2021 Report on Financial Condition and Economic Experience Study

PREPARED FOR THE PENSION FUNDING COUNCIL • AUGUST 2021

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Contents

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Letter of Introduction
2021 Report on Financial Condition and Economic Experience Study

August 2021

As required under the Revised Code of Washington (RCW) 41.45.030, this report documents the results of a study on the financial condition and long-term economic experience for the Washington State retirement systems performed by the Office of the State Actuary (OSA).

The primary purpose of this report is to assist the Pension Funding Council (PFC) in evaluating whether to adopt changes to the long-term economic assumptions identified in RCW 41.45.035. We do not recommend using this report for other purposes.

The focus of the Report on Financial Condition (RFC) is on the financial health of the retirement systems, whereas the Economic Experience Study (EES) involves comparing actual economic experience with the assumptions made and considering future expectations for these assumptions. Pursuant to statute, the EES also includes a set of recommended long-term economic assumptions made by the State Actuary.

We encourage you to submit any questions you might have concerning this report to our mailing address or our e-mail address at state.actuary@leg.wa.gov. We also invite you to visit our website (leg.wa.gov/osa) for further information regarding the actuarial funding of the Washington State retirement systems.

Sincerely,

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SECTION ONE: Report on Financial Condition

Report on Financial Condition

The RFC brings together key findings and themes from pension reports produced by OSA as required under RCW 41.45.030. We present this report and the EES to assist the PFC in evaluating whether to adopt changes to the long-term economic assumptions identified in RCW 41.45.035.

We use both affordability and solvency measures to report on the financial condition (or health) of the Washington State retirement systems. For this report, we define the following:

- ❖ Affordability is the ability to provide adequate funding to the pension plans.
- ❖ Solvency is the ability of the pension plans to pay for member benefits when due.

This report presents our assessment of the affordability and solvency of Washington State retirement systems by reviewing both current and projected actuarial measures. The RFC is broken into the following sections:

- ❖ **Current Status of Retirement Systems.**
- ❖ **Where the Retirement Systems Are Headed.**
- ❖ **How the Future Can Look Different.**
- ❖ **Planning for the Future.**

We advise the reader to take into consideration affordability and solvency measures outlined in all four sections of this report before making a determination on the financial condition of the retirement systems. It is important to consider this report in its entirety because the overall health of the Washington State retirement systems is dependent on various components and historical trends may not match future projections.

As of the publication of this report, the long-term impact of COVID-19 on the Washington State retirement systems is not yet known. We provide a brief discussion of its potential impacts on affordability and solvency measures in the **How the Future Can Look Different** section of this report.

Current Status of Retirement Systems

Adequate funding improves the health of the Washington State retirement systems. The adequate (or required) contributions represent the contributions necessary to satisfy full funding under current benefit provisions, assumptions, methods, and funding policy defined under Chapter 41.45 RCW.

OSA performs actuarial valuations on the Washington State retirement systems. For these valuations, OSA calculates the required contribution rates as a percentage of salary necessary to fully fund the systems. The rates are based on the adopted funding policy and long-term assumptions disclosed in the Actuarial Valuation Report (AVR). The results of the valuations are presented to the PFC and the Law Enforcement Officers' and Fire Fighters' Retirement System (LEOFF) Plan 2 Board, who adopt contribution rates on a bi-annual basis, subject to revision by the Legislature. The adopted or enacted contribution rates may differ from the required contribution rates.

The following table displays the adopted employee and employer contribution rates for the 2021-23 Biennium. With exception of the Washington State Patrol Retirement System (WSPRS), these contribution rates are lower than the prior two biennia.

Adopted 2021-23 Contribution Rates

	Employee	Employer[1]		
System	Normal Cost	Normal Cost	UAAL	Total
PERS[2]	6.36%	6.36%	3.71%	**10.07%**
TRS[2]	8.05%	8.05%	6.19%	**14.24%**
SERS[2]	7.76%	7.76%	3.71%	**11.47%**
PSERS	6.50%	6.50%	3.71%	**10.21%**
LEOFF[3]	8.53%	8.53%	0.00%	**8.53%**
WSPRS	8.61%	17.66%	N/A	**17.66%**

[1] Excludes DRS administrative expense fee.

[2] Plan 1 members' contribution rate is statutorily set at 6.0%. Members in Plan 3 do not make contributions to their defined benefit.

[3] LEOFF 2 contribution rates. No member or employer contributions are required for LEOFF Plan 1 when the plan is fully funded.

As discussed in the *2019 Report on Financial Condition and EES*, contribution rates had been trending upwards prior to the 2021-23 Biennium and reached historic highs in some systems. However, the contribution rates were expected to begin a downward trend beginning with the 2021-23 Biennium which is consistent with what we observed. The reasons for the expected downward trend in contribution rates are explained in the **Where the Retirement Systems Are Headed** section.

The following table summarizes the change in total employer (normal cost plus Unfunded Actuarial Accrued Liability [UAAL]) contribution rates over the last four biennia. We summarize the historical contribution rates below because the rates collected by employers can affect the affordability measures. In general, affordability measures improve with a decrease in adequate contribution rates because it requires a smaller portion of the budget.

Total Employer Contribution Rates[1]				
	2015-17 Biennium	2017-19 Biennium	2019-21 Biennium	2021-23 Biennium
System	*Collected*	*Collected*	*Collected*	*Adopted*
PERS[2]	11.00%	12.52%	12.68%	10.07%
TRS[2]	12.95%	15.02%	15.33%	14.24%
SERS[2]	11.40%	13.30%	13.01%	11.47%
PSERS[2]	11.36%	11.76%	11.96%	10.21%
LEOFF[3]	8.41%	8.75%	8.59%	8.53%
WSPRS	8.01%	12.81%	17.50%	17.66%

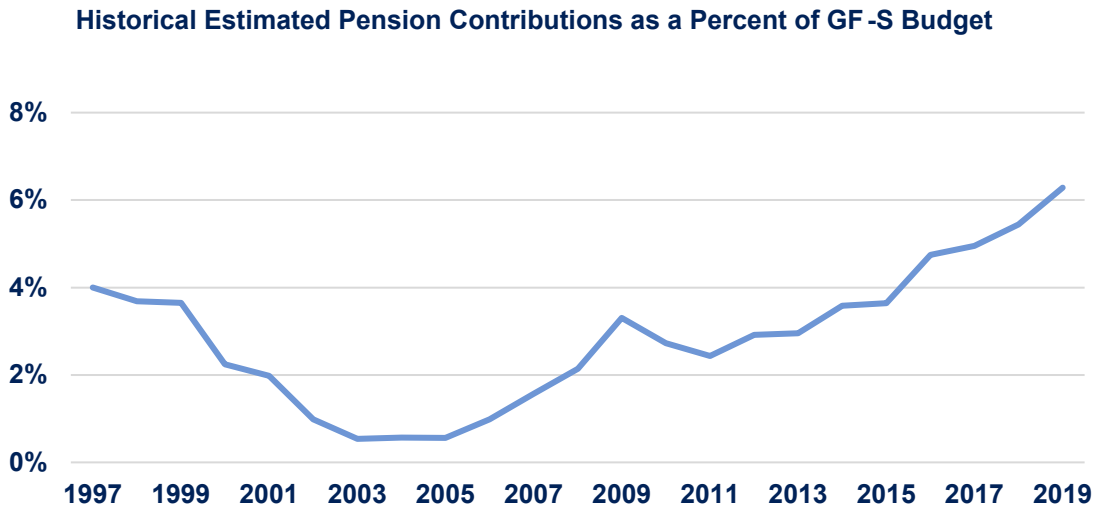
[1] *Excludes DRS administrative expense fee.*

[2] *Includes the Plan 1 UAAL rate.*

[3] *LEOFF 2 contribution rates. No member or employer contributions are required for LEOFF 1 when the plan is fully funded.*

Other measures to assess the affordability of the Washington State retirement systems include contributions as a percent of budget and plan maturity measures. These are just two examples of tools to assess affordability and are not meant to be exhaustive. Please see our Commentary on Risk webpage for additional measures as well as an explanation of the individual measures.

The following graph summarizes the historical estimated General Fund-State (GF-S) pension contributions as a percent of the GF-S budget. The highest estimated GF-S pension contributions as a percent of GF-S budget occurred in Fiscal Year (FY) 2020, coinciding with the highest collected contribution rates for most systems. As discussed in the following section, we expect this ratio will decline in the future.



Note: We rely on actual GF-S budgets found in the Washington State Economic and Revenue Forecast reports. We also rely on pension contirbutions found in Annual Comprehensive Financial Reports and our actuarial valuation reports. To estimate GF-S contributions, we apply our historical assumed fund splits to the applicable year. See Plan Maturity Measures on our Commentary on Risk webpage for additional details.

We also considered how the relationship of pension contributions to the budget would look for local employers. According to the *2020 DRS Annual Comprehensive Financial Report*, there are approximately 250 cities and towns employing members of the Washington State retirement systems. This information can be time consuming to summarize for each employer, so we focused our analysis on select local employers based on the amount of their pension contributions and also their geographic location. We've begun compiling this information for select local employers, but it was not included in this report due to data limitations. As of publication of this report, we believe the data is limited because it is only available since 2016. We would also like to confirm our analysis with the local employers. Limitations aside, we internally calculated the ratio of pension contributions relative to the budget, for these select employers, and observed this ratio to range between 4.5 percent and 6.0 percent. This range is comparable to what we observed for the previous graph, Historical Estimated Pension Contributions as a Percent of GF-S Budget; however, we acknowledge that this range may not apply to every local employer. We will continue to track and monitor this relationship and may post results for local employers in a future report on financial condition.

The previous graph provides information on what the state contributed in the past, but we also consider who pays for these pension contributions. Active employees, excluding LEOFF 1 and Plan 3 members, and their employers contribute to the defined benefits of the Washington State retirement systems. The contributions and investment returns fund the expected benefits of the systems. As the retirement systems mature, the ratio of active members to retirees declines. As an example, we observed approximately 0.5 fewer actives per retiree, across all retirement plans, over the last ten years.

A decrease of the actives to retirees ratio can indicate more potential pressure on contributing members and their employers to cover pension costs. A table of the maturity measures of the Washington State retirement systems, by plan, can be found on our Commentary on Risk webpage.

The funded ratio, as a consistent measurement over time, also provides insight into the impact of past funding. OSA uses the funded ratio as a solvency measure in this report. The ratio helps answer the question, "Has the plan accumulated sufficient assets to pay the expected benefits that have been earned to date by its members?" It equals the plan assets divided by the present value of all accrued (or earned) benefits under the applicable actuarial cost method. For example, if the funded ratio of a plan is 103 percent, then we assume there is $1.03 in assets for every $1.00 of present value of accrued (or earned) benefits. For these calculations, we use the long-term expected rate of return consistent with the state's funding policy to determine the present value of accrued benefits.

The funded ratio (or funded status) can be significantly impacted by changes in assumptions and/or actual plan experience. In total, the funded status has increased since the 2014 measurement, but the individual plans went through a period of declining funded statuses followed by a period of increasing funded statuses.

- **Period of Declining Funded Statuses** – In 2015 and 2016, the retirement systems experienced lower than expected rates of return, a decrease in the assumed return on investments, and a phase-in of the budget impact of updated mortality assumptions. During the phase-in, collected contribution rates were below the required rates in absence of the phase-in leading to short-term underfunding.
- **Period of Increasing Funded Statuses** – Following 2016, the retirement systems experienced further decreases to the assumed return on investments, but this cost was partially offset by other changes in economic assumptions. In addition, the systems experienced higher than expected returns for FYs 2017 through 2019 as well as new demographic assumptions which improved the funding levels of the systems.

The following table provides the funded ratio as of our 2019 AVR as well as a history dating back to our 2014 AVR. While we show a funded ratio both by individual plan and on a combined basis, keep in mind that absent a qualified merger or plan termination, a plan cannot use another plan's assets to pay its benefits.

Funded Status on an Actuarial Value Basis*										
(Dollars in Millions)	PERS		TRS		SERS	PSERS	LEOFF		WSPRS	Total
	Plan 1	Plan 2/3	Plan 1	Plan 2/3	Plan 2/3	Plan 2	Plan 1	Plan 2		
Accrued Liability	$11,535	$42,600	$8,405	$16,883	$6,474	$685	$4,077	$11,992	$1,370	$104,020
Valuation Assets	$7,461	$40,766	$5,558	$15,311	$5,872	$690	$5,734	$13,294	$1,301	$95,987
Unfunded Liability	**$4,074**	**$1,833**	**$2,847**	**$1,572**	**$602**	**($6)**	**($1,657)**	**($1,302)**	**$70**	**$8,033**
Funded Ratio										
2019	**65%**	**96%**	**66%**	**91%**	**91%**	**101%**	**141%**	**111%**	**95%**	**92%**
2018	60%	91%	63%	90%	89%	96%	135%	108%	93%	89%
2017	57%	89%	60%	91%	88%	95%	131%	109%	92%	86%
2016	56%	87%	61%	89%	87%	94%	126%	105%	91%	84%
2015	58%	88%	64%	92%	89%	95%	125%	105%	98%	86%
2014	61%	90%	69%	94%	91%	96%	127%	107%	100%	87%

Note: Totals may not agree due to rounding.

**Liabilities valued using the EAN cost method at an interest rate of 7.5%. All assets have been valued under the actuarial asset method.*

The actuarial community has not agreed on a funded ratio threshold that determines a plan as "healthy" and a single measure like the funded ratio may not be sufficient to make that determination; however, we consider all open plans as well as LEOFF Plan 1 on target for full funding. As of the latest measurements, the Public Employees' Retirement System (PERS) Plan 1 and the Teachers' Retirement System (TRS) Plan 1 are less well-funded compared to their open plan counterparts, and most of their members have already retired. For this reason, PERS 1 and TRS 1 require additional contributions in order to get their funding levels back on track for full funding. As defined under RCW 41.45.060, only employers make the additional contributions to PERS 1 and TRS 1; however, the state recently made a commitment[1] to make an additional payment of $800 million in FY 2023 towards the unfunded liability of TRS 1.

