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PREPARATORY DISCUSSION FOR UPCOMING EXPERIENCE STUDY

OREGON PUBLIC EMPLOYEES RETIREMENT SYSTEM

Presented by:

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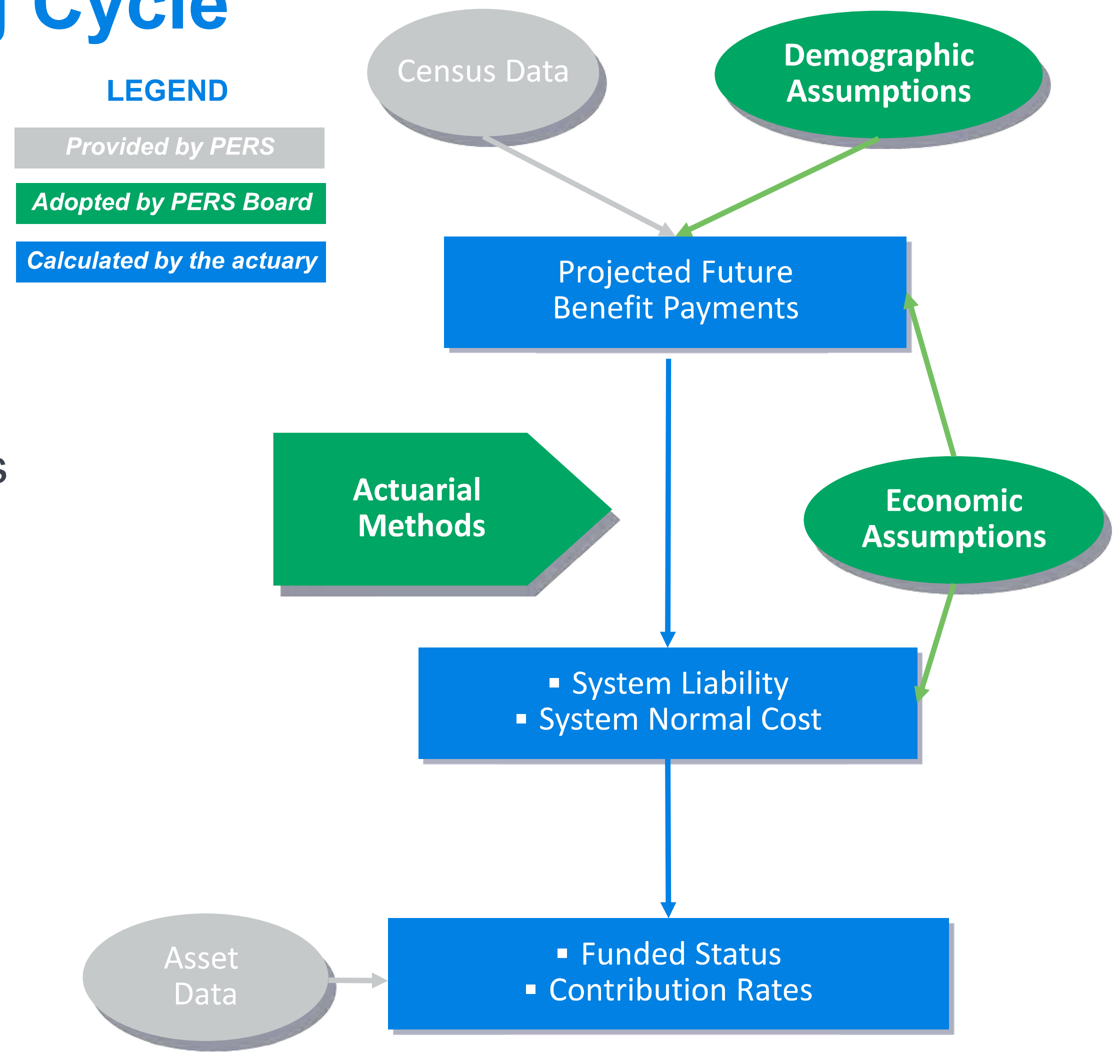
March 29, 2021

