

**Audit of Actuarial Valuations**

**State of Washington  
Pension Funding Council**

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**September 20, 2006**

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September 20, 2006

Pension Funding Council  
c/o Department of Retirement Systems  
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Olympia, Washington 98504-8380

Chairman Moore and Members of the Council:

Enclosed is our Report for the Audit of the September 30, 2005 Actuarial Valuations prepared pursuant to Revised Code of Washington (RCW) 41.45.110. We have appreciated the opportunity to conduct this audit and to work with the Pension Funding Council and the Pension Funding Council Work Group.

Should there be any questions regarding the content of the report, do not hesitate to contact us.

The undersigned are members of the American Academy of Actuaries and meet the Qualification Standards of the American Academy of Actuaries to render the actuarial opinions contained herein.

Sincerely,

Marilyn M. Oliver, F.S.A., M.A.A.A.  
Actuary and Principal  
Oliver Consulting  
Audit Manager

John E. Bartel, A.S.A., M.A.A.A.  
President  
Bartel Associates, LLC  
Audit Peer Review

## TABLE OF CONTENTS

A.	Summary .....	1
B.	Introduction.....	5
C.	Review of Contribution Rate Determination	
1.	Overview.....	6
2.	Review .....	7
a)	Member Data .....	7
b)	Valuation Software .....	8
c)	Actuarial Value of Assets .....	10
d)	Contribution Rate Formulas and Calculations.....	10
e)	Assumption Changes .....	11
3.	Contribution Rates .....	13
D.	Observations and Recommendations.....	15

### Appendix

A.	Detailed Data Summary .....	A-1
B.	Detailed Results of Parallel Computer Runs.....	A-6
1.	Summary by Contribution Rate Set.....	A-6
2.	Summary by of Active / Inactive Results for Contribution Rate Set 1 .....	A-9

## **A. Summary**

Oliver Consulting was retained by the Pension Funding Council, pursuant to Revised Code of Washington (RCW) 41.45.110, to conduct the year 2006 concurrent biennial audit of the actuarial valuations prepared by the Office of the State Actuary (OSA) and used for actuarial rate setting purposes. Peer review and actuarial support for the audit was performed by Bartel Associates, LLC. Along with review of technical issues, peer review included review of the scope of the audit and the methodologies utilized.

The following Washington State Retirement Plans were included in the audit:

- Public Employees' Retirement System, Plan 1 (PERS 1)
- Public Employees' Retirement System, Plans 2 and 3 (PERS 2/3)
- Teachers' Retirement System, Plan 1 (TRS 1)
- Teachers' Retirement System, Plans 2 and 3 (TRS 2/3)
- School Employees' Retirement System, Plans 2 and 3 (SERS 2/ 3)
- Law Enforcement Officers' and Fire Fighters' Retirement System, Plan 1 (LEOFF 1)
- Washington State Patrol Retirement System, Plans 1 and 2 (WSPRS 1/2)

The new Public Safety Employees' Retirement System (PSERS) was not included in this audit.

The audit of the contribution rates encompassed the following areas:

1. Member data
2. Valuation software
3. Actuarial value of assets
4. Contribution rate formulas and calculations
5. Material changes in assumptions recommended by the Office of the State Actuary

Our review included checks of data for general reasonability, parallel processing to check data edits and actuarial liability and present value calculations, and checks of worksheets used to calculate final contribution rates. In addition, we reviewed formulas and methods for compliance with actuarial theory and standards, contribution rates for consistency with the September 30, 2004 actuarial valuation results, and material changes in

recommended assumptions since the last actuarial audit for conformance with actuarial theory and standards.

Our data testing found no material differences and our parallel testing of liability determinations produced results comparable to those produced by OSA for the four contribution rate sets brought before the Council today. Formulas and methods used were reasonable in the aggregate and in keeping with statutory requirements.

OSA's recommended assumptions include a change to incorporate a projection of future mortality improvement in assumed mortality rates. The proposed change to the mortality assumption is discussed in detail in the body of the report. We agree that allowance for future mortality improvement produces a more accurate picture of the plan's liabilities and agree that the mortality improvement assumption chosen is reasonable. We note that mortality improvement assumption changes would generally be made at the time of an experience study so that mortality rates can be addressed as a whole, but do not think it inappropriate to change at this time. We also note that the change may have administrative implications. Such implications are outside the scope of our audit, but merit consideration.

### **Contribution Rates**

Four sets of contribution rates are being brought before the Council as follows:

1. With mortality improvements, with gainsharing,
2. With mortality improvements, without gainsharing,
3. Without mortality improvements, with gainsharing, and
4. Without mortality improvements, without gainsharing.

We have reviewed each set and agree with the Office of the State Actuary's calculations. We have reviewed Set 1, which the Office of the State Actuary is recommending, for compliance with Actuarial Standards of Practice and agree that it satisfies those standards. The contribution rates are set out in Table 1.

**Table 1: Proposed Contribution Rates excluding Administrative Expense**

## 1. With Mortality Improvements, With Gainsharing

	Employer Rates		Member Rates	
	2007-08 <sup>1</sup>	2008-09	2007-08	2008-09
PERS	7.08%	8.64%	4.60%	5.28%
TRS	8.12%	9.89%	3.30%	3.79%
SERS	8.41%	9.71%	4.29%	4.71%
LEOFF 1	0.00%	0.00%	0.00%	0.00%
WSPRS	8.79%	8.79%	7.74%	7.74%

## 2. With Mortality Improvements, Without Gainsharing

	Employer Rates		Member Rates	
	2007-08	2008-09	2007-08	2008-09
PERS	6.43%	7.99%	4.60%	5.28%
TRS	6.10%	7.87%	3.30%	3.79%
SERS	6.12%	7.42%	4.29%	4.71%
LEOFF 1	0.00%	0.00%	0.00%	0.00%
WSPRS	8.79%	8.79%	7.74%	7.74%