In summation, we observe the selected affordability and solvency measures were mixed over the duration of the observed period; however, these measures have improved more recently. Reasons for this include:

- The most recently adopted contribution rates have begun an expected decline which improves affordability of the retirement plans. As the contribution rates decline, so will the GF-S as a percent of GF-S budget.
- The retirement systems are maturing, which means that when pension costs increase, a greater burden is often placed on members and employers than in the past.
- The funded status has generally trended upwards since 2014 and we believe all open plans and LEOFF 1 remain on target for full funding.
- The recent adoption of adequate (or, actuarially required) contribution rates has put the retirement systems in a good position for the future.
- Consistent with current funding policy, the closed PERS 1 and TRS 1 require additional contributions in order to achieve full funding. TRS 1 solvency will be further improved by the state's recent $800 million additional funding commitment to the plan for FY 2023. The following section of this report looks ahead and details when we project those plans to reach full funding in the future.

[1]*Section 747 of Engrossed Substitute Senate Bill 5092 (2021).*

Where the Retirement Systems are Headed

Looking ahead, we expect the contribution rates for the Washington State retirement systems will continue a period of decline. Under this "expected" scenario, we assume policy makers adopt adequate contribution rates as well as no changes to current assumptions or benefit provisions. Future changes to assumptions may be required to maintain adequate contribution rates and those assumption changes could lead to future contribution rate increases that we did not take into account in this section.

The following table summarizes the projected total employer (normal cost plus UAAL) contribution rates over the next three biennia. Except for WSPRS, the projected Plan 2 employee contribution rates are expected to follow a similar directional trend as employer rates.

Total Employer Contribution Rates[1]				
	2021-23 Biennium	2023-25 Biennium	2025-27 Biennium	2027-29 Biennium
System	*Adopted*	*Projected*	*Projected*	*Projected*
PERS[2]	10.07%	9.20%	8.86%	5.09%
TRS[2]	14.24%	13.80%	13.45%	7.04%
SERS[2]	11.47%	10.67%	10.13%	6.12%
PSERS[2]	10.21%	9.94%	9.86%	6.14%
LEOFF[3]	8.53%	8.53%	7.74%	7.78%
WSPRS	17.66%	20.71%	12.91%	11.03%

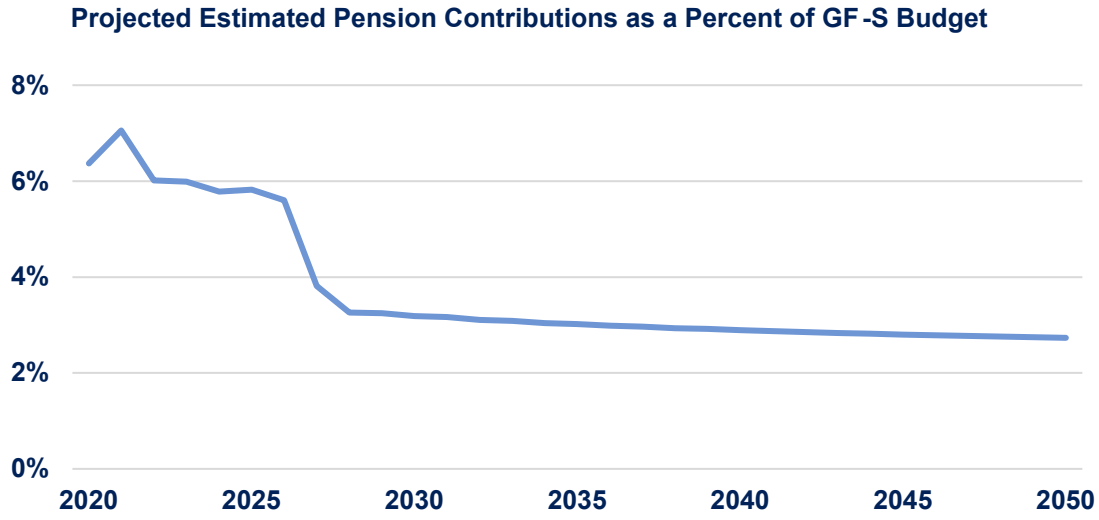
[1] *Excludes DRS administrative expense fee.*
[2] *Includes the Plan 1 UAAL rate.*
[3] *LEOFF 2 contribution rates. No member or employer contributions are required for LEOFF 1 when the plan is fully funded.*

The displayed projected contribution rates continue a downward trend due to four main reasons:

1. We expect PERS 1 and TRS 1 will attain 100 percent funded status during this projection period. Under current law, UAAL contributions to these plans are no longer required once these two plans attain this status. For this reason, we see a significant decline in the projected total employer contributions rates for PERS, TRS, the School Employees' Retirement System (SERS), and the Public Safety Employees' Retirement System (PSERS). Please see our Projected Contribution Rates webpage for our most recent projection for when these plans are expected to attain 100 percent funded status.
2. We expect the cost of new hires for most plans will be less than current members. For example, PERS, TRS, and SERS 2/3 employees, hired after May 1, 2013, receive less subsidized early retirement benefits than members hired prior to that date.
3. The LEOFF 2 Board adopted contribution rates for the next four years (2021-23 and 2023-25 Biennia). Following the 2023-25 Biennium, the lower contribution rates reflect the LEOFF 2 Board's current funding policy which requires lower minimum contributions when the plan exceeds a funded status of 105 percent.

4. Under Section 711(6) of *Engrossed Substitute House Bill 1160* (2019), the Legislature managed a short-term volatility in WSPRS contribution rates with a three biennia phase-in to help stabilize rates. The 2023-25 Biennium is the final biennium of rate stabilization and we expect a significant decrease in employer rates during this period, under current assumptions and benefit provisions, due to the assumed completion of the phase-in. In addition, we expect a past benefit enhancement (related to improved survivor benefits) to be fully pre-funded during this time period.

On an expected basis, pensions contributions as a percent of the budget are expected to become a smaller percent of the state and local government budgets as the contribution rates decline. As an example, we expect this ratio to approximately halve for the state when the Plans 1 UAAL attain 100 percent funded status and the UAAL payments are no longer required. The following graph displays the projected GF-S pension contributions as a percent of GF-S budget. Currently, the state contributes more than double the long-term expected percent of GF-S budget.



Note: We relied on the June 2020 Washington State Economic and Revenue Forecast for the short-term GF-S forecast. All other assumptions, including long-term GF-S growth, rely on data, assumptions, and methods consistent with our most recently published actuarial valuation report (2019 AVR) and its supporting projection assumptions. Use of another report can lead to different results but the long-term trend is not expected to change.

While contribution rates and pension contributions as a percent of budget measures are expected to decline, we expect the retirement systems to continue to mature. The estimated reduction in the ratio of active members to retirees could place more pressure on contributing members and their employers, particularly if the future is different than assumed. For all plans, the ratio of actives to retirees is expected to continue the downward trend that was discussed in the prior section and reach a long-term ratio of actives to retirees of approximately 1.5. A table of the historical and projected maturity measures of the Washington State retirement systems, by plan, can be found on our Commentary on Risk webpage.

We anticipate the solvency measures to improve because we assume plans will collect the contributions necessary to fully fund the pension system moving forward. Excluding plans with a funded ratio above 100 percent, the collection of adequate contributions helps those plans trend towards a funded ratio of 100 percent. As of the publication date of this report, LEOFF Plans 1 and 2 and PSERS have a funded ratio above 100 percent. For projected analysis contained in this **Where the Retirement Systems Are Headed** section, we relied on data, assumptions, and assets consistent with the 2019 AVR and projection assumptions found on our OSA Projection Disclosures webpage. Actual experience may vary from our assumptions.

In summation, we expect our selected affordability and solvency measures to generally improve going forward.

- We expect both the contribution rates and the pension contributions as a percent of budget will improve affordability since we expect contribution rates to decline. Furthermore, we expect employer contributions will significantly decline once PERS 1 and TRS 1 attain 100 percent funded status. These two plans are expected to attain this funded status as summarized on our *Projected Contribution Rates* webpage.
- Affordability can worsen because of the maturation of the retirement systems and its added pressure on contributing members and employers under unfavorable economic scenarios.
- We also expect the funded ratios to improve because we assume adequate contribution rates will be adopted to fully fund all plans.

How the Future Can Look Different

The forecasting measures contained in the prior section provide information based on best estimate assumptions made regarding the future. These projections are sometimes referred to as being made on an expected basis. We also consider how the future may look different than expected, and what factors have the biggest impact on our projections.

Three main factors that can materially influence our projections are:

- **Investment Experience** – Volatility of actual investment experience along with consistent experience above or below our assumption can significantly impact results.
- **Choices Made by Policy Makers** – The Legislature and other policy makers could adopt contribution rates above or below the required rate to fund the plans and/or adopt benefit improvements. Either of these will influence our projected results as we assumed full funding and no benefit improvements in the prior section.
- **Demographic Experience** – The salaries, ages, and number of new hires may not match our demographic assumptions. Additionally, the longevity of current and future retirees may be different than currently assumed.

Our risk assessment model estimates the impact of unexpected events due to differing investment returns and/or actions by policy makers. Our model starts by summarizing the results of 2,000 equally likely scenarios with randomly simulated economic outlooks. This helps us assign probabilities, or likelihoods, to certain outcomes based on the assumptions and methods we use. Please see the *2016 Risk Assessment Assumptions Study* for additional information.

The model also allows for two funding options: "Current Law" and "Past Practices". Current Law assumes no future benefit improvements and the recent trend of no funding shortfalls to continue indefinitely. This funding option allows us to compare how the expected results (presented in the prior section) change when actual investment returns do not match our assumed investment return. Past Practices assumes funding shortfalls and the enactment of future benefit improvements, both consistent with actual history.

The Select Measures of Pension Risk table summarizes three different affordability and solvency metrics of the risk assessment model:

1. Chance that the GF-S pension budget is either half (or double) of the current share of GF-S budget (affordability).
2. Chance of a plan going into pay-go status, i.e., running out of assets before the last benefit is paid (solvency).
3. Chance of plan funded status falling below 60 percent (solvency).

For 2,000 scenarios, the measures estimate the likelihood of these events occurring at some point in the future. For example, a 5 percent likelihood of pay-go reflects that in any given year during the noted projection periods, the highest likelihood that pay-go will occur is approximately 5 percent.

The select measures in the following table reflect the Current Law and Past Practices funding options. While the future is unknown, we use these funding options to better understand financial risk to the pension systems and risk management, particularly through looking at how the measures change instead of relying on the value of a specific measure itself.

Select Measures of Pension Risk as of June 30, 2019

	Current Law		Past Practices	
Projection Period	Next 20 Years (FY 2020-39)	20-50 Years (FY 2040-69)	Next 20 Years (FY 2020-39)	20-50 Years (FY 2040-69)
Affordability Measures				
Chance of Pensions Double their Current Share of GF-S[1]	<1%	1%	1%	2%
Chance of Pensions Half their Current Share of GF-S[1]	54%	67%	50%	47%
Solvency Measures				
Chance of PERS 1, TRS 1 in Pay-Go[2]	<1%	5%	3%	6%
Chance of Open Plan in Pay-Go[2]	<1%	<1%	<1%	<1%
Chance of PERS 1, TRS 1 Total Funded Status Below 60%	6%	6%	13%	7%
Chance of Open Plans Total Funded Status Below 60%	9%	11%	22%	29%

[1] *Pensions approximately 6.4% of current GF-S budget; does not include higher education.*

[2] *When today's value of annual pay-go cost exceeds $50 million.*

Affordability and solvency measures worsen under the Past Practices funding option as a result of assuming funding shortfalls and benefit improvements consistent with past practices. Under this funding scenario, the plans become more expensive and receive less funding. For projection analysis contained in this section, we relied on data, assumptions, and assets consistent with the 2019 AVR and projection assumptions found on our OSA Projection Disclosures webpage. Actual experience may vary from our assumptions. For additional information, our website, Pension Funding Risk Assessment, summarizes the annual graphs of each metric as of the most recently published AVR.

This section focused on the impact of investment return volatility and choices made by policy makers on affordability and solvency measures. In general, the Select Measures of Pension Risk table summarizes results under less favorable economic scenarios. The affordability and solvency results would improve if experience matches our long-term economic assumptions. The affordability and solvency measures worsen when we randomly simulate economic outlooks because actual investment returns are more volatile than assumed on a deterministic basis and include possible returns below our assumption (Current Law). The measures also generally worsen if we assume future benefit improvements and funding shortfalls (Past Practices).

The impact of changes in demographic experience was not quantified in this section but can materially influence our projections. If the actual new hires are younger than expected or if we observe higher than expected numbers of new hires, then those members may help to subsidize future plan costs. For example, new hires are not eligible for the same subsidized early retirement as members hired before May 1, 2013, so, on average, they are cheaper than current members. Alternatively, fewer new hires than expected could create additional future plan costs since fewer new hires are available to subsidize the plan costs of relatively more expensive current members. The longevity of current and future retirees, i.e., how long retirees will collect their benefit, can also materially impact future plan costs. New hire demographics and retiree longevity are just two examples of how actual demographic experience can influence our projections and is not meant to be an exhaustive list. Please see our Commentary on Risk webpage for additional discussion on demographic risks to the retirement systems.

Unexpected significant events, such as COVID-19, can also bring about a different future than what we project. The impact of COVID-19 on the affordability and solvency measures for the Washington State retirement systems is not known as of the publication of this report; however, it could impact the three main influences on our projections that we highlighted earlier in this section (investment experience, choices made by policy makers, and demographic experience). This unexpected event led to a lower than expected *June 2020 GF-S Revenue Forecast* as well as lower than expected investment returns in 2020 which could negatively impact affordability and solvency measures. However, policy makers helped to improve the long-term affordability and solvency of the plans by adopting adequate rates for the 2021-23 Biennium and so did the higher than expected *June 2021 GF-S Revenue Forecast* and investment returns for FY 2021. Lastly, COVID-19 may impact the longevity of current and future retirees, but we do not have enough information at this time to determine if this improves or worsens the metrics discussed in this section.

