Actuarial Note Transmittal

Amendment 10803 to Senate Bill 1071, Printer's Number 1913
October 24, 2016

The Independent Fiscal Office (IFO) submits an actuarial note for **Amendment A10803 to Senate Bill 1071, Printer's Number 1913** in accordance with section 615-B of the Administrative Code of 1929 (added on July 20, 2016). Per statute, the IFO selected an enrolled actuary (Milliman, Inc.) to prepare the actuarial note, and a copy of the actuary's work product follows page 26 of this transmittal document.

The actuary submitted an actuarial note for Amendment A10699 to Senate Bill 1071, Printer's Number 1913, and after submission, a new amendment reflecting a technical change in the language was provided to the office. The IFO reviewed A10803, consulted with its actuary regarding the change and determined that the amendment will have no actuarial cost impact beyond the actuarial cost impact in the note for Amendment A10699.

Amendment A10803 amends the Public School Employees' Retirement Code and the State Employees' Retirement Code to require most new employees to select one of three new plan design options. This transmittal includes two main sections, a bill summary (page 2) and a bill analysis (page 8), along with an appendix (page 21) and glossary (page 25). The actuarial note prepared by Milliman, a supplemental analysis discussing the proposal's impact on asset allocation prepared by Cheiron, the Buck Consultants, LLC (PSERS) cost note and the Korn Ferry Hay Group, Inc. (SERS) cost note are attached.

The bill summary includes a description of current law (page 2), a detailed overview of the three plan design options (page 3), a discussion of proposed changes that affect current and future members (page 6) and a summary of actuarial funding changes (page 6). The bill analysis provides a comparison of benefits (page 8), an overview of the actuarial impact (page 10), a risk transfer analysis (page 12) and an asset allocation analysis (page 18).

Table 1 summarizes the proposal's expected impact on employer contributions for fiscal years 2017-18 to 2048-49 based on the cost notes prepared by the Systems' actuaries. The table includes the costs/(savings) for cash flow in millions of nominal dollars as well as present values computed at 3.7% and 7.5% discount rates. Additional summary and annual detail can be found on page 10.

Table 1: Impact on Employer Contributions for Fiscal Years 2017-18 to 2048-49

FY Ending	Cash Flow	Present Value at 3.7%	Present Value at 7.5%
2018 - 2028	$354.0	$275.0	$215.5
2029 - 2039	($306.6)	($153.4)	($77.8)
2040 - 2049	($2,664.7)	($952.9)	($347.0)
Total	**($2,617.4)**	**($831.3)**	**($209.3)**

Notes: Amounts in millions and based on Systems' actuarial projections. Present value as of June 30, 2017. Values are expressed as costs/(savings).

Bill Summary

The Public School Employees' Retirement System (PSERS) and the State Employees' Retirement System (SERS) (Systems) administer governmental, cost-sharing, multiple-employer defined benefit pension plans. The plans provide retirement allowances and other benefits, including disability and death benefits, to public school and state government employees. Membership in PSERS and SERS is mandatory for most school and state employees, although participation by certain employees is optional.

The Systems provide retirement benefits under the authority of the Public School Employees' Retirement Code and the State Employees' Retirement Code (Codes). The retirement plans administered by the Systems are defined benefit (DB) plans that provide retirement benefits based on the product of three components: (1) a member's final average salary, (2) a member's years of accumulated service credit and (3) a benefit accrual rate, or multiplier. For example, a retiree with 30 years of service, a final average salary of $60,000 and a multiplier of 2.0% would receive an annual retirement benefit of $60,000 x 30 x 0.020 = $36,000, or $3,000 per month.

Current Law (Act 120 of 2010)

PSERS and SERS have a long history of providing retirement benefits to Pennsylvania residents. For PSERS, enabling legislation was enacted in 1917; for SERS, 1923. The general benefit designs remained largely unchanged for at least two decades prior to the major changes enacted under Act 9 of 2001. The act increased the employee contribution rates by 1.25 percentage points, reduced the vesting period from 10 to 5 years and increased the benefit accrual rate, or multiplier, from 2.0% to 2.5%.

Act 120 of 2010 implemented provisions that negated or reversed certain changes made by Act 9. For most new employees, the act reduced the benefit accrual rate (2.5% to 2.0%), increased the vesting period (5 to 10 years) and increased the superannuation age (62 to 65). The appendix provides more detail on the provisions applicable to members who accumulated service credit prior to Act 120 of 2010.

The provisions of Act 120 remain in place for new members of PSERS (hired after June 30, 2011) and SERS (hired after December 31, 2010). For new members, the relevant provisions are as follows:

- The standard employee contribution, as a percent of compensation, is 7.5% (PSERS) or 6.25% (SERS). The employee may elect to make higher contributions in exchange for a higher benefit accrual rate (see below).
- Employer contributions are actuarially determined.
- The standard benefit accrual rate, or multiplier, is 2.0%. However, within 45 days of first becoming a member, the employee may elect a 2.5% benefit accrual rate in exchange for an employee contribution rate of 10.3% (PSERS) or 9.3% (SERS).
- Final average salary is based on the three highest non-overlapping years of service.
- Vesting (eligibility for benefits) occurs after accumulating 10 years of service credit.

- Superannuation, or normal retirement age, is (1) age 65 with at least three years of service credit or (2) any combination of age and service that totals 92 with at least 35 years of service. Superannuation is age 55 for members of the General Assembly and certain public safety employees.
- If the investment rate of return falls short of projections for a number of years, then employees may be subject to shared-risk contributions (discussed later).

Proposal: Three Plan Design Options

The bill amends the Codes to provide new members of the Systems with three retirement benefit options. The new plan designs would be applicable to most public employees hired by school or state employers beginning July 1, 2018 (PSERS) or January 1, 2018 (SERS). New members would have 90 days (PSERS) or 45 days (SERS) to choose one of the three design options, and the election would be irrevocable and final, including for all future non-exempt periods of employment. The new plan options include two "side-by-side" hybrid retirement plans and a third stand-alone defined contribution (DC) retirement plan. The two hybrid plans include a DB and DC component.

Current members of PSERS and SERS would (1) remain subject to their current benefit design and (2) be ineligible to participate in the new plans. New state police officers, corrections officers and other hazardous duty personnel are exempt from participation in the new plans, and they would remain eligible for plans under current law. New judges and legislators would be included under the new plans. Members who return following a break in service would remain members of their respective classes in the Systems.

A brief summary of the three pension design options follows. The descriptions identify the three main parameters of the plans: (1) the employee contribution rate, (2) the employer contribution rate and (3) the benefit accrual rate, or multiplier. Table 2 displays details for the three options alongside the comparable provisions of current law (Act 120).

Option 1: Default Side-by-Side Hybrid Plan

If no election is made from among the three options, new school employees become members of "Class T-G," and most new state employees become members of "Class A-5." Members of these classes participate in both a DB and DC plan. Under this option:

- Employees contribute a total of 8.5% of compensation, which would be divided between the DB and DC components as follows: PSERS members 5.5% (DB) and 3.0% (DC); SERS members 5.0% (DB) and 3.5% (DC).
- For the DB component, the employer contribution rate would be actuarially determined. For the DC component, the employer contribution rate is 2.0% of compensation.
- A multiplier of 1.25% applies to the DB component of the plans.

Table 2: Comparison of Benefit Design for New Employees						
	Current Law	Option 1: Default Hybrid		Option 2: Alternative Hybrid		Option 3: DC Only
	DB ONLY	**DB**	**DC**	**DB**	**DC**	**DC**
Employee Contribution Rate	PSERS 7.5% SERS 6.25%	5.5% 5.0%	3.0% 3.5%	4.5% 4.0%	3.0% 3.5%	7.5%
Vesting Period	10 years	5 years 10 years	3 years	5 years 10 years	3 years	3 years
Benefit Accrual Rate	2.0%	1.25%	n.a.	1.0%	n.a.	n.a.
Superannuation	1) Age 65 with a minimum of 3 years credit or 2) Any combination of age and service that totals 92 with at least 35 years of credited service	Age 67 with a minimum of 3 years of service credit		Age 67 with a minimum of 3 years of service credit		n.a.
Final Average Salary	Highest 3 years	Highest 5 years		Highest 5 years		n.a.
Employer Contribution Rate	Actuarially determined	Actuarially determined	2.0%	Actuarially determined	2.0%	2.0% 3.5%

Note: Current law employee contribution and benefit accrual rates exclude optional buy-up.