## 3. Without Mortality Improvements, With Gainsharing

	Employer Rates		Member Rates	
	2007-08	2008-09	2007-08	2008-09
PERS	6.46%	8.02%	4.15%	4.83%
TRS	7.38%	9.15%	2.90%	3.39%
SERS	7.76%	9.06%	3.89%	4.31%
LEOFF 1	0.00%	0.00%	0.00%	0.00%
WSPRS	7.75%	7.75%	6.70%	6.70%

## 4. Without Mortality Improvements, Without Gainsharing

	Employer Rates		Member Rates	
	2007-08	2008-09	2007-08	2008-09
PERS	5.84%	7.40%	4.15%	4.83%
TRS	5.44%	7.21%	2.90%	3.39%
SERS	5.58%	6.88%	3.89%	4.31%
LEOFF 1	0.00%	0.00%	0.00%	0.00%
WSPRS	7.75%	7.75%	6.70%	6.70%

<sup>1</sup> July 1 – June 30 for PERS, LEOFF 1, and WSPRS; September 1 – August 31 for TRS and SERS

**Recommendations**

As a result of the audit we did not find any material gaps in the valuation processes or procedures. However, based on our review, we make the recommendations outlined below.

- 1) Include in the next audit of the systems' financial statements a review of the procedures used to supply September 30 fund balance data to the Office of the State Actuary. The review should include items such as ascertaining that the information supplied by the three sources (the Department of Retirement Systems, the State Investment Board and the Office of the State Treasurer) is consistent.
  
- 2) Upgrade the process used to value vested terminations.

We wish to thank the Office of the State Actuary for their cooperation during the course of the audit including Matt Smith, Martin McCauley, and Christi Steele (who performed admirably as our interface).

## **B. Introduction**

Oliver Consulting was retained by the Pension Funding Council, pursuant to Revised Code of Washington (RCW) 41.45.110, to conduct the year 2006 concurrent biennial audit of the actuarial valuations prepared by the Office of the State Actuary (OSA) and used for actuarial rate setting purposes. Peer review and actuarial support for the audit were provided by Bartel Associates, LLC. Along with technical review, the peer review included review of the scope of the audit and the methodologies utilized.

The audit took place over a two-month period and was conducted concurrently with the final stages of the Office of the State Actuary's September 30, 2005 actuarial valuations.

The following Washington State Retirement Plans were included in the audit:

- Public Employees' Retirement System, Plan 1 (PERS 1)
- Public Employees' Retirement System, Plans 2 and 3 (PERS 2/3)
- Teachers' Retirement System, Plan 1 (TRS 1)
- Teachers' Retirement System, Plans 2 and 3 (TRS 2/3)
- School Employees' Retirement System, Plans 2 and 3 (SERS 2/ 3)
- Law Enforcement Officers' and Fire Fighters' Retirement System, Plan 1 (LEOFF 1)
- Washington State Patrol Retirement System, Plans 1 and 2 (WSPRS 1/2)

The new Public Safety Employees' Retirement System (PSERS) was not included in this audit.

Four sets of contribution rates are being brought before the Council as follows:

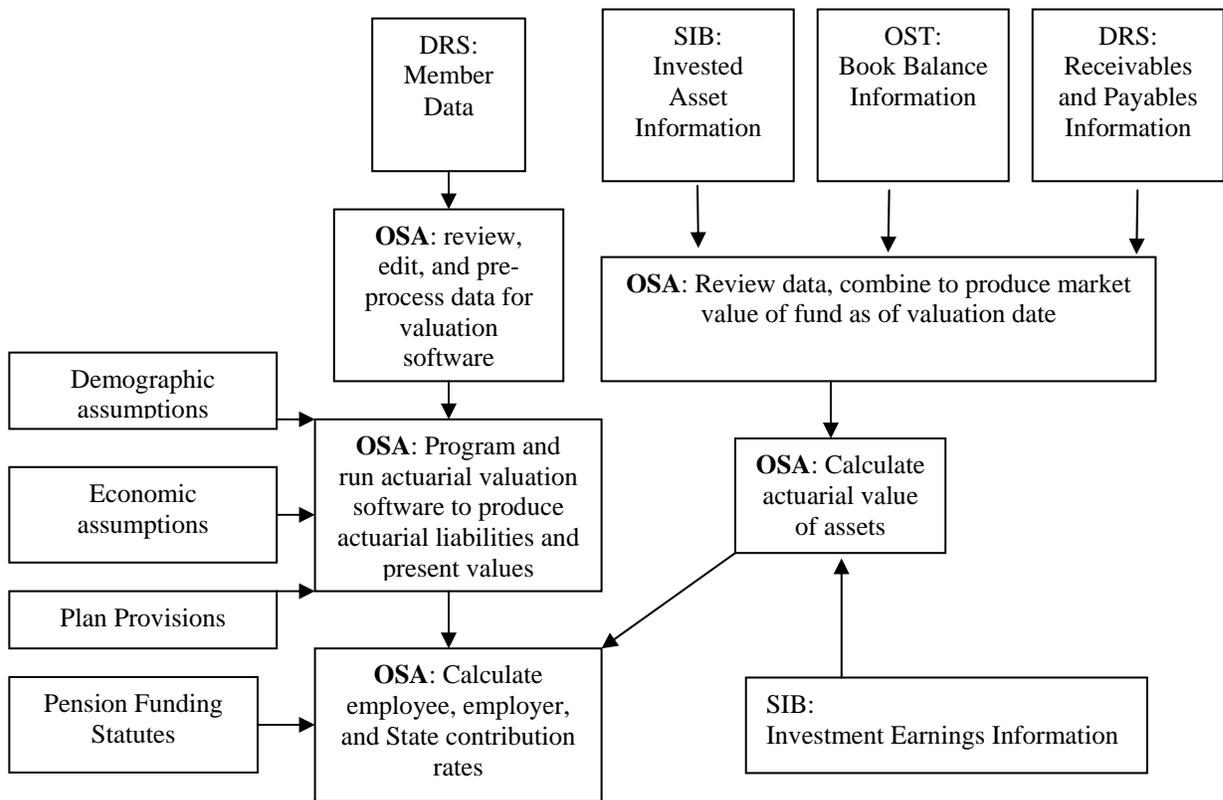
1. With mortality improvements, with gainsharing,
2. With mortality improvements, without gainsharing,
3. Without mortality improvements, with gainsharing, and
4. Without mortality improvements, without gainsharing.

