



Valuation Methods & Assumptions

OREGON PUBLIC EMPLOYEES RETIREMENT SYSTEM

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Today's Agenda

- Background
- Recent legislative changes
- Recap of economic assumptions and actuarial methods
 - Includes long-term investment return assumption
 - Reviewed in detail at last Board meeting
- Overview of demographic assumptions
- Rate collar
- Estimated effect of assumptions

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Executive Summary

- Since last meeting, we analyzed PERS member census and are recommending updates to certain demographic assumptions
 - Combined, those recommendations are estimated to have a:
 - Increase of \$0.3 billion in the UAL (rounded to the nearest \$100 million)
 - 0.4% of payroll increase in the system-average advisory 2023-2025 uncollared rate
 - We recommend adopting the revised rate collar methodology described in this presentation
 - Reflects a simpler and somewhat narrower collar than the existing approach
 - Adds a restriction to not allow any decrease in a pool's UAL Rate until funded status criteria are met
 - Based on current data from the capital market outlooks for future investment return prepared by OIC's consultants and others, are well below the current investment return assumption of 7.2%
 - In our opinion it is **necessary** to lower the long-term future investment return assumption by **at least 0.20%**; we **recommend** reducing the assumption **further** to more closely reflect current outlooks
 - A decrease to 7.0%/6.8% is estimated to:
 - Increase the UAL as of December 31, 2020 by \$2.0/\$3.9 billion
 - Increase the system-average advisory 2023-2025 uncollared base rate by 1.5%/3.0% of payroll
 - This change is in addition to the 0.4% of payroll increase for recommended demographic assumptions noted above

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Background

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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
 - Assumed rate
 - 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**

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Two-Year Rate-Setting Cycle

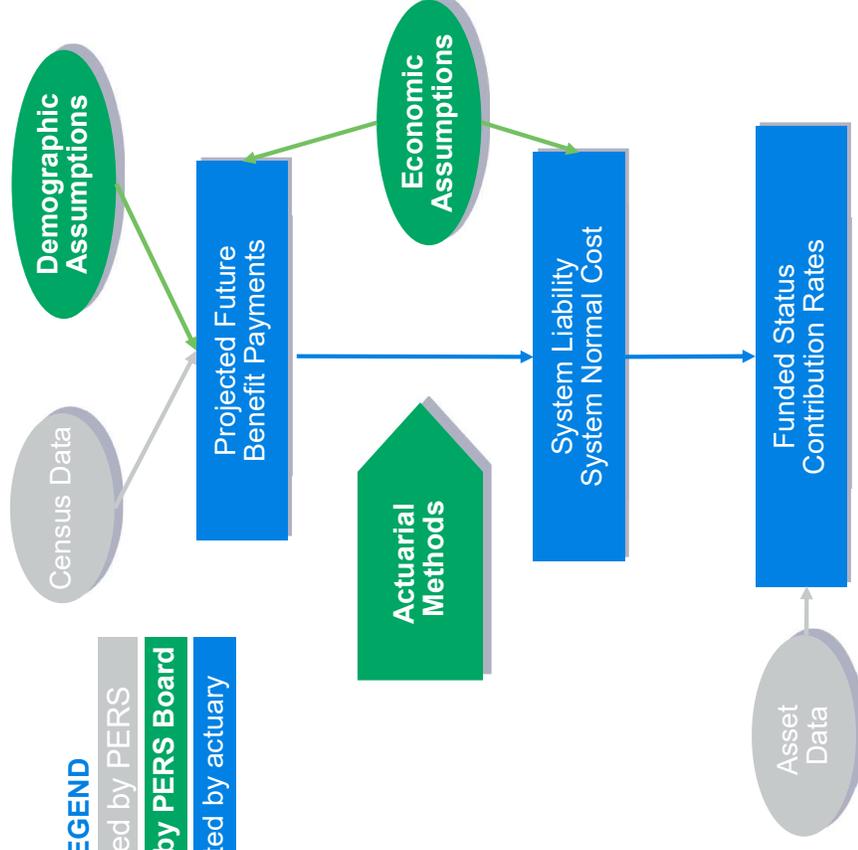
- **July 2021: Assumptions & methods adopted by Board in consultation with the actuary**
- October 2021: System-wide 12/31/20 actuarial valuation results
- December 2021: Advisory 2023-2025 employer-specific contribution rates
- July 2022: System-wide 12/31/21 actuarial valuation results
- September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

LEGEND

Provided by PERS

Adopted by PERS Board

Calculated by actuary



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Valuation Process and Timeline

- Actuarial valuations are conducted annually
 - Alternate between “rate-setting” and “advisory” actuarial valuations
 - The next valuation as of December 31, 2020 will be an advisory actuarial valuation
- 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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Guiding Objectives - Methods & Assumptions

- Transparent
- Predictable and stable rates
- Protect funded status
- Equitable across generations
- Actuarially sound
- GASB compliant

Some of the objectives can conflict, particularly in periods with significant volatility in investment return or projected benefit levels. Overall system funding policies should seek an appropriate balance between conflicting objectives.

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The Fundamental Cost Equation

- Long-term program costs are the contributions, which are governed by the “fundamental cost equation”:

$$\text{BENEFITS} = \text{CONTRIBUTIONS} + \text{EARNINGS}$$

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Governance Structure

- **Benefits:**
 - Plan design set by Oregon Legislature
 - Subject to judicial review
- **Earnings:**
 - Asset allocation set by OIC
 - Actual returns determined by market
- **Contributions:**
 - Funding, including methods & assumptions, set by PERS Board
 - Since contributions are the balancing item in the fundamental cost equation, PERS Board policies primarily affect the **timing** of contributions
 - Different actuarial methods and assumptions produce different projected future contribution patterns



Recent Legislative Changes

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Notable Changes from 2021 Legislative Session

- Senate Bill 111
 - Omnibus bill made several administrative and technical edits
 - Also **increased spousal death benefit** for members who die while retirement eligible and either actively employed or recently terminated
 - We intend to reflect this change in the December 31, 2020 actuarial valuation and will be able to estimate the effect on system-wide liability
- House Bill 2906
 - **Increases the pay threshold before member redirect applies, effective in 2022**
 - In 2022, \$3,333 per month threshold rather than \$2,500 plus two years' inflation adjustment
 - \$3,333 will be inflation-indexed after 2022
 - This will reduce member contributions to EPSA accounts and the funding of the Tier 1/Tier 2 and OPSRP programs compared to before the change

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Effects of House Bill 2906

- For members above the threshold in 2022, redirected contributions will continue at 2.50% of payroll (Tier 1/Tier 2) or 0.75% of payroll (OPSRP)
- The 2021-2023 employer contribution rates adopted by the Board reflected projected tier-wide average member redirect offsets of:
 - 2.45% of Tier 1/Tier 2 payroll
 - 0.70% of OPSRP payroll
- The 0.05% of payroll difference between the offset for an affected member and the projected tier-wide level of redirect reflects the estimated effect of the pay threshold in place for 2021
 - With 2022's higher threshold under HB 2906, the estimated difference increases to 0.10% of payroll, as shown later in the presentation with our recommendation for the assumption used to set 2023-2025 rates
- When adopting the 2021-2023 employer contribution rates in October 2020, the Board reserved the right to revise the projected tier-wide rate offset for redirected member contributions if judicial or legislative action eliminated or changed this provision
- The Board could revise adopted 2021-2023 employer rates effective January 1, 2022, but the change's magnitude, uncertainty of the estimate, and administrative challenges should be considered

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Economic Assumptions (Other Than Investment Return) and Actuarial Methods

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Economic Assumptions and Actuarial Methods

- At the June 4, 2021 meeting, the Board reviewed
 - Non-investment economic assumptions
 - Actuarial methods (including rate collar)
 - Investment return assumption
- Our recommendations regarding economic assumptions and actuarial methods are generally unchanged since the June meeting
 - One added refinement to consider on surplus amortization policy for retiree healthcare program contribution rates
- Our rate collar recommendation, which is in a subsequent section of this presentation, builds upon discussion from June and includes specific adjustments for Tier 1/Tier 2 independent employers

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Assumptions to Be Reviewed

Details of these recommendations are included in our June 2021 presentation

	12/31/2019 Valuation Assumptions	12/31/2020 Valuation Proposed* Assumptions
Inflation	2.5%	2.4% or lower
Real Wage Growth	<u>1.0%</u>	<u>1.0%</u>
System Payroll Growth	3.5%	3.4% or lower
Administrative Expenses	\$40.5 million	\$59 million

No explicit assumption is made for investment-related expenses, which are accounted for implicitly in the analysis of the long-term investment return assumption

