	17,605,026	\$	3,106,769	\$	20,711,795
2017	\$	19,329,769	\$	3,411,136	\$	22,740,905
2018	\$	19,813,714	\$	3,496,538	\$	23,310,252
2019	\$	16,240,589	\$	2,865,986	\$	19,106,575
2020	\$	17,887,629	\$	3,156,640	\$	21,044,269
2021	\$	9,167,025	\$	1,617,710	\$	10,784,735
2022	\$	7,017,725	\$	1,238,422	\$	8,256,147
2023	\$	11,837,810	\$	2,089,025	\$	13,926,835
2024	\$	11,718,471	\$	2,067,966	\$	13,786,437
2025	* \$	4,989,802	\$	772,668	\$	5,762,470

\* As of March



#### FY 2025 FUND TRANSFERS

DATE	MANAGER	ΔΜΟΠΝΤ	DATE	MANAGER	AMOUNT
7/15/2024	Principal Capital MGT RE	(\$1,808,410,00)	12/12/2024	MSPERS Short-term	\$225,000,000,00
7/15/2024		\$1 808 /10 00	12/18/2024	Enoch	(\$150,000,000,000,000
7/23/2024	GCM Grosvenor 2014-1	(\$545,454,55)	12/18/2024	MSPERS Short-term	\$150,000,000,000
7/22/2024	Heitman Value Partners V	(\$545,454.55) \$545,454.55	12/10/2024	CCM Crowoper 2014 1	(\$4,108,502,000
0/7/2024	MSDEDS Short form	(\$20,220,620,28)	12/20/2024	AEW Bortnoro X	(\$4,198,595.00)
0/1/2024	Plue Owl Londing Fund 2022	(\$20,379,020.30)	12/20/2024	CCM Crowener 2014 1	\$4,198,595.00 (\$2,160,404,00)
0/1/2024	Blue Owi Lending Fund 2023	\$20,379,020.30 (\$407.005.74)	12/23/2024		(\$2,160,494.00)
8/8/2024	GCM Grosvenor 2014-1	(\$127,285.71)	12/23/2024		\$2,160,494.00
8/8/2024	GCM Grosvenor 2024-1	\$127,285.71	1/14/2025	Pathway PEF 2013	(\$3,750,000.00)
8/8/2024	GCM Grosvenor 2014-1	(\$511,589.67)	1/14/2025	AG Realty Value Fund XI	\$3,750,000.00
8/8/2024	GCM Grosvenor 2018-1	\$511,589.67	1/16/2025	GCM Grosvenor 2014-1	(\$10,687,500.00)
8/8/2024	GCM Grosvenor 2014-1	(\$15,334,600.00)	1/16/2025	Reality Assoc. Fund XIII	\$10,687,500.00
8/8/2024	GCM Grosvenor 2018-1	\$15,334,600.00	1/27/2025	Pathway PEF 2013	(\$13,387,536.85)
8/16/2024	GCM Grosvenor 2009-1	(\$21,000,000.00)	1/27/2025	Pathway PEF 2021	\$13,387,536.85
8/16/2024	Pathway PEF 2008	(\$29,000,000.00)	2/6/2025	Reality Assoc. Fund XII	(\$778,037.00)
8/16/2024	Pathway PEF 2016	(\$90,000,000.00)	2/6/2025	Invesco VA Fund VI	\$778,037.00
8/16/2024	Principal Capital MGT RE	(\$30,000,000.00)	2/11/2025	GCM Grosvenor 2014-1	(\$81,000.00)
8/16/2024	UBS Trumbull Growth & Income Fund	(\$3,000,000.00)	2/11/2025	GCM Grosvenor 2024-1	\$81,000.00
8/16/2024	UBS Trumbull Property Fund	(\$12,000,000.00)	2/11/2025	GCM Grosvenor 2014-1	(\$498,750.00)
8/16/2024	JPM Strategic Property Fund	(\$19,000,000.00)	2/11/2025	GCM Grosvenor 2018-1	\$498,750.00
8/16/2024	Invesco U.S. Income Fund	(\$3,000,000.00)	2/27/2025	NT SP 500 Index	(\$500,000,000.00)
8/16/2024	AG Realty Core Plus Fund III	(\$1,000,000.00)	2/27/2025	MSPERS Short-term	\$500,000,000.00
8/16/2024	Heitman Value Partners IV	(\$4,000,000.00)	2/28/2025	MSPERS Short-term	(\$400,000,000.00)
8/16/2024	Reality Assoc. Fund XI	(\$9,000,000,00)	2/28/2025	SIT Short Duration	\$400.000.000.00
8/16/2024	Reality Assoc. Fund XIII	(\$5,000,000,00)	3/3/2025	Pathway PEF 2013	(\$13,148,234,05)
8/16/2024	AFW Partners VIII	(\$4,000,000,00)	3/3/2025	Pathway PEF 2021	\$13 148 234 05
8/16/2024	AFW Partners IX	(\$4,000,000,00)	3/10/2025	NT MSCI World Ex US	(\$100,000,000,00)
8/16/2024	Hancock Timber Fund	(\$1,000,000,00)	3/10/2025	MSPERS Short-term	
8/16/2024	MSPERS Short-term	\$235 400 000 00	3/19/2025	MSPERS Short-term	\$250,000,000,00