Planning for the Future

The Legislature and other policy makers cannot control some elements which impact plan health such as membership demographics or the actual return on investments. However, adopting adequate contribution rates, based on best estimate assumptions, and enacting benefit enhancements are within the purview of policy makers.

Providing adequate funding in a timely manner improves the long-term outlook of the Washington State retirement systems and provides an opportunity to maximize the investment return on those contributions. Adequate funding requires contribution rates based on the best estimate of future experience, which OSA reviews regularly and makes recommendations like the ones contained in the attached EES.

Adopting sustainable and affordable benefit improvements will also help maintain affordable pension costs.

We view affordability and solvency as measures that typically move in opposite directions. As an example, if the Legislature determines that pension contributions are not affordable then they may not adopt the required (or adequate) contribution levels. If the Legislature does not adopt adequate contributions, then the pension plans will become more affordable in the short-term due to the lower contribution rates; however, solvency can worsen because the plans are not receiving adequate long-term funding. In turn, this can weaken the long-term affordability of the plans. Employees and employers would need to contribute more in the future to make up for the prior inadequate contributions and missed investment earnings on those contributions.

Fully funding our pension systems can serve the systems well in the long term and puts the retirement plans in a better financial position to endure tougher economic environments that will inevitably return in the future.

Affordability and solvency are a delicate balance. Constant monitoring, readjusting, and understanding the risks involved will put decision makers, and hopefully the retirement systems, in the best position going forward.

SECTION TWO: Economic Experience Study

Economic Experience Study

Executive Summary

According to the Revised Code of Washington (RCW) 41.45.030 (2), the Pension Funding Council (PFC) may adopt changes to the long-term economic assumptions every two years by October 31. As an example, any assumptions adopted by October 31, 2021, will be effective July 1, 2023, for contribution rate-setting purposes. Any changes adopted by the PFC are subject to revision by the Legislature.

Guided by applicable actuarial standards of practice, the Office of the State Actuary performed an Economic Experience Study (EES) to develop a recommendation for each long-term economic assumption. We developed the recommended assumptions as a consistent set of economic assumptions, and we recommend reviewing them as a whole, as opposed to individual recommendations.

Our recommendation remains unchanged for assumed inflation; however, we are recommending a significant decrease to the Investment Rate of Return assumption. We also recommend a decrease to General Salary Growth. For the assumed Membership Growth for Plan 1 Funding, we recommend a slight increase, which represents less precision in the assumption. The following table summarizes the recommendations for the long-term economic assumptions in the prior and current EES, along with the assumptions that are currently set in statute.

Summary of Economic Recommendations

Assumption	Statutory Assumptions	2019 EES	2021 EES
Total Inflation	2.75%	2.75%	2.75%
General Salary Growth	3.50%	3.50%	3.25%
Investment Rate of Return	7.40% LEOFF 2 7.50% Other Plans	7.40%	7.00%
Membership Growth for Plan 1 Funding*	1.25% TRS 0.95% PERS	0.95%	1.00%

**Applies to the amortization of PERS 1 and TRS 1 UAAL.*

For context, we summarized the economic assumptions amongst our "peer" retirement systems. We also summarized how the Investment Rate of Return assumption has changed since our previous EES for retirement systems across all states and share the historical economic assumptions for the Washington State pension systems. Please see **Appendix F, Appendix G,** and **Appendix H** for additional details.

General Approach to Setting Economic Assumptions

Actuarial Standard of Practice Number 27 (ASOP 27), titled *Selection of Economic Assumptions for Measuring Pension Obligations*, identifies the following process for selecting economic assumptions:

- ❖ Identify components, if any, of the assumption;
- ❖ Evaluate relevant data;
- ❖ Consider factors specific to the measurement;
- ❖ Consider other general factors; and
- ❖ Select a reasonable assumption.

With the exception of the Membership Growth for Plan 1 Funding assumption, we used the "building-block" method to develop each assumption in the 2021 EES. Using this method, the actuary determines the individual components for each economic assumption. Then the actuary may combine estimates for each applicable component to arrive at a best estimate for the given economic assumptions. Further, when setting each building-block assumption, we considered the actuarial duration of the corresponding measurement. The duration helps us understand the time horizon of the liabilities to which these assumptions apply. Please see **Appendix A** for a description of duration in this context.

We developed the recommended economic assumptions as a consistent set, and we recommend reviewing them as a whole. The adoption of one or more assumption changes, but not all assumption changes, could lead to inconsistencies. For example, inflation is a building block for both our General Salary Growth and Investment Rate of Return assumptions. Thus, lowering the Inflation assumption and General Salary Growth assumption without lowering the Investment Return assumption could lead to internal inconsistencies between assumptions. An inconsistent set of assumptions could be less accurate than a consistent set of assumptions and lead to future cost increases or decreases.

Experience Study and Recommended Assumptions

For each assumption studied, we provide a high-level summary containing the following:

- ❖ What the assumption is and how we use it in our funding model.
- ❖ High-level takeaways from the study of the assumption.
- ❖ The data we studied and the assumptions we made.
- ❖ How we developed the assumption.
- ❖ Our recommendation.

The **Economic Experience Study Appendices** provide additional details on the development of these recommendations.

Total Inflation

What Is the Total Inflation Assumption and How Do We Use It?

The Total Inflation assumption represents the increase in the general price of goods in the Seattle-Tacoma-Bellevue (STB) region. For funding purposes, we primarily use this assumption to model post-retirement Cost-Of-Living Adjustments (COLAs). Retired members[1] who currently receive a pension from the Washington State retirement systems receive a COLA based on changes in the STB Consumer Price Index (CPI). We also use total inflation in the development of the General Salary Growth assumption and a component of total inflation—national inflation—in the development of the Investment Return assumption.

High-Level Takeaways

Historical inflation measures remain generally consistent with downward historical trends. However, recent CPI, over the course of the recovery from the pandemic, has trended sharply upward. We do not believe the recent increase in inflation will continue over the long-term.

The Federal Reserve maintains their long-term inflation target of 2 percent with a short-term target moderately exceeding 2 percent.

Looking to the future, external national inflation forecasts suggest mixed expectations. Most, but not all, expect projected inflation to decline slightly from our prior study. Regional inflation has continued to outpace national inflation and we expect that to continue.

Data and Assumptions

We relied on historical inflation data from the Bureau of Labor Statistics (BLS) and historical treasury rates from the Federal Reserve from 1950 to 2020. We also considered historical information from the Washington State Investment Board (WSIB) and the Economic and

[1]*For PERS 1 and TRS 1, this applies only to members who elected the optional COLA payment form at retirement.*

Revenue Forecast Council (ERFC), and took into consideration estimates for future inflation, including projections from IHS Markit (IHS)[2], the Social Security Administration (SSA), and the Congressional Budget Office (CBO).

General Methodology

For the total inflation, we developed our assumption using a building block method. This method requires the actuary to determine the components of each assumption and make an estimate for each component. We then combine the estimated components to arrive at a best estimate for the assumption.

We identified two building block components: (1) national inflation and (2) a regional adjustment for the price inflation differential. We make a recommendation on total inflation only; however, we analyzed both inflation components and the relationship between them. Please see **Appendix B** for this analysis and for additional details surrounding this assumption.

Recommendation

Based on the current economic climate and the relative uncertainty associated with the global pandemic, along with mixed inflation expectations for the future, we did not change our Inflation assumptions or our estimate of the underlying components.

We recommend a Total Inflation assumption of 2.75 percent, comprised of a 2.35 percent national inflation component and a 0.40 percent regional price inflation differential component. This results in no change to our recommended Total Inflation assumption or national inflation component as they remain a reasonable expectation for the future.

Inflation Assumption		
	Old	New
All Plans	2.75%	2.75%

General Salary Growth

What Is the General Salary Growth Assumption and How Do We Use It?

The General Salary Growth assumption is used to project wages for the purposes of determining future retirement benefits and contribution rates as a percent of payroll. As discussed in the **Membership Growth for Plan 1 Funding** section, this assumption is also used to estimate the payroll over the next ten years which allows us to calculate the Unfunded Actuarial Accrued Liability (UAAL) and Plan 1 benefit enhancement contribution rates required under current funding policy.

General salary growth is one of two building blocks used to develop the assumption for total salary growth. The other building-block is service-based salary growth, which we study as part of our *2013-18 Demographic Experience Study*. Generally, a participant's salary will grow over the long term in accordance with economic factors such as inflation and real wage growth

[2]*Previously referred to as Global Insight.*

(or productivity), and with demographic factors such as service-based salary growth (including promotions). **This analysis focuses on salary growth that relates to economic factors.**

High-Level Takeaways

The historical general salary growth of the retirement systems can be volatile on a year-to-year basis, in part, due to inflation. Average real wage growth has also fluctuated depending on the observed period. Overall, we observed a downward trend in general salary growth over the past few decades, and we expect these lower levels of general salary growth to persist in the future. The historical downward trend in general salary growth is consistent with our observations for inflation. In previous experience studies, we lowered our Total Inflation assumption which in turn lowered our General Salary Growth assumption.

Looking forward, we believe the current Inflation assumption remains reasonable, but we expect lower real wage growth – a reduction in that component of the assumption by 25 basis points (or 0.25 percent). The new assumption reflects downward trends in real wage growth forecasts and remains in line with historical estimates of real wage growth.

Data and Assumptions

In developing this assumption, we relied on historical data and/or forecasts from the following sources: Washington State Department of Retirement Systems (DRS), BLS, SSA, Bureau of Economic Analysis (BEA), and CBO to help inform our recommendation.

Please see **Appendix C** for the supporting analysis and additional details surrounding this assumption.

General Methodology

We developed our General Salary Growth assumption using two building-block components: (1) total inflation and (2) real wage growth. We analyzed total inflation and formed a recommendation for this assumption in the **Total Inflation** section of this report.

In **Appendix C**, we evaluate real wage growth as the annual average wage growth less inflation. Under this methodology, we assume population demographics, e.g., average age and average service, will remain consistent year over year so the service-based salary increase component of annual wage growth also is assumed to remain constant. We then reviewed the real wage growth rates over various historical periods. For consistency among our economic and demographic salary assumptions, we also considered how we studied service-based salary increases during the demographic experience study and the range of actual real wage growth considered in that study. In addition to historical growth, we reviewed expectations for future real wage growth over the next ten years consistent with the duration of future salaries for active members in the DRS pension plans.

To finalize the recommended assumptions, we relied on our professional judgment.

Recommendation

We recommend a General Salary Growth assumption of 3.25 percent, comprised of a 2.75 percent total inflation component and a 0.50 percent real wage growth component. This results in a reduction in General Salary Growth assumption of 25 basis point due to a decrease in the real wage growth component.

General Salary Growth Assumption		
	Old	New
All Plans	3.50%	3.25%

Investment Rate of Return

What Is the Investment Rate of Return Assumption and How Do We Use It?

The Investment Rate of Return assumption represents the assumed annual return on assets used to pay pension benefits. Consistent with current state funding policy, we use the assumption to discount future benefit payments and salaries for members of the retirement systems to today's value. We then compare current assets with the present value of benefit payments and salaries to determine contribution rates.

High-Level Takeaways

Under their new 2021 Capital Market Assumptions (CMAs), WSIB reduced the expected return on each asset class when compared to the 2019 CMAs.

We applied our professional judgment to make adjustments to the WSIB's expected returns accounting for our expectations of the future, consistency with our other economic assumptions, and the different time horizon of the Washington State retirement systems compared to the 15-year time horizon of the CMAs.

We also considered but do not recommend at this time, a separate Investment Rate of Return assumption for the closed Plans 1. We did not make any adjustment for the impacts of future climate change.

Data and Assumptions

In developing this assumption, we consulted with and relied on data provided by WSIB. We also relied on the American Academy of Actuaries' February 2019 practice note on forecasting investment returns for pension actuaries. Please see the practice note on the Academy's website for more information.

General Methodology

While historical returns were considered, we primarily relied on WSIB's expectations for the future and our professional judgment when setting this assumption. We reviewed WSIB's most recent CMAs, target and actual asset allocations, and simulated returns over various periods. We also considered how the returns could change under different CMAs. (Please see **Appendix D** for this analysis and for additional details surrounding this assumption.)

Recommendation

We recommend an Investment Rate of Return assumption of 7.00 percent. While our methodology to develop the recommendation is generally consistent with the prior study, the new recommendation represents a significant decline from the 2019 EES recommendation of 7.40 percent, largely due to new CMAs. For example, WSIB reduced the expected one-year return of each asset class by at least 0.40 percent.

The PFC adopted the currently prescribed assumption of 7.50 percent for the 2021-23 Biennium and that assumption would continue for all future biennia under current law unless a new assumption is adopted.

Investment Return Assumption		
	Old	New
All Plans	7.40%	7.00%

Membership Growth for Plan 1 Funding

What Is the Membership Growth for Plan 1 Funding Assumption and How Do We Use It?

The Public Employees' Retirement System (PERS) and the Teachers' Retirement System (TRS) Plans 1 UAAL, and any future Plan 1 benefit enhancements, are amortized over ten years of future system payroll. We use this assumption to estimate the payroll over the next ten years which allows us to calculate the UAAL and Plan 1 benefit enhancement contribution rates required under current funding policy.

The Plans 1 UAAL contribution rates described above are also subject to statutory minimums. As displayed in our most recent actuarial valuation report (*2019 Actuarial Valuation Report* [AVR]), the statutory minimum UAAL contribution rates exceed, and are expected to remain above, the rates calculated from the ten-year amortization. When these minimum rates are in effect, the Membership Growth for Plan 1 Funding assumption is not expected to impact the calculated UAAL contribution rates. **Therefore, we do not expect this assumption or our recommendation in this study to impact future calculated[3] UAAL contribution rates.**

Employers of PERS, the School Employees' Retirement Systems (SERS), and the Public Safety Employees' Retirement System (PSERS) members pay contributions towards the PERS 1 UAAL. For this reason, the projected payroll for amortizing the PERS 1 UAAL includes pay from current and future members of these three systems. We will use the term "PERS" in reference to the combined system growth of PERS, SERS, and PSERS. The projected payroll for the TRS 1 UAAL includes pay from current and future TRS members.