Four-Meeting Process – Assumptions & Methods

- March 29: Assumed rate, including preliminary Milliman outlook model
- June 2: Joint meeting with Oregon Investment Council (OIC)
  - Assumed rate – outlooks from OIC's consultants, Milliman
- June 4: Economic assumptions, system funding methods
  - Inflation and system payroll growth
  - Actuarial methods, including amortization and rate collaring policy
- July 23: Demographic assumptions, Board direction to actuary
  - Member-specific assumptions based on study of recent PERS experience
  - Assumptions and methods adopted for use in:
    - 12/31/2020 actuarial valuation with advisory 2023-2025 contribution rates
    - 12/31/2021 actuarial valuation with proposed final 2023-2025 contribution rates

Two-Year Rate-Setting Cycle

- **July 2021: Assumptions & methods adopted by Board in consultation with the actuary**
- October 2021: System-wide 12/31/20 actuarial valuation results
- December 2021: Advisory 2023-2025 employer-specific contribution rates
- July 2022: System-wide 12/31/21 actuarial valuation results
- September 2022: Disclosure & adoption of employer-specific **2023-2025 contribution rates**



Valuation Process and Timeline

- Actuarial valuations are conducted annually
  - Alternate between "rate-setting" and "advisory" valuations
  - This valuation as of 12/31/2020 is advisory
- Board adopts contribution rates developed in rate-setting valuations, and those rates go into effect 18 months after the valuation date

Valuation Date	Employer Contribution Rates
12/31/2017 →	July 2019 – June 2021
12/31/2019 →	July 2021 – June 2023
12/31/2021 →	July 2023 – June 2025

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The Assumed Rate

The Assumed Rate: What Is It?

- Assumed rate: expected average annual **future** investment return

- PERS Board sets the assumed rate every two years
  - This year the rate will be selected at the July 23 meeting

- The assumed rate is used to determine:
  - The contribution cost rate for benefits earned in the future (normal cost rate)
  - The system's current unfunded actuarial liability (UAL)
  - The contribution cost rate to systematically amortize UAL over time (UAL rate)
  - Actuarial equivalence factors (AEFs) for amounts of optional benefit forms
  - AEFs to convert account balances to "money match" annuities for Tiers 1 & 2
  - Account balance interest crediting level for Tier 1 actives

Use of the Assumed Rate

The PERS Funding Equation

At the end of each calendar year, the PERS actuaries calculate the system's funded status using the following basic equation:

B	=	C	+	E
BENEFITS		CONTRIBUTIONS		EARNINGS
Present value of earned benefits		*Employer funds to pay for pension benefits*		*Future returns on investment funds*
Set by: Oregon Legislature		Set by: PERS Board		Managed by: Oregon Investment Council

Every two years, the PERS Board adjusts contribution rates so that, over time, contributions will be sufficient to fund the benefits earned, if earnings follow assumptions.

- "B" is predictable with a relatively high degree of certainty
- "E" is the unpredictable **actual** future investment return on PERS assets
- "C" is the balancing item --- it must provide to "B" what "E" fails to cover

- The **assumed rate** is the Board's estimate of "E" to prudently set "C"
- The Board's decision on "E" does **not** affect actual future earnings