### C. Review of Contribution Rate Determination

#### 1. Overview

Chart 1, below, provides an overview of the main components of the actuarial valuation process. Processes performed by the Office of the State Actuary are labeled “OSA” and were included in the concurrent audit. In addition, we reviewed actuarial methods and processes used in the calculations and assumption changes since the last actuarial audit.

Chart 1: Overview of the Main Components of the Actuarial Valuation Process



OSA: Office of the State Actuary  
 DRS: Department of Retirement Systems  
 OST: Office of the State Treasurer  
 SIB: State Investment Board

## 2. Review

Results of our review are discussed by area below.

### *(a) Member Data*

Audit of the data was not within the scope of the project, but we did perform data checks that include the following to assure that the data and editing and pre-processing procedures were reasonable. These include:

Record tracing: Traced sample records from DRS unedited data to OSA edited data.

Cost-of-living increases: To assure that cost-of-living increases were appropriately included in the data, checked COL increases in 2004 and 2005 for sample records.

Unedited data reconciliation: Independently summarized the unedited data and compared with OSA's summary.

Parallel data editing: Reviewed the OSA data editing process and performed edits on the raw data for the items below. Results were then compared to OSA's results.

#### Salaries:

- Reviewed the OSA salary adjustment policy for actives and vested terminations
- Calculated adjusted compensation for low service active members based on OSA policy
- Calculated the salary for vested terminations based on OSA salary setting procedures

#### Service:

- Reviewed OSA's service adjustments
- Calculated service based on valuation date and member entry date, compared the results with OSA service for reasonability - noted differences in service for PERS 1 and TRS 1 members that were explained by OSA staff.

#### Date of Birth, Entry Age and Sex:

- Reviewed and performed OSA editing procedures for each item

#### Benefit Payments:

- Reviewed OSA adjustment procedures and recalculated

We noted that the procedures used to check and edit the data were appropriate and reasonable for a plan of this size and based on the results of our parallel calculations the procedures were appropriately applied. (See Appendix A.)

**(b) Valuation Software**

This year the Office of the State Actuary changed software systems to a more current system. A significant portion of the audit was devoted to reviewing the new software system, including review of test cases and performing a parallel determination of the actuarial results produced by the new software. As part of this process, we also reviewed actual benefit calculations supplied by DRS to assure that our understanding of plan provisions was correct.

The rationale behind “parallel processing” of the valuation is to ensure that the OSA computer models have been evaluated in their totality, that no material items have been overlooked, and that the methods are reasonable. The appropriate test is that any differences between the two “parallel” sets of liabilities fall within reasonable tolerances. (The anticipated result is not to exactly duplicate the results of the OSA valuation. Differences in software model implementations and OSA’s long-term and in-depth understanding of the system make it unlikely that the numbers will match to the dollar.) This procedure yields the strongest test possible of the liabilities and other present values used in the contribution determination process.

A comparison of the results of our parallel processing with the results of the Office of the State Actuary is shown on the next page for the “with mortality improvements, with gainsharing” rates recommended by OSA. Total OSA active and retired liabilities fall within a reasonable range of the parallel run liabilities. Results for the other three sets of contribution rates are similar. Detailed results of the testing are shown in Appendix B. (A cutoff date of September 11 was established for programming changes. Modifications since that date have been transmitted to OSA and will be incorporated in future valuations. The impact of these changes is not reflected in the results shown below or in Appendix B.)

Table 2: Results of Parallel Processing for Contribution Rate Set 1  
(With Mortality Improvement, with Gainsharing)

Present Values of Fully Projected Benefits (Millions) <sup>2</sup> :			
	OSA	Oliver Consulting	Ratio: OC to OSA
PERS 1	\$13,786.1	\$13,771.3	99.9%
PERS 2/3	\$17,402.5	\$17,456.6	100.3%
TRS 1	\$10,962.5	\$10,907.2	99.5%
TRS 2/3	\$6,448.8	\$6,427.8	99.7%
SERS 2/3	\$2,528.5	\$2,529.0	100.0%
LEOFF 1	\$4,261.2	\$4,271.9	100.3%
WSPRS 1/2	\$811.2	\$821.4	101.3%

Present Values of Future Salaries (Millions):			
	OSA	Oliver Consulting	Ratio: OC to OSA
PERS 1	\$3,104.2	\$3,105.5	100.0%
PERS 2/3	\$63,017.4	\$63,027.0	100.0%
TRS 1	\$2,061.3	\$2,063.6	100.1%
TRS 2/3	\$36,519.6	\$36,531.8	100.0%
SERS 2/3	\$10,248.9	\$10,250.6	100.0%
LEOFF 1	\$159.8	\$160.3	100.3%
WSPRS 1/2	\$762.7	\$762.6	100.0%

In the process of converting to the new software system, OSA reviewed and, in several instances, simplified various methods and techniques used in its calculations. In addition, several changes were made to conform to the new software system. We reviewed these changes from a technical and process-oriented perspective and consider them reasonable in the aggregate and appropriate for the current rate-setting process.

<sup>2</sup> Excludes value of items not processed using valuation software (i.e. account refunds for terminated nonvested, deferred disability benefits for PERS 1, and TRS Lump Sum Death Benefit under RCW 41.32.523).