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Key Actuarial Methods

	12/31/2019 Valuation Methods	12/31/2020 Valuation Proposed* Methods
Cost Allocation Method	Entry Age Normal	No change
UAL (Shortfall) Amortization Method	<p>Level percent of pay, layered fixed periods: <i>Tier 1/Tier 2:</i></p> <ul style="list-style-type: none"> • Re-amortized over 22 years as of 12/31/2019 per SB 1049 • 20 years as ongoing Board policy <p><i>OPSRP:</i> 16 years <i>RHIA/RHIPA:</i> 10 Years</p>	<p>No change to Tier 1/Tier 2 and OPSRP</p> <p>Adopt policy for RHIA/RHIPA surplus amortization as described on next slide</p>
Rate Collar	<p>Limits change in base contribution rate to larger of 20% of current rate or 3.00% of payroll; Collar widens incrementally when funded status below 70%</p>	Recommend modifying structure as discussed in June meeting and following section

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RHIA & RHIPA Surplus Amortization

- The combination of a shorter amortization period and recent experience gains has dramatically improved the funded status of the RHIA and RHIPA programs in recent years
 - At 12/31/2019 RHIA was at 159% funded status (up from 90% four years prior)
 - At 12/31/2019 RHIPA was at 87% funded status (up from 16% four years prior)
- For the last two rate-setting valuations the RHIA UAL rate was set to 0%, but was not allowed to be negative (a negative rate is a contribution rate offset or credit)
 - This meant the full RHIA normal cost of 0.05% was charged on Tier 1/Tier 2 payroll
 - We recommended this approach because RHIA results are sensitive to retiree participation rates, and it was unknown whether the funded status actuarial surplus would persist
- Given the continued experience of RHIA and the potential that RHIPA may be over 100% funded status soon, **we recommend adopting a policy for amortization when in surplus:**
 - When funded status is over 100% at a rate-setting valuation, **amortize the actuarial surplus over Tier 1/Tier 2 payroll using a rolling 20-year amortization basis**
 - Allow the resulting negative UAL Rate to **offset the normal cost** for the program, but not below 0.0%
 - If either program subsequently fell below 100%, the UAL would then be amortized over combined payroll following the existing 10-year closed, layered amortization policy

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Rate Collar

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Rate Collar

- PERS applies a “rate collar” methodology as part of rate-setting process, as discussed in detail at recent Board meetings
 - Current rate collar parameters designed in 2005-2006, when system-wide rates were lower
- In June, we presented details and stress test results of a proposed alternate collar structure
 - Based on Board and stakeholder feedback over the last several months of discussions
 - Proposed structure:
 - Focuses the rate collar on the UAL Rate component (rather than sum of Normal Cost Rate and UAL Rate)
 - Collar width is 3% of pay for the Tier 1/Tier 2 UAL Rate for the two large Tier 1/Tier 2 experience-sharing pools and 1% of pay for OPSRP, which pools its experience state-wide
 - Specifics of rate collar width for independent employers’ Tier 1/Tier 2 UAL Rates were reserved for later discussion
 - We illustrated the effect of rate decrease restrictions, wherein the UAL Rate would not be allowed to decrease at all until the relevant experience-sharing pool was at least 90% funded excluding side accounts
- We recommend adopting the proposed structure, with UAL Rate decrease restrictions and the further detail regarding Tier 1/ Tier 2 independent employers discussed on the next slides
- To avoid a potential 3% of pay contribution rate cliff tied to a 1% change in funded status, we recommend adding a phase-in feature to UAL Rate decrease restrictions modeled in June

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UAL Rate Decrease Restrictions – Adding a Phase-in Feature

- Tying UAL Rate decreases to a flat 90% funded status trigger could present challenges
 - Could have a biennium where one large Tier 1/Tier 2 rate pool is 90% funded and a 3% Tier 1/Tier 2 UAL Rate decrease is allowed for that pool, while the other large Tier 1/Tier 2 rate pool is 89% funded and the Tier 1/Tier 2 UAL Rate is unchanged for that pool
- To avoid such an abrupt contribution rate change differences based on a small difference in funded status, we recommend the UAL Rate decrease restrictions include a phase-in feature, from 87% to 90% funded status, of the allowable UAL Rate decrease

Allowable UAL Rate Decrease	
Rate Pool Funded Status	Tier 1/Tier 2 Schools/SLGRP OPSRP
87% or less	0.00%
88%	1.00%
89%	2.00%
90% or more	3.00%
	1.00%

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Rate Collar – Tier 1/Tier 2 UAL Rates for Independent Employers

- In the most recent rate-setting valuation, nearly 130 employers with “independent employer” status received individually calculated Tier 1/Tier 2 rates
 - These independent employers do not benefit from the stabilizing effects of experience pooling effect like SLGRP or School District employers do
 - Independent employers have a wide variety of employer sizes and types;
 - For small independent employers, liability and payroll results can vary significantly from one biennium to the next
- The width of the rate collar proposed for the large Tier 1/Tier 2 rate pools reflects their current funded position, level of contribution rates, and the expected demographic stability of those pools
 - Since independent employers have more varied starting points and more volatile liability and payroll changes from biennium to biennium, we recommend a wider rate collar for independent employers

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Rate Collar – Tier 1/Tier 2 UAL Rates for Independent Employers

- Current structure:
 - Width of collar is determined as greater of 3% of pay or 20% of the current rate in effect (Normal Cost Rate plus UAL Rate)
 - Collar is applied to the sum of the two rate components (Normal Cost Rate plus UAL Rate)
 - Independent employers that were not included in the prior rate-setting valuation due to zero payroll are exempt from the collar in the current rate-setting valuation
 - New employers have rates set to uncollared rates in their first rate-setting valuation; rate collar applies in future biennia
 - By long-standing Board policy, independent employers have a minimum rate of 6% for Tier 1/Tier 2 payroll
 - This was more significant when first adopted, but now applies to very few employers and has little effect
- Proposed structure:
 - Width of collar for the Tier 1/Tier 2 UAL Rate is **greater of 4% of pay or one-third of the difference between the collared and uncollared UAL Rates** at the last rate-setting valuation
 - **Collar is applied on the Tier 1/Tier 2 UAL Rate**; changes in the Normal Cost Rate will be fully reflected
 - UAL Rate would **not be allowed to decrease with full collar until 90% funded** (grade-in from 87% to 90%)
 - For employers that currently have funded status less than 100%, the maximum UAL Rate allowed would never be less than 0.00% (relevant if the prior biennium's collared UAL Rate was significantly negative)
 - Employers that were not included in the prior rate-setting valuation are exempt from the collar in the current rate-setting valuation (continuation of existing policy)

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Long-Term Investment Return Assumption

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Long-Term Investment Return Assumption

- Uses of the investment return assumption
 - As a “discount rate” for establishing the:
 - Actuarial accrued liability, which is a net present value
 - Associated unfunded actuarial liability, also called the UAL or actuarial shortfall
 - Guaranteed crediting level for regular Tier 1 active member account balances
 - Annuitization rate for converting member account balances to lifetime money match monthly benefits



Reflecting expectations for both investment earnings and benefit levels for certain members, the assumption helps set a reasonable and appropriate budgeting glide path for projected employer contribution rates

Use of the Assumed Rate

$$B = C + E$$

BENEFITS = CONTRIBUTIONS + EARNINGS

present value of
earned benefits

Design set by:
Oregon Legislature

employer and member funds to
pay pension benefits

Set by:
PERS Board

future returns on
invested funds

Managed by:
Oregon Investment Council
Oregon State Treasury

- “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

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Investment Return 50th Percentile Outlooks

- We applied a standard mean/variance model to calculate 50th percentile return estimates based on capital market outlook assumptions from three sources
 - OIC assumption – reflects consensus among OST staff and consultants Meketa & Aon
 - Milliman
 - 2020 Horizon survey of 10-year capital market assumptions (survey of 39 advisors)
 - The Horizon survey was published in July 2020, based on outlooks from the first half of 2020
- Estimates do not reflect any possible “alpha” due to selected managers potentially outperforming market benchmarks over the long term, net of fees
- Today’s speakers are not credentialed investment advisors
 - We are presenting Milliman capital market outlook model results based on assumptions developed by Milliman’s credentialed investment professionals