Considerations in Assumed Rate Selection

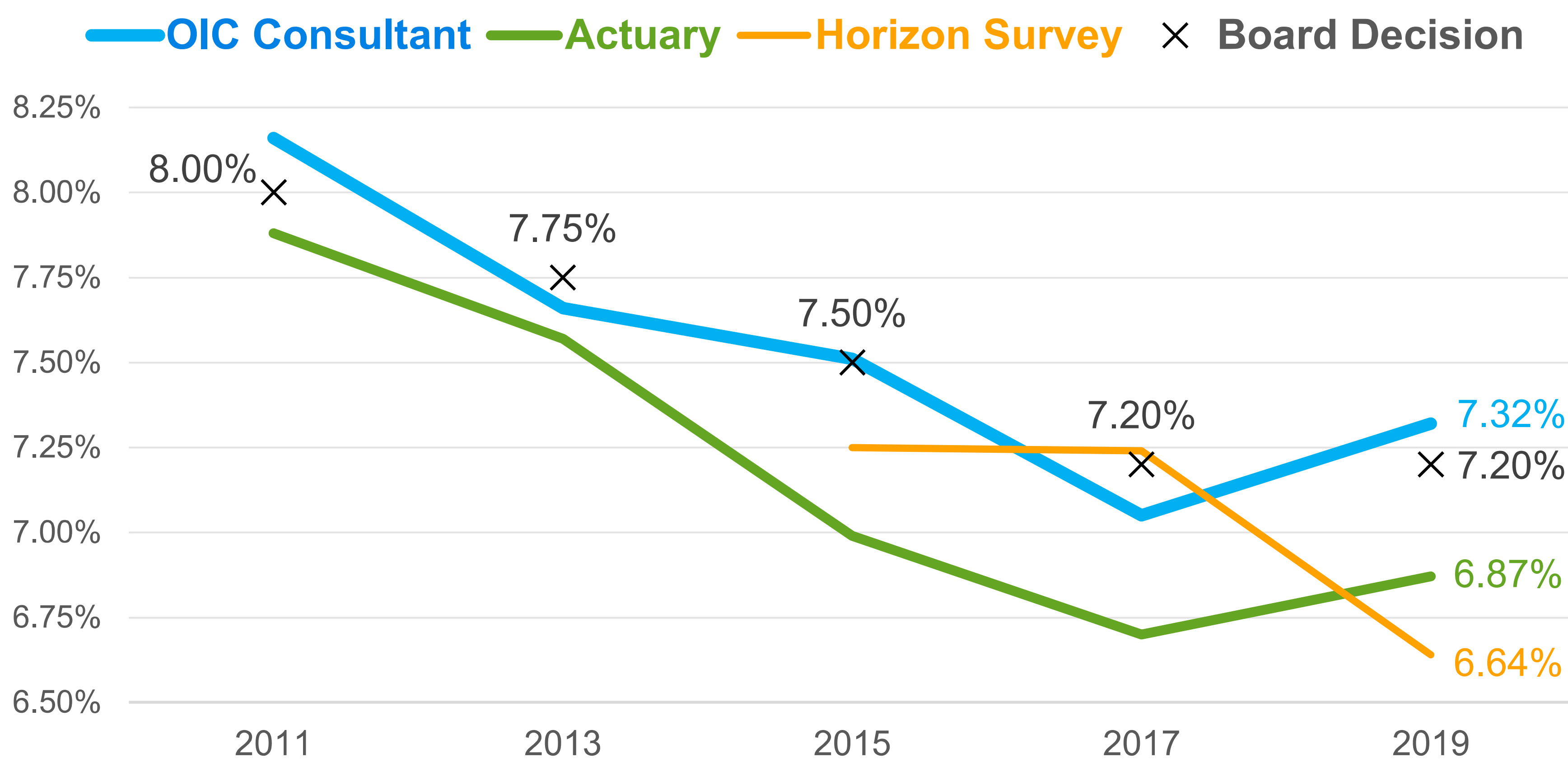
- Rate selected should be **prudent**, based on best-estimate outlooks

- Stakeholders should realize rate selected **will not affect actual returns**

- Recent returns are generally not considered a predictor of future returns
  - Likeliest possible effect: **strong recent returns may lead to lower future returns**

Investment Return 50th Percentile Outlooks

Geometric Returns from Outlook Models in Prior Five Reviews



Assumed Rate - Data Used in Prior Board Decision

- The table below is from the **July 2019** Board meeting
  - Median returns are geometric averages over the timeframe indicated

	2019 Outlook Milliman	2019 Outlook OIC Consultant	2019 Outlook Horizon
Median Annualized Return	**6.87%**	**7.32%**	**6.64%**
Assumed Inflation	2.50%	2.25%	2.24%
Time Horizon Modeled	20 years	10 years	10 years

- To avoid the potential risk of a modified opinion, GASB requires an assumption for financial reporting is not disclaimed by the actuary
  - A disclaimer would be required under Actuarial Standards of Practice (ASOPs) if the assumption "*significantly conflicts*" with what the actuary considers reasonable
- The OIC consultant's outlook is important in our reasonability assessment

Preliminary Updates to Milliman Outlooks

	2019 Outlook Milliman Final	2021 Outlook Milliman Preliminary
Median Annualized Geometric Return	**6.87%**	**6.12%**
Assumed Inflation	2.50%	2.40%
Time Horizon Modeled	20 years	20 years