[3]*Contribution rates for any future Plan 1 benefit enhancements are collected above and beyond the minimum Plan 1 UAAL contribution rates and will continue to rely on the ten-year amortization rates.*

This assumption is separate from our System Growth for Open Plans assumption which was last updated during the 2016 Risk Assessment Assumptions Study (RAAS) and estimates long-term growth of the retirement plans.

High-Level Takeaways

The historical growth of the retirement systems can be volatile on a year-to-year basis because it is influenced by market environments and the ability of employers to hire/retain employees. In addition to market environments, employer budgets have been impacted by mandated school funding requirements[4], which largely increased school funding, and COVID-19.

We observed lower than expected growth for PERS and TRS after the Great Recession followed by higher-than-expected growth rates in Fiscal Years (FYs) 2014 through 2020. Following FY 2020, COVID-19 may impact the growth of PERS and TRS; however, its long-term impact is unclear. We assume any impact to membership growth, related to COVID-19, is short-term and will not have a material impact on our forward-looking assumption over the next ten years.

Consistent with the 2019 EES, we do not expect PERS and TRS growth to be materially different from each other and our prior recommendation remains our best estimate. However, we rounded the assumption to reflect a lower level of precision in our future growth expectation.

Data and Assumptions

In developing this assumption, we relied on historical system membership data from DRS. We also considered historical Washington State population data and forecasts from the Office of Financial Management (OFM).

Please see **Appendix E** for this analysis and for additional details surrounding this assumption.

General Methodology

We reviewed the growth rates over various historical periods. In addition to historical growth, we considered both OFM and our own expectations of the future.

To finalize the recommended assumptions, we relied on our professional judgment.

Recommendation

We recommend a Membership Growth for Plan 1 Funding assumption of 1.00 percent for both PERS and TRS. Based on our analysis, we believe the prior recommendation remains reasonable, but the number of decimal places implies a higher level of precision than is expected in the assumption. We rounded the prior recommendation up to 1.00 percent to reflect a lower level of precision in our future growth expectation.

Membership Growth for Plan 1 Funding Assumption

	Old	New
PERS	0.95%	1.00%
TRS*	0.95%	1.00%

**The currently prescribed TRS 1 assumption is 1.25%.*

[4]*Under Engrossed Substitute House Bill 1109 (2019), the Legislature provided additional funding to school districts which is expected to continue at similar levels in future biennia.*

Office of the State Actuary

"Supporting financial security for generations."

Actuarial Certification Letter
Economic Experience Study

August 2021

This report documents the results of an economic experience study of the retirement plans defined under Chapters 41.26 (excluding Plan 2), 41.32, 41.35, 41.37, 41.40, and 43.43 of the Revised Code of Washington (RCW). The primary purpose of this report is to assist the Pension Funding Council in evaluating whether to adopt changes to the long-term economic assumptions identified in RCW 41.45.035. This report should not be used for other purposes.

An economic experience study involves comparing actual economic experience with the assumptions we made for applicable experience study periods. We also review other relevant data to form expectations for the future. The analysis concludes with the selection of a recommended set of economic assumptions. We use Actuarial Standard of Practice Number 27 (ASOP 27), titled *Selection of Economic Assumptions for Measuring Pension Obligations*, to guide our work in this area.

Unless noted otherwise in this report, this economic experience study includes the most recently available plan provisions, participant data, and asset data.

The Department of Retirement Systems provided member and beneficiary data to us. We checked the data for reasonableness as appropriate based on the purpose of this experience study. WSIB provided asset information as of June 30, 2021. We did not audit the financial or participant data. We relied on all the information provided as complete and accurate. In our opinion, this information is substantially complete for purposes of this experience study.

We relied on the CMAs and return simulations from WSIB to help formulate expectations for future rates of annual investment return. We reviewed the CMAs and return simulations for reasonableness and had discussions with WSIB about their methods and sensitivities of their model as appropriate based on the purpose of this experience study.

The recommendations in this experience study involve the interpretation of many factors and the application of professional judgment. We believe that the data, assumptions,

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and methods used in the underlying experience study are reasonable and appropriate for the primary purpose stated above. The use of another set of data, assumptions, and methods, however, could also be reasonable and could produce materially different results. Another actuary may review the results of this analysis and reach different conclusions.

In our opinion, all methods, assumptions, and calculations are reasonable and are in conformity with generally accepted actuarial principles and applicable standards of practice as of the date of this publication.

The undersigned, with actuarial credentials, meet the Qualification Standards of the American Academy of Actuaries to render the actuarial opinions contained herein. While this report is intended to be complete, we are available to offer extra advice and explanation as needed.

Sincerely,

Matthew M. Smith, FCA, EA, MAAA
State Actuary

Luke Masselink, ASA, EA, MAAA
Senior Actuary

SECTION THREE: Economic Experience Study Appendices

APPENDIX A – Retirement Plan Duration

Selecting appropriate economic assumptions requires consideration of the period over which the assumptions will be applied. For example, in setting a salary growth assumption we consider the average expected future working lifetime of active members. And, when setting an assumption for the expected rate of investment return, we consider both the future working lifetime and the life expectancy once members retire.

Duration is an actuarial measurement used by our office to determine a relevant period to forecast economic assumptions contained in this report. The duration represents an average length of plan liabilities or salaries measured in today's dollars. As an example, consider a plan with a liability duration of 15 years. This means we would expect about half of the plan's liability, measured in today's dollars, to be paid as benefit payments before 15 years and the other half after 15 years. The same concept applies to a salary duration of 5 years: half of future salaries received before 5 years and half after.

Duration by Open and Closed Plans										
	Historical Duration					Projected Duration				
Duration of Liabilities										
	2011	2013	2015	2017	2019	2021	2023	2025	2027	2029
Open Plans	21.4	21.9	21.3	20.8	20.7	20.2	19.9	19.6	19.4	19.3
Closed Plans	8.5	8.9	8.8	8.6	8.1	7.8	7.4	7.1	6.7	6.4
Duration of Salaries										
	2011	2013	2015	2017	2019	2021	2023	2025	2027	2029
Open Plans	7.6	7.6	7.8	7.9	8.2	8.3	8.4	8.5	8.6	8.7

The previous table contains plan duration estimates. We estimate liability duration by dividing the Present Value of Future Benefits (PVFB) measured at different discount rates. We perform the same calculation with the present value of salaries to determine the duration of salaries.

$$Duration = \left(\frac{PVFB\ discounted\ by\ 6.5\%\ per\ year}{PVFB\ discounted\ by\ 7.5\%\ (Statutory\ Rate)\ per\ year} - 1\right) \times 100$$

We considered duration by retirement plans, split between whether they are open or closed to new hires. For purposes of this analysis, the closed plans consist of PERS, TRS, and the Law Enforcement Officers' and Fire Fighters' Retirement System Plans 1, which closed to new hires in 1977, and the open plans consist of all the other DRS administered plans (Plans 2/3). We observed a difference in duration between the closed and open plans because younger members have a significantly longer duration than older members. Open plan liability duration also varies by individual plans as each has a different demographic make-up. We focused on the duration of all open plans combined and believe 20-25 years provides a reasonable target for each plan. We also see a difference between liability and salary duration because the liability corresponds to life expectancy of all plan members, while salary only corresponds to the future working lifetime of the active group.

We also considered results from our projection system to get a sense of how duration may change as the plans continue to mature and assumed new hires join the open plans. Ultimately, we focused on the duration from our 2019 AVR after observing the open plan duration remains relatively stable on a projected basis.

APPENDIX B – Total Inflation Assumption

Methodology

We developed the Total Inflation assumption using a building block method with two components—national inflation and a regional price inflation differential. We set these assumptions with a 10- to 25-year projection period in mind, consistent with the closed and open retirement plan liability durations. We use total inflation as a component of projected salary growth and for post-retirement COLAs, and the national inflation component as a building block of the Investment Rate of Return assumption. Please see the **Appendix A** section at the start of the Appendices for more information on this measure.

Our analysis for the two building block components considered several sources of information. We relied on the historical CPI produced by BLS, which measures the price inflation for a fixed basket of goods. Specifically, we used the Urban Wage Earners and Clerical Workers (CPI-W) for historical national inflation and the STB CPI-W for historical regional inflation. We also considered current Federal Reserve monetary policy, recent Treasury Inflation-Protected Securities (TIPS) data, and inflation projections from other experts.

Analysis

We took the following steps to develop our best estimate recommendation:

1. **Set assumption for national inflation component.**

   Historical National Inflation

   We first considered historical national inflation data from BLS back to 1950. We applied geometric averages over various ranges to determine if a trend exists. Average inflation showed a relatively consistent trend of decreasing inflation over time. One reason for the observed decrease in annual percentage changes in CPI stems from the U.S. economy evolving from farming to a service- and knowledge-based economy over approximately the last 70 years. During that evolution period, the U.S. economy experienced globalization and technological advancements, which generally lead to lower inflation due to a decreased labor unit cost (increased labor productivity) that reduced the cost of goods.

   Recent history (the last ten years) was heavily influenced by low inflation following the Great Recession and the more recent economic impacts of the COVID-19 pandemic. We don't believe this short-term history is a good predictor of future inflation. Long-term averages over 25 to 30 years yield a more stable inflation history and provides a range between approximately 2.10 and 2.25 percent.

National CPI-W Geometric Averages	
1950-2020	3.41%
Last 30 years	2.26%
Last 25 years	2.11%
Last 20 years	2.03%
Last 15 years	1.87%
Last 10 years	1.66%
Last 5 years	1.70%

Breakeven Inflation Analysis (TIPS)

We also examined inflation projections using TIPS and nominal bonds (Treasuries). TIPS bonds are Treasury issued bonds intended to mute the influence of inflation on the bond's maturity value by allowing the maturity value to fluctuate with changes in the National CPI. As such, TIPS can be used to approximate annual national inflation by subtracting the TIPS yield from the yield of a non-inflation adjusted Treasury security with the same maturity. The resulting inflation estimate is the "TIPS breakeven inflation rate", which is the level of inflation that causes the TIPS and nominal bonds to yield the same value.

However, there are questions about the accuracy of using the breakeven inflation rate to estimate future inflation. As noted by WSIB in their 2021 Capital Markets White Paper, the market mechanism that determines breakeven inflation can skew under dire economic scenarios in which investors prefer the safety of Treasuries over the illiquidity of TIPS. While the breakeven inflation rate may not provide the most reliable measure of inflation expectations, it still provides additional data on inflation estimates over various periods.

Market Expected Inflation			
Year	(A) 10-Year TIPS Breakeven Inflation*	(B) 30-Year TIPS Breakeven Inflation*	(B) - (A)
2016	1.57%	1.74%	0.17%
2017	1.87%	1.97%	0.10%
2018	2.08%	2.10%	0.03%
2019	1.74%	1.80%	0.06%
2020	1.49%	1.66%	0.17%
Average	1.75%	1.85%	0.10%

Note: Totals may not agree due to rounding.
**Difference in nominal and TIPS bond with the same maturity.*

We also compared this implicit inflation projected by the short-term (ten-year) and long-term (30-year) breakeven inflation rates to determine how market expectations for inflation change over different periods. Comparing the short- and long-term breakeven inflation over the last five years provides insight into how recent market expectations for inflation have evolved. This analysis provided comparison points to historical inflation and projections from other experts. In general, we observed a modest average difference of about 0.10 percent in short- and long-term inflation expectations based on bonds.

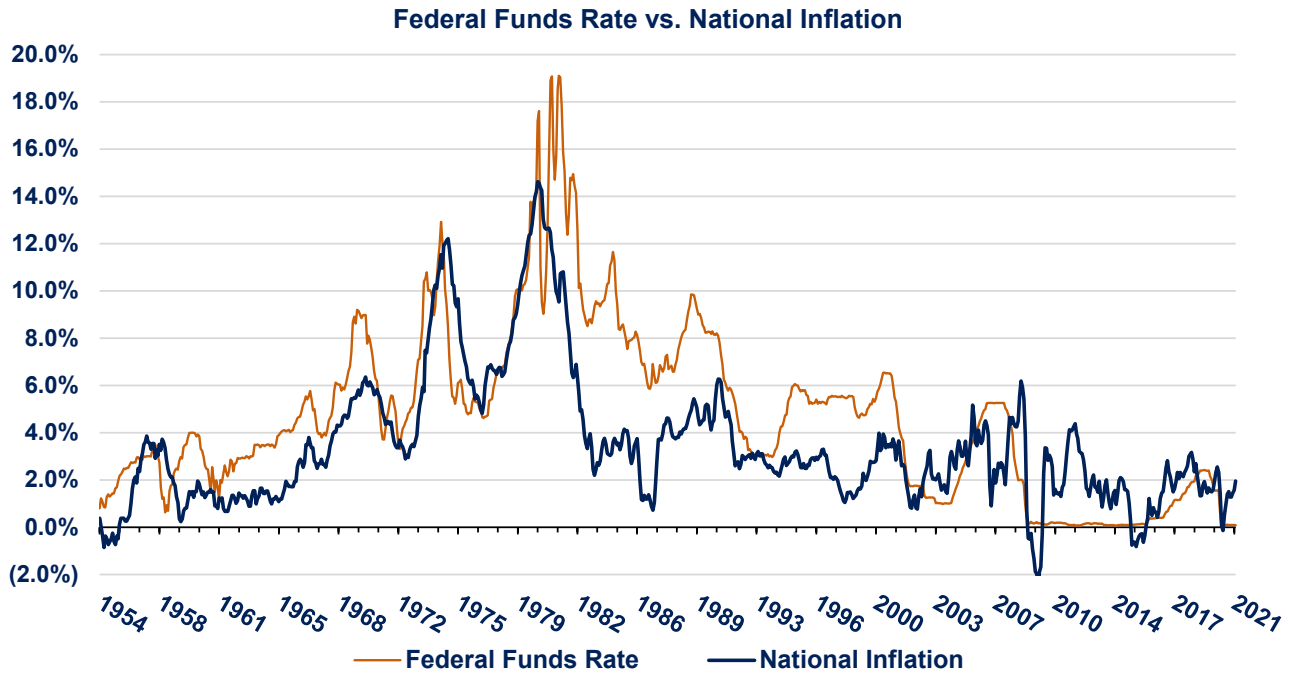
Federal Reserve Inflation Target

The Federal Reserve has taken a larger role managing national inflation in recent years. As of January 2012, the Federal Reserve adopted an explicit inflation target of 2 percent per year. Historically the Federal Reserve has managed inflation without a stated target, but these practices have been in place for several decades. By adjusting the "Federal Funds Rate", the rate at which banks can borrow money, the Federal Reserve can increase or decrease the amount of money in the economy. Changing the availability of money in the

economy has a corresponding impact on the level of inflation. The Federal Reserve clarified the 2 percent inflation target is not short-term in nature. Rather, inflation would reach 2 percent over the "medium-term" in absence of unpredictable changes in the economy.