Details on Milliman and Horizon outlook assumptions are in the Appendix

Investment Return 50th Percentile Outlooks

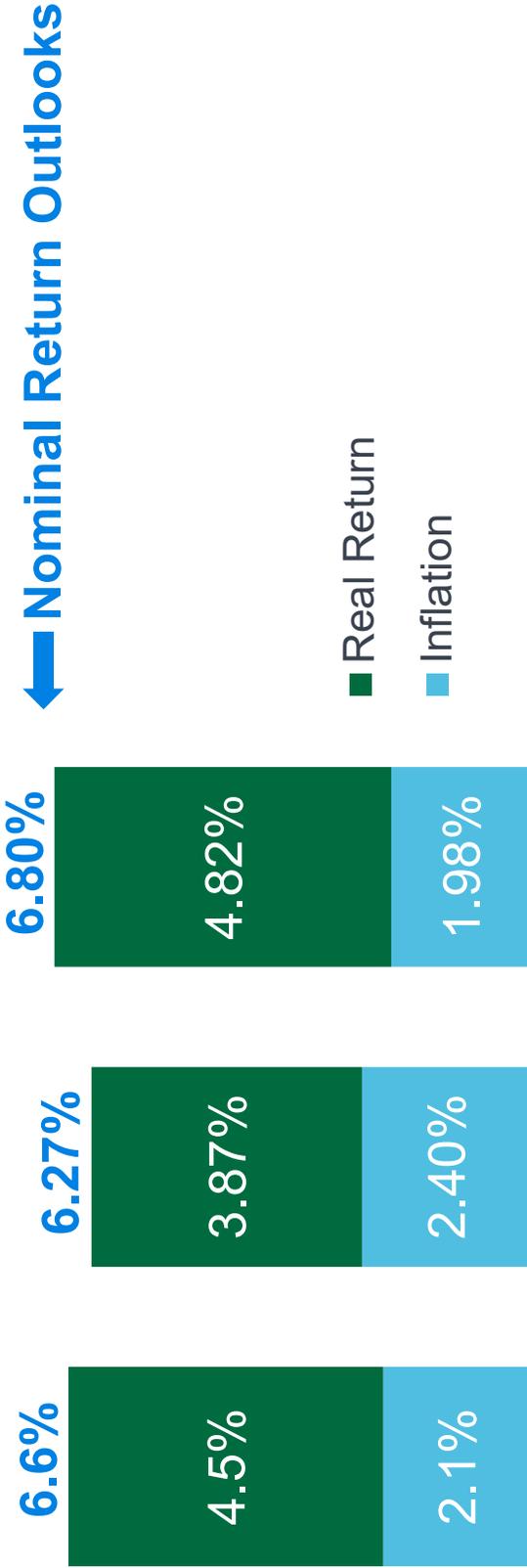
Geometric Returns from Outlook Models in Current and Prior Five Reviews



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Investment Return 50th Percentile Outlooks & Component Building Blocks

- Estimates are geometric annualized average returns based on the OIC’s long-term asset allocation for each set of capital market assumptions

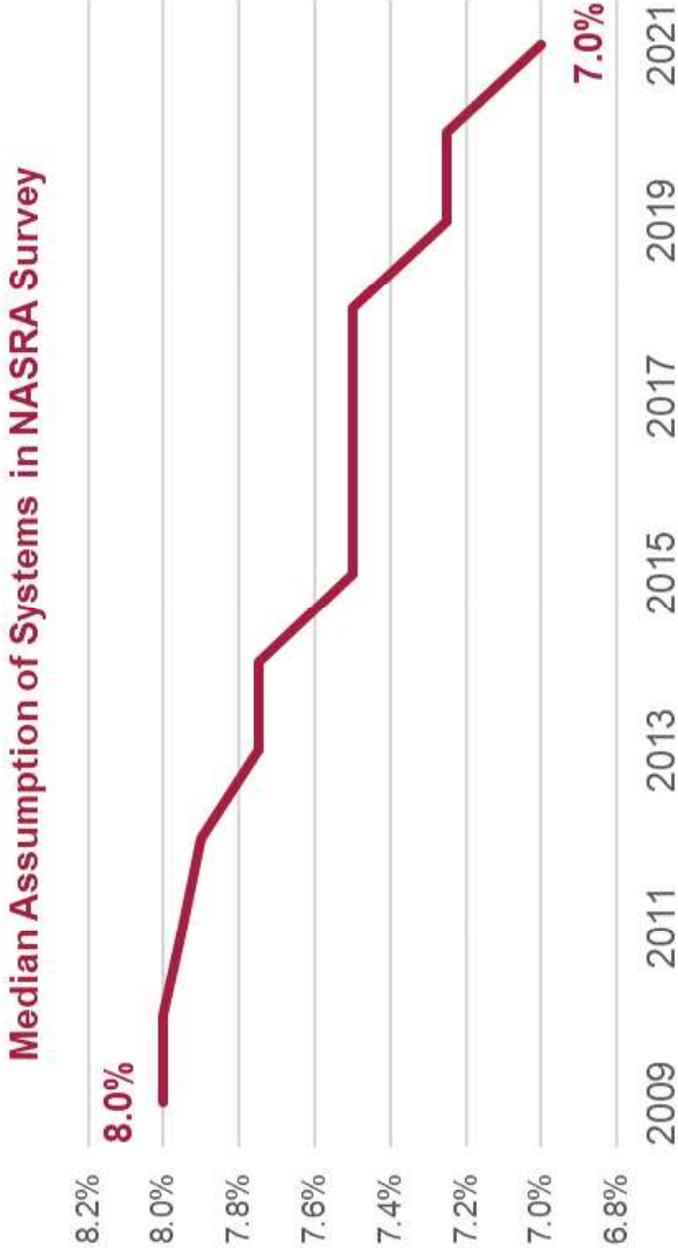


*Reflects real returns from Milliman capital market outlook assumptions adjusted for potential 2.40% inflation assumption

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Comparison to Peer Systems

- There is a downward trend in public plan return assumptions, with a current median assumption for large public systems of 7.00%



Source: NASRA (May 2021)

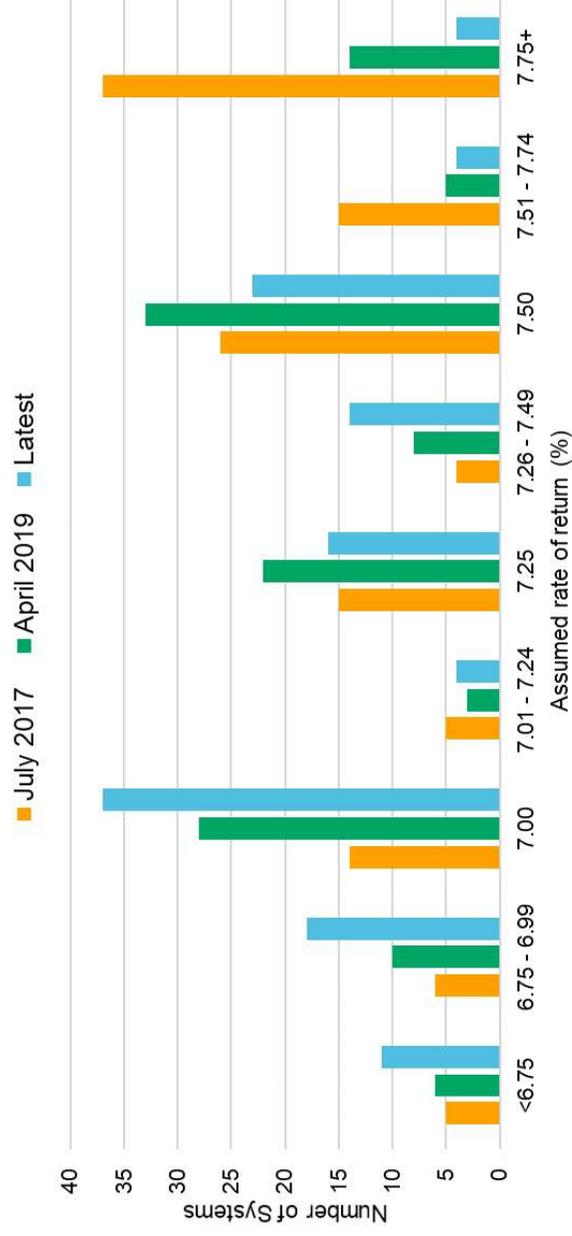
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Comparison to Peer Systems

- The distribution of about 130 systems tracked by the NASRA Public Fund Survey is shown below
- Two years ago, the most common assumption was 7.50%; now the most common assumption is 7.00% and over half of all plans have an assumption of 7.00% or lower

Distribution of Investment Return Assumption

NASRA Public Survey



Source: NASRA (May 2021)

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Effects of Lowering the Assumed Return

- A lower investment return assumption would produce higher calculated liabilities and contribution rates as of the actuarial valuation date
- Liabilities are net present values, as of the valuation date, of a benefit payment projection that stretches far into the future
 - Changing the assumption modifies the *projected* balance of the fundamental cost equation between future investment earnings and future contributions
 - The *actual* balance will depend on actual investment earnings, not on the assumed return adopted by the PERS Board
- The increase in the uncollared 2023-25 system average base employer contribution rate resulting from lowering the assumed return was estimated in our March presentation as:
 - Assumed rate of 7.00% increases system average uncollared contribution rates by 1.5%-1.6% of payroll
 - Assumed rate of 6.80% increases system average uncollared contribution rates by 3.1%-3.2% of payroll
- For PERS, such an assumption change would also lower benefits for future retirements calculated under the Money Match formula

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Considerations in Setting the Return Assumption

- Based on current data from the capital market outlook models, the guiding objectives, and Actuarial Standards of Practice:
- In our opinion it is **necessary to lower** the long-term future investment return assumption by **at least 0.20%**
- We **recommend** reducing the assumption **further** to more closely reflect the current range of outlooks
- The OIC, working with Meketa (primary investment consultant) and Aon (secondary investment consultant), estimates a long-term average future nominal return of 6.6% under the proposed allocation over the next 20 years
- The 6.6% OIC outlook has two building blocks: 4.5% real return and 2.1% inflation
- Social Security's intermediate assumptions outlook for long-term inflation is 2.4%
- Example of combining outlook building blocks: a 4.5% real return outlook plus a 2.4% inflation outlook would result in a 6.9% outlook for nominal return