**(c) Actuarial Value of Assets**

Because the actuarial liabilities of the system are reduced by the value of the assets in determining the contribution rate, volatility in the value of assets is reduced by using a smoothed asset value when calculating contribution rates. This “actuarial value” of assets is calculated by adjusting market value to take into account yearly actuarial investment gains and losses<sup>3</sup> over a period that runs from 1 to 8 years depending on the size of the gain or loss. We reviewed the Office of the State Actuary’s calculation of this value. In addition, we reviewed OSA’s calculation of the market value of the fund as of September 30, 2005. (This calculation is necessary because audited financial statements are prepared as of June 30.)

In our review of the market value calculation, no signs of any inconsistencies in the data supplied by the SIB, DRS, and OST were found. However, our review of the market value calculation was limited to reviewing OSA’s computations that combined this information to produce the market value of assets as of September 30, 2005. Since the value of assets is pivotal to the funding process, we believe it would be advisable to ask the auditors, during their June 30 audit of the system’s financial statements, to review the procedures used by SIB, DRS, and OST when supplying information to OSA for their September 30 market value calculations. This review should include items such as the consistency of cutoff dates.

**(d) Contribution Rate Formulas and Calculations**

Using actuarial formulas, actuarial liabilities and present values are combined with the actuarial value of assets to produce contribution rates. Under Actuarial Standards of Practice a variety of formulas for this combination can be acceptable. The contribution rate formulas used by the OSA were reviewed to ascertain whether they fit within this range, both from the perspective of actuarial acceptability and from the perspective of representing acceptable interpretations of the State of Washington’s pension funding statutes. Based on our review, the formulas used in determining both sets of contribution rates, including the change in the method of calculating normal cost adopted in the

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<sup>3</sup> Earnings in excess of those expected using the actuarial valuation assumptions.

9/30/2004 valuation and the phase-in adjustments, are appropriate both actuarially and from the perspective of recognizing the pension statutes.

The contribution rate formulas were applied in Microsoft Excel to produce the final contribution rates. These contribution rates were then adjusted for the impact of year 2006 legislation using the contribution rates contained in the fiscal notes for the applicable legislation - which were accepted for audit purposes. We reviewed and checked these calculations, including the rate phase-in adjustments that were the last step in the process, for both sets of contribution rates being brought before the Board today.

As a final check, contribution rates were compared with the September 30, 2004 contribution rates for reasonability. Taking into account gains and losses on the actuarial value of assets and the increases in contribution rates due to the software and methodology changes during the year, the progression of rates was reasonable.

#### **(e) Material Assumption Changes**

We reviewed the changes to the current mortality assumptions recommended by the Office of the State Actuary. We agree that the proposed changes in mortality assumptions are reasonable. A more detailed discussion follows.

#### **Mortality Improvement Assumption**

It is proposed that an assumption regarding future mortality improvement be incorporated in the mortality assumptions. Generally changes of this nature are addressed when mortality assumptions are reviewed in an experience study, so that any adjustments address the mortality assumption as a whole; however, it is not inappropriate to implement the changes independent of an experience study.

The recognition of future mortality improvement in actuarial valuations is in line with current trends in actuarial practice. It presents a picture of the plan's liabilities that is more accurate because it recognizes the possibility of future mortality improvement, which, though not predictable, would generally be recognized as more likely than not.

The future mortality improvement assumption would be included by using 50% of a mortality projection scale developed by the Society of Actuaries (Scale AA). This scale would be applied on a “generational basis”, which leads to mortality rates that differ by year of birth.

Scale AA is based on mortality improvement trends among Civil Service Retirement System and Social Security participants between 1977 and 1993. At the 50% level, average Scale AA decreases in mortality rates for ages 55 through 81 are approximately .75% per year for males and .30% per year for females. At the 50% level, these decreases remain well below more recent (through 2003) experience for male Civil Service Retirement System participants. At the 50% level, for females, they are slightly higher than both more recent experience and the 1977-1993<sup>4</sup> experience. We agree that 50% of Scale AA is a reasonable assumption for projecting future mortality improvement.

The application of the Scale on a “generational basis” is the most accurate means of projection from an actuarial view and minimizes the need for periodic mortality table updates; however, any ramifications in terms of determining actuarial equivalence factors for benefit administration (due to the feature that resulting mortality rates vary by year of birth) should be considered. A variety of methods are available for recognizing future mortality improvement – each potentially having different ramifications in terms of benefit administration and recognition of mortality improvement in contribution rates.

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<sup>4</sup> This is because a floor of .50% per year was applied to mortality improvement rates in deriving Scale AA. This floor affected female mortality improvement rates between ages 58 and 69.

### 3. Contribution Rates

Four sets of contribution rates are being brought before the Council as follows:

1. With mortality improvements, with gainsharing,
2. With mortality improvements, without gainsharing,
3. Without mortality improvements, with gainsharing, and
4. Without mortality improvements, without gainsharing.

We have reviewed each set and agree with the Office of the State Actuary's calculations. We have reviewed Set 1, which the Office of the State Actuary is recommending, for compliance with Actuarial Standards of Practice and agree that it satisfies those standards. The contribution rates are set out below.