(hatched) = PSERS (shaded) = SERS **DB** = Defined Benefit **DC** = Defined Contribution

Option 2: Alternative Side-by-Side Hybrid Plan

New members may elect an alternative side-by-side hybrid benefit plan. Under this plan, new school employees become members of "Class T-H," and most new state employees become members of "Class A-6." The DC component remains the same as the default hybrid plan, while the DB component contains lower employee contribution and benefit accrual rates. Under this option:

- Employees contribute a total of 7.5% of compensation, which would be divided between the DB and DC components as follows: PSERS members 4.5% (DB) and 3.0% (DC); SERS members 4.0% (DB) and 3.5% (DC).
- For the DB component, the employer contribution rate would be actuarially determined. For the DC component, the employer contribution rate is 2.0% of compensation.
- A multiplier of 1.00% applies to the DB component of the plans.

Option 3: Stand-alone Defined Contribution Plan

In lieu of the hybrid plans, the bill provides for a stand-alone DC retirement benefit plan. This plan would not include a DB component, and is similar to the federal government's Thrift Savings Plan or 401(k) plans. New school employees and most new state employees would contribute 7.5% of compensation, with an employer contribution of 2.0% (PSERS) or 3.5% (SERS) of compensation.

Other Plan Design Provisions

In addition to modifications to the parameters of the benefit formula, the bill enacts changes to other provisions that will impact new members of the Systems. Similar to the proposed changes to the benefit formula, current members remain unaffected.

Defined Contribution Plans in General

Participants in any of the DC plans (the stand-alone plan or the two hybrid plans) would have an individual investment account in which participant and employer contributions accumulate, and investment experience, fees and costs are credited or charged. The Systems would each provide at least 10 investment options for the investment accounts (through at least three third-party advisors).

Vesting Period

New members would become vested in the DB component of the two hybrid plans after accumulating five years (PSERS) or ten years (SERS) of service credit. For the DC component of the two hybrid plans and the stand-alone DC plan, a participant becomes fully vested in the employer contributions after three years of employment, and the employee's contributions would vest immediately.

Superannuation

For the DB component of the hybrid plans (Classes T-G, T-H, A-5 and A-6), the age for superannuation, or unreduced retirement benefits, is age 67 with a minimum of three years of service credit. Members who elect an early retirement receive an actuarial reduction to their benefits, unless the member has 25 years of credited service and is age 62 or older, in which case the benefit is reduced by 3.0 percent per annum for each year the member is under age 67.

Final Average Salary

A member's final average salary is one of the components of the statutory formula used to compute the pension benefit under the DB plan component. The bill provides that the final average salary for new members of the Systems (Classes T-G, T-H, A-5 and A-6) shall be equal to the average of the five highest non-overlapping years of compensation. For SERS, the amount of voluntary overtime pay included may not exceed 10 percent of the base salary paid during that same period.

Withdrawal of Employee Contributions

Under current law, retiring members in certain classes of service may withdraw all or a portion of their own contributions plus statutory interest (accumulated deductions) in one lump sum or in up to four installment payments. This alternative is often referred to as "Option 4." Members of Classes T-E, T-F, A-3 and A-4 (post-Act 120 members) are not permitted to withdraw their accumulated deductions.

The bill amends current law to allow post-Act 120 members to withdraw their accumulated deductions, but the withdrawal must be actuarially equivalent. New members electing the side-by-side hybrid plans in Classes T-G and T-H in PSERS and Classes A-5 and A-6 in SERS would be permitted to make actuarially equivalent Option 4 withdrawals.

Shared-Risk/Shared-Gain Provision

The bill extends the shared-risk provisions applicable to current members in Classes T-E, T-F, A-3 and A-4 (post-Act 120 members) to new members electing a side-by-side hybrid in Classes T-G, T-H, A-5 or A-6. A variable employee contribution rate, known as the "shared-risk contribution rate," is determined by the investment performance of each System. The computed shared-risk rate is added to the basic contribution rate of each membership class if the actual investment rate of return deviates from the actuarially assumed rate of return by more than 1.0 percentage point over specified look-back periods (10 years when fully phased-in). The shared-risk contribution rate is adjusted in increments of 0.5 percentage points, with a maximum increase of 2.0 percentage points.

The bill adds a shared-gain provision for new members and post-Act 120 members that allows a member's contribution rate to be reduced by up to 2.0 percentage points below the member's initial rate, under the same conditions that the employee contribution rate can increase. The same computation would be used by both the shared-risk and shared-gain features (except in reverse directions) and may deviate up to 2.0 percentage points from the base contribution rate.

Actuarial Funding Provisions

The bill includes various actuarial funding provisions that affect the computation of employer contribution rates, unfunded liabilities and funded ratios for the DB plans. (See appendix for additional discussion of actuarial funding provisions in general.)

- Plow-back of savings The bill provides a schedule of additional employer contributions to reduce unfunded liabilities and increase funded ratios for the Systems. The schedule for each System is based on the amount that each System's actuary anticipates will be saved as a result of this legislation. These additional contributions would not supplant any other employer contributions and would be assessed as a percentage of all covered compensation.
- Normal cost calculation The bill requires SERS to use the traditional Entry-Age Actuarial Cost Method to determine the normal cost beginning with the 2021 actuarial valuation. The proposed

method is based on the benefits and contributions for all covered employees from their date of entry, while the current method is based on the costs and benefits for the average new employee. The new method, when implemented, will result in a higher normal cost and increase employer contributions compared to the current method. PSERS currently uses the method proposed for SERS, and the bill would not change the PSERS computation.

- Amortization period Currently, unfunded actuarial gains and losses that arise from new benefit changes are amortized over a 10-year period. Beginning July 1, 2018, the bill requires SERS to amortize all of the unfunded actuarial gains and losses that result from enactment of this bill over a 30-year period on a level-dollar basis. This provision does not apply to PSERS, which would continue to amortize all unfunded actuarial gains and losses from new benefit changes over a 10-year period.
- Asset smoothing For PSERS, the bill provides that the 10-year asset smoothing method will be constrained to be within 30 percent of the market value of assets.

Bill Analysis

This section provides context to evaluate the impact of the bill. The comparison of benefits quantifies the differences between current law and the proposal for three prototype employees. An actuarial impact section highlights key data from the actuarial note submitted by the Independent Fiscal Office's (IFO) consulting actuary. The risk transfer and asset allocation sections address new requirements of the statute.

Comparison of Benefits

The bill proposes a shift in benefit design for new members of PSERS and SERS who begin service after the applicable effective dates. The proposal changes the benefit accrual rate and final average salary computation for defined benefit (DB) plan participants under the two hybrid options, and each of the three options introduces a defined contribution (DC) plan for new members. The complex nature of this shift makes it difficult to assess how the cumulative effects of the design changes will impact future benefits.

The comparison uses three prototype employees to illustrate the impact of the changes. Benefits are computed under current law, the default hybrid plan and the DC-only plan for each of the three employees. For each prototype employee, the IFO uses consistent salary assumptions, retirement age and investment returns. Length of service (15, 25 and 35 years) varies between prototypes to demonstrate the impact of a member's tenure on the analysis. Table 3 displays the results of the comparison.

The attachments to this document provide additional benefit comparisons prepared by Buck Consultants (PSERS) and the Korn Ferry Hay Group (SERS). The assumptions used in those analyses may differ from the ones used in this analysis, and the results may be sensitive to such differences.

Under both options reviewed, retirement benefits for new members of the Systems decline compared to the current benefits provided under Act 120. In addition, under most circumstances, employee contributions rise. This increased cost may reduce a member's ability to contribute to personal savings, separate from the benefits provided by the Systems.

Due to the benefit design differences between PSERS and SERS, retirement benefits under the proposal are somewhat lower for PSERS, even though members of both Systems would have the same total employee contribution rates. This is the result of SERS having a higher employee contribution rate for the DC component of the default hybrid plan and a higher employer contribution rate for the DC-only plan. For the DC component of the plans, members of SERS would have a higher DC account balance at retirement, while the DB portion of the plans (if applicable) would remain constant between the Systems.

The bill allows DC plan participants who terminate service to receive an annuity from a provider retained by the Systems for that purpose. While other distribution options are available, this analysis assumes that the prototype employees use their total vested defined contributions to purchase single life annuities upon retirement, and that the cost approximates the average market-based premium for such products. The pricing incorporates the provider's profit margin and capital reserve requirements; therefore, the income produced by the annuity will reflect those costs. See the notes at the bottom of Table 3 for detail regarding other assumptions incorporated into the analysis.