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Overview of Demographic Assumptions

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Demographic Assumptions

- We statistically analyzed member census data provided by PERS
 - Four years of experience data analyzed for most demographic assumptions
 - Eight years of experience data analyzed for individual member salary increase assumptions
- Recommended assumptions were developed based on the statistical analysis
- Full details of the analysis are in our formal experience study report
- We reviewed the effect of 2020 experience on our analysis, given that the pandemic and related events could lead to outlier results in 2020 that may not provide an appropriate statistical basis for a forward-looking assumption
- For mortality, we ultimately removed 2020 experience from our analysis due to higher death rates across much of the retiree population
- For school district salary increase, we removed 2020 experience since it was noticeably lower than other years and may have been driven by pandemic-related furloughs
- For other assumptions, there was not as clear a case to remove or adjust 2020 experience, so the 2020 experience data was included

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Summary of Demographic Assumptions

- Mortality assumptions mostly unchanged and continue to use base mortality tables specific to current and former governmental employees in public plans
 - Also incorporate most recent data in assumption for projected future mortality improvement
- Adjust likelihood of retirement assumption at some ages where recent experience differed from current assumption
- Increase merit portion of individual member salary assumption for all three groups
- Adjust pre-retirement termination assumptions for one group
- Adjust two of three disability incidence assumptions
- Updates to assumed final average salary adjustments for factors such as unused vacation and sick leave for most groups for Tier 1/Tier 2 members eligible under those provisions
- Updates to assumed lump sum and service purchase election rates
- Adjustments to post-retirement medical program assumptions
 - Participation levels (RHIA & RHIPA)
 - Healthcare inflation assumption for RHIPA program

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Mortality Assumption

- For each group, the mortality assumption consists of two parts:
 - A **base table** – for a given age, lists a probability of death at that age
 - A **projection scale** – modifies base table entries to reflect anticipated continued mortality improvement over time
 - Reflects common-sense understanding that a new retiree today has a longer life expectancy than a new retiree 25 years ago...and that a new retiree 25 years from now is reasonably anticipated to have a longer life expectancy than a new retiree today
- We recommend continuing to use “Pub-2010” base tables from the Society of Actuaries (SOA) Public Plans Mortality Study published in January 2019
 - For School District males, we recommend using a blend of 80% teacher mortality and 20% general mortality, rather than 100% teacher mortality used previously
 - Consistent with recent experience for this group, and reasonable given that the school district workforce includes teachers and non-teachers

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Mortality Assumption

- ORS 238.607: adopted actuarial equivalency factors *must use the best actuarial information on mortality available at the time*
 - We separately reviewed police and fire mortality per ORS 238.608
 - We matched PERS experience to the SOA's Public Plans ("Pub-2010") base tables
 - PERS was one of the systems that contributed data to the study; in general the tables fit experience well
 - Calibrated to PERS experience as needed with "age set-backs" or other adjustments to standard table
 - For mortality improvement projection scale, maintained approach adopted in prior experience study of using a projection scale based on 60-year average annual improvement from Social Security mortality experience
 - Updated to reflect most recent information available at the time (through 2017)
 - This update leads to slightly more projected mortality improvement (longer life expectancy) at most ages

Technical details on our recommendation and more information on the mortality assumption are in our formal Experience Study report

Mortality Assumption

- Illustrative effect of assumption changes for non-disabled retiree:

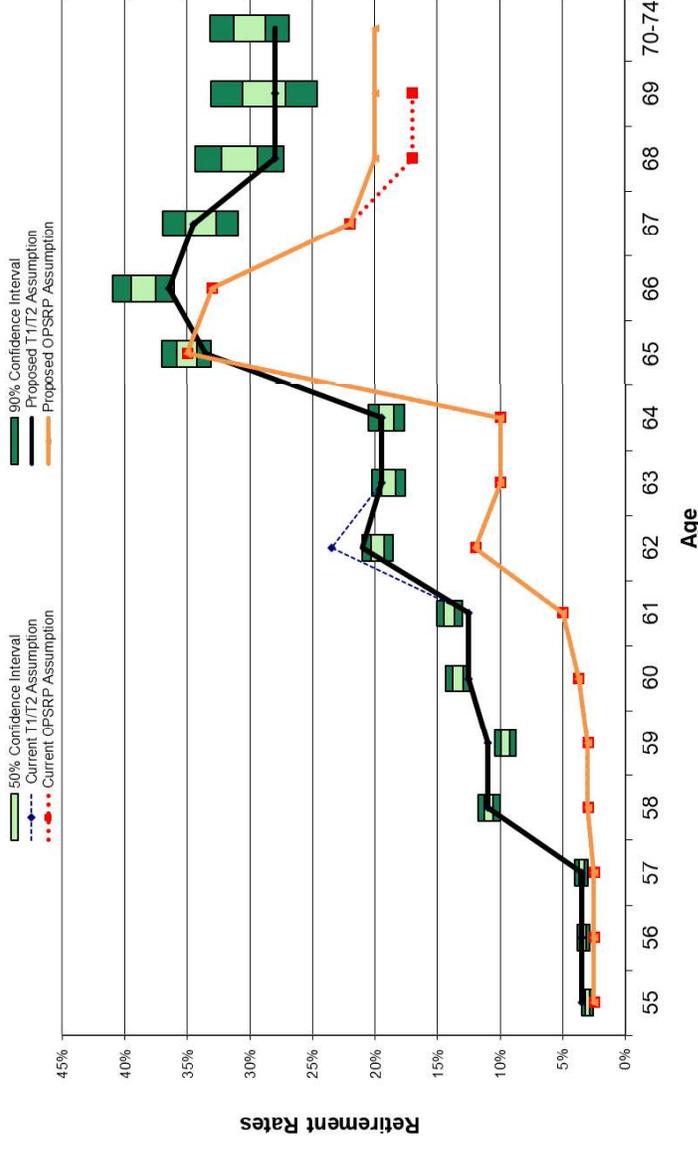
Future Life Expectancy (in years)	Retires at Age 60 in 2021			Retires at Age 60 in 2041		
	Current	New	Change	Current	New	Change
School District Male	27.9	27.7	-0.2	29.1	29.0	-0.1
General Service Male	27.1	27.2	0.1	28.5	28.7	0.2
Police & Fire Male	25.9	26.0	0.1	27.2	27.4	0.2
School District Female	30.0	30.2	0.2	31.2	31.4	0.2
General Service Female	28.7	28.9	0.2	30.0	30.2	0.2
Police & Fire Female	28.7	28.9	0.2	30.1	30.3	0.2

- The table above has three assumed preconditions, all of which serve to increase the life expectancy:
 - The individual is assumed to have already survived to age 60
 - The individual is assumed to have served in PERS-covered employment
 - The individual is assumed to not be disabled as of age 60

Rate of Retirement Assumption

- The likelihood that an eligible member retires at a given age
- Structure:
 - School District
 - Other General Service
 - Police & Fire
 - Divided into 3 service bands
 - Tier 1/Tier 2 vs. OPSRP
- Modifications made to assumptions at certain ages to more closely align with recent experience
- Also extended age at which 100% retirement assumption starts to 70 for Police & Fire and 75 for all others

School District
Members with 15 - 29 Years of Service

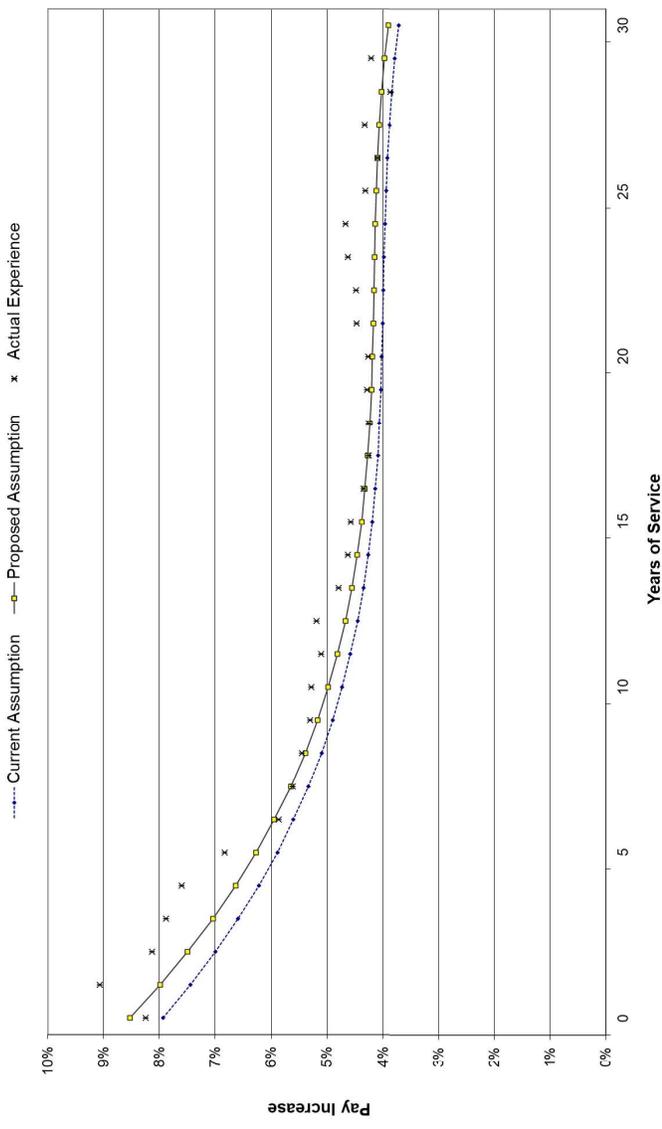


Example shown above. Recommendations for other groups shown in detailed Experience Study report.