**Table 3: Proposed Contribution Rates excluding Administrative Expense**

1. With Mortality Improvements, With Gainsharing

	Employer Rates		Member Rates	
	2007-08 <sup>5</sup>	2008-09	2007-08	2008-09
PERS	7.08%	8.64%	4.60%	5.28%
TRS	8.12%	9.89%	3.30%	3.79%
SERS	8.41%	9.71%	4.29%	4.71%
LEOFF 1	0.00%	0.00%	0.00%	0.00%
WSPRS	8.79%	8.79%	7.74%	7.74%

2. With Mortality Improvements, Without Gainsharing

	Employer Rates		Member Rates	
	2007-08	2008-09	2007-08	2008-09
PERS	6.43%	7.99%	4.60%	5.28%
TRS	6.10%	7.87%	3.30%	3.79%
SERS	6.12%	7.42%	4.29%	4.71%
LEOFF 1	0.00%	0.00%	0.00%	0.00%
WSPRS	8.79%	8.79%	7.74%	7.74%

<sup>5</sup> July 1 – June 30 for PERS, LEOFF 1, and WSPRS; September 1 – August 31 for TRS and SERS

## 3. Without Mortality Improvements, With Gainsharing

	<b>Employer Rates</b>		<b>Member Rates</b>	
	<b>2007-08</b>	<b>2008-09</b>	<b>2007-08</b>	<b>2008-09</b>
PERS	6.46%	8.02%	4.15%	4.83%
TRS	7.38%	9.15%	2.90%	3.39%
SERS	7.76%	9.06%	3.89%	4.31%
LEOFF 1	0.00%	0.00%	0.00%	0.00%
WSPRS	7.75%	7.75%	6.70%	6.70%

## 4. Without Mortality Improvements, Without Gainsharing

	<b>Employer Rates</b>		<b>Member Rates</b>	
	<b>2007-08</b>	<b>2008-09</b>	<b>2007-08</b>	<b>2008-09</b>
PERS	5.84%	7.40%	4.15%	4.83%
TRS	5.44%	7.21%	2.90%	3.39%
SERS	5.58%	6.88%	3.89%	4.31%
LEOFF 1	0.00%	0.00%	0.00%	0.00%
WSPRS	7.75%	7.75%	6.70%	6.70%

### **D. Additional Observations and Recommendations**

The item below was noted during the audit and we believe should be addressed in the future.

- We understand that the Office of the State Actuary plans to review and upgrade the process for determining liabilities for vested terminations. We agree that it is appropriate to review and upgrade the procedures, techniques, and assumptions used to value this group, including the use of estimated rather than actual pay rates.

## Appendix A: Detailed Data Summary

<b>PERS</b>	<b>OSA</b>			<b>OC</b>			<b>Ratio OSA / OC</b>		
	<u>Plan 1</u>	<u>Plan 2</u>	<u>Plan 3</u>	<u>Plan 1</u>	<u>Plan 2</u>	<u>Plan 3</u>	<u>Plan 1</u>	<u>Plan 2</u>	<u>Plan 3</u>
<b>Active Members</b>									
Count	15,962	118,400	21,216	15,962	118,400	21,216	100.0%	100.0%	100.0%
Average Age	56.6	45.7	41.8	56.6	45.7	41.8	100.0%	100.0%	100.0%
Average Service	22.0	9.9	7.8	22.0	9.9	7.8	100.0%	100.0%	100.0%
Average Salary	\$49,248	\$46,399	\$44,817	\$49,248	\$46,399	\$44,817	100.0%	100.0%	100.0%
Total Salary (000's)	\$786,094	\$5,493,663	\$950,833	\$786,094	\$5,493,663	\$950,833	100.0%	100.0%	100.0%
% of Male	41.6%	48.4%	48.0%	41.6%	48.4%	48.0%	100.0%	100.0%	100.0%
<b>Termination Vested</b>									
Count	2,833	17,941	1,793	2,833	17,941	1,793	100.0%	100.0%	100.0%
Average Age	57.4	50.7	48.3	57.4	50.7	48.3	100.0%	100.0%	100.0%
Average Service	13.9	9.9	12.9	13.9	9.9	12.9	100.0%	100.0%	100.0%
Average Salary	\$38,323	\$42,074	\$50,666	\$38,534	\$41,987	\$50,179	99.5%	100.2%	101.0%
Total Salary (000's)	\$108,569	\$754,857	\$90,844	\$109,168	\$753,284	\$89,971	99.5%	100.2%	101.0%
% of Male	31.7%	35.4%	42.8%	31.7%	35.4%	42.8%	100.0%	100.0%	100.0%
<b>Service Retired</b>									
Count	46,804	11,238	293	46,804	11,238	293	100.0%	100.0%	100.0%
Average Age	72.8	71.4	62.7	72.8	71.4	62.7	100.0%	100.0%	100.0%
Ave. Monthly Benefit	\$1,502	\$758	\$435	\$1,500	\$758	\$435	100.2%	100.0%	99.8%
% of Male	47.3%	45.1%	50.9%	47.3%	45.1%	50.9%	100.0%	100.0%	100.0%
<b>Duty Disabled</b>									
Count	95			95			100.0%		
Average Age	61.			60.9			100.0%		
Ave. Monthly Benefit	\$496			\$476			104.3%		
% of Male	73.7%			73.7%			100.0%		
<b>Non-Duty Disabled</b>									
Count	1,599	1,385	28	1,599	1,385	28	100.0%	100.0%	100.0%
Average Age	68.1	63.3	57.7	68.1	63.2	57.7	100.0%	100.0%	100.0%
Ave. Monthly Benefit	\$749	\$351	\$259	\$749	\$351	\$259	100.0%	100.0%	100.0%
% of Male	38.0%	47.8%	60.7%	38.0%	47.8%	60.7%	100.0%	100.0%	100.0%
<b>Beneficiary</b>									
Count	6,297	848	22	6,297	848	22	100.0%	100.0%	100.0%
Average Age	77.9	67.9	58.0	77.9	67.9	58.0	100.0%	100.0%	100.0%
Ave. Monthly Benefit	\$776	\$466	\$251	\$776	\$466	\$251	100.0%	100.0%	100.0%
% of Male	9.0%	17.3%	13.6%	9.0%	17.3%	13.6%	100.0%	100.0%	100.0%