Table 3: Comparison of Retirement Benefits by Years of Service (Age 65 with a Final Year Salary of $60,000)	35 Years		25 Years		15 Years	
	PSERS	**SERS**	**PSERS**	**SERS**	**PSERS**	**SERS**
Current Law	$40,500	$40,500	$28,705	$28,705	$17,104	$17,104
Default Hybrid Plan	$31,708	$32,583	$21,530	$22,071	$12,540	$12,839
DB Component	$22,995	$22,995	$16,127	$16,127	$9,546	$9,546
DC Component	$8,753	$9,629	$5,403	$5,943	$2,994	$3,293
Percentage Change in Employee Contributions	13%	36%	13%	36%	13%	36%
DC-Only Plan	$16,631	$19,257	$10,265	$11,886	$5,688	$6,586
Percentage Change in Employee Contributions	0%	20%	0%	20%	0%	20%
Percentage of Current Law Benefits						
Default Hybrid Plan	78%	80%	75%	77%	73%	75%
DC-Only Plan	41%	48%	36%	41%	33%	39%
Replacement of Pre-Retirement Income						
Current Law	68%	68%	48%	48%	29%	29%
Default Hybrid Plan	53%	54%	36%	37%	21%	21%
DC-Only Plan	28%	32%	17%	20%	9%	11%

Notes:
1. Rate of return is 6.0% net of fees (0.5%) for the DC plans.
2. DB is based on the maximum single life annuity. DC is based on a single life annuity, purchased from a third-party provider.
3. Average annual salary growth of 5.15% weighted more heavily at the beginning of a career.
4. For the proposal, early retirement penalty of 6.0% (3.0% per year for each year prior to age 67).

The prototype employees in the comparison retire after age 65, but that assumption does not necessarily explain the majority of separations. According to recent data provided to the IFO by the Systems, only 30 percent (PSERS) and 34 percent (SERS) of separations are for members age 60 or older. If one expands the range to age 50 or older, the share of separations increases to 51 percent (PSERS) and 61 percent (SERS).

Actuarial Cost Impact

Milliman submitted the attached actuarial note after reviewing Amendment A10699 to Senate Bill 1071, Printer's Number 1913, the actuarial cost estimate provided by Buck Consultants, the consulting actuary for PSERS (see attachment) and the actuarial cost estimate provided by the Korn Ferry Hay Group, the consulting actuary for SERS (see attachment).

Table 4 displays the expected nominal dollar cash flow costs/(savings) for employer contributions for the fiscal years (FY) 2017-18 through 2048-49 for both Systems under the proposal, as provided by the System actuaries. The table also shows the present value of the expected cash flow costs/(savings) as of June 30, 2017, assuming end of year payment, at 3.7% (a proxy for budget growth) and 7.5% (the investment return used in the Systems' cost notes). The 3.7% proxy for budget growth is based on the annual growth in projected General Fund revenue from FY 2017-18 to FY 2020-21 shown in the IFO's January 2016 five-year economic and budget outlook. Table 6 provides detail for each fiscal year.

The total costs/(savings) shown in Table 4 differ from those in the cost note for SERS. The SERS cost note displays projections through FY 2051-52, and the last three years are excluded from the table to provide costs that are consistent with the period reported for PSERS. For further detail, see the actuarial note provided by Milliman and the cost notes provided by the Systems' consulting actuaries.

Table 5 shows the expected liabilities of the Systems for current law and the proposal at the end of the projection period used by the Systems' actuaries. As demonstrated in Table 4, savings due to the proposal do not appear for some time, and focusing on the end of the projection period provides a better measure of the proposal's eventual impact on the actuarial accrued liabilities of PSERS and SERS.

Table 4: Impact on Employer Contributions for Fiscal Years 2017-18 to 2048-49

	Cash Flow			Present Value at 3.7%			Present Value at 7.5%		
FY Ending	**PSERS**	**SERS**	**Total**	**PSERS**	**SERS**	**Total**	**PSERS**	**SERS**	**Total**
2018-2028	$94.6	$259.4	$354.0	$80.4	$194.7	$275.0	$68.7	$146.9	$215.5
2029-2039	(81.6)	(225.0)	(306.6)	(40.0)	(113.3)	(153.4)	(19.9)	(58.0)	(77.8)
2040-2049	(821.9)	(1,842.9)	(2,664.7)	(280.3)	(672.6)	(952.9)	(97.4)	(249.6)	(347.0)
Total	**(808.9)**	**(1,808.5)**	**(2,617.4)**	**(240.0)**	**(591.3)**	**(831.3)**	**(48.6)**	**(160.7)**	**(209.3)**

Notes: Amounts in millions and based on Systems' actuarial projections. Present value as of June 30, 2017. Values expressed as costs/(savings). See next page for breakdown by fiscal year.

Table 5: Estimated Liabilities under Current Law and Proposal at 2047 Valuation

	PSERS		SERS
	Present Value of Benefits	**Actuarial Accrued Liability**	**Actuarial Accrued Liability**
Current Law	$216,982	$187,236	$56,598
Proposed Law (DB Only)	$178,189	$162,754	$45,538
Percentage Reduction	-17.9%	-13.1%	-19.5%

Notes: Amounts in millions and based on Systems' actuarial projections. Source: Milliman actuarial note.

Table 6: Impact on Employer Contributions for Fiscal Years 2017-18 to 2048-49 ($ millions)									
	Cash Flow			Present Value at 3.7%			Present Value at 7.5%		
FY End	PSERS	SERS	Total	PSERS	SERS	Total	PSERS	SERS	Total
2018	$0.0	$2.0	$2.0	$0.0	$1.9	$1.9	$0.0	$1.8	$1.8
2019	11.1	0.1	11.2	10.3	0.1	10.4	9.6	0.1	9.7
2020	22.0	(2.2)	19.8	19.7	(2.0)	17.8	17.7	(1.8)	15.9
2021	18.3	(5.9)	12.4	15.8	(5.1)	10.7	13.7	(4.4)	9.3
2022	15.6	(9.7)	5.9	13.0	(8.1)	4.9	10.9	(6.8)	4.1
2023	12.1	75.4	87.5	9.7	60.6	70.3	7.8	48.8	56.7
2024	9.4	62.7	72.1	7.3	48.6	55.9	5.7	37.8	43.4
2025	4.4	51.5	55.9	3.3	38.5	41.8	2.5	28.9	31.3
2026	0.8	40.1	40.9	0.6	28.9	29.5	0.4	20.9	21.4
2027	0.6	28.6	29.1	0.4	19.9	20.3	0.3	13.9	14.1
2028	0.4	16.8	17.2	0.3	11.3	11.5	0.2	7.6	7.8
2029	0.3	5.0	5.2	0.2	3.2	3.4	0.1	2.1	2.2
2030	0.1	(7.3)	(7.2)	0.1	(4.6)	(4.5)	0.0	(2.9)	(2.8)
2031	(0.1)	(14.3)	(14.4)	(0.1)	(8.6)	(8.7)	(0.0)	(5.2)	(5.2)
2032	(2.0)	(14.5)	(16.6)	(1.2)	(8.4)	(9.6)	(0.7)	(4.9)	(5.6)
2033	(5.8)	(15.7)	(21.5)	(3.2)	(8.8)	(12.0)	(1.8)	(4.9)	(6.7)
2034	(5.5)	(18.1)	(23.6)	(3.0)	(9.8)	(12.8)	(1.6)	(5.3)	(6.9)
2035	(11.3)	(21.2)	(32.4)	(5.9)	(11.0)	(16.9)	(3.1)	(5.8)	(8.8)
2036	(9.7)	(25.5)	(35.2)	(4.9)	(12.8)	(17.7)	(2.5)	(6.5)	(8.9)
2037	(12.7)	(30.6)	(43.3)	(6.2)	(14.8)	(20.9)	(3.0)	(7.2)	(10.2)
2038	(15.9)	(37.4)	(53.3)	(7.4)	(17.4)	(24.8)	(3.5)	(8.2)	(11.7)
2039	(19.0)	(45.4)	(64.4)	(8.5)	(20.4)	(28.9)	(3.9)	(9.2)	(13.1)
2040	(24.4)	(53.7)	(78.1)	(10.6)	(23.3)	(33.9)	(4.6)	(10.2)	(14.8)
2041	(30.2)	(63.5)	(93.6)	(12.6)	(26.5)	(39.1)	(5.3)	(11.2)	(16.5)
2042	(31.6)	(222.2)	(253.8)	(12.7)	(89.6)	(102.3)	(5.2)	(36.4)	(41.6)
2043	(38.6)	(241.5)	(280.1)	(15.0)	(93.9)	(108.9)	(5.9)	(36.8)	(42.7)
2044	(2.1)	(256.1)	(258.2)	(0.8)	(96.0)	(96.8)	(0.3)	(36.3)	(36.6)
2045	(52.1)	(271.2)	(323.4)	(18.9)	(98.1)	(116.9)	(6.9)	(35.8)	(42.7)
2046	(64.0)	(275.1)	(339.1)	(22.3)	(95.9)	(118.2)	(7.9)	(33.8)	(41.6)
2047	(178.0)	(161.3)	(339.3)	(59.8)	(54.2)	(114.1)	(20.3)	(18.4)	(38.8)
2048	(194.8)	(152.4)	(347.2)	(63.2)	(49.4)	(112.6)	(20.7)	(16.2)	(36.9)
2049	(206.1)	(145.9)	(352.0)	(64.4)	(45.6)	(110.1)	(20.4)	(14.4)	(34.8)
Total	**(808.9)**	**(1,808.5)**	**(2,617.4)**	**(240.0)**	**(591.3)**	**(831.3)**	**(48.6)**	**(160.7)**	**(209.3)**

Risk Transfer

Section 615-B of the Administrative Code requires the inclusion of a "risk transfer analysis" in the actuarial note for legislation that proposes "substantial benefit design changes" under the Codes. The Independent Fiscal Office (IFO), in consultation with its actuary, has determined that the changes proposed in Amendment 10699 to Senate Bill 1071, Printer's Number 1913 qualify as substantial benefit design changes. Therefore, the note and this transmittal include a risk transfer analysis.