Individual Member Salary Increase Assumption

- Reflects combined effects of merit/longevity, general wage growth and inflation assumptions
 - Reviewed eight years of individual pay increases
- Structure:
 - School District
 - Other General Service
 - Police & Fire
- Actual recent experience was generally higher than the current assumption for each group
- In calculating actual experience, we removed experience years with significant one-off changes
 - Salary increases associated with elimination of pick-up
 - 2020 school district furloughs

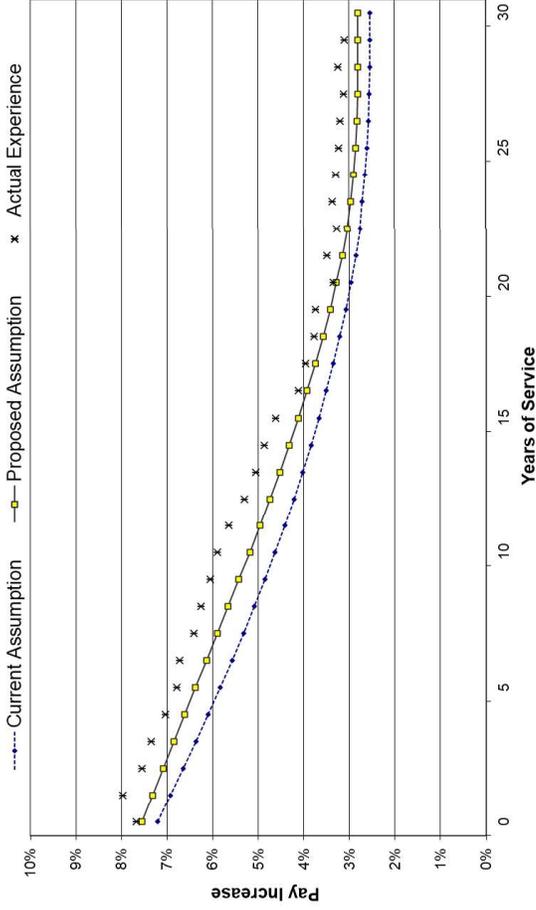
Police & Fire



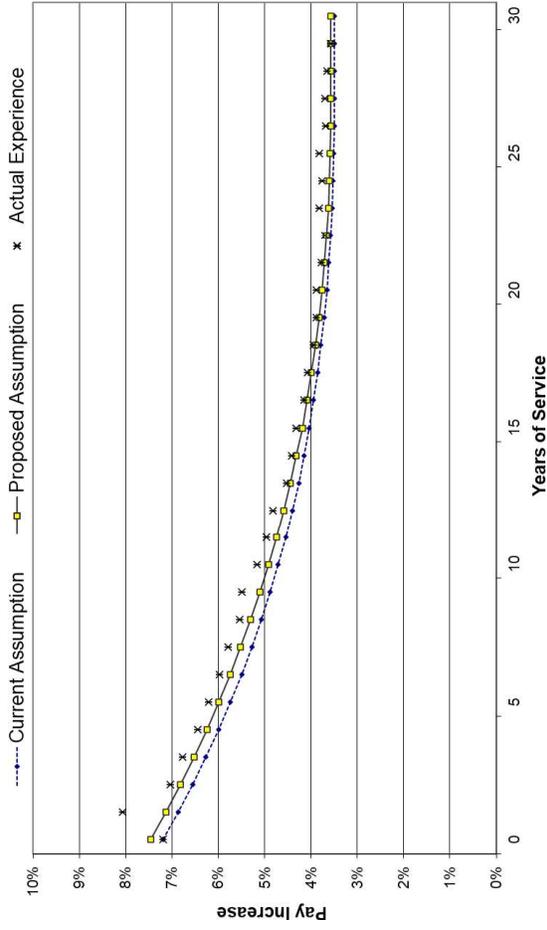
Individual Member Salary Increase Assumption

- School District and Other General Service had higher increases than assumed

School Districts



Other General Service

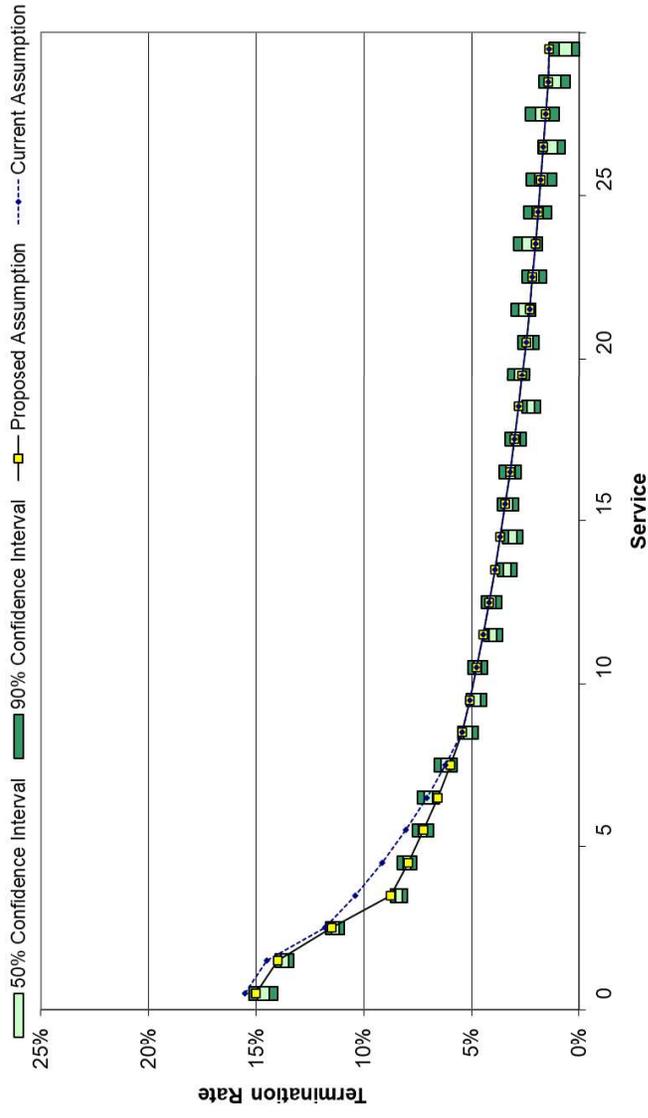


- Assumptions updated reflecting a blend of current assumption and recent observed experience

Pre-Retirement Employment Termination Assumption

- The likelihood that a member leaves employment at a given service level prior to retirement eligibility for reasons other than death or disability
- We recommend adjusting the early years of the assumption for one of the five groups
 - Reflects relatively minor, but statistically significant, differences between the current assumption and observed experience

Other General Service Female



Example shown above. Recommendations for other groups shown in detailed Experience Study report.

Final Average Salary Adjustments

- In the valuation, we apply assumptions regarding the increase in final average salary for Tier 1/Tier 2 members attributable to:
 - Unused sick leave
 - Lump sum distribution of vacation pay (only affects Tier 1)
- Only relevant when benefits are calculated using Full Formula or Formula Plus Annuity
- As remaining Tier 1/Tier 2 actives become a smaller and longer-service group, experience has generally increased (though the assumption applies to a smaller group)
- We adjusted our analysis to more heavily weight experience for higher liability members, and recommend some adjustments as shown below to more closely track recent experience:

Unused Sick Leave	Current Assumption	Proposed Assumption
State GS Male	7.00%	8.25%
State GS Female	3.75%	5.00%
School District Male	7.75%	9.50%
School District Female	5.75%	6.50%
Local GS Male	5.25%	7.25%
Local GS Female	3.50%	4.50%
State Police & Fire	4.00%	4.25%
Local Police & Fire	7.25%	7.50%
Inactive Members	3.25%	5.00%

Tier 1 Vacation Cash Out	Current Assumption	Proposed Assumption
State GS	2.25%	2.50%
School District	0.25%	0.25%
Local GS	3.25%	3.50%
State Police & Fire	2.75%	2.75%
Local Police & Fire	4.25%	4.75%