- **OIC consultant outlooks will be shared on June 2**
  - Milliman's outlook will be updated for the June Board meeting, including reflection of any changes to OIC's target asset allocation policy
- Board's 2019 2.50% inflation assumption used in the 2019 Milliman outlook
  - That was below Social Security's long-term outlook at that time of 2.60%
  - Social Security's current long-term outlook of 2.40% is used as a placeholder in Milliman's preliminary 2021 outlook
  - Other key inflation outlooks are currently below 2.40%

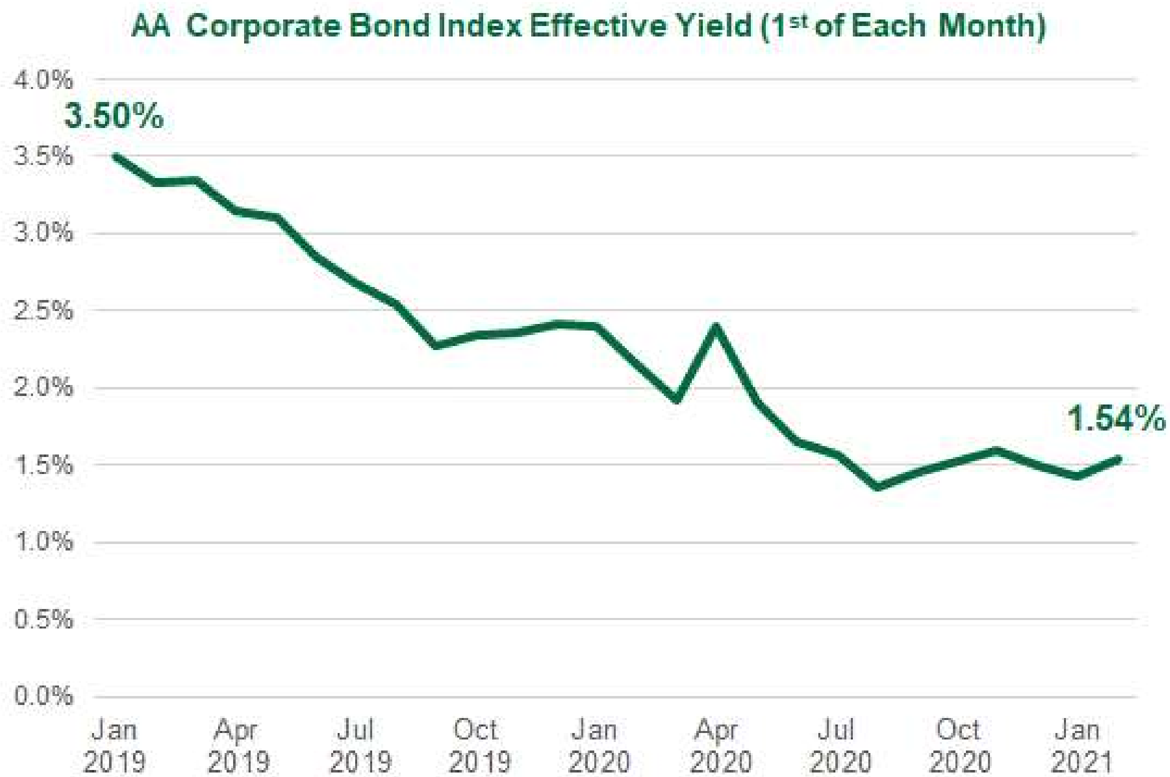
Why Did Milliman's Outlook Decrease So Much?

- Milliman's outlook is based on January 2021 market conditions
- The S&P 500 P/E ratio increased substantially from 2019 to 2021

- This helped create strong cumulative two-year public equity returns (+41.1% for PERS), but **will make it harder to achieve strong future public equity returns**

Why Did Milliman's Outlook Decrease So Much?