<b>TRS</b>	<b>OSA</b>			<b>OC</b>			<b>Ratio OSA / OC</b>		
	<u>Plan 1</u>	<u>Plan 2</u>	<u>Plan 3</u>	<u>Plan 1</u>	<u>Plan 2</u>	<u>Plan 3</u>	<u>Plan 1</u>	<u>Plan 2</u>	<u>Plan 3</u>
<b>Active Members</b>									
Count	8,592	7,205	51,473	8,592	7,205	51,473	100.0%	100.0%	100.0%
Average Age	56.9	50.7	41.9	56.9	50.7	41.9	100.0%	100.0%	100.0%
Average Service	24.8	13.6	9.0	24.8	13.6	9.0	100.0%	100.0%	100.0%
Average Salary	\$63,531	\$57,379	\$51,386	\$63,531	\$57,379	\$51,386	100.0%	100.0%	100.0%
Total Salary (000's)	\$545,855	\$413,418	\$2,645,012	\$545,855	\$413,418	\$2,645,012	100.0%	100.0%	100.0%
% of Male	27.7%	25.9%	29.4%	27.7%	25.9%	29.4%	100.0%	100.0%	100.0%
<b>Termination Vested</b>									
Count	1,328	2,536	3,158	1,328	2,536	3,158	100.0%	100.0%	100.0%
Average Age	57.3	50.6	50.9	57.3	50.6	50.9	100.0%	100.0%	100.0%
Average Service	13.8	9.2	13.0	13.8	9.2	13.0	100.0%	100.0%	100.0%
Average Salary	\$42,118	\$44,080	\$54,111	\$42,515	\$44,261	\$53,993	99.1%	99.6%	100.2%
Total Salary (000's)	\$55,933	\$111,786	\$170,884	\$56,460	\$112,247	\$170,510	99.1%	99.6%	100.2%
% of Male	20.6%	23.1%	25.7%	20.6%	23.1%	25.7%	100.0%	100.0%	100.0%
<b>Service Retired</b>									
Count	31,969	1,223	621	31,969	1,223	621	100.0%	100.0%	100.0%
Average Age	70.5	69.4	64.0	70.5	69.4	64.0	100.0%	100.0%	100.0%
Ave. Monthly Benefit	\$1,728	\$1,109	\$515	\$1,728	\$1,109	\$515	100.0%	100.0%	100.0%
% of Male	45.5%	27.3%	24.5%	45.5%	27.3%	24.5%	100.0%	100.0%	100.0%
<b>Duty Disabled</b>									
Count	800			800			100.0%		
Average Age	68.0			68.0			100.0%		
Ave. Monthly Benefit	\$1,159			\$1,159			100.0%		
% of Male	38.6%			38.6%			100.0%		
<b>Non-Duty Disabled</b>									
Count		72	36		72	36		100.0%	100.0%
Average Age		61.8	57.1		61.8	57.1		100.0%	100.0%
Ave. Monthly Benefit		\$500	\$218		\$500	\$218		100.0%	100.0%
% of Male		29.2%	41.7%		29.2%	41.7%		100.0%	100.0%
<b>Beneficiary</b>									
Count	2,495	56	49	2,495	56	49	100.0%	100.0%	100.0%
Average Age	76.2	65.7	56.5	76.2	65.7	56.5	100.0%	100.0%	100.0%
Ave. Monthly Benefit	\$1,024	\$630	\$236	\$1,024	\$630	\$236	100.0%	100.0%	100.0%
% of Male	17.6%	41.1%	53.1%	17.6%	41.1%	53.1%	100.0%	100.0%	100.0%

<b>SERS</b>	<b>OSA</b>			<b>OC</b>			<b>Ratio OSA / OC</b>		
	<u>Plan 1</u>	<u>Plan 2</u>	<u>Plan 3</u>	<u>Plan 1</u>	<u>Plan 2</u>	<u>Plan 3</u>	<u>Plan 1</u>	<u>Plan 2</u>	<u>Plan 3</u>
<b>Active Members</b>									
Count		19,387	30,963		19,387	30,963	100.0%	100.0%	
Average Age		49.8	46.5		49.8	46.5	100.0%	100.0%	
Average Service		10.2	7.3		10.2	7.3	100.0%	100.0%	
Average Salary		\$24,494	\$23,462		\$24,470	\$23,254	100.1%	100.9%	
Total Salary (000's)		\$474,859	\$726,463		\$474,407	\$720,017	100.1%	100.9%	
% of Male		22.5%	21.4%		22.5%	21.4%	100.0%	100.0%	
<b>Termination Vested</b>									
Count		3,073	2,491		3,073	2,491	100.0%	100.0%	
Average Age		50.7	52.8		50.7	52.8	100.0%	100.0%	
Average Service		9.6	12.5		9.6	12.5	100.0%	100.0%	
Average Salary		\$25,428	\$27,268		\$25,346	\$27,131	100.3%	100.5%	
Total Salary (000's)		\$78,141	\$67,925		\$77,888	\$67,584	100.3%	100.5%	
% of Male		17.3%	16.1%		17.3%	16.1%	100.0%	100.0%	
<b>Service Retired</b>									
Count		1,249	647		1,249	647	100.0%	100.0%	
Average Age		67.9	64.7		67.9	64.7	100.0%	100.0%	
Ave. Monthly Benefit		\$589	\$264		\$589	\$264	100.0%	100.0%	
% of Male		32.8%	25.0%		32.8%	25.0%	100.0%	100.0%	
<b>Duty Disabled</b>									
Count									
Average Age									
Ave. Monthly Benefit									
% of Male									
<b>Non-Duty Disabled</b>									
Count		125	37		125	37	100.0%	100.0%	
Average Age		60.4	60.3		60.4	60.3	100.0%	100.0%	
Ave. Monthly Benefit		\$275	\$205		\$275	\$205	100.0%	100.0%	
% of Male		38.4%	45.9%		38.4%	45.9%	100.0%	100.0%	
<b>Beneficiary</b>									
Count		52	21		52	21	100.0%	100.0%	
Average Age		62.7	61.8		62.7	61.8	100.0%	100.0%	
Ave. Monthly Benefit		\$350	\$162		\$350	\$162	100.0%	100.0%	
% of Male		36.5%	38.1%		36.5%	38.1%	100.0%	100.0%	