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Member Redirect Offset

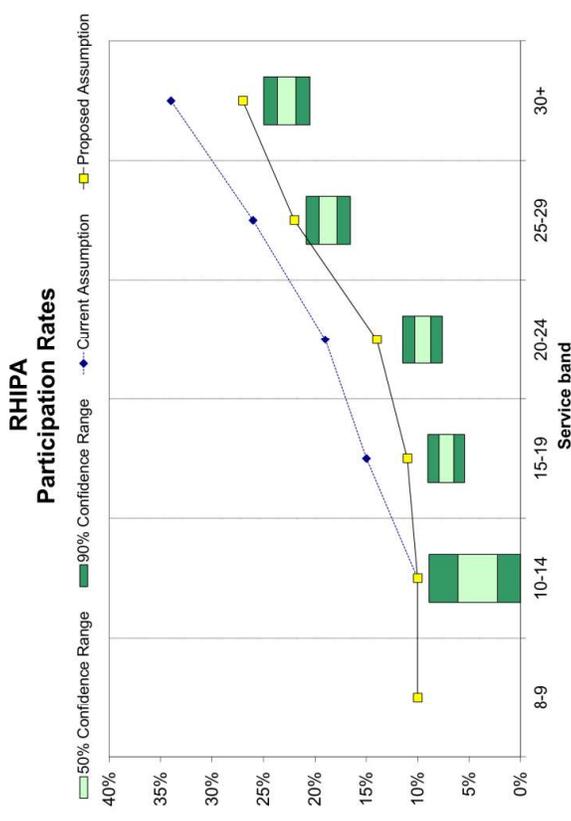
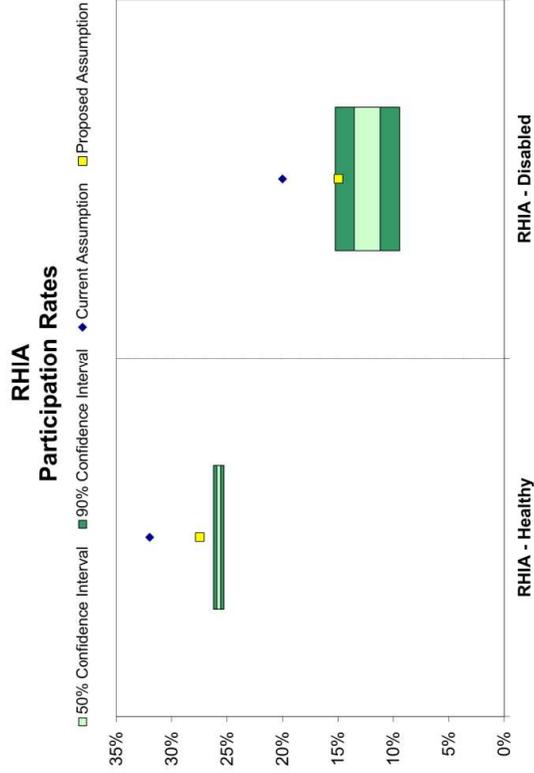
- Senate Bill 1049 redirected a portion of the 6% of pay member contributions to Employee Pension Stability Accounts (EPSAs) that help fund the Tier 1/Tier 2 and OPSRP programs
 - 2.50% of pay for Tier 1/Tier 2 and 0.75% of pay for OPSRP
 - Both originally only applied to members with salary greater than \$2,500 per month (indexed)
 - House Bill 2906 modifies this level to \$3,333 per month effective in 2022
 - Applies when funded status (including side accounts) is less than 90% in the rate-setting valuation
- The 2021-2023 employer contribution rates adopted by the Board in October 2020 were based on SB 1049 and reflect projected system-average member redirect offset contributions of:
 - 2.45% of Tier 1/Tier 2 payroll
 - 0.70% of OPSRP payroll
- The 0.05% of payroll difference between the actual offset for affected members and the assumed system-wide effect of the redirect reflects the estimated effect of SB 1049's \$2,500 (indexed) monthly pay threshold

Member Redirect Offset

- For the 2023-2025 biennium, the member redirect is expected to continue to apply (the relevant funded status is unlikely to exceed 90% by 12/31/2021)
- Based on the updated pay threshold and the member salary distribution from the most recent valuation, for calculation of 2023-2025 employer contribution rates we recommend the Board adopt projected system-average member redirect offsets of:
 - 2.40% of Tier 1/Tier 2 payroll
 - 0.65% of OPSRP payroll
- The increase from 0.05% to 0.10% of payroll for the estimated effect of the pay threshold provisions is due to the change in the threshold from \$2,500 to \$3,333 made by HB 2906

RHIA and RHIPA Assumptions

- Updates to retiree healthcare participation assumptions based on observed experience:
 - Healthy RHIA: Lower participation rate from 32.0% to 27.5%
 - Disabled RHIA: Lower participation rate from 20% to 15%
 - RHIPA: Lower rates in longer-service categories
- Health care cost trend assumption applied to RHIPA full subsidy amount was also updated
- Based on analysis by Milliman health actuaries



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Estimated Effect of Assumption Changes

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Preliminary Effect of Changes – Liability

- Estimated effect on combined Tier 1, Tier 2, and OPSRP liabilities based on preliminary valuation work

12/31/2020 Accrued Liability	Assumed Return 7.2%	Assumed Return 7.0%	Assumed Return 6.9%	Assumed Return 6.8%	Assumed Return 6.6%
Current assumptions	\$91.8 B				
Salary/sick lv/vacation	\$0.3 B				
Other demographic assumptions	<u>\$0.0 B</u>				
Revised assumptions (before assumed return)	\$92.2 B				
Assumed return	<u>\$0.0 B</u>	<u>\$2.0 B</u>	<u>\$3.0B</u>	<u>\$4.0 B</u>	<u>\$5.9B</u>
Revised assumptions	\$92.2 B	\$94.1 B	\$95.1 B	\$96.1 B	\$98.1 B

Numbers shown may not add due to rounding

Preliminary Effect of Changes – Uncollared 2023-2025 Rates

- Estimated impact on uncollared system-average advisory pension rates for 2023-2025 based on preliminary valuation work
- Results do not reflect any adjustment for already known 2021 asset returns

	Assumed Return 7.2%		Assumed Return 7.0%		Assumed Return 6.9%		Assumed Return 6.8%	
	UAL	Normal Cost						
Salary/sick lv/vaca	0.2%	0.4%	0.2%	0.4%	0.2%	0.4%	0.2%	0.4%
Other assumptions	(0.1%)	0.0%	(0.1%)	0.0%	(0.1%)	0.0%	(0.1%)	0.0%
Assumed return	<u>0.0%</u>	<u>0.0%</u>	<u>0.9%</u>	<u>0.6%</u>	<u>1.4%</u>	<u>0.8%</u>	<u>1.9%</u>	<u>1.1%</u>
Total	0.1%	0.4%	1.0%	0.9%	1.5%	1.2%	1.9%	1.5%
Combined Total	0.4%		1.9%		2.7%		3.4%	

Changes shown are stated as a percent of payroll, reflect a 3.40% payroll growth assumption, and exclude changes for the RHIA & RHIPA programs. Numbers may not add due to rounding.

Agenda Items – Remaining 2021 Meetings

- Needed action before completion of actuarial valuations:
 - Adoption of assumptions and methods for use in the following valuations:
 - December 31, 2020 “advisory” valuation that estimates 2023-2025 rates
 - December 31, 2021 valuation that calculates recommended 2023-2025 rates
- October meeting:
 - Presentation of system-level December 31, 2020 actuarial valuation results
 - Adoption of actuarial equivalency factors effective January 1, 2022
- December meeting:
 - Acceptance of the December 31, 2020 actuarial valuation report and employer-specific advisory 2023-2025 contribution rates
 - Financial modeling over the next twenty years under a variety of possible future scenarios for actual investment return



Appendix

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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, along with prior presentations to the PERS Board, including the December 2020, February 2021, and March 2021 presentations to the PERS Board should be referenced for additional detail on the data, assumptions, methods, and plan provisions underlying this presentation. Preliminary December 31, 2020 valuation results shown in the presentation reflect data provided as of that date, which will be summarized in our forthcoming December 31, 2020 actuarial valuation report 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 as well as capital market expectations provided by Meketa, capital market information published by Horizon Actuarial Services, and information presented to the Oregon Investment Council. 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 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.

In assessing the Milliman capital market expectations presented in this report, per Actuarial Standards of Practice we disclose reliance upon a model developed by Milliman colleagues who are credentialed investment professionals with expertise in capital outlook modeling.

All costs, liabilities, rates of interest, and other factors for the System have been determined on the basis of actuarial assumptions and methods which in our professional opinion 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 financial 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 assumptions used in the actuarial valuation.



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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 Data

Except where noted, our analysis of demographic assumptions was based on data for the experience period from January 1, 2017 to December 31, 2020 as provided by the Oregon Public Employees Retirement System (PERS). PERS is solely responsible for the validity, accuracy and comprehensiveness of this information; the results of our analysis can be expected to differ and may need to be revised if the underlying data supplied is incomplete or inaccurate.