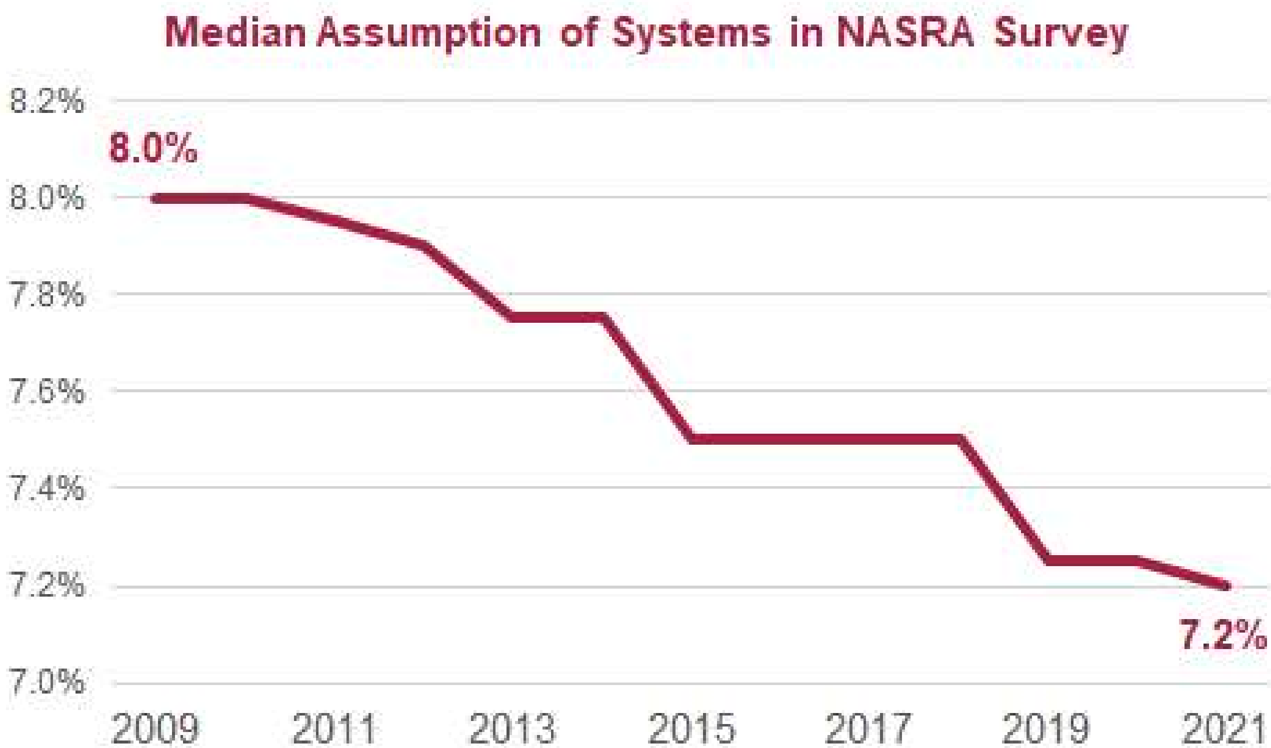
- Fixed income yields decreased to historic lows between January 2019 and January 2021



- Yield decreases led to strong cumulative two-year fixed income returns (+17.2% for PERS), but **will make it harder to achieve strong future fixed income returns**

What About the Assumptions of Other Systems?

- This line shows the median return assumption over time for 130 large and/or statewide public systems



- The median may decrease to **7.0%** by the end of 2021
  - That happening would mean the mid-point of public systems' return assumptions would have decreased by a full 1.0% in just over a decade

System-Average Liability and Contribution Rate Effects

Valuation Date:	12/31/2019	12/31/2020		
	Final 2021-23 at	Preliminary Estimated Advisory 2023-25 at		
Assumed Rate:	7.20%	7.20%	7.00%	6.80%
Funded Status (Excluding Side Accounts)	72%	73%	72%	70%
Unfunded Actuarial Liability (UAL) (Excluding Side Accounts)	$24.6 B	$24.3 B	$26.3 B	$28.4 B
System-Average Uncollared Total Contribution Rates				
Total Normal Cost Rate (Employer plus Member)	11.09%	10.90%	11.44%	12.02%
Tier 1/Tier 2 UAL Rate	13.13%	13.17%	13.93%	14.70%
OPSRP UAL Rate	1.69%	1.63%	1.86%	2.09%
Uncollared Total Base Rate	**25.91%**	**25.70%**	**27.23%**	**28.81%**