The statute does not specify the types of risk to be included in a risk transfer analysis. However, recent draft standards of practice published by the Actuarial Standards Board identify five types of risk that may significantly impact a plan's financial condition.[1] Those risks are as follows:

- Investment Investment returns may diverge from expectations.
- Longevity Annuitants may live longer than expected.
- Interest Rate Interest rates may differ from assumptions and affect asset and liability values.
- Asset/Liability Mismatch Changes in asset values may not be matched to changes in the values of liabilities (e.g., insufficient short-term assets that are more liquid).
- Contribution Components include: (1) the plan's funding policy may not be consistent with an actuarially determined contribution, (2) actuarial contributions may not be made in accordance with the plan's funding policy or (3) material changes may occur in the plan's contribution base.

The final three types of risk are generally relevant for pension plans, but are less relevant for the active or retired members of those plans. Therefore, those types of risk are not discussed further.

A sixth type of risk noted by actuaries is inflation risk. This risk reflects the potential loss of purchasing power caused by rising price levels. Some DB plans provide retirees with cost-of-living-adjustments to offset inflation and maintain the purchasing power of future benefits. The current DB plans offered by the Systems provide a fixed annual benefit that is not adjusted for inflation. Therefore, the retiree will bear any inflation risk under current law, and that risk is not materially affected by transferring a portion of the retirement benefit to a DC plan. In both cases, retirees do not receive a cost-of-living increase upon entering retirement. Therefore, inflation risk is not discussed further and the remainder of this section considers only investment and longevity risks.

The bill reduces the Commonwealth's exposure to risks associated with the Systems' pension plans by lowering benefits for new members through adjustments to the benefit accrual rate, final average salary and the superannuation age. Over time, the bill also reduces future risk exposure because it transfers a portion of retirement benefits to a DC plan in which the member assumes investment and longevity risks. The provisions of the bill apply only to new members, and the full reduction in risk exposure will be phased-in over several decades as new employees are hired, become vested and ultimately retire.

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[1] See *Assessment and Disclosure of Risk Associated with Measuring Pension Obligations and Determining Pension Plan Contributions*, Second Exposure Draft, Approved for Exposure by the Actuarial Standards Board in June 2016.

Currently, there is no consensus regarding the methods to quantify risk transfers that may result from changes to an existing pension plan, but the Actuarial Standard Board's draft standards of practice mentions various methods that could be used to assess risk from the perspective of the employer. The document notes that risk assessment methods could include scenario tests, sensitivity tests, stochastic modeling and stress tests. For the purpose of this analysis, the IFO constructed an investment return sensitivity analysis that can be used to inform the magnitude of the shift of investment risk from the Commonwealth to employees under the proposal. The IFO's consulting actuary confirmed that such an approach is a reasonable method that could be used to quantify the shift of investment risk.

The actuaries contracted by the IFO and the actuaries contracted by the Systems made the following observations regarding risk transfer:

Korn Ferry Hay Group (SERS actuary, see page 9 of the cost note)

> In addition to the cumulative savings described above, it is important to note the eventual "transfer of risk" that would occur if this Three-Way Hybrid/DC Proposal were to become law. That is, the conversion of SERS from the pure DB system that it is today to a hybrid design with an ever-growing DC component, including participant-directed investments, would result in a gradual transfer of investment risk from SERS' employers to SERS' members (employees). By the end of the projection period (fiscal 2052), this DB/DC design would result in a substantial reduction of investment risk being borne by SERS employers, relative to the level of risk they currently bear.

Buck Consultants (PSERS actuary, see page 4 of the cost note)

> It should be noted that under the Amendments, the portion of the benefits provided to Class T-G and Class T-H members and Class DC participants by the DC plan is subject to investment risk that would be fully borne by participants. Under PSERS, only Class T-E, Class T-F and now proposed Class T-G and Class T-H members share responsibility for the fund's investment risk through the Act 2010-120 and the Amendments "shared-risk" additional member contributions. Class T-C and T-D members are not subject to "shared-risk" contributions. Additionally, participants would bear the full cost associated with "longevity risk" (i.e., the chance of running out of money in retirement) for benefits provided by the DC plan, while under PSERS, longevity risk is borne by the System except in the case of members who elect an Option 4 lump sum withdrawal at retirement. For these members, longevity risk is borne on the lump sum withdrawal while PSERS bears the longevity risk only on the residual annuity payable to the member.

Cheiron (provided supplemental analysis to the IFO, see pages 1-2 and 19 of the letter)

> The implications of the hybrid plan are:
>
> - To reduce the overall costs of the Systems through lower benefits to new members.
> - To add to the potential savings by transferring a portion of investment risk and longevity risk of providing retirement income to these new membership classes which will provide lower retirement security for future employees. At the same time the employees gain only limited upside investment risk from the DB plan.
> - Provide downside investment risk protection by providing for direct transfer of the cost of lower than expected investment returns with future increases in member contributions.
>
> ***
>
> There is downside investment risk and longevity risk as part or all of the benefit is provided under the DC portion of the Three Way Hybrid Plan. Risk transfers do not easily have a discernable cost because the cost is born in different ways. In turn it creates a level of risk to the individual that is much greater than the risk transferred because the individual cannot achieve the same investment return and their cost to cover the longevity risk on their own becomes difficult.

The Milliman risk transfer analysis largely confirms the analysis performed by the IFO and found in the risk transfer section of this document. In their analysis, Milliman notes that "(b)y providing lower DB benefits to new hires, the Commonwealth is reducing their exposure to investment risk, longevity risk, and inflation risk and transferring these risks to the employees." (See pages 23-24 of the Milliman letter.)

Investment Risk Transfer Analysis

For this analysis, the IFO performed two simulations. The first simulation estimates the impact from a 1.0 percentage point reduction in investment returns on an employee's projected DC retirement benefits under the proposal for three prototype employees, with varying years of service. The second simulation also considers a 1.0 percentage point drop in investment returns, but estimates the impact on employer contributions under current and proposed law. The data for the employer simulation was provided by PSERS and SERS based on a request made by the IFO.

Employee Simulation

Table 7 shows the results of a 1.0 percentage point reduction in investment returns, from 6.0 to 5.0 percent, on retirement benefits under the proposal. The employee simulation is limited to the default hybrid plan and DC-only plan. Under those two options, the total decline in retirement benefits for the hybrid plan is lower due to the DB component of that plan. Because the DB benefit is calculated using a formula and is not dependent on market returns, members of DB plans are largely insulated

from negative fluctuations of the investment markets. Both the DC component of the hybrid plan and the DC-only plan decline by the same percentage, as market performance directly impacts the value of an individual's retirement account.

Employer Simulation

The employer simulation allows the assumed rate of return under current law (CL) and proposed law (PL) to fall by 1.0 percentage point, from 7.5 to 6.5 percent. The lower return is treated as an adjustment to the assumed rate of return and, therefore, does not directly impact shared-risk contributions. Based on this simulation, the investment risk transfer from the employer's perspective, due to adoption of the proposal, is equal to the difference between the increase in employer contributions under current and proposed law when moving from a 7.5 to a 6.5 percent assumed rate of return:

(PL at 6.5% - PL at 7.5%) – (CL at 6.5% - CL at 7.5%) = risk transfer

The computed risk transfer reflects the difference in the sensitivity of employer contributions under current and proposed law if assumed investment returns were to fall by 1.0 percentage point.

Table 8 shows the risk transfer computation for SERS and PSERS based on simulations performed by the Systems. Under current law, total employer contributions increase by $50.6 billion ($250.2 less $199.6 billion) or 25.4 percent, due to the 1.0 percentage point reduction in the assumed rate of return. Under the proposal, total employer contributions increase by $46.3 billion (23.5%). The differential between those figures is -$4.3 billion (-8.5%), which quantifies the higher sensitivity of employer contributions under the current system from a 1.0 percentage point reduction in the assumed rate of return. Because total risk does not change but is merely shifted, the figure also serves as an estimate of the risk shifted from employers to employees.