Member data was summarized according to the actual and potential member decrements during each year. Actual and potential decrements were grouped according to category of employment, sex, age, and/or service depending on the demographic assumption.

Where possible, we attempted to identify decrements that were spread across two calendar years (for example, if a member retired in one year, but didn't commence benefits until January 1 of the following year) so that we could reflect these decrements as individual events.

In order to capture experience across a broader range of budget, collective bargaining, and economic cycles, our analysis of salary increases covered observed salary experience from 2012 through 2020 as provided by PERS.

Our analysis focused on observed salary levels during consecutive calendar years for members who remained in active employment across both years, so that the observed change in salary would not be influenced by the reduced number of months worked during a year in which the member decrements. Similarly, we focused on experience above the 5th percentile and below the 95th percentile of observed salary increases in order to avoid the potential distorting effect of including extreme salary changes that likely resulted from unusual events.

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Rate Collar – Current Policy Limits Sum of Two Rate Components

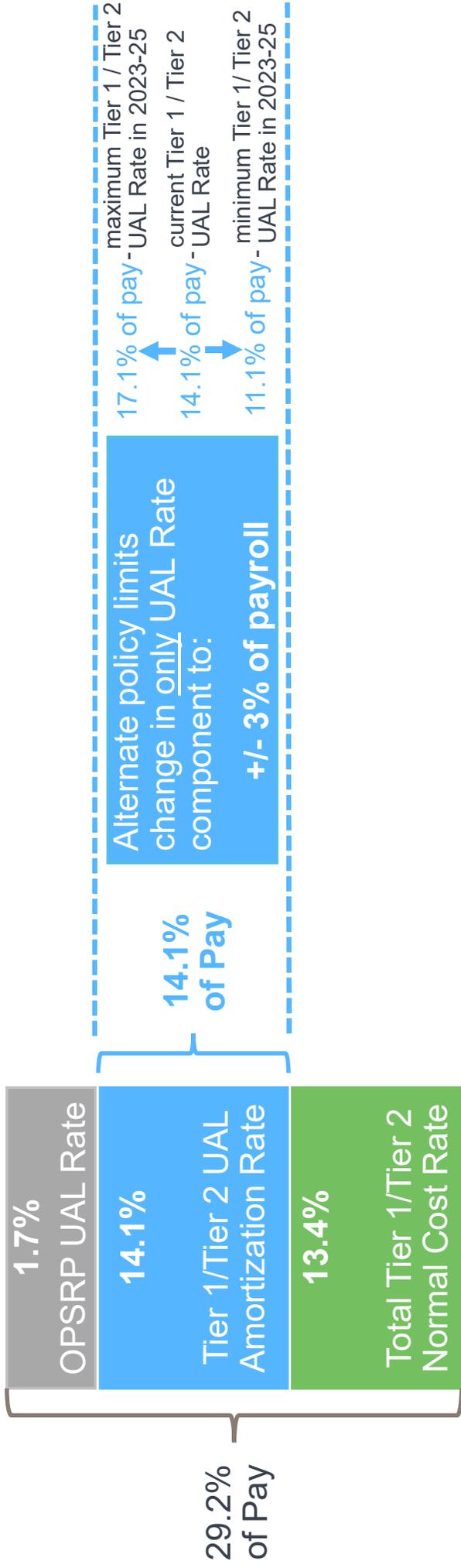
- School district without a side account – pension contribution rate on Tier 1/Tier 2 payroll



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Rate Collar – Alternate Policy Limits Only UAL Rate Components

- School district without a side account – pension contribution rate on Tier 1 / Tier 2 payroll



Potential Pension Rate in 2023-25

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Appendix

Actuarial Basis

Capital Market Assumptions – Milliman Real Return Outlook Adjusted for 2.40% Inflation Assumption

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 input provided by Meketa (OIC’s primary consultant) and reflects proposed changes to the Oregon Investment Council’s target allocation for the Oregon PERS Fund that are expected to be adopted in June 2021.

	Annual Arithmetic Mean	20-Year Annualized Geometric Mean	Annual Standard Deviation	Policy Allocation
Global Equity	7.11%	5.85%	17.05%	30.62%
Private Equity	11.35%	7.71%	30.00%	25.50%
US Core Fixed Income	2.80%	2.73%	3.85%	23.75%
Real Estate	6.29%	5.66%	12.00%	12.25%
Master Limited Partnerships	7.65%	5.71%	21.30%	0.75%
Infrastructure	7.24%	6.26%	15.00%	1.50%
Commodities	4.68%	3.10%	18.85%	0.63%
Hedge Fund of Funds – MultiStrategy	5.42%	5.11%	8.45%	1.25%
Hedge Fund Equity-Hedge	5.85%	5.31%	11.05%	0.63%
Hedge Fund – Macro	5.33%	5.06%	7.90%	5.62%
US Cash	1.77%	1.76%	1.20%	(2.50%)
US Inflation (CPI-U)		2.40%	1.65%	N/A
Fund Total (reflecting asset class correlations)	7.06%	6.31%*	13.08%	100.00%

* Reflects 0.09% 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 **6.27%**.

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Appendix

Actuarial Basis

Capital Market Assumptions - Horizon

For assessing the expected portfolio return under an additional set of capital market assumptions, we applied the assumptions from the 2020 Survey of Capital Market Assumptions published by Horizon Actuarial Services, LLC. According to the survey report, the 10-year return assumptions shown below represent an average of the expectations for 39 investment advisors responding to the survey.

	10-Year Annualized Geometric Mean	Annual Standard Deviation	Policy Allocation
US Equity – Large Cap	6.16%	16.22%	13.78%
Non-US Equity – Developed	6.80%	18.05%	13.78%
Non-US Equity – Emerging	7.85%	24.23%	3.06%
US Corporate Bonds – Core	2.60%	5.47%	23.75%
US Treasuries (Cash Equivalents)	1.56%	1.78%	(2.50%)
Real Estate	5.75%	16.84%	12.25%
Hedge Funds	4.74%	8.00%	7.50%
Commodities	3.19%	17.60%	0.63%
Infrastructure	6.94%	14.58%	2.25%
Private Equity	9.08%	21.99%	25.50%
Inflation	1.98%		N/A
Fund Total (reflecting asset class correlations)	6.87%*		100.00%

* 10-year annualized geometric median is **6.80%**.

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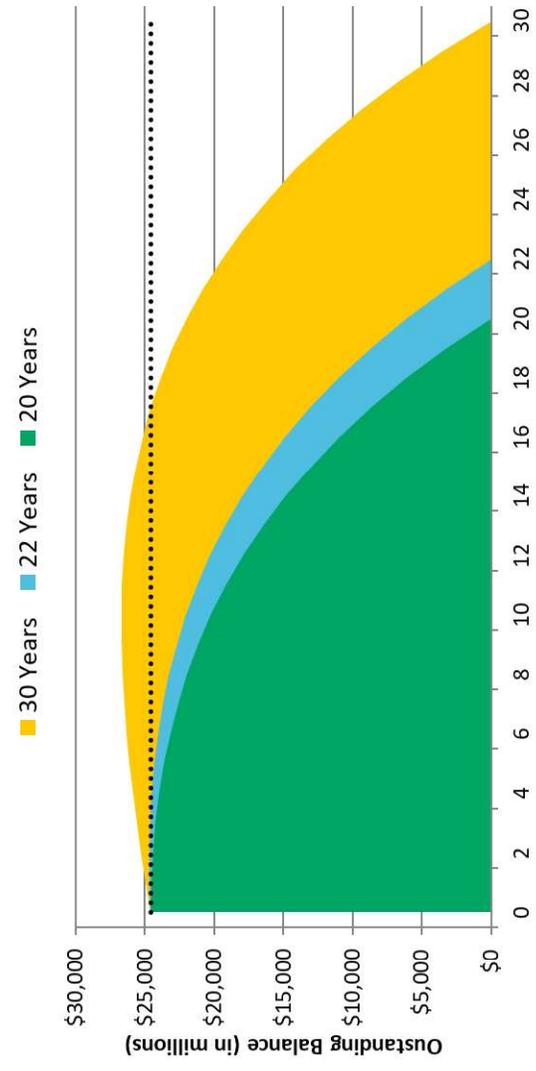
Remaining Balances for 20-, 22-, & 30-Year Amortizations