8/30/2024	Pathway PEE 2013	(\$12,145,250,07)	3/10/2025	Acadian Global	(\$45,000,000,00)
8/30/2024	Pathway PEF 2021	(\$12,145,250.07) \$12,145,250.07	3/10/2025	Harding Loevner	(\$35,000,000,00)
9/6/2024	Pathway PEF 2013	(\$2,625,000,00)	3/10/2025	I SV Global Value	(\$30,000,000,000)
0/6/2024	Pathway PEE 2013	(\$2,025,000.00) \$2,625,000.00	3/10/2025		(\$20,000,000.00)
9/0/2024	MSDEDS Short form	\$2,023,000.00 (\$5,552,200,00)	2/10/2025	Eichor	
9/11/2024	MOPERS SHOIL-LEITH	(\$5,552,200.00)	3/19/2023	FISHER Weathrook DE Fund VI	(\$00,000,000.00)
9/11/2024	GCIVI GIOSVEIIOI PC 2023		3/20/2023	Westbrook RE Fund X	(\$1,220,513.00)
9/12/2024	GCIVI Grosvenor 2014-1	(\$1,800,000.00)	3/26/2025		\$1,220,513.00
9/12/2024		\$1,800,000.00	3/26/2025	GCIVI Grosvenor 2014-1	(\$1,049,383.00)
9/20/2024	GCM Grosvenor 2014-1	(\$7,388,515.00)	3/26/2025	AEW Partners IX	\$1,049,383.00
9/20/2024	Westbrook RE Fund XI	\$7,388,515.00	3/27/2025	GCM Grosvenor 2014-1	(\$1,090,909.09)
9/20/2024	From Special State Funding to MSPERS Short-term	\$110,000,000.00	3/27/2025	Heitman Value Partners V	\$1,090,909.09
10/4/2024	GCM Grosvenor 2014-1	(\$10,493,056.85)	3/28/2025	GCM Grosvenor 2014-1	(\$2,861,522.00)
10/4/2024	GCM Grosvenor 2018-1	\$10,493,056.85	3/28/2025	AEW Partners X	\$2,861,522.00
10/4/2024	Pathway PEF 2013	(\$11,338,146.49)	3/28/2025	GCM Grosvenor 2014-1	(\$25,000,000.00)
10/4/2024	Pathway PEF 2021	\$11,338,146.49	3/28/2025	TA Reality Core Property Fund	\$25,000,000.00
10/22/2024	MSPERS Short-term	(\$6,993,006.99)	3/31/2025	TA Reality Core Property Fund	\$50,000,000.00
10/22/2024	Blue Owl Lending Fund 2023	\$6,993,006.99	3/31/2025	Principal Capital Management	(\$50,000,000.00)
10/28/2024	Reality Assoc. Fund XII	(\$1,934,578.00)	3/31/2025	Principal Capital Management	(\$25,000,000.00)
10/28/2024	Invesco VA Fund VI	\$1,934,578.00	3/31/2025	Invesco US Income Fund	\$25,000,000.00
10/28/2024	Reality Assoc. Fund XII	(\$7,500,000.00)	3/31/2025	MSPERS Short-term	(\$400,000,000.00)
10/28/2024	Reality Assoc. Fund XIII	\$7,500,000.00	3/31/2025	SIT Short Duration	\$400,000,000.00
11/7/2024	GCM Grosvenor 2014-1	(\$81,000.00)	4/1/2025	MSPERS Short-term	(\$16,208,000.10)
11/7/2024	GCM Grosvenor 2024-1	\$81,000.00	4/1/2025	GCM Grosvenor PC 2023	\$16,208,000.10
11/7/2024	GCM Grosvenor 2014-1	(\$498,750.00)			
11/7/2024	GCM Grosvenor 2018-1	\$498,750.00			
11/20/2024	GCM Grosvenor 2014-1	(\$1,745,454.55)			
11/20/2024	Heitman Value Partners V	\$1,745,454.55			
11/25/2024	Pathway PEF 2013	(\$3,603,691.00)			
11/25/2024	AG Realty Value Fund XI	\$3,603,691,00			
11/25/2024	SIT Short Duration	(\$245.000.000.00)			
11/25/2024	MSPERS Short-term	\$245,000,000,00			
11/27/2024	MSPERS Short-term	(\$5,066,699,71)			
11/27/2024	GCM Grosvenor PC 2023	\$5,066,699,71			
12/2/2024	SIT Short Duration	(\$100,000,000,000,00)			
12/2/2024	MSPERS Short-term				
12/4/2024	SIT Short Duration	(\$125,000,000,000,000)			
12/7/2024	MSPERS Short-term	\$125,000,000.00)			
12/7/2024	Northern Trust S&P 500	(\$150,000,000,000,000			
12/0/2024	MSDERS Short-term	\$150,000,000.00)			
12/0/2024		φ100,000,000.00 (¢g 310 £31 03)			
12/9/2024	Faulway FEF 2013 Dathway DEE 2021	(40,310,534.23)			
12/9/2024	Faulway PEF 2021	φο, 3 10, 534.23			
12/10/2024	MODEDS Short form				
12/10/2024	NIGHERS SHULLERM				
12/13/2024	SIT SHOLL DURATION	(⇒∠∠⊃,000,000.00)			