Table 7: Comparison of Retirement Benefits at Lower Rate of Return by Years of Service (Age 65 with a Final Year Salary of $60,000)

	35 Years		25 Years		15 Years	
	PSERS	**SERS**	**PSERS**	**SERS**	**PSERS**	**SERS**
Default Hybrid Plan at 6.0%	$31,708	$32,583	$21,530	$22,071	$12,540	$12,839
Default Hybrid Plan at 5.0%	$30,342	$31,080	$20,928	$21,408	$12,337	$12,616
Change to DC Plan	-$1,366	-$1,503	-$602	-$663	-$203	-$223
Percent Change to DC	-15.6%	-15.6%	-11.2%	-11.2%	-6.8%	-6.8%
Percent Change to Total	-4.3%	-4.6%	-2.8%	-3.0%	-1.6%	-1.7%
DC Only Plan at 6.0%	$16,631	$19,257	$10,265	$11,886	$5,688	$6,586
DC Only Plan at 5.0%	$14,036	$16,252	$9,120	$10,560	$5,303	$6,140
Change to Plan	-$2,595	-$3,005	-$1,145	-$1,326	-$385	-$446
Percent Change	-15.6%	-15.6%	-11.2%	-11.2%	-6.8%	-6.8%

The table also displays the impact in the first, second and final decade of the 30-year forecast window. As expected, the risk transfer is much stronger in the final decade, as a greater share of members are enrolled in the hybrid system. Conversely, during the first decade, little to no risk transfer occurs. By the final year of the analysis (not shown), the risk transfer largely achieves a steady-state level, and the computed investment risk transfer increases to roughly one-third.

The simulation used a deterministic approach, where the assumed rate of return is known with certainty and remains constant in all future years. A more sophisticated approach would use a stochastic analysis that also assumes the average return falls by 1.0 percentage point, but employs a simulation that allows returns to vary randomly over the 30-year horizon based on a specified (normal) distribution. However, a more sophisticated analysis would not alter the general results that (1) material risk is transferred away from the employer to employees, (2) the transfer grows over time and (3) the transfer is nearly fully phased-in by the end of the 30-year window. In general, a stochastic analysis would likely increase both the absolute and relative size of the risk transfer compared to the more general approach used for this note, perhaps by a significant amount.

It should also be noted that the risk transfer results will be sensitive to the assumptions regarding participation rates in the various plan options. The SERS actuary assumed the following plan participation rates: default hybrid (40 percent), alternative hybrid (40 percent) and DC-only (20 percent). The respective figures used by the PSERS actuary are 65 percent, 30 percent and 5 percent. To the extent that participation is higher for the DC-only plan, the potential risk transfer would increase. In particular, the risk transfer analysis would be responsive to the assumption regarding the PSERS DC-only plan participation rate.

Table 8: Impact of Lower Returns on Employer Contributions, FY 2017-18 to FY 2048-49

	Current Law	Proposed Law	Dollar Change
7.5% return	$199.6	$196.9	-$2.7
6.5% return	$250.2	$243.1	-$7.0
Difference	**$50.6**	**$46.3**	**-$4.3**

Total Percent or Dollar Change	**-8.5%**	**-$4.3**
First Decade	-0.8%	-$0.1
Second Decade	-6.4%	-$1.3
Third Decade	-19.4%	-$2.9

Note: Billions of dollars. Cash flow basis.
Source: Simulation data provided by PSERS and SERS. Computations by IFO.

Longevity Risk

An important objective of retirement plans is the provision of income that will be available for the entire lifespan of a retiree. A risk to lifetime income is longevity risk, which reflects the potential that a retiree could outlive their assets. Ensuring lifetime income can be accomplished by pooling longevity risk, that is, distributing the risk across many participants. Under DB plans, longevity risk is pooled across all plan participants, and the employer bears all of the risk that plan assets will be sufficient to cover future distributions. The DB plan can ensure lifetime incomes to retirees because pooled funds essentially transfer a portion of projected benefits away from members with short lifespans to those with longer lifespans. The DB plans base their funding on an average lifespan, as opposed to very long or short lifespans.

Due to the pooling of funds, employees bear no longevity risk in a DB plan. By contrast, some retirees will outlive their assets in a DC plan, while others may have significant resources that remain at the end of their lifespan. In a DC plan, prudent individuals would accumulate extra funds to self-insure against lifespans that exceed the average life expectancy.

A widely-used method that individuals can use to reduce or eliminate the longevity risk of a DC plan is the purchase of a fixed-income annuity. An employee may use all or a portion of the savings in their DC account to purchase an annuity that provides a fixed (or variable) and predictable stream of income over their lifetime. In this manner, the employee shifts the longevity risk to the insurer who sells the annuity.

One method to quantify employee-specific longevity risk is to consider the premium that a purchaser must pay to convert a lump sum amount into an annuity that offers a flow of income over the remainder of their lifetime. Data from the most recent edition of the *Annuity Shopper Buyer's Guide* (October 2016), as well as other research, suggest an approximate range of 10-20 percent premium to purchase a lifetime annuity for an individual age 65. A premium must be paid so the seller of the annuity can cover their costs, risks and generate a profit. Some analysts have noted that individual annuity purchasers may pay a somewhat higher premium because providers know that individuals are more likely to purchase an annuity if they are in good health, and therefore, have a higher probability that their lifespan will exceed the average.

If policymakers have concerns regarding the shifting of longevity risk under DC plans, some existing DC plans also pool resources or require the purchase of annuities. In this manner, these plans mimic the pooling of resources by DB plans. Alternatively, policymakers may believe that higher longevity risk is an acceptable tradeoff to allow employees to maintain control over their assets, and allow occasional withdrawals at their discretion.

Asset Allocation

Section 615-B of the Administrative Code requires that actuarial notes "shall include, but not be limited to, a risk transfer analysis and, if requested by an officer listed in this subsection, an analysis of the potential impact on the asset allocation and related costs for the systems." The IFO received a request by an authorized requestor to include an analysis of the potential impact of the bill on asset allocation and related costs for the systems. Therefore, that analysis is included in this note.

For this purpose, the IFO requested that Milliman address the proposal's impact on asset allocation in its actuarial note. In addition, the office contracted with Cheiron to provide a supplemental analysis and requested input from the Systems' actuaries (Hay Group and Buck Consultants). The relevant commentary appears below. Certain passages were italicized by the IFO to add emphasis, but were not italicized in the original document.

Buck Consultants (PSERS actuary, see page 7 of the cost note)

> This analysis is based on an assumed 7.50% annual discount rate. However, under the Amendments, it is possible that liquidity issues may arise due to the shift in liability towards retirees and that the PSERS Board may change the asset allocation to reduce the risk of the portfolio and reflect the need to hold a growing proportion of its assets in more liquid, less volatile asset classes. In general, lowering the risk of the portfolio lowers the discount rate used in the System's valuation. This generally increases the accrued liabilities and contribution requirements of the System. *The cost impact of the Amendments could thus change, potentially significantly, if there is a change in the asset allocation and expected asset return.* We recommend that an analysis be performed by PSERS' investment consultant using projected cash flows of the System based on the provisions of the Amendments to determine whether such a reduction in the future assumed long-term rate of return on assets may be warranted. If so, the projections shown on the attachments should be recalculated accordingly.

Korn Ferry Hay Group (SERS actuary, see page 3 of the cost note)

> Whereas some past pension reform proposals put forth by the Commonwealth legislature have mandated that all, or a high percentage of, future new entrants, no longer be covered by a DB system (thus calling for full or near closure of the SERS DB system), that is not the case under this Three-Way Hybrid/DC Proposal. Therefore, in our cost analyses relating to this proposal, *Korn Ferry Hay Group does not consider it necessary or appropriate to factor in any future reduction(s) to the annual investment return assumption (of 7.50 percent) currently used for the funding of SERS*.

Milliman (see page 26 and 27 of the letter)

> We note that neither System actuary reduced the investment return assumption in preparing their actuarial cost estimates of this Amendment. Buck recommended that PSERS' investment consultant perform an analysis in their cost note. Hay indicated in their cost estimate that it was not "necessary or appropriate to factor in any future reduction(s) to the annual investment return assumption" currently used.
>
> In determining if the System's asset allocation should be modified due to the enactment of the Amendment, we reviewed each System's liquidity ratio to determine the percentage of assets to be used to cover a year of benefit payments. If this percentage increases over time, we would then potentially expect a shift in the plan's asset allocation to more liquid assets.
>
> *Because the liquidity ratio would decline for both Systems under the Amendment, we would not expect a change in the plan's asset allocation to more liquid assets*.