Given the advent of the global pandemic, along with the recession and subsequent recovery experienced through 2020, the Federal Reserve clarified their position by reaffirming the medium-term 2 percent target. They offered further explanation, stating that they will aim to increase short-term inflation above the target such that long-term averages remain "anchored" at 2 percent. To support this target, they continue their COVID-19 pandemic response policy towards the Federal Funds Rate which is to hold the rate between 0.00 percent and 0.25 percent until labor market conditions improve.

We compared the historical Federal Funds Rate and national inflation in the following graph.



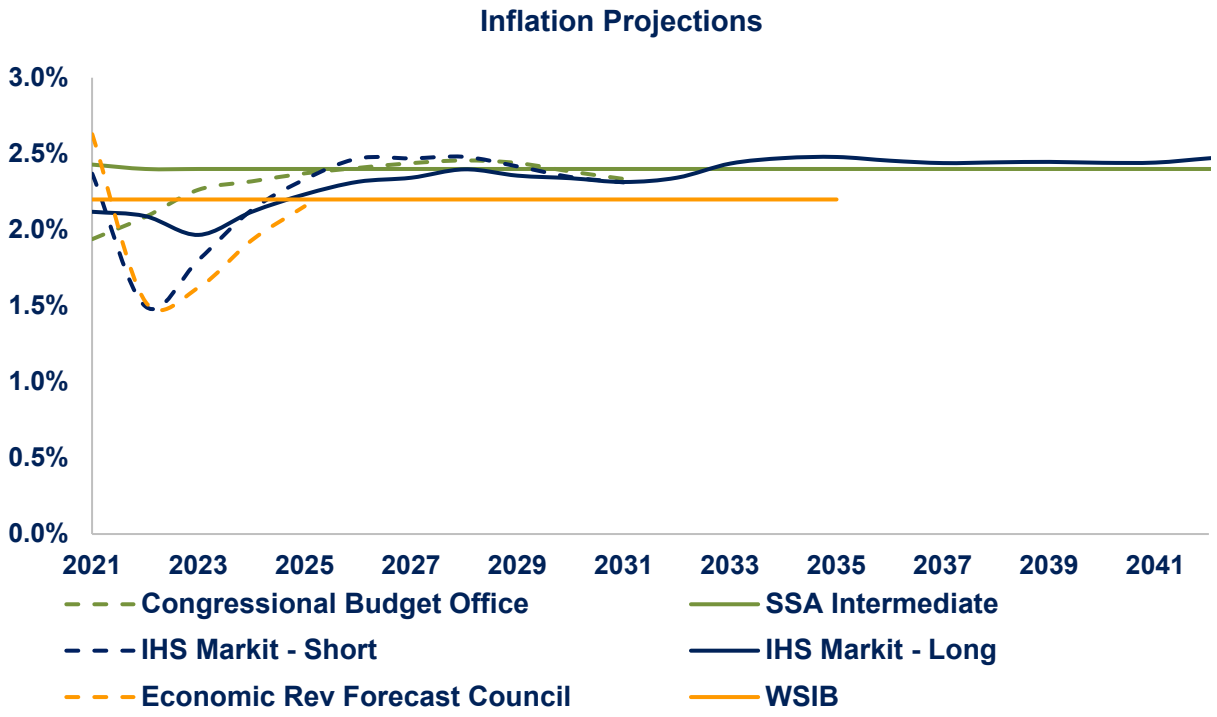
The previous graph shows a strong correlation between the Federal Funds Rate and national inflation. We observe periods of inflation spikes followed by increases in the Federal Funds Rate and corresponding decreases in inflation. As an example of inflation control in practice, the 1990s featured a strong economy that typically leads to higher levels of inflation. We observed an increase in the Federal Funds rate during that decade which maintained inflation around the 3 percent level. Looking over the past decade, as the economy moved further from the Great Recession the Federal Funds Rate increased above historic lows as inflation began to rise. More recently, the Federal Open Market Committee (FOMC) adjusted the target rate range back down to historic lows in response to the COVID-19 global pandemic. FOMC expects to maintain this rate until the labor markets recover, and until inflation moderately exceeds the 2 percent target for some time. Over the course of the recovery from the pandemic, observed CPI has trended upward

and sharply so over recent months. We do not believe the recent increase in inflation will continue over the long-term. We considered the current FOMC Federal Funds policy along with its longer-term inflation policy when setting our assumptions.

Other Expert Inflation Projections

We reviewed short- and long-term forecasts to get a sense for what other experts in the field expect moving forward. In this context, short-term forecasts are typically 5 to 15 years while long-term forecasts are 15 years or greater. We considered forecasts from the CBO, SSA, ERFC, IHS[5], and WSIB. We observed short-term forecasts (CBO, ERFC, IHS-Short, and WSIB) with an average annual inflation of 2.18 percent and long-term forecasts (SSA Intermediate and IHS-Long) with an average of 2.40 percent.

With regard to short-term forecasts, the IHS-Short and ERFC forecasts show a drop in near-term expected inflation before trending back up. The Revenue forecast published by the ERFC noted the Federal Reserve's response to the pandemic lead to lowering the Federal Funds Rate back to near zero levels. They also shared the Federal Reserve's intent to keep the Federal Funds Rate low until certain triggers are met, including allowing inflation to rise above 2 percent for some time. After such time, the Federal Reserve anticipates raising the Federal Funds Rate again to manage inflation back to 2 percent over the long-term.



[5]*Previously referred to as Global Insight.*

Short-Term vs. Long-Term Inflation

We set the Inflation assumption considering the duration of liabilities for each retirement plan. The Plans 1, which closed to new hires in 1977, will pay the majority of benefits much earlier than the open Plans 2/3 as indicated in the following table.

Average Plan Duration*		
	Closed Plans 1	Open Plans 2/3
Years	8.1	20.7

**Duration based on OSA's 2019 AVR.*

We considered the average difference in long and short-term inflation projections using the breakeven inflation rate (1.85% - 1.75% = 0.10%) and other expert projections (2.40% - 2.18% = 0.22%). Finally, we also considered the 2 percent long-term inflation target of the Federal Reserve, along with its short-term expectations and pandemic response policies set by FOMC. Given the relatively small difference in long and short-term inflation expectations and the inherent uncertainty, particularly from the pandemic, in forecasting future inflation over any period, we believe a single Inflation assumption for all plans remains reasonable. We revisit the concept of short- and long-term assumptions for closed and open plans in application to the General Salary Growth assumption and the Investment Rate of Return assumption.

National Inflation Recommendation

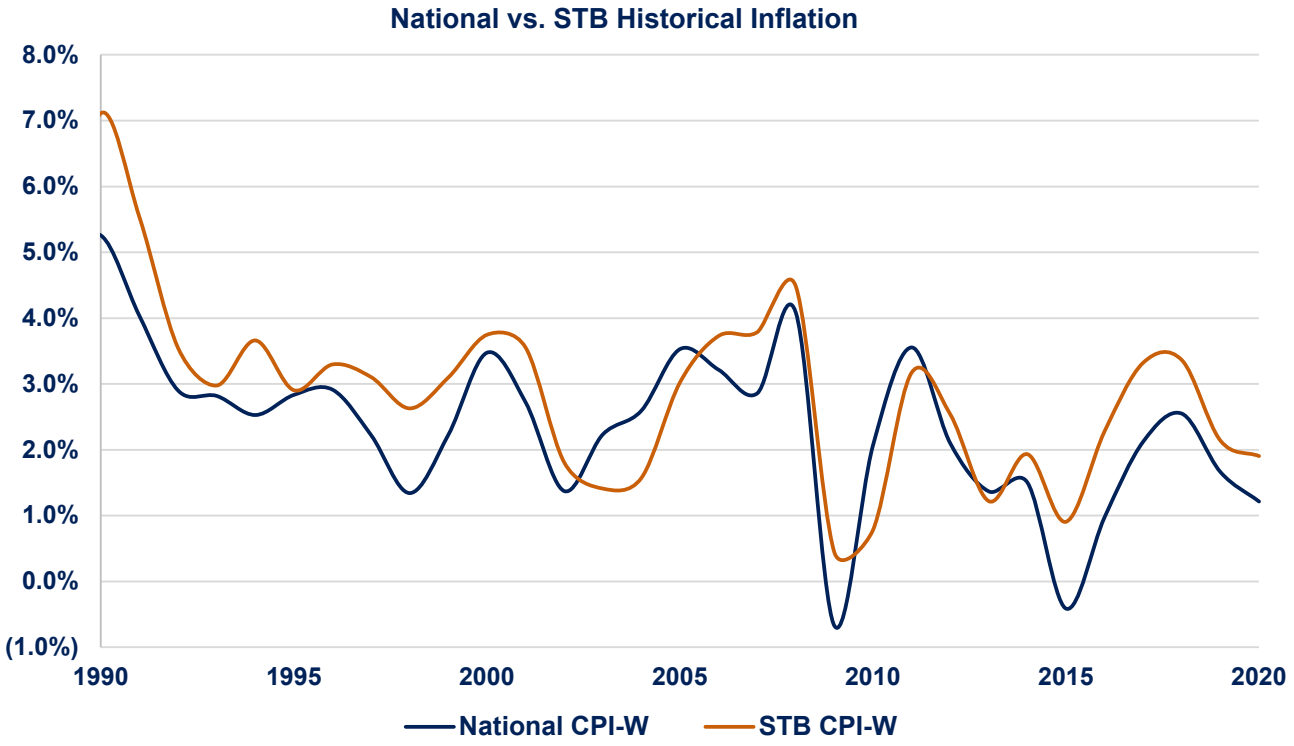
We believe there is significant uncertainty in our nation's economic outlook as we progress through the global pandemic. Focusing on external forecasts, the Federal Reserve maintains their long-term inflation target of 2 percent but acknowledges it will allow inflation to trend above 2 percent in the near-term. Other expert forecasts show mixed changes since the prior study—the short-term average inflation decreased slightly while long-term average inflation remained the same. Individually, some experts lowered their inflation outlook since the last study while others increased them.

We recommend maintaining the long-term national inflation assumption of 2.35 percent. We arrived at this recommendation weighing several considerations such as the 20- to 30-year average historical national inflation of 2.0 to 2.3 percent, the Federal Reserve annual target inflation of 2 percent (or above in the short-term), the range of 2.2 to 2.4 percent between average short and long-term forecasts from other experts, and the uncertainty in the current market environment.

2. Reviewed the regional price inflation differential.

We base our assumption for the regional price inflation differential on the average difference between the STB CPI-W and the National CPI-W over a range of historical periods. BLS modified the STB index in 2018 by removing prices for Island, Kitsap, and Thurston counties. After that, the index only includes costs for Pierce, King, and Snohomish counties.

Geometric Averages			
	STB CPI-W	National CPI-W	Difference
1950-2020	3.58%	3.41%	0.18%
Last 30 years	2.72%	2.26%	0.46%
Last 25 years	2.52%	2.11%	0.42%
Last 20 years	2.36%	2.03%	0.34%
Last 15 years	2.39%	1.87%	0.52%
Last 10 years	2.27%	1.66%	0.62%
Last 5 years	2.60%	1.70%	0.90%



The average difference in inflation over the last 20, 25, and 30 years has consistently ranged between 0.30 percent and 0.50 percent. We observe higher inflation in the STB region because evidence suggests the local economy grows differently than the national economy as a whole. The STB region features some of the world's largest companies like Boeing, Microsoft, and Amazon and has experienced considerable residential growth. We believe the presence of well-paying jobs, combined with immigration from other states, resulted in a greater tendency toward price inflation in Washington State.

As part of our analysis, we considered the item categories within BLS CPI data to get a sense for how each category changes and how they compare between national and regional indices. We are mindful of how the global pandemic may impact future inflation as well as the regional price inflation differential. Over the last 20 years, the primary category where

STB outpaced national inflation was housing. This category also comprises almost half of the weighting across all categories when calculating the change in CPI. If the shift to teleworking that occurred due to the pandemic becomes more permanent, we could see that component continuing to drive the regional inflation difference for years to come.

Recent data suggests a higher differential in the short-term, however we expect regional inflation differential will trend downward over time. After reviewing the relationship between National CPI-W and STB CPI-W (as shown in the following graph) and considering our expectations for future STB inflation, we maintain our 0.40 percent regional price inflation differential.

We will continue to monitor this trend and will consider adjusting or potentially removing this component if the historical regional price inflation differential shows signs of significant change over longer-term experience periods.

3. Recommendation.

We build our Total Inflation assumption by adding our best estimate for the national inflation assumption (2.35 percent) to our best estimate for the regional price inflation differential (0.40 percent). As a result, our best estimate assumption for total inflation is 2.75 percent per year.