<b>LEOFF</b>	<b>OSA</b>			<b>OC</b>			<b>Ratio OSA / OC</b>		
	<u>Plan 1</u>	<u>Plan 2</u>	<u>Plan 3</u>	<u>Plan 1</u>	<u>Plan 2</u>	<u>Plan 3</u>	<u>Plan 1</u>	<u>Plan 2</u>	<u>Plan 3</u>
<b>Active Members</b>									
Count	723			723			100.0%		
Average Age	55.6			55.6			100.0%		
Average Service	31.0			31.0			100.0%		
Average Salary	\$77,139			\$77,139			100.0%		
Total Salary (000's)	\$55,771			\$55,771			100.0%		
% of Male	98.5%			98.5%			100.0%		
<b>Termination Vested</b>									
Count	7			7			100.0%		
Average Age	53.6			53.6			100.0%		
Average Service	30.2			30.2			100.0%		
Average Salary	\$85,000			\$84,000			101.2%		
Total Salary (000's)	\$595			\$588			101.2%		
% of Male	100.0%			100.0%			100.0%		
<b>Service Retired</b>									
Count	2,667			2,667			100.0%		
Average Age	67.6			67.6			100.0%		
Ave. Monthly Benefit	\$3,249			\$3,247			100.0%		
% of Male	97.5%			97.5%			100.0%		
<b>Duty Disabled</b>									
Count	3,628			3,628			100.0%		
Average Age	64.1			64.2			100.0%		
Ave. Monthly Benefit	\$2,833			\$2,833			100.0%		
% of Male	99.0%			99.0%			100.0%		
<b>Non-Duty Disabled</b>									
Count	569			569			100.0%		
Average Age	64.0			64.0			100.0%		
Ave. Monthly Benefit	\$2,373			\$2,373			100.0%		
% of Male	96.5%			96.5%			100.0%		
<b>Beneficiary</b>									
Count	1,285			1,285			100.0%		
Average Age	72.5			72.5			100.0%		
Ave. Monthly Benefit	\$2,668			\$2,665			100.1%		
% of Male	2.1%			2.1%			99.7%		

<b>WSP</b>	<b>OSA</b>			<b>OC</b>			<b>Ratio OSA / OC</b>		
	<u>Plan 1</u>	<u>Plan 2</u>	<u>Plan 3</u>	<u>Plan 1</u>	<u>Plan 2</u>	<u>Plan 3</u>	<u>Plan 1</u>	<u>Plan 2</u>	<u>Plan 3</u>
<b>Active Members</b>									
Count	941	81		941	81		100.0%	100.0%	
Average Age	40.1	29.6		40.1	29.6		100.0%	100.0%	
Average Service	13.4	2.7		13.4	2.7		100.0%	100.0%	
Average Salary	\$65,254	\$48,250		\$65,254	\$48,250		100.0%	100.0%	
Total Salary (000's)	\$61,404	\$3,908		\$61,404	\$3,908		100.0%	100.0%	
% of Male	92.0%	92.6%		92.0%	92.6%		100.0%	100.0%	
<b>Termination Vested</b>									
Count	44			44			100.0%		
Average Age	41.9			41.9			100.0%		
Average Service	11.4			11.4			100.0%		
Average Salary	\$64,409			\$64,091			100.5%		
Total Salary (000's)	\$2,834			\$2,820			100.5%		
% of Male	86.4%			86.4%			100.0%		
<b>Service Retired</b>									
Count	673			673			100.0%		
Average Age	63.1			63.1			100.0%		
Ave. Monthly Benefit	\$3,388			\$3,387			100.0%		
% of Male	99.3%			99.3%			100.0%		
<b>Duty Disabled</b>									
Count	58			58			100.0%		
Average Age	62.6			62.6			100.0%		
Ave. Monthly Benefit	\$0			\$0			100.0%		
% of Male	93.1%			93.1%			100.0%		
<b>Non-Duty Disabled</b>									
Count									
Average Age									
Ave. Monthly Benefit									
% of Male									
<b>Beneficiary</b>									
Count	119			119			100.0%		
Average Age	72.0			72.0			100.0%		
Ave. Monthly Benefit	\$1,353			\$1,353			100.0%		
% of Male	0.0%			0.0%			100.0%		

## Appendix B: Detailed Results of Parallel Computer Runs

### 1. Summary by Contribution Rate Set<sup>6</sup>:

Set 1: (With Mortality Improvement, with Gainsharing)

Present Values of Fully Projected Benefits (Millions):			
	OSA	Oliver Consulting	Ratio: OC to OSA
PERS 1	\$13,786.1	\$13,771.3	99.9%
PERS 2/3	\$17,402.5	\$17,456.6	100.3%
TRS 1	\$10,962.5	\$10,907.2	99.5%
TRS 2/3	\$6,448.8	\$6,427.8	99.7%
SERS 2/3	\$2,528.5	\$2,529.0	100.0%
LEOFF 1	\$4,261.2	\$4,271.9	100.3%
WSPRS 1/2	\$811.2	\$821.4	101.3%

Present Values of Future Salaries (Millions):			
	OSA	Oliver Consulting	Ratio: OC to OSA
PERS 1	\$3,104.2	\$3,105.5	100.0%
PERS 2/3	\$63,017.4	\$63,027.0	100.0%
TRS 1	\$2,061.3	\$2,063.6	100.1%
TRS 2/3	\$36,519.6	\$36,531.8	100.0%
SERS 2/3	\$10,248.9	\$10,250.6	100.0%
LEOFF 1	\$159.8	\$160.3	100.3%
WSPRS 1/2	\$762.7	\$762.6	100.0%

<sup>6</sup> Excludes value of items not processed using valuation software (i.e. account refunds for terminated nonvested, deferred disability benefits for PERS 1, and TRS Lump Sum Death Benefit under RCW 41.32.523).