Cheiron (provided supplemental analysis to the IFO, see page 2-3, 18 and 20 of the letter)

> However, because the Three Way Hybrid Plan continues to include new entrants in their respective Systems under a defined benefit program, *there is nothing in the plan design or projected future cash flows that would necessarily drive the Systems' Boards to change their current allocation of assets immediately*. Over time, as an increasing portion of retirement security will be subject to the DC benefit component, the asset allocations in the DC plan will be, we assume, somewhat discretionary with the individual participant bearing all the risks and rewards of making their own asset allocation decisions.
>
> Over time, we could expect the asset allocation to face increased pressure in the management of cash as benefit payments will continue to increase as contributions to the Systems decrease, resulting in what we call negative net cash flow. Such negative cash flow results from more funds going out of the fund then are being contributed calling for demands from investments to produce cash income and/or liquidation of assets to meet the benefit payments. *This can have an impact on asset allocation as more income producing assets are needed to meet the net cash flow out of the Systems*. The nature of having a negative net cash flow can also affect more conservative investment strategies to reduce downside risk, because recovery from down markets is imparted and slowed when there is a negative net cash flow (the funds that go out are in excess of funds coming back in and do not contribute to investment return recovery).
>
> As a function of the funding policy, negative cash flow is not an issue for PSERS until after 2035, when the expected contributions decline as a function of fully amortizing the 2010 unfunded liability; whereas for SERS, by 2023, when negative cash flows represent 4% or more of the projected assets, asset allocations may need to change to address the need for additional cash each year.

***

The cost implications of any asset allocation should be defined more in terms of achieving the Board's risk tolerances over some target investment return. It should not be about an allocation that maximizes a return within a poorly defined risk range. As a result, the cost of alternative asset allocations is not defined in terms of additional contributions needed or reduced but in terms of costs staying within an acceptable and sustainable range and/or making meaningful funding progress within a time horizon.

***

Also, given the expected funding progress under the Three Way Hybrid Plan, we find no reason to anticipate immediate changes to the asset allocations of the Systems due to the plan design change.

Appendix

This appendix provides additional information on the major benefit design changes made to the Public School Employees' Retirement Code and the State Employees' Retirement Code (Codes) that have occurred over the past two decades.

Table A1 presents a benefit design comparison for the Public School Employees' Retirement System (PSERS) and the State Employees' Retirement System (SERS) (Systems) over three different time periods. (Special membership classes are not considered.) The comparison includes the employee contribution rate, vesting period, benefit accrual rate, superannuation and final average salary. It also includes a computation of a maximum single life annuity for each plan design.

The three time periods are as follows:

- Pre-Act 9 Covers members hired before 7/1/2001 (PSERS) and 1/1/2002 (SERS). The plans offered the same basic benefit formula from the time the authorizing statutes were moved to the Pennsylvania Consolidated Statutes in the 1970s until the enactment of Act 9 in 2001. Under that legislation, pre-Act 9 active members had the option to elect participation in the new membership class established in the act. The election applied to all credited years of service for the member, regardless of whether the service occurred prior to or subsequent to the election.

Table A1: Benefit Design Comparison

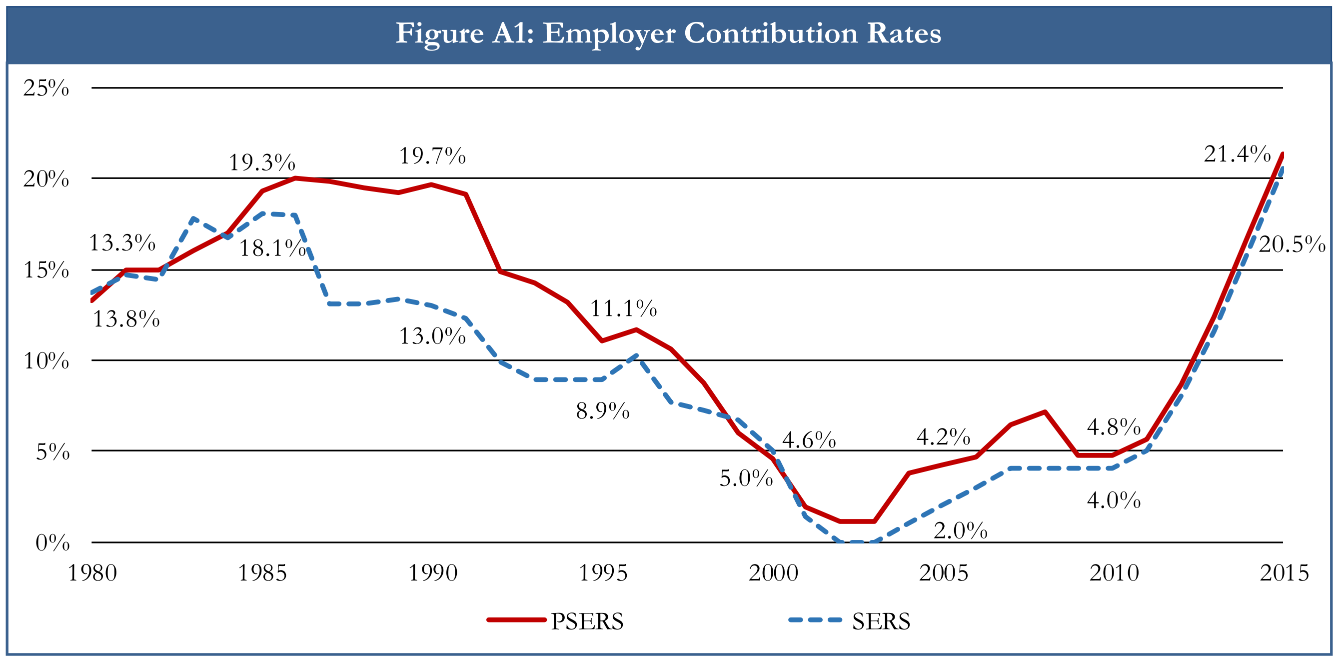
	Pre-Act 9	Act 9 of 2001	Act 120 of 2010
Total Employee Contribution Rate	PSERS 6.25%	7.50%	7.50%
	SERS 5.00%	6.25%	6.25%
Vesting Period	10 years	5 years	10 years
Benefit Accrual Rate	2.00%	2.50%	2.00%
Superannuation	(1) Age 62 with at least 1 full year of service, (2) age 60 with 30 or more years of service or (3) any age with 35 years of service	(1) Age 62 with at least 1 full year of service, (2) age 60 with 30 or more years of service or (3) any age with 35 years of service	(1) Age 65 with a minimum of 3 years of service credit or (2) any combination of age and service that totals 92 with at least 35 years of credited service
	(1) Age 60 with 3 years of service or (2) any age with 35 years of service	(1) Age 60 with 3 years of service or (2) any age with 35 years of service	
Final Average Salary	Highest 3 years	Highest 3 years	Highest 3 years
Maximum Single Life Annuity	$40,500	$50,625	$40,500
	$40,500	$50,625	$40,500

Notes: Maximum single life annuity is based on 35 years of credited service at the superannuation age and a final salary of $60,000. The Act 120 benefit design represents the default plan and does not include the optional buy-up.

- Act 9 of 2001 Covers new entrants to the Systems who were hired (1) after 6/30/2001 and before 7/1/2011 (PSERS) or (2) after 12/31/2001 and before 1/1/2012 (SERS). The act established new classes of membership and increased pension benefits for school and state employees through a retroactive increase to the benefit accrual rate. The vesting period was reduced, and employee contributions were increased. The benefit provisions also include the pre-Act 9 members who elected membership in one of the new classes.
- Act 120 of 2010 Covers new entrants to the Systems who were hired after 6/30/2011 (PSERS) or after 12/31/2011 (SERS). The act established new classes of membership and reduced the basic benefit accrual rate and vesting period to pre-Act 9 levels. However, the employee contribution remained at the higher Act 9 levels. New members may elect to receive the Act 9 benefit accrual rate by paying additional employee contributions. This election is not reflected in Table A1.

In addition to the major benefit design changes previously detailed, this appendix provides information on changes to the funding provisions of the Codes. Generally, the overall funding objective of a public employee pension plan is to provide reserves sufficient to fund the benefits of plan members when those benefits become due and to fund, over time, any unfunded liability through installment payments. PSERS and SERS are funded through employer contributions, employee contributions and returns on investments. The employer contribution requirements for the Systems are determined using the employer normal cost, plus any contribution requirements necessary to amortize the unfunded liabilities of the Systems over the statutorily-specified amortization time periods (as modified by the experience adjustment factor). The Boards of the Systems, in consultation with their actuaries, establish the employer contribution rate annually. Figure A1 displays the employer contribution rates from 1980 to 2015.