Exhibits for Appendix B

Historical Inflation Data

	Annual % Change					Annual % Change			
Year	STB CPI-W	National CPI-W	STB CPI-W	National CPI-W	Year	STB CPI-W	National CPI-W	STB CPI-W	National CPI-W
1989	344.5	365.2	4.68%	4.82%	2005	579.3	568.9	3.02%	3.53%
1990	369.0	384.4	7.11%	5.26%	2006	600.9	587.2	3.73%	3.22%
1991	389.4	399.9	5.53%	4.03%	2007	623.7	604.0	3.79%	2.86%
1992	403.2	411.5	3.54%	2.90%	2008	651.6	628.7	4.48%	4.09%
1993	415.2	423.1	2.98%	2.82%	2009	654.5	624.4	0.44%	(0.67%)
1994	430.4	433.8	3.66%	2.53%	2010	659.6	637.3	0.78%	2.07%
1995	442.9	446.1	2.90%	2.84%	2011	680.5	660.0	3.17%	3.56%
1996	457.5	459.1	3.30%	2.91%	2012	697.8	673.9	2.54%	2.10%
1997	471.7	469.3	3.10%	2.22%	2013	706.3	683.1	1.22%	1.37%
1998	484.1	475.6	2.63%	1.34%	2014	719.9	693.4	1.93%	1.50%
1999	499.1	486.2	3.10%	2.23%	2015	726.5	690.5	0.91%	(0.41%)
2000	517.8	503.1	3.75%	3.48%	2016	743.1	697.2	2.28%	0.98%
2001	536.2	516.8	3.55%	2.72%	2017	767.7	712.1	3.32%	2.13%
2002	545.9	523.9	1.81%	1.37%	2018	793.6	730.2	3.36%	2.55%
2003	553.6	535.6	1.41%	2.23%	2019	810.5	742.4	2.14%	1.66%
2004	562.3	549.5	1.57%	2.60%	2020	826.0	751.4	1.90%	1.21%

Data source: Department of Labor, Bureau of Labor Statistics (BLS).

National CPI Projections

	CBO	ERFC	IHS - Short	IHS - Long	SSA Int	WSIB		IHS - Long	SSA Int
2021	1.94%	2.63%	2.37%	2.12%	2.43%	2.20%	2037	2.44%	2.40%
2022	2.09%	1.53%	1.50%	2.09%	2.40%	2.20%	2038	2.44%	2.40%
2023	2.26%	1.62%	1.80%	1.97%	2.40%	2.20%	2039	2.45%	2.40%
2024	2.32%	1.93%	2.13%	2.12%	2.40%	2.20%	2040	2.44%	2.40%
2025	2.37%	2.15%	2.33%	2.23%	2.40%	2.20%	2041	2.44%	2.40%
2026	2.41%		2.47%	2.32%	2.40%	2.20%	2042	2.47%	2.40%
2027	2.44%		2.47%	2.34%	2.40%	2.20%	2043	2.50%	2.40%
2028	2.46%		2.48%	2.40%	2.40%	2.20%	2044	2.50%	2.40%
2029	2.44%		2.42%	2.36%	2.40%	2.20%	2045	2.53%	2.40%
2030	2.38%		2.35%	2.34%	2.40%	2.20%	2046	2.55%	2.40%
2031	2.34%		2.31%	2.32%	2.40%	2.20%	2047	2.55%	2.40%
2032				2.34%	2.40%	2.20%	2048	2.55%	2.40%
2033				2.44%	2.40%	2.20%	2049	2.57%	2.40%
2034				2.47%	2.40%	2.20%	2050	2.58%	2.40%
2035				2.48%	2.40%	2.20%	2051	2.62%	2.40%
2036				2.46%	2.40%				

The National SSA intermediate forecast is produced using a different basket of goods from the CBO, ERFC, and IHS national projections. The SSA uses Urban Wage Earners and Clerical Workers while the other forecasts use All Urban Consumers. However, we do not believe an adjustment is required given the minor differences in the averages over the last 25 years.

APPENDIX C – General Salary Growth Assumption

Methodology

We developed the General Salary Growth assumption using a building-block method with two components—total inflation and real wage growth. ASOP 27 defines inflation as "price changes over the whole of the economy," and real wage growth (productivity) is defined as "the rates of change in a group's compensation attributable to the change in real value of goods or services per unit of work." We observed annual wage growth, inflation, and real wage growth over various historical periods to estimate historical national and Washington State ranges and trends.

In setting the Total Inflation and Real Wage Growth assumptions, we considered the population and period over which we applied the General Salary Growth assumption. We target these assumptions to be consistent with the duration of salaries for our open pension plans—approximately ten years. We used the duration of open plan salaries because the vast majority of the active employee population exists in these open plans. Please see **Appendix A** for more information on this measure.

Analysis

We took the following steps to develop our general salary growth recommendation:

1. **Reviewed historical general salary growth.**

   We began our analysis by reviewing the historical trend in average annual salary growth for employees in the open plans administered by DRS. Overall, we observed a downward trend in the general salary growth over the past few decades which is consistent with the historical inflation trend.

Estimated General Salary Growth Employees of DRS-Administered Open Plans			
Geometric Averages	Observed Growth of Average Salary (a + b)	Observed Inflation (a)	Estimated Real Wage Growth (b)
Last 10 years (2010-2019)	2.73%	2.17%	0.56%
Last 20 years (2000-2019)	3.38%	2.46%	0.92%
Last 30 years (1990-2019)	3.60%	2.90%	0.69%

   The previous table is meant to summarize how general salary growth is trending, but we developed the assumption by reviewing its components (inflation and real wage growth) separately.

2. Reviewed total inflation.

We studied total inflation in depth and developed a recommendation of 2.75 percent for this assumption, which we also rely upon for the first building block of the General Salary Growth assumption.

We considered an adjustment to the Total Inflation assumption for purposes of setting the General Salary Growth assumption because the duration of the General Salary Growth assumption, approximately ten years, is on the shorter end of the duration range for the Total Inflation assumption, which focused on a 10- to 25-year period. While the components of total inflation—national inflation and the regional price differential—may be different in the short-term, we believe a Total Inflation assumption of 2.75 percent is still reasonable to use as a building block of the General Salary Growth assumption. Please see the **Total Inflation** section and **Appendix A** of this report for details regarding the development of this assumption.

3. Reviewed historical real wage growth.

To evaluate a range for the Real Wage Growth assumption and identify any historical trends, we examined DRS (Washington State) wage growth for the Plans 2/3 employees. We also considered salary data from external sources. The salary data from the external sources include SSA and BEA national data across employees from all industries as well as BEA state and local government.

With this data, we estimated annual real wage growth by deducting observed annual CPI growth (annual observed inflation) from average wage growth corresponding to each data source. We relied on relevant CPI depending on whether the data was national or local. Under this methodology, we assume population demographics, e.g., average age and average service, will remain consistent year over year so the service-based salary increase component of annual wage growth also is assumed to remain constant.

Estimated Real Wage Growth

	Washington State*	National Measures**		
Geometric Averages	DRS - State Employees	SSA	BEA - All Industries	BEA - State and Local Government
Last 10 years (2010-2019)	0.56%	1.13%	0.82%	0.54%
Last 20 years (2000-2019)	0.92%	0.77%	0.84%	0.77%
Last 30 years (1990-2019)	0.69%	0.96%	0.91%	0.78%

**Local inflation – Seattle-Tacoma-Bellevue Urban Wage Earners and Clerical Workers CPI.*
***National inflation – U.S. city average Urban Wage Earners and Clerical Workers CPI.*

Based on the above historical data, we believe 0.50 percent to 1.00 percent represents a reasonable range for the Real Wage Growth assumption, but we are also mindful of maintaining consistency among our economic and demographic salary assumptions. During the *2013-18 Demographic Experience Study*, we relied on our estimated range of

real wage growth over the past 20 years to aid in setting the service-based salary increases. These ranges varied by retirement system but the largest systems, PERS and TRS, had a range of 0.0 percent to 0.8 percent and 0.0 percent to 0.5 percent, respectively.

4. **Future expectations for real wage growth.**

The last item we considered when studying real wage growth was expectations for the future. We reviewed various national forecasts and analyses to inform this expectation and considered it in the context of the duration of salaries for the open plans. To estimate real wage growth, we calculated the difference between percent change in employment cost index and inflation for CBO[6] and the difference between percent change in average annual wage in covered employment and inflation for SSA[7].

The national forecasts are higher than what is displayed in the historical tables because the forecasts have a broader definition of employee compensation which can include items such as employee wages, employer provided health insurance, paid time off, retirement benefits, etc. Due to the inclusion of additional sources of employee compensation, beyond employee wages, we do not rely on these forecasts to set an assumption. Rather, we compare forecasts from national sources to evaluate assumption consistency and whether the forecasts have significantly changed from our last study. According to the CBO and SSA forecasts, the average annual real wage growth is expected to be lower over the next ten years than what was previously forecasted.

Projected 10-Year Average Annual Real Wage Growth

	2019*	2021
CBO	0.90%	0.80%
SSA	1.71%	1.49%

Note: National forecasts include additional sources of employee compensation beyond employee wages.

**Numbers re-stated for this report to display the 10-year average instead of range.*

Lastly, we considered the future economic environment without explicit projections of wage growth or inflation. Specifically, we considered the extensive impact Artificial Intelligence (AI) and automation might have on the economy. We relied on analysis from experts in innovation and technology, which include MIT and the consulting firm McKinsey & Company. Analyses suggest that extreme productivity growth from AI, while expected, may not take effect quickly. Industries may take years to incorporate new technology and thus productivity gains will likely be a delayed result of current investment.[8]

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[6] *"The Budget and Economic Outlook: 2019 to 2029" and "The Budget and Economic Outlook: 2021 to 2031". Congressional Budget Office.*

[7] *The 2019 OASDI Trustees Report" and "The 2020 OASDI Trustees Report". Social Security Administration.*

[8] *Relihan, Tom. "A calm before the AI productivity storm". Ideas Made to Matter, Productivity. Massachusetts Institute of Technology (MIT), January 2, 2019.*

Furthermore, AI and automation may expand productive output, but have disparate impacts on various sectors of the economy and income levels. Some experts claim it may increase the wages for high and low earners but have a net decrease on wages for middle income earners[9]. For these reasons, we did not make an explicit adjustment for the impacts of AI and automation when selecting recommendation.

5. **Recommendation.**

We recommend a Total Inflation assumption of 2.75 percent as discussed in the **Total Inflation** section of this report.

To determine a recommendation for real wage growth, we considered both historical and future expectations of growth as well as how this assumption is used to develop our other salary assumptions. A range of 0.5 percent to 1.0 percent appears reasonable for setting the Real Wage Growth assumption. We recommend the Real Wage Growth assumption to be on the lower end of the range when we also consider consistency with service-based salary analysis in the demographic experience study and the declining forecasts from external sources. Given all this information, we recommend a lower Real Wage Growth assumption of 0.50 percent.

Thus, in setting our recommendation for general salary growth, we combine our recommendation for total inflation (2.75 percent) with our recommendation for real wage growth (0.5 percent) and arrive at a recommended General Salary Growth assumption of 3.25 percent.

[9] "*How will automation affect jobs, skills, and wages?*" *McKinsey Global Institute, March 2018.*

APPENDIX D – Investment Rate Of Return Assumption

Methodology

The recommended Investment Rate of Return assumption represents the anticipated returns on the Commingled Trust Fund's (CTF) current and future assets, net of expenses. We apply this assumption as a single rate to all plans invested in the CTF. We based the assumption on a 10- and 20- to 25-year projection period, consistent with the approximate closed and open retirement plan durations. Please see **Appendix A** for more information on this measure.

The Investment Rate of Return assumption is coordinated with WSIB's CMAs, which represents their expected asset performance, and the current asset allocation policy, or targets, for the CTF. Future changes to the CTF asset allocation policy or CMAs may require a new recommendation for the Investment Rate of Return assumption.

We took into consideration the "building block" method to develop this assumption. Under this method, the actuary determines the individual components for each economic assumption. Then the actuary may combine estimates for each applicable component to arrive at a best estimate for the given economic assumption.

In setting this assumption, we considered past investment returns, how economic conditions have changed and their possible impacts on future returns. However, we primarily relied on WSIB's expectation for future investment returns. We reviewed the simulated market returns from the current target asset allocation and CMAs provided by WSIB. Where appropriate, we used professional judgment to adjust the CMAs for consistency with our Inflation assumption and consistency with the retirement system's liability duration. We did not make adjustments to our recommendation for the impacts of future climate change. Lastly, we considered the sensitivity of the simulated returns to different CMAs.

Analysis

We took the following steps to develop our recommendation:

1. **Reviewed historical investment returns.**

   The following table summarizes the historical investment returns we observed over the given periods. See the **Exhibits for Appendix D** section for historical returns by year.

Historical WSIB Annual Average Returns	
Past 5 Years	12.57%
Past 10 Years	10.01%
Past 15 Years	8.27%
Past 20 Years	8.33%
Past 25 Years	8.81%
Past 30 Years	9.19%

Source: Washington State Investment Board. Returns restated for 1993 and beyond.

We observed that the historical average investment return is sensitive to the period and the inclusion of asset returns during FY 2020 and FY 2021. Including the last two fiscal years shows average historical returns consistently outpacing assumed returns during each timeframe. The resurgent FY 2021 recovery following the initial market downturn from the COVID-19 pandemic led to the highest annual return in the last 35 years.

2019 EES—Historical WSIB Annual Average Returns	
Past 5 Years	7.85%
Past 10 Years	10.49%
Past 15 Years	8.30%
Past 20 Years	7.17%
Past 25 Years	8.94%
Past 30 Years	8.81%

Source: WSIB. Returns restated for 1993 and beyond.

The previous table is from our 2019 EES and therefore excludes FY 2020 and FY 2021 returns.

A complete market cycle includes a bear market, recovery, and bull market, and is perhaps best represented by the 15- and 20-year averages in the previous table. The 15-year average contains returns just prior to the start of the Great Recession, and the 20-year average contains returns starting near the beginning of the 2001-07 market cycle, both continuing through the current cycle. Returns over periods beyond 20 years include experience from the strong markets of the 1990's that increase average returns.