## Set 2: (With Mortality Improvement, without Gainsharing)

Present Values of Fully Projected Benefits (Millions):			
	OSA	Oliver Consulting	Ratio: OC to OSA
PERS 1	\$13,277.9	\$13,263.3	99.9%
PERS 2/3	\$17,258.5	\$17,312.0	100.3%
TRS 1	\$10,543.4	\$10,490.7	99.5%
TRS 2/3	\$6,006.2	\$5,985.5	99.7%
SERS 2/3	\$2,337.1	\$2,337.8	100.0%
LEOFF 1	\$4,261.2	\$4,271.9	100.3%
WSPRS 1/2	\$811.2	\$821.4	101.3%
Present Values of Future Salaries (Millions): Same as Set 1 on prior page.			

## Set 3 (Without Mortality Improvement, with Gainsharing)

Present Values of Fully Projected Benefits (Millions):			
	OSA	Oliver Consulting	Ratio: OC to OSA
PERS 1	\$13,577.6	\$13,561.8	99.9%
PERS 2/3	\$16,865.9	\$16,915.6	100.3%
TRS 1	\$10,812.5	\$10,758.0	99.5%
TRS 2/3	\$6,267.3	\$6,246.1	99.7%
SERS 2/3	\$2,462.1	\$2,465.5	100.1%
LEOFF 1	\$4,216.2	\$4,227.0	100.3%
WSPRS 1/2	\$795.2	\$805.8	101.3%

Present Values of Future Salaries (Millions):			
	OSA	Oliver Consulting	Ratio: OC to OSA
PERS 1	\$3,102.2	\$3,103.5	100.0%
PERS 2/3	\$62,940.3	\$62,949.8	100.0%
TRS 1	\$2,060.5	\$2,062.8	100.1%
TRS 2/3	\$36,485.2	\$36,497.4	100.0%
SERS 2/3	\$10,239.5	\$10,241.7	100.0%
LEOFF 1	\$159.7	\$160.2	100.3%
WSPRS 1/2	\$762.2	\$762.1	100.0%

## Set 4: (Without Mortality Improvement, without Gainsharing)

Present Values of Fully Projected Benefits (Millions):			
	OSA	Oliver Consulting	Ratio: OC to OSA
PERS 1	\$13,084.9	\$13,069.9	99.9%
PERS 2/3	\$16,728.9	\$16,777.9	100.3%
TRS 1	\$10,405.6	\$10,353.6	99.5%
TRS 2/3	\$5,843.5	\$5,822.6	99.6%
SERS 2/3	\$2,279.4	\$2,281.7	100.1%
LEOFF 1	\$4,216.2	\$4,227.0	100.3%
WSPRS 1/2	\$795.2	\$805.8	101.3%
Present Values of Future Salaries (Millions): Same as Set 3 on prior page			

**2. Summary of Active / Inactive Results<sup>7</sup> for Contribution Rate Set 1  
(With Mortality Improvement, with Gainsharing)**

OSA	Oliver Consulting	Ratio OC / OSA
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**Present Value of Fully Projected Benefits for Active Members**

PERS 1	\$4,341.8	\$4,308.3	99.2%
PERS 2	\$14,249.1	\$14,274.3	100.2%
PERS 3	\$1,123.3	\$1,122.1	99.9%
TRS 1	\$3,121.3	\$3,123.5	100.1%
TRS 2	\$1,552.9	\$1,549.0	99.7%
TRS 3	\$4,370.4	\$4,355.3	99.7%
SERS 2	\$1,345.6	\$1,346.1	100.0%
SERS 3	\$900.1	\$896.1	99.6%
LEOFF 1	\$497.5	\$498.7	100.2%
WSPRS 1	\$401.6	\$402.0	100.1%
WSPRS 2	\$16.9	\$17.0	100.8%

**Present Value of Fully Projected Benefits for Inactive Members**

PERS 1	\$9,444.3	\$9,463.0	100.2%
PERS 2	\$1,957.2	\$1,987.4	101.5%
PERS 3	\$72.8	\$72.8	100.0%
TRS 1	\$7,841.2	\$7,783.8	99.3%
TRS 2	\$342.3	\$344.1	100.5%
TRS 3	\$183.2	\$179.4	97.9%
SERS 2	\$200.9	\$204.6	101.9%
SERS 3	\$81.9	\$82.3	100.5%
LEOFF 1	\$3,763.7	\$3,773.2	100.3%
WSPRS 1	\$392.7	\$402.3	102.5%
WSPRS 2 <sup>8</sup>	-	-	-

<sup>7</sup> Present values exclude the value of items not processed using valuation software (i.e. account refunds for terminated nonvested, deferred disability benefits for PERS 1, and TRS Lump Sum Death Benefit under RCW 41.32.523).

<sup>8</sup> There are no inactive members of WSPRS 2 other than terminated nonvested members entitled to account refunds, who are not processed using valuation software.

## Contribution Rate Set 1: (With Mortality Improvement, with Gainsharing), continued

	<b>OSA</b>	<b>Oliver Consulting</b>	<b>Ratio OC / OSA</b>
<b>Present Value of Future Salaries</b>			
PERS 1	\$3,104.2	\$3,105.5	100.0%
PERS 2	\$53,328.3	\$53,370.2	100.1%
PERS 3	\$9,689.2	\$9,656.8	99.7%
TRS 1	\$2,061.3	\$2,063.6	100.1%
TRS 2	\$3,819.4	\$3,817.9	100.0%
TRS 3	\$32,700.2	\$32,713.9	100.0%
SERS 2	\$3,980.2	\$3,964.1	99.6%
SERS 3	\$6,268.7	\$6,286.5	100.3%
LEOFF 1	\$159.8	\$160.3	100.3%
WSPRS 1	\$681.4	\$681.2	100.0%
WSPRS 2	\$81.3	\$81.5	100.2%