Current ongoing policy

- Tier 1 / Tier 2: **20 years**
- OPSRP: **16 years**

UAL Balance Over Time by Selected Amortization Period

Level % of pay amortization, 7.20% interest, 3.40% payroll growth



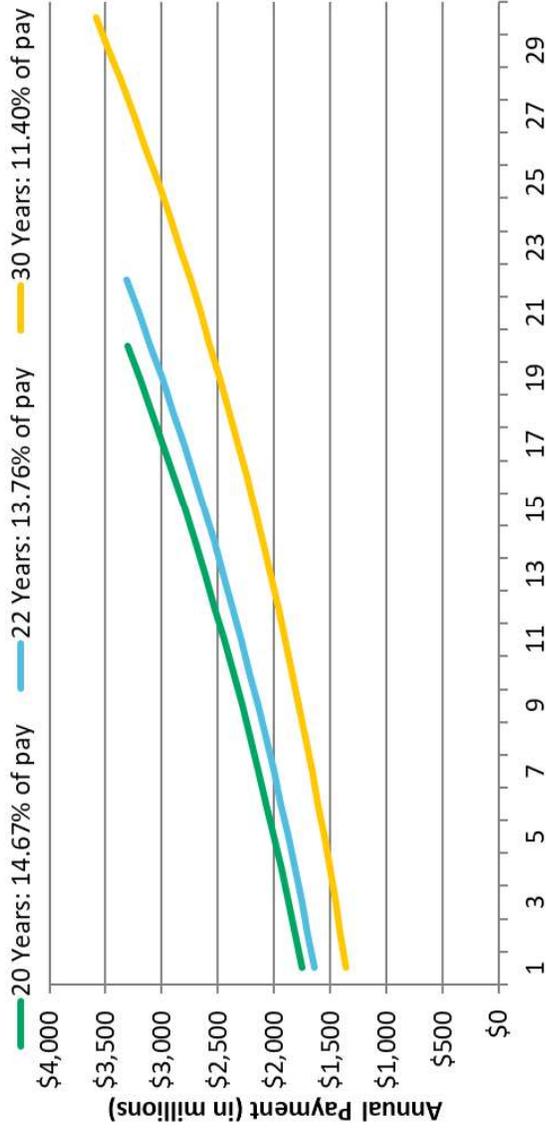
- **Why 20 years or less?** If actual experience matches the assumption...
 - with 22 years zero progress is made in decreasing the initial UAL until year 4
 - with 30 years the UAL has increased by about 9% after the first decade, and zero progress is made in decreasing the initial UAL until year 17

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Illustration of UAL Amortization Periods

Annual UAL Payments by Selected Amortization Period

Level % of pay amortization, 7.20% interest, 3.40% payroll growth



Current policy

- Tier 1 / Tier 2:
20 years
- OPSRP:
16 years

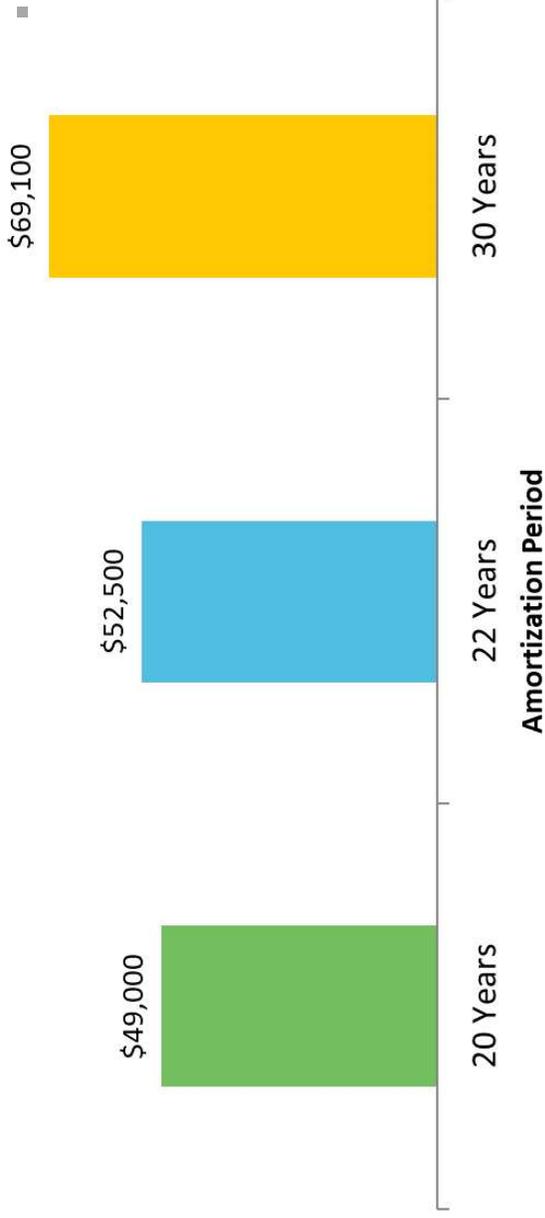
Illustration of UAL Amortization Periods

Current policy

- Tier 1 / Tier 2: **20 years**
- OPSRP: **16 years**

Total Repayment (\$M) by Selected Amortization Period

Level % of pay amortization, 7.20% assumed return, 3.40% payroll growth



This illustrates total amortization payments for a \$24.6 billion shortfall over periods of 20, 22 or 30 years

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Effects of Lowering the Assumed Return

- Lowering the assumption to 6.90% or 6.80% would affect the Money Match calculation for a member age 59½ with a \$135,000 member account balance as of 6/30/2021 as shown:

		Starting Benefit Under Assumed Rate*		
Benefit Commencement		7.20%	6.90%	6.80%
7/1/2021		\$1,895		
12/1/2021		\$1,959		
1/1/2022			\$1,921	\$1,904
4/1/2022			\$1,961	\$1,941
6/1/2022			\$1,986	\$1,968

* Illustration uses 2020 actuarial equivalency mortality in calculation of all benefits

- At a 6.80% assumption, it would take about six months without retirement for the December 2021 initial benefit level to be reached
- At a 6.90% assumed return, it would take about four months
- Illustration ignores Full Formula “floor”, which may mitigate any benefit decrease

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Mortality Assumption

	Current Assumption	Proposed Changes
Healthy Retired	Pub-2010 Generational, with unisex Social Security scale (1955-2015 experience) Healthy Retiree, Sex distinct	Pub-2010 Generational, with unisex Social Security scale (1957-2017 experience) Healthy Retiree, Sex distinct
<ul style="list-style-type: none"> School district male Other GS male P&F male 	<p>Teachers, no set back</p> <p>General Employees, set back 1 year</p> <p>Public Safety, no set back</p>	<p>Blend 80% Teachers/20% General Employees, no set back</p> <p>General Employees, set back 1 year</p> <p>Public Safety, no set back</p>
<ul style="list-style-type: none"> School district female Other GS female P&F female 	<p>Teachers, no set back</p> <p>General Employees, no set back</p> <p>Public Safety, set back 1 year</p>	<p>Teachers, no set back</p> <p>General Employees, no set back</p> <p>Public Safety, set back 1 year</p>
Disabled Retired	Pub-2010 Disabled, Generational with unisex Social Security scale (1955-2015) Sex distinct	Pub-2010 Disabled, Generational with unisex Social Security scale (1957-2017) Sex distinct
<ul style="list-style-type: none"> P&F male Other male P&F female Other female 	<p>50% Public Safety/50% Non-Safety, no set back</p> <p>Non-Safety, set forward 2 years</p> <p>50% Public Safety/50% Non-Safety, no set back</p> <p>Non-Safety, set forward 1 year</p>	<p>50% Public Safety/50% Non-Safety, no set back</p> <p>Non-Safety, set forward 2 years</p> <p>50% Public Safety/50% Non-Safety, no set back</p> <p>Non-Safety, set forward 1 year</p>
Non-Retired Mortality	Pub-2010 Generational, with unisex Social Security scale (1955-2015) Employee (Non-Annuitant), Sex distinct	Pub-2010 Generational, with unisex Social Security scale (1957-2017) Employee (Non-Annuitant), Sex distinct
<ul style="list-style-type: none"> School district male Other GS male P&F male 	<p>Teachers, no set back, scaled 120%</p> <p>General Employees, set back 1 year, scaled 115%</p> <p>Public Safety, no set back, not scaled</p>	<p>Blend 80% Teachers/20% General Employees, no set back, scaled 125%</p> <p>General Employees, set back 1 year, scaled 115%</p> <p>Public Safety, no set back, not scaled</p>
<ul style="list-style-type: none"> School district female Other female 	<p>Teachers, no set back, not scaled</p> <p>General Employees, no set back, scaled 125%</p> <p>Public Safety, set back 1 year, not scaled</p>	<p>Teachers, no set back, not scaled</p> <p>General Employees, no set back, scaled 125%</p> <p>Public Safety, set back 1 year, not scaled</p>

Retirement System Risks

- Oregon PERS, like all defined benefit plans, is subject to various risks that will affect future plan liabilities and contribution requirements, including:
 - **Investment risk:** the potential that investment returns will be different than expected
 - **Demographic risks:** the potential that mortality experience, retirement behavior, or other demographic experience for the plan population will be different than expected
 - **Contribution risk:** the potential that actual future contributions will be materially different than expected, for example if there are material changes in the System's covered payroll
- The results of an actuarial valuation are based on one set of reasonable assumptions, but it is almost certain that future experience will not exactly match the assumptions.
- Further discussion of plan risks and historical information regarding plan experience are shown in our annual actuarial valuations. In addition, our annual financial modeling presentation to the PERS Board illustrates future outcomes under a wide range of future scenarios reflecting variation in key risk factors.