Figure A1: Employer Contribution Rates



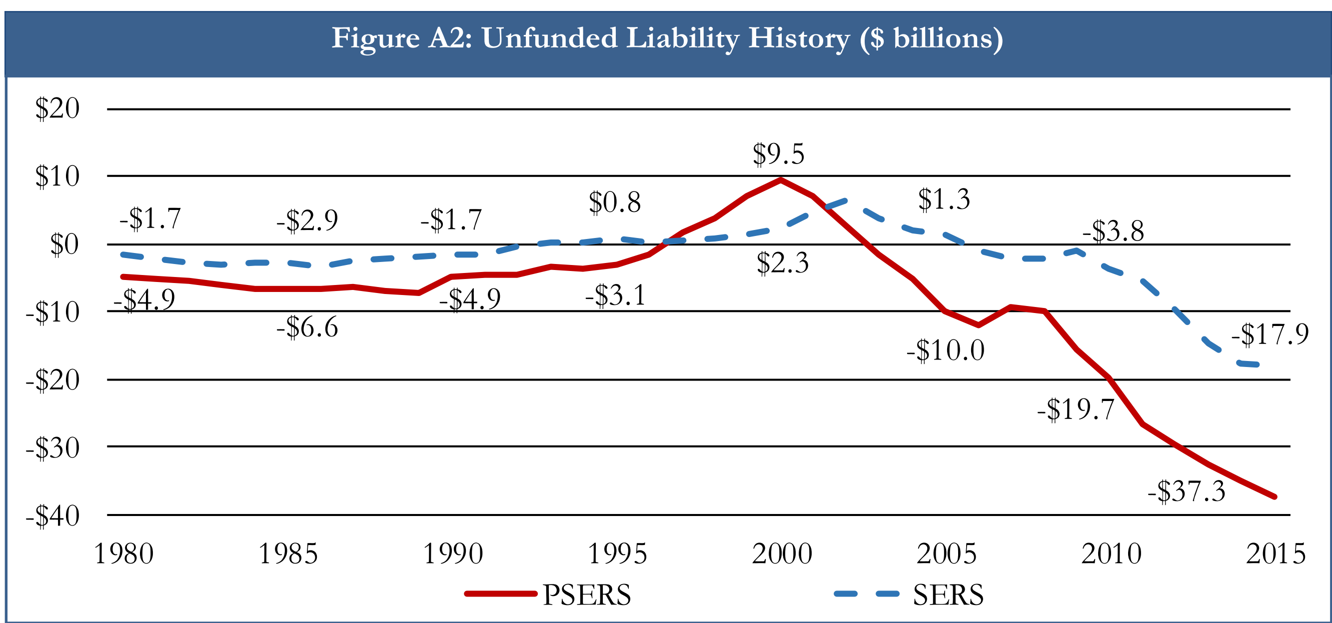
As the funded ratio (ratio of assets to liabilities) of a pension plan declines below 100%, the plan's assets represent an increasingly smaller portion of the system's accrued liabilities. This funding shortfall may occur for many reasons, including benefit enhancements, unfavorable investment returns, changes in major economic or demographic assumptions or underfunding by the employer. Figure A2 displays the unfunded actuarial accrued liabilities for the Systems between 1980 and 2015.

The unfunded actuarial accrued liability existing in a pension trust fund must be amortized over time through installment payments and may be influenced by: (1) amortization periods, (2) asset smoothing periods and (3) limits on employer contribution rates (collars). Recent changes to these three funding provisions are as follows:

Amortization Period With the passage of Act 23 of 1991, the existing unfunded actuarial accrued liabilities of the Systems were amortized so that the amounts increased by 5.0 percent per annum over a 20-year period. Act 9 of 2001 restructured that approach by amortizing all unfunded actuarial accrued liabilities as of July 1, 2002, over a 10-year period on a level-dollar basis. Act 40 of 2003 made additional changes to those provisions in order to recognize pre-Act 9 gains more quickly (amortized over a 10-year period) and delay the recognition of post-Act 9 losses (amortized over a 30-year period), effectively reducing employer contribution rates for 10 years. More recently, Act 120 of 2010 restructured all unfunded actuarial accrued liabilities of the Systems over a 30-year period on a level percentage of pay basis. This extension and payment method suppressed the Systems' annual amortization contribution requirements going forward.

Asset Smoothing In public pension systems, asset smoothing involves the gradual recognition of investment gains and losses over time and is part of the method used to determine the actuarial value of assets in a pension trust fund. One goal of the various smoothing methods is to avoid large year-to-year fluctuations in employer contribution requirements that may otherwise result from volatility in the investment markets. Prior to Act 120, both PSERS and SERS employed a five-year smoothing period to recognize

Figure A2: Unfunded Liability History ($ billions)

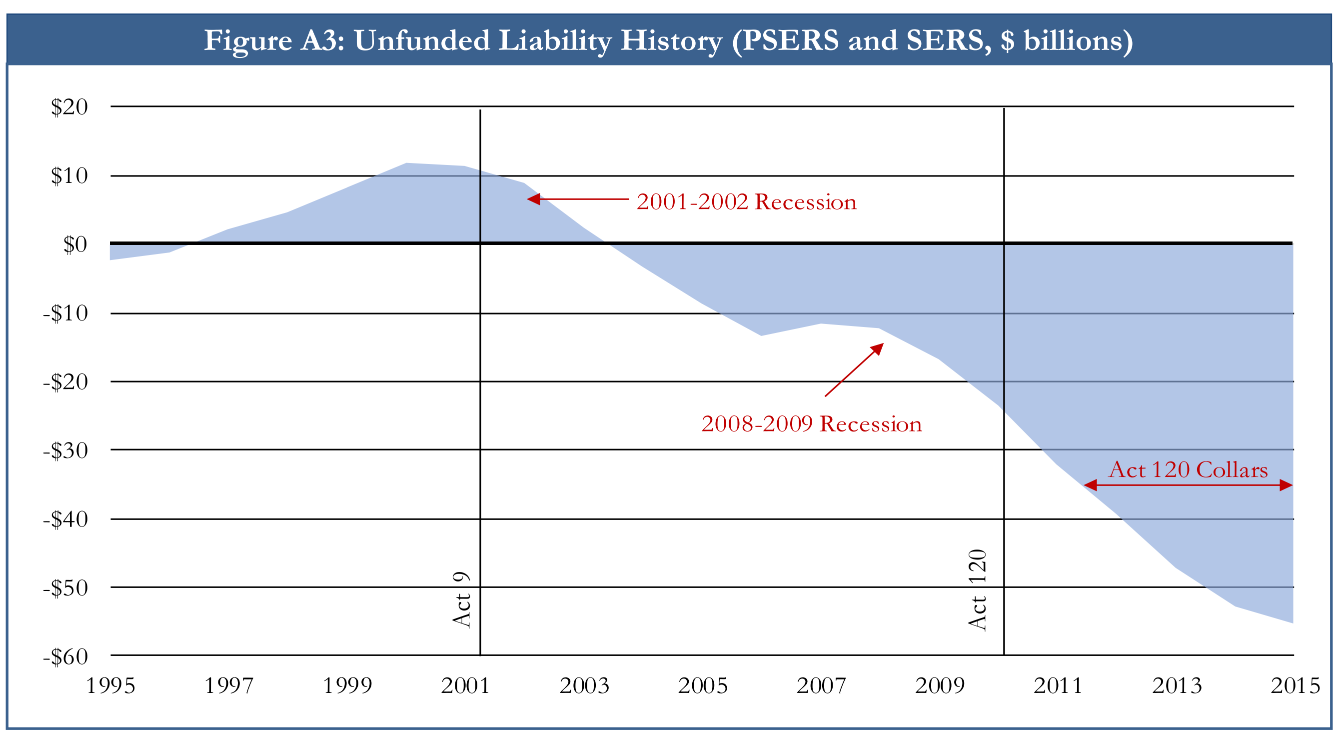


investment gains and losses. Act 120 amended the smoothing period for PSERS to 10 years. In the short-term, the extended smoothing period mitigates the negative effects of major investment losses. However, the delay in the recognition of investment gains and losses may cause the actuarial value of assets to deviate significantly from the market value of assets.

Collars Under Act 120 of 2010, the methods used to determine the employer contribution requirements for PSERS and SERS were modified by imposing limits, referred to as "collars," on the rate at which employer contributions can increase from year to year. The collars apply only if the calculation of the employer contribution rate results in an actuarially required contribution rate that is greater than the collared rate. Beginning with the July 1, 2011 fiscal year, and for each year thereafter, Act 120 limits the annual increase in employer contributions. Currently that limit is no more than 4.5 percentage points per annum.

Figure A3 displays the combined actuarial surpluses and unfunded liabilities of each System from 1995 to 2015. The time period begins with a small net unfunded liability, but by the late 1990s, the unfunded liabilities were eliminated, and the Systems experienced actuarial surpluses. This result was made possible by strong investment returns related to the "dot com" bubble and the corresponding economic expansion. Recessions in 2001 and 2008 significantly reduced investment returns for the pension plans, and combined with the effects of Act 9 of 2001 and other benefit enhancements, the unfunded liabilities grew dramatically. Between 2002 and 2010, statutory changes temporarily suppressed employer contributions by modifying amortization periods, altering asset smoothing rules and imposing rate collars. These statutory changes contributed to the unfunded liabilities by deferring employer contributions to future years.