While we consider historical investment returns in this study, they are not a good predictor of future long-term experience. However, past returns may provide estimates for certain statistical components of asset classes such as volatilities and correlations. WSIB includes this history in their CMAs. In addition, past investment returns are a product of the economic conditions of the time they occurred. As we analyze returns further in the past, the economic conditions that produced those returns are usually very different than today.

The following list details a few examples of how economic conditions have changed and the possible impacts on future returns:

- **Stock market returns may revert to historical averages.**
  When the economy is experiencing high growth, stock market valuations as measured by their Price to Earnings (P/E) Ratio tend to increase, meaning investors are willing to pay more for the same amount of earnings, all else held constant. Over the last 30 years, the Standard and Poor's 500 P/E Ratio increased significantly, well above the historical average. If P/E ratios return toward their long-term average, we would expect a negative impact on stock prices, and therefore lower future stock market returns.

- **Increasing government debt.**
  The amount of U.S. government debt has risen to historic levels. The use of debt (or "leverage") generally improves returns. However, paying down or stabilizing a large debt requires cutting from other programs or raising taxes, both of which hurt prospective economic growth. According to the U.S. Treasury, and in alignment with the implementation of the CARES Act, the government recently added a large amount of debt to aid in pandemic relief, the full impact of which remains to be experienced.

- **Inflation could be different in the future.**
  In the short-term, we could experience high inflation as a consequence of the pandemic and monetary response policy—a low Federal Funds rate. We also note that other inflation forecast experts are mixed on their expectations for the future under the current market climate. As investment returns are comprised of real returns plus inflation, future inflation levels will impact future rates of investment return.

The list above is not exhaustive and only meant to illustrate how the past and future may differ and how those different conditions could produce different future returns. Other examples that could impact future investment rates of return include technological advances, low productivity growth, sustained negative impacts due to the pandemic, future climate change, and a shift in population demographics. Future economic conditions are difficult to predict and markets may yield different returns than in the past.

2. Reviewed Expectations for the Future - WSIB's CMAs and simulated future investment returns.

WSIB assigns three pieces of information to each asset class they invest in to form the CMAs:

- Expected annual return.
- Standard deviation of the annual return.
- Correlations between the annual returns of each asset class with every other asset class.

WSIB then uses the CMAs and their target asset allocation to project (or simulate) future investment returns over the next 15 years. The following tables display the target asset allocation, expected annual return, and standard deviation for this study (2021 EES) and the prior study (2019 EES). Please see WSIB's 2021 White Paper for asset class correlations and modeling applications.

WSIB Target Asset Allocation			
	2021	2019	Difference
Global Equity	32%	32%	0%
Tangible Assets	7%	7%	0%
Fixed Income	20%	20%	0%
Private Equity	23%	23%	0%
Real Estate	18%	18%	0%
Cash	0%	0%	0%
Total	100%	100%	

WSIB Portfolio Statistics & Capital Market Assumptions						
	Expected 1-Year Return			Standard Deviation		
Asset Class	2021	2019	Difference	2021	2019	Difference
Global Equity	8.1%	8.5%	(0.4%)	19.0%	18.5%	0.5%
Tangible Assets	6.9%	7.3%	(0.4%)	12.0%	13.0%	(1.0%)
Fixed Income	3.7%	4.4%	(0.7%)	6.0%	6.0%	0.0%
Private Equity	11.1%	11.5%	(0.4%)	25.0%	25.0%	0.0%
Real Estate	7.6%	8.0%	(0.4%)	13.0%	14.0%	(1.0%)
Cash	1.7%	2.6%	(0.9%)	1.5%	1.5%	0.0%

The current target asset allocation was set in 2018 and has not changed since the 2019 EES. However, the one-year expected return decreased across all asset classes, along with mixed changes to expected standard deviation (or volatility). Please see the **Exhibits for Appendix D** section for a comparison of the expected annual return, standard deviation, and target asset allocation for this study and the prior four experience studies.

WSIB provided our office with simulated future investment returns under varying projection periods. The changes in one-year expected return and volatility noted above consistently produce lower simulated returns over the various periods. These return simulations are produced by randomizing annual returns using the CMA statistics and target asset allocation. They then calculate an average annual return for the simulation and repeat the process many times. WSIB provided us with the simulated annual investment returns by percentile and for various time horizons ranging between 1 year to 50 years.

WSIB also compares their simulated results against the current adopted investment rate of return. They note in their White Paper that when looking over a 15-year period, their simulations earned less than 7.5 percent per year 56.5 percent of the time. The following table displays the annual returns for the 25-year simulations from our current and prior economic studies. We chose the 25-year simulation period to correspond to the open retirement liability duration of 20 to 25 years.

Simulated Future Investment Returns*			
	2021	2019	Difference
75th Percentile	8.8%	9.3%	(0.5%)
60th Percentile	7.6%	8.1%	(0.5%)
55th Percentile	7.2%	7.7%	(0.5%)
Median Return	6.9%	7.4%	(0.5%)
45th Percentile	6.5%	7.0%	(0.5%)
40th Percentile	6.1%	6.6%	(0.5%)
25th Percentile	4.9%	5.4%	(0.5%)

**Simulated returns over 25-year period.*

Generally, we observed a decrease of approximately 50 basis points across all percentiles of the simulations between the 2021 and 2019 studies. Specifically, the median annual return decreased by 48 basis points (rounded to negative 0.5 percent). We can interpret the median return as the return that splits half of all simulations above and half below that value. Put another way, there is a 50 percent chance returns will exceed the median return and a 50 percent chance they will fall below the median return.

Displayed simulations rely on a log-stable distribution, which relies more heavily on actual historical returns to inform the future distribution (and volatility) of returns.

The simulated future investment returns represent WSIB's best estimate of future returns for the CTF but require a number of simplifying assumptions. The simulated returns are calculated assuming the target asset allocation and CMAs will remain constant throughout the projection period. We reviewed quarterly asset allocations since 2015 to understand how the actual allocation compares to the target. We observed certain asset classes exhibiting relatively consistent trends above or below targets, while staying within WSIB's acceptable range. If the variance between actual and target allocation continued or grew over the long-term, then the simulated return profile will look different than above. We estimate the 2021 median return could increase or decrease by five to ten basis points if recent trends persist.

It is important to note that WSIB sets their CMAs for a 15-year time horizon. We apply the assumptions over a longer 25-year period for purposes of determining funding requirements consistent with current state funding policy. As noted in the **Recommendation** section, we apply adjustments using our professional judgment to arrive at assumptions consistent with measurement periods shorter and longer than 15 years.

3. Considered short-term vs. long-term simulated returns.

We studied simulated returns over time horizons similar to the duration of liabilities for each retirement plan. The Plans 1, closed to new hires in 1977, have a much shorter duration than the Plans 2/3, which remain open to new hires. The following table shows the aggregated average duration for Plans 1 and Plans 2/3.

Average Plan Duration*		
	Closed Plans 1	Open Plans 2/3
Years	8.1	20.7

**Duration based on OSA's 2019 AVR.*

We considered the difference in the percentiles of the 10- and 25-year simulated returns given the different durations among closed and open plans. Comparing simulated returns for the 10- and 25-year time horizons, we observed less deviation from the median at the upper and lower percentiles under the longer, 25-year period. As the table shows, as the percentile moves away from the median, the difference between the simulation periods

increases in magnitude. However, we saw only a 5 basis point difference in the median return. This suggests a single assumption may continue to be reasonable for all plans. In the Recommendation section, later in this Appendix, we apply adjustments to these median returns based on our professional judgment and the different time horizons. When reviewing these adjustments, we also consider the different durations of the closed versus the open plans to determine if a single assumption remains reasonable.

Simulated Investment Returns*			
	10 Years	25 Years	Difference**
75th Percentile	10.0%	8.8%	(1.2%)
60th Percentile	8.0%	7.6%	(0.4%)
55th Percentile	7.5%	7.2%	(0.3%)
Median Return	6.9%	6.9%	(0.1%)
45th Percentile	6.4%	6.5%	0.1%
40th Percentile	5.8%	6.1%	0.3%
25th Percentile	3.9%	4.9%	1.0%

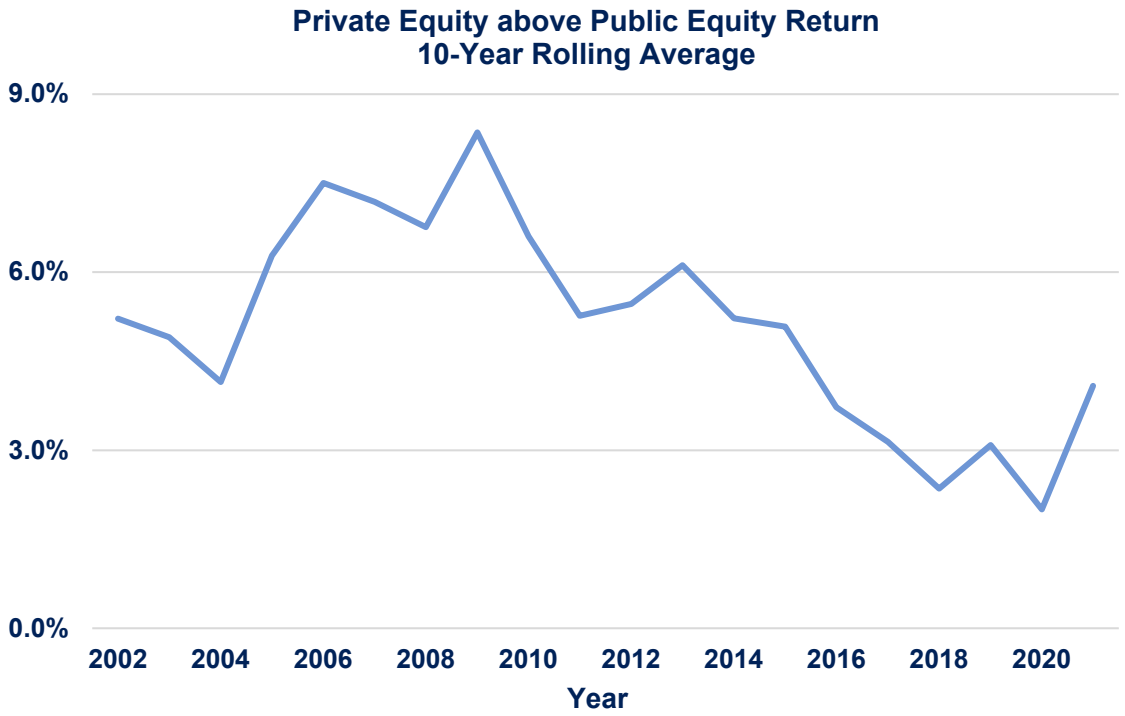
**Simulated returns from 2021 CMAs and asset allocation.*
***Rounded difference. Totals may not agree due to rounding.*

4. **Reviewed sensitivity of the simulated returns to the CMAs.**
   As with any assumption, we recognize that the CMAs may not match reality so we estimated how the median simulated return may change under a different set of CMAs. To do this, we modeled a decrease or an increase in the expected one-year return of private equities and global equities by 1 percent. We chose these two asset classes because they comprise 55 percent of the target asset allocation and have the greatest amount of uncertainty around their return (standard deviation). The following table displays our estimate of the change in the median simulated return. Note that we made no adjustment to expected volatility of either asset class.

25-Year Estimated Median Return Sensitivity					
		Private Equity Expected Return		Global Equity Expected Return	
	Base	(1%)	1%	(1%)	1%
Median Return	6.9%	6.7%	7.1%	6.6%	7.2%

The WSIB private equity assumed return is based on a 300 basis point (3.00 percent) premium or increase above the global equity expected return. WSIB's White Paper recognizes a premium of 0 to 500 basis points as a reasonable range.

As discussed, we set our Investment Rate of Return assumption based on a shorter or longer time horizon than WSIB depending on the given plan. We considered this different time horizon and its implications on our selection of a private equity premium, or rather, an adjustment to the premium that WSIB applies in its CMAs.



The previous graph shows a historical downward trend in the private equity premium, that is, historical private equity returns over and above that of public equity. We believe this trend is a result of the maturing and evolving private equity market and, in our opinion, will continue. As more investors have joined the market over the last 20 years, competition for and efficiency of private equity investments have increased, driving down the resulting return. We believe a 300 basis point private equity premium is appropriate for a 10- or 15-year period. However, we believe a lower premium in the range of 200 to 250 basis points is reasonable and corresponds to a longer 25-year period.

In addition to an adjustment to the private equity premium, we also considered reversion to average historical returns in the equity asset classes, also known as "mean reversion." WSIB applies a mean reversion adjustment in several asset classes as disclosed in their White Paper. For equities, their mean reversion adjustment is called "anticipated P/E contraction" as they expect P/E ratios to revert back toward long-term historical averages. Assuming mean reversion reduces the annual expected return in the asset class, we analyzed the adjustments WSIB made to equities and how that adjustment could change over different time horizons. Extending the mean reversion time horizon to 25 years reduces the magnitude of the annual mean reversion adjustment, thus increasing annual expected return in equities. Alternatively, if the mean reversion occurred during a shorter time horizon, that could lead to a larger reduction to the expected equity return over 10 years. A mean reversion could occur over 10 years and still be consistent with an assumed mean reversion over 15 years. In that instance, an adjustment to the mean reversion adjustment for a period closer to 10 years would not be necessary. We considered no adjustment to the standard deviation in our analysis.

Recommendation.
To inform our assumption, we used our professional judgment to adjust WSIB's CMAs to account for our expectations for the future, consistency with our other economic assumptions, and the different time horizons of our valuation.