- Preliminary 12/31/2020 estimates do not reflect updated census information or assumption changes that may occur in the upcoming experience study

Rate Collaring

- PERS applies a “rate collar” as part of rate-setting process, as discussed in detail in recent Board meetings
- Based on the results of the December 31, 2019 valuation, rate collar does not limit rates for the 2021-23 biennium for the large rate pools
  - Collared and uncollared rates are equal
- December’s financial modeling included illustration of potential modifications to the collar structure
- Any change to the rate collar structure would be adopted as part of the upcoming experience study
- Any potential collar changes would be considered in conjunction with changes in assumed rate or other assumptions

Agenda for Upcoming Presentations

- June 2: Assumed rate
  - Joint board meeting with Oregon Investment Council (OIC)
  - Outlooks from OIC's consultants, updates to Milliman's model

- June 4: Economic assumptions, rate-setting methods
  - Inflation and system payroll growth
  - Amortization and contribution rate collaring

- July 23: Demographic assumptions, Board decisions
  - Member-specific assumptions based on study of recent PERS experience
  - Assumptions and methods adopted will be used for:
    - 12/31/2020 actuarial valuation with advisory 2023-2025 contribution rates
    - 12/31/2021 actuarial valuation with 2023-2025 contribution rates proposed for adoption

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Appendix

Certification

This presentation discusses actuarial methods and assumptions for use in the valuation of the Oregon Public Employees Retirement System ("PERS" or "the System"). For the most recent complete actuarial valuation results, including cautions regarding the limitations of use of valuation calculations, please refer to our formal Actuarial Valuation Report as of December 31, 2019 ("the Valuation Report") published on September 17, 2020. The Valuation Report, including all supporting information regarding data, assumptions, methods, and provisions, is incorporated by reference into this presentation. The statements of reliance and limitations on the use of this material is reflected in the actuarial report and still apply to this presentation. The Valuation Report should be referenced for additional detail on the assumptions, methods, and plan provisions underlying this presentation.

This presentation also summarizes a limited number of high-level preliminary estimates based on information projected to December 31, 2020 from the December 31, 2019 actuarial valuation. These results are preliminary in nature, are shown here only for illustrating the effect of assumption changes, and should not be relied upon for other purposes. Final results will be published in the December 31, 2020 Actuarial Valuation Report to be published later this year. In preparing this presentation, we relied, without audit, on information (some oral and some in writing) supplied by the System's staff and information published by Oregon State Treasury. This information includes, but is not limited to, statutory provisions, employee data, and financial information. We found this information to be reasonably consistent and comparable with information used for other purposes. The valuation results depend on the integrity of this information. If any of this information is inaccurate or incomplete our results may be different and our calculations may need to be revised.

All costs, liabilities, rates of interest, and other factors for the System have been determined on the basis of actuarial assumptions and methods which are individually reasonable (taking into account the experience of the System and reasonable expectations); and which, in combination, offer a reasonable estimate of anticipated experience affecting the System. The valuation results were developed using models intended for valuations that use standard actuarial techniques.

Future actuarial measurements may differ significantly from the current measurements presented in this report due to such factors as the following: plan experience differing from that anticipated by the economic or demographic assumptions; changes in economic or demographic assumptions; increases or decreases expected as part of the natural operation of the methodology used for these measurements (such as the end of an amortization period or additional cost or contribution requirements based on the plan's funded status); and changes in plan provisions or applicable law. Due to the limited scope of our assignment, we did not perform an analysis of the potential range of future measurements. Our annual financially modeling presentation to the PERS Board should be referenced for additional analysis of the potential variation in future measurements. The PERS Board has the final decision regarding the appropriateness of the assumptions.

Certification

The calculations in this report have been made on a basis consistent with our understanding of the plan provisions described in the appendix of the Valuation Report. Determinations for purposes other than meeting these requirements may be significantly different from the results contained in this report. Accordingly, additional determinations may be needed for other purposes.

Milliman's work is prepared solely for the internal business use of the Oregon Public Employees Retirement System. Milliman does not intend to benefit or create a legal duty to any third party recipient of its work product.