Figure A3: Unfunded Liability History (PSERS and SERS, $ billions)



Glossary

Actuarial Accrued Liability — The difference between the present value of future plan benefits and the present value of the future normal cost of those benefits. It is the portion of the present value of future plan benefits attributable to service accrued as of the valuation dates.

Actuarial Value of Assets — The value of the pension plan investments and other property used for the purpose of an actuarial valuation. Actuaries often select an asset valuation method that smooths the effects of short-term volatility in the market value of assets.

Actuarially Equivalent — A benefit having the same present value as the benefit it replaces.

Amortization — Paying off an interest-bearing liability through a series of installment payments, as opposed to paying it off in one lump sum payment.

Defined Benefit (DB) Plan — The pension benefit to be provided at retirement is defined, while the contributions to be made over the period of employment are variable based on the experience of the pension fund. Upon retirement, a DB plan participant is entitled to receive a benefit that is calculated using a formula that considers factors such as age, duration of service with the employer and compensation.

Defined Contribution (DC) Plan — The contributions to be made over the period of employment are defined, while the pension benefit to be provided at retirement is variable based on the experience of the pension fund. Upon retirement or separation from service, a DC plan participant is generally entitled only to the balance standing to the credit of the individual's retirement account.

Employee Contribution — The percentage of salary deducted from an employee's paycheck and allocated to the retirement fund.

Employer Contribution — The percentage of payroll the employer contributes to the retirement fund. The employer contribution is equal to the sum of the normal cost and amortization of the unfunded liability.

Maximum Single Life Annuity — The maximum monthly pension amount a pension plan participant is entitled to receive under the statutory formula, without regard to options providing for survivor benefits.

Normal Cost

The portion of the total present value of benefits that actuaries allocate to each year of service, both past and future. It is the annual premium that the employer must contribute to fund the benefit. If it is paid for each year of service (and all actuarial assumptions are met), then the employee's pension benefit would be fully funded at the time of retirement.

Side-by-Side Hybrid

Combines a DB based on the employee's final average salary with a separate DC savings account.

Stacked Hybrid

Earnings below a certain point are covered by a DB plan and earnings above that point are covered by a DC plan.

Unfunded Actuarial Liability

The excess of the actuarial accrued liability over the actuarial value of assets. It is the present value of benefits earned to date that are not covered by current plan assets.

Vesting

The right of an employee to the benefits he or she has accrued even if employment under the plan is terminated. An employee who has met the vesting requirements of a pension plan is said to have a vested right. Employee contributions are always fully vested.

Vesting Period

The length of employment required before an employee may qualify for retirement benefits.

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Re: Amendment A10699 to Senate Bill 1071, Printer's Number 1913

Dear Mr. Knittel:

As requested, we have prepared an actuarial note on Amendment A10699 to Senate Bill 1071, Printer's Number 1913 (Amendment). The Amendment would amend both the Public School Employees' Retirement Code and the State Employees' Retirement Code to enact significant reforms applicable to both current and future members of the Public School Employees' Retirement System (PSERS) and the State Employees' Retirement System (SERS). Please note this is a lengthy commentary on the Amendment, which is indicative of the significant changes proposed to PSERS and SERS for the two multi-billion dollar systems. Comments and discussion on benefits, actuarial methods, and the projections completed by the System actuaries are included throughout this actuarial note, which contains the following sections.

- Executive Summary (starting on page 2)
- Summary of the Amendment (starting on page 3 and more fully described in Exhibit I starting on page 30)
- Discussion of the Amendment (starting on page 4)
- Review of Estimated Actuarial Cost Prepared by System Actuaries (starting on page 14)
- New Entrant Cost Comparison (starting on page 20)
- Risk Transfer Analysis (starting on page 21)
- Potential Impact on the Asset Allocation (starting on page 25)
- Basis for Analysis (starting on page 28)

This actuarial note assumes that, prior to enactment, a technical correction will be made to Section 404(1)(i) of the Amendment to change the beginning fiscal year over which the

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change in accrued liability due to this Amendment for SERS shall be funded from July 1, 2017 to July 1, 2018.

Our comments and discussion are summarized in the following Executive Summary.

Executive Summary

This actuarial note on Amendment A10699 to Senate Bill 1071, Printer's Number 1913, contains several items that we believe are important to the reader. These items are summarized below and are expanded in further detail throughout this actuarial note.

- The PSERS cost analysis performed by Buck, including the additional contributions to be made in future years due to savings estimated for this Amendment, did not reflect the revised actuarial assumptions adopted by the PSERS Board in June 2016. (See page 16 for discussion.)
- The mortality assumption used by the System actuaries does not include any adjustment for future mortality improvements in the projected valuations. This produces lower defined benefit plan costs than what would be projected had future mortality improvement been included. (See pages 16 and 18 for discussion.)
- We support the change in the normal cost determination to be based on all active members in the System rather than the average new member. As PSERS was already using this methodology, this change only impacts SERS. (See page 10 for discussion.)
- We believe consideration should be given to reducing the amortization period used for all future actuarial gains or losses for both systems. (See page 13 for discussion)
- The disability benefit for new PSERS members may cause an incentive for such members to seek a disability retirement as the accrual rate is higher than the accrual rate for a retirement benefit (2% versus 1.25% or 1%). (See page 8 for discussion.)
- By applying the existing early retirement and disability assumptions to new PSERS members, the liabilities if this Amendment is enacted may be understated. (See page 17 for discussion.)
- Prior to the Amendment's enactment, we suggest that the differences between PSERS and SERS be reviewed to ensure that this is the intent of the Amendment's sponsors. (See page 7 for discussion). In particular,
    - Vesting for new members would be 5 years in PSERS and 10 years in SERS.
    - The disability benefit for new members is higher in PSERS than in SERS for members with the same characteristics.
    - The employer contribution rate for DC only participants would be 2% in PSERS and 3.5% in SERS.

- There may be drafting errors in the Amendment that impact the shared-risk and shared gain provisions for SERS. These potential drafting errors should be corrected, if necessary, prior to the Amendment's enactment. (See page 9 for discussion.)
- In light of the shared-risk and shared-gain provisions and the requested risk transfer analysis, it is our opinion that stochastic modeling analyzing various economic outcomes should be performed for both Systems to fully understand the underlying risks to employer costs and employee contributions associated with these provisions. (See page 14 for discussion.)
- In the new sensitivity analysis under the risk transfer analysis section, the savings estimated due to the Amendment would be expected to be greater by 329% for PSERS and 16% for SERS if measured at a 6.5% investment return assumption versus the current 7.5% assumption. Reasons for the different impact for each system include the change in the normal cost determination for SERS and election percentages for those future members electing the DC only plan. (See pages 21 to 23 for discussion.)
- By providing lower DB benefits to new hires, the Commonwealth is reducing their exposure to investment risk, longevity risk, and inflation risk and transferring these risks to the employee. There is an approximate 13% reduction in expected future DB accrued liabilities and risk exposure for PSERS and an approximate 20% reduction in expected future DB accrued liabilities and risk exposure for SERS at the end of the projection period. (See page 24 for discussion).
- Based on a measure of the liquidity ratio for each System and the Commonwealth's risk exposure as represented by the liabilities of the Systems to the Commonwealth's budget, we would not expect a change in the Systems' asset allocation due to the enactment of the Amendment. (See pages 26 and 27 for discussion).

Summary of the Amendment

Amendment A10699 to Senate Bill 1071, Printer's Number 1913, would amend both the Public School Employees' Retirement Code and the State Employees' Retirement Code to enact significant reforms applicable to both current and future members of the Public School Employees' Retirement System (PSERS) and the State Employees' Retirement System (SERS).

If the Amendment is enacted, Act 120 hires (Class T-C, T-D, A-3, and A-4 members) would become eligible for Option 4 on a cost neutral basis and become subject to a shared gain adjustment (along with the current shared risk adjustment) on their member contributions.

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Also, employees who join PSERS on or after July 1, 2018 and most employees, including general employees, judges, and legislators, who join SERS on or after January 1, 2018 would have a choice between three benefit designs when first eligible – two new hybrid tiers of benefits - containing both defined benefit ("DB") and defined contribution ("DC") components - or a stand-alone defined contribution plan. State Police and most other hazardous duty members would be exempt from these changes for new hires in SERS and instead would continue to be classified as Class A-3 or A-4 members.

In addition to the benefit design changes, two major financing changes would occur. First, there would be additional employer contribution rates equal to the projected savings due to these changes that are designed to pay down the unfunded accrued liability faster for both PSERS and SERS than the amortization schedules would dictate. Second, the method for determining