- **Adjust Inflation Assumption** – To reflect the difference between WSIB's and our Inflation assumptions. In the CMAs, WSIB assumes 15-year national inflation of 2.20 percent each year. In this study, we recommend a long-term (20- to 25-year) national inflation assumption of 2.35 percent. This means we expect the CTF to return about 15 basis points (0.15 percent) higher each year over a 25-year period. We believe this adjustment is necessary for the open plans to retain consistency between the entire set of economic assumptions, however no inflation adjustment may be necessary for the closed plan duration of 10 years.
- **Adjust Private Equity Premium Over Global Equity Assumption** – To reflect assumptions consistent with a longer time horizon. We believe WSIB's CMAs for private equity are appropriate for a 10- or 15-year time horizon. However, we believe a private equity premium of 250 (instead of 300) basis points is reasonable for our longer-term outlook. As this asset class continues to mature and evolve, we expect increased competition for investment opportunities and more efficient markets. The historical trend of private equity returns over public equity performance has demonstrated a consistent downward trend, especially over the last decade. For the longer time horizon, we estimate the simulated median return to decrease by 5 to 15 basis points with this assumption change. For the closed plans, we believe no adjustment is needed.
- **Consider Mean Reversion of Global Equity and Private Equity Return Assumptions** – To reflect assumptions consistent with a longer time horizon. We believe WSIB's mean reversion adjustments to equities (anticipated P/E contraction) are appropriate for a 10- or 15-year time horizon. We believe smaller adjustments are more appropriate for our longer-term outlook. Based off WSIB's adjustments and the longer time horizon associated with the pension system's liabilities for our open plans, we would expect annual mean reversion adjustments to be smaller in magnitude, thereby increasing the expected annual return in equities. Based on our review, we slightly increased our assumed investment return recommendation due to mean reversion

For the open plans, starting with a simulated return of 6.9 percent, we make an upward 0.15 percent adjustment for the Inflation assumption and apply adjustments for our private equity expectations and investment returns reverting toward historical means. For the closed plans, we also start with a simulated return of 6.9 percent, but make little to no adjustments for the shorter time horizon. With these adjustments and considerations in mind, we arrive at our recommendation for the Investment Rate of Return assumption of 7.00 percent for all plans.

Exhibits for Appendix D

Portfolio Statistics & Capital Market Assumptions					
Target Asset Allocation					
	2021	**2019**	**2017**	**2015**	**2013**
Global Equity	32%	32%	37%	37%	37%
Tangible Assets	7%	7%	5%	5%	5%
Fixed Income	20%	20%	20%	20%	20%
Private Equity	23%	23%	23%	23%	25%
Real Estate	18%	18%	15%	15%	13%
Cash	0%	0%	0%	0%	0%
Expected 1-Year Returns					
	2021	**2019**	**2017**	**2015**	**2013**
Global Equity	8.10%	8.50%	8.50%	8.80%	8.75%
Tangible Assets	6.90%	7.30%	7.10%	6.60%	6.80%
Fixed Income	3.70%	4.40%	3.90%	3.90%	3.50%
Private Equity	11.10%	11.50%	11.50%	11.80%	11.75%
Real Estate	7.60%	8.00%	8.00%	8.00%	8.00%
Cash	1.70%	2.60%	2.30%	2.30%	2.50%
Standard Deviation on 1-Year Returns					
	2021	**2019**	**2017**	**2015**	**2013**
Global Equity	19.00%	18.50%	18.00%	18.85%	18.50%
Tangible Assets	12.00%	13.00%	13.00%	8.60%	7.30%
Fixed Income	6.00%	6.00%	5.50%	5.25%	5.75%
Private Equity	25.00%	25.00%	25.00%	25.00%	28.00%
Real Estate	13.00%	14.00%	14.00%	15.70%	15.50%
Cash	1.50%	1.50%	1.00%	2.00%	2.00%

Historical Plan Performance	
Fiscal Year Ending June 30	**Investment Return**
1982	2.50%
1983	47.30%
1984	(0.03%)
1985	29.80%
1986	26.90%
1987	16.90%
1988	4.20%
1989	13.50%
1990	8.30%
1991	9.50%
1992	8.20%
1993	13.07%
1994	2.10%
1995	16.24%
1996	16.49%
1997	20.18%
1998	17.12%
1999	11.76%
2000	13.56%
2001	(6.75%)
2002	(5.15%)
2003	3.02%
2004	16.72%
2005	13.05%
2006	16.70%
2007	21.33%
2008	(1.22%)
2009	(22.84%)
2010	13.21%
2011	21.14%
2012	1.39%
2013	12.36%
2014	17.06%
2015	4.93%
2016	2.65%
2017	13.44%
2018	10.20%
2019	8.36%
2020	3.71%
2021	28.68%

Note: Time-weighted returns. Some returns restated.
Source: WSIB.

APPENDIX E – Membership Growth for Plan 1 Funding

Historical Data

The following table summarizes the historical average annual growth rates we observed in PERS and TRS over the given periods.

Historical Growth		
	PERS	TRS
Past 5 Years	2.1%	2.9%
Past 10 Years	1.1%	1.8%
Past 15 Years	1.0%	1.1%
Past 20 Years	0.9%	1.1%

The more recent (Past 5 Years) growth has significantly exceeded our 2019 EES recommended growth of 0.95 percent per year, but we do not expect this growth to be reflective of the future. The Past 20 Years is expected to be more reflective of the future because it contains the "full cycle" of growth which includes lower than expected growth following the Great Recession as well as the higher-than-expected growth from the bounce back to Great Recession.

TRS has slightly outpaced PERS over the past 20 years; however, this difference is more pronounced in the last 5 to 10 years. The significant difference in growth is partially related to a heightened focus over the last decade on school funding and increasing the number of teachers per student. Following the recent, large investments in school funding that contributed to the higher-than-normal TRS system growth, we expect TRS growth to slow down and return to longer term historical averages because we believe additional investments in school funding have stabilized.

As of the publication of this report, the impact of COVID-19 on the growth of the Washington State retirement system is not yet available in our data.

Projected State Population Growth

When reviewing short-term growth in the Washington State retirement systems, we consider the most recent projections from OFM[10] for the Washington State population. We considered this source of information because historically the growth in the retirement system and the state population have been reasonably correlated. Over the last 20 years, PERS and Washington State (All Ages) growth has been 81 percent correlated and TRS and Washington State (Ages 5-17) has been 52 percent correlated. However, the presence of a correlation is not sufficient to infer the presence of a predictive or causal relationship. Given this, we relied on OFM forecasts as additional relevant data to consider when setting our PERS and TRS recommendation but did not rely on the forecasts as predictors of retirement system growth.

[10] *Source: OFM, "Forecast of the State Population, November 2020 Forecast".*

We display the OFM projections below for the next ten and twenty years.

Projected WA State Population Growth				
	2018 Forecast		2020 Forecast	
	All Ages	Ages 5-17	All Ages	Ages 5-17
Next 10 Years	1.2%	0.7%	0.8%	0.0%
Next 20 Years	1.0%	0.6%	0.8%	0.1%

The forecasts from OFM have declined since our 2019 EES (displayed under "2018 Forecast") which indicates the overall state population is projected to grow at a slower pace. Most notably, the Ages 5-17 (or school aged children) are not expected to grow over the next ten years. The OFM forecasts have declined as a result of a decrease in net migration (or families moving to Washington) and lower fertility rates within the state.

Similar to the OFM projections, we believe future PERS and TRS growth will be less than observed recently. The statewide projected growth from OFM remains in line with our PERS recommendation of 1 percent per year. With respect to TRS, given the recent high annual growth rates, we do not believe TRS retirement system will trend towards zero growth in the next ten years.

It could be reasonable to assume lower growth rates for the Membership Growth for Plan 1 Funding assumption based on OFM's forecasts or higher growth rates based on recent historical retirement system growth. We will also consider how these forecasts impact our long-term growth rate assumptions which we study during the RAAS.

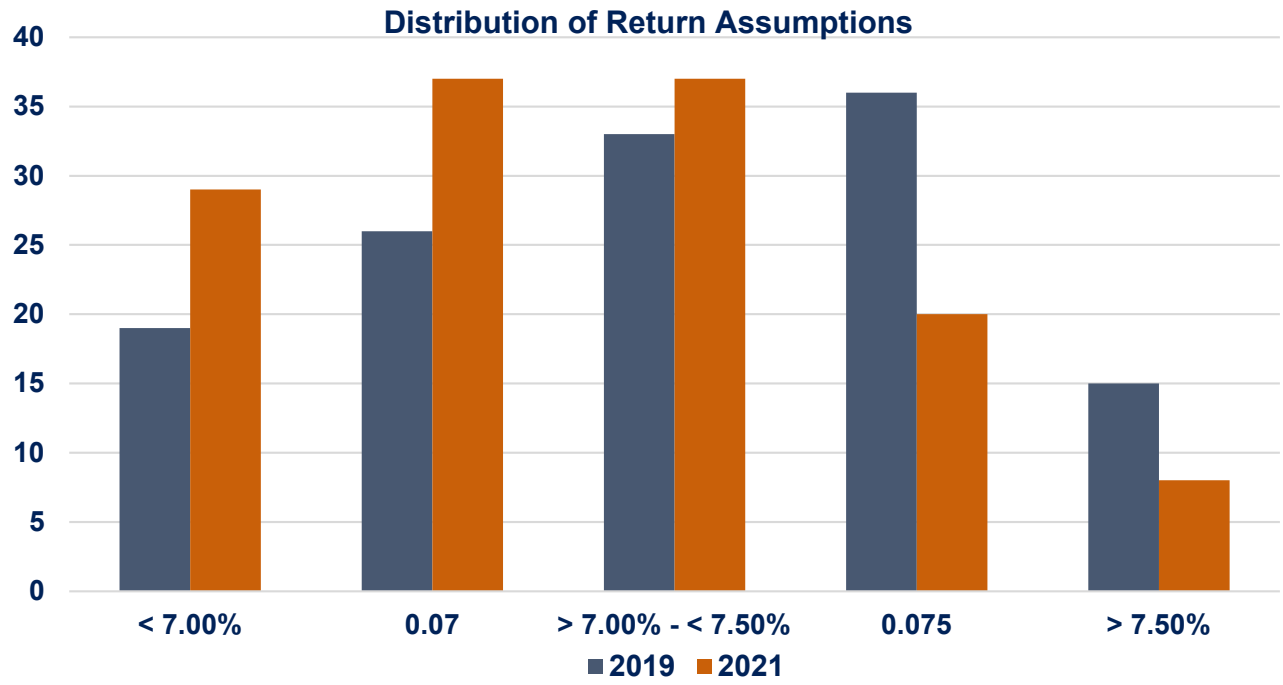
APPENDIX F – Peer Retirement System Economic Assumptions

Economic Assumptions for Selected Plans Outside Washington[1]				
Plan Name	Investment Return	General Salary Growth	Real Wage Growth[2]	Inflation
WA 2021 Economic Experience Study Recommendations	7.00%	3.25%	0.50%	2.75%
WA Currently Prescribed Economic Assumptions	7.50%	3.50%	0.75%	2.75%
Alaska PERS	7.38%	2.75%	0.25%	2.50%
Alaska Teachers	7.38%	2.75%	0.25%	2.50%
California PERS	7.00%	2.75%	0.25%	2.50%
California Teachers	7.00%	3.50%	0.75%	2.75%
Colorado PERA	7.25%	3.00%	0.70%	2.30%
Florida Retirement System	7.00%	3.25%	0.85%	2.40%
Idaho PERS	7.05%	3.75%	0.75%	3.00%
Iowa PERS	7.00%	3.25%	0.65%	2.60%
Missouri State Employees	6.95%	2.50%	0.25%	2.25%
Ohio PERS	7.20%	3.25%	0.75%	2.50%
Oregon PERS	7.20%	3.50%	1.00%	2.50%
Wisconsin Retirement System	5.40%	3.00%	0.50%	2.50%
Selected Public Plans Outside WA–Average	**6.98%**	**3.10%**	**0.58%**	**2.53%**
Selected Public Plans Outside WA–Minimum	**5.40%**	**2.50%**	**0.25%**	**2.25%**
Selected Public Plans Outside WA–Maximum	**7.38%**	**3.75%**	**0.75%**	**3.00%**

[1] *Data gathered from NASRA, the Public Plans Database maintained by the Center for Retirement Research, and individual system Annual Comprehensive Financial Reports or actuarial valuations. Where more recent updates were available (e.g., via press release issued after the last report), that information was used. For systems having multiple benefit tiers with different assumptions, the largest was used. Data as of June 2021.*

[2] *For comparison to our economic assumptions, we assumed Real Wage Growth was the difference between General Salary Growth and Inflation.*

APPENDIX G – Change in Other States' Investment Rate of Return Assumption



Data Source: National Association of State Retirement Administrators; http://www.nasra.org. Data as of June 2021.

APPENDIX H – Historical Economic Assumptions for Washington State Pension Systems

Historical Economic Assumptions for Washington State Pension Systems					
Valuation Years	**Investment Return**	**General Salary Growth**	**Inflation**	**Real Wage Growth**	**Membership Growth for Plan 1 Funding**
1989 - 1994	7.50%	5.50%	5.00%	0.50%	0.75% TRS 1.25% PERS
1995 - 1997	7.50%	5.00%	4.25%	0.75%	0.90% TRS 1.25% All Others
1998 - 1999	7.50%	4.00%	3.50%	0.50%	0.90% TRS 1.25% All Others
2000 - 2008	8.00%	4.50%	3.50%	1.00%	0.90% TRS 1.25% All Others
2009 - 2010	8.00%	4.50% LEOFF 2 4.00% Other Plans	3.50%	1.00% LEOFF 2 0.50% Other Plans	0.90% TRS 1.25% All Others
2011 - 2012	7.5% LEOFF 2 7.9% Other Plans	3.75%	3.00%	0.75%	0.80% TRS 0.95% PERS
2013 - 2014	7.5% LEOFF 2 7.8% Other Plans	3.75%	3.00%	0.75%	0.80% TRS 0.95% PERS
2015	7.5% LEOFF 2 7.7% Other Plans	3.75%	3.00%	0.75%	0.80% TRS 0.95% PERS
2016	7.5% LEOFF 2 7.7% Other Plans	3.75%	3.00%	0.75%	1.25% TRS 0.95% PERS
2017 - 2018	7.4% LEOFF 2 7.5% Other Plans	3.50%	2.75%	0.75%	1.25% TRS 0.95% PERS
2019 - 2020	7.4% LEOFF 2 7.5% Other Plans	3.50%	2.75%	0.75%	1.25% TRS 0.95% PERS

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