No third party recipient of Milliman's work product should rely upon Milliman's work product. Such recipients should engage qualified professionals for advice appropriate to their own specific needs.

The consultants who worked on this assignment are retirement actuaries. Milliman's advice is not intended to be a substitute for qualified legal or accounting counsel.

The signing actuaries are independent of the System. We are not aware of any relationship that would impair the objectivity of our work.

On the basis of the foregoing, 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 and the *Code of Professional Conduct* and *Qualification Standards for Actuaries Issuing Statements of Actuarial Opinion in the United States* published by the American Academy of Actuaries. We are members of the American Academy of Actuaries and meet the Qualification Standards to render the actuarial opinion contained herein.

Appendix

Cyclically Adjusted Price-to-Earnings Ratio

Cyclically Adjusted PE Ratio (CAPE ratio), also referred to as Schiller PE ratio, is based on the average inflation adjusted earnings of the prior 10 years. Values shown are as of January 1 and were retrieved from: https://www.multpl.com/shiller-pe/table/by-year.

AA Corporate Bond Index

Index shown is the ICE BofA AA US Corporate Index Effective Yield published by the Federal Reserve Bank of St. Louis. Values are as of the first of the month and were retrieved from: https://fred.stlouisfed.org/series/BAMLC0A2CAAEY.

System-Average Liability and Contribution Rate Effects

Estimated December 31, 2020 system-average liabilities and contribution rates were projected based on results from the December 31, 2019 valuation,. Unless noted otherwise, results reflect the data, assumptions, methods, and provisions summarized in the Valuation Report.

Valuation assets as of December 31, 2020 were estimated based on information provided for the 2020 Preliminary Earnings Crediting discussion at the February 1, 2021 PERS Board meeting.

Uncollared total contribution rates as of December 31, 2020 were calculated using a payroll growth assumption of 3.40%.

Appendix
Actuarial Basis
Capital Market Assumptions - Milliman

For assessing the expected portfolio return under Milliman's capital market assumptions (adjusted for inflation assumption shown below), we considered the Oregon PERS Fund to be allocated among the model's asset classes as shown below. This allocation is based on the Oregon Investment Council's Statement of Investment Objectives and Policy Framework for the Oregon PERS Fund, as revised April 2018, and changes adopted in April 2019.

	Annual Arithmetic Mean	20-Year Annualized Geometric Mean	Annual Standard Deviation	Policy Allocation
US Large/Mid-Cap Equity	6.33%	5.15%	16.45%	16.17%
US Small Cap Equity	7.42%	5.50%	21.15%	1.35%
US Micro-Cap Equity	8.11%	5.75%	23.60%	1.35%
Non-US Developed Equity	7.78%	6.31%	18.45%	13.47%
Emerging Markets Equity	9.55%	6.86%	25.40%	4.23%
Non-US Small Cap Equity	8.22%	6.51%	20.00%	1.92%
Private Equity	11.35%	7.71%	30.00%	17.50%
US Core Fixed Income	2.80%	2.73%	3.85%	9.60%
US Short-Term Bonds	2.49%	2.47%	2.05%	9.60%
US Bank/Leveraged Loans	4.91%	4.66%	7.40%	3.60%
High Yield Bonds	5.77%	5.36%	9.70%	1.20%
Real Estate	6.29%	5.66%	12.00%	10.00%
Global REITs	8.03%	6.36%	19.75%	2.50%
Timber	6.55%	5.81%	13.00%	1.13%
Farmland	6.95%	6.21%	13.00%	1.13%
Infrastructure	7.24%	6.26%	15.00%	2.25%
Commodities	4.68%	3.10%	18.85%	1.13%
Hedge Fund of Funds - Diversified	4.08%	3.85%	7.10%	1.50%
Hedge Fund Event-Driven	5.59%	5.26%	8.70%	0.37%
US Inflation (CPI-U)		2.40%	1.65%	**N/A**
Fund Total (reflecting asset class correlations)	**6.86%**	**6.16%***	**12.64%**	**100.00%**

* Reflects 0.10% average reduction to model passive investment expenses. The model does not try to assess the actual investment expenses for active management. The model's 20-year annualized geometric median is **6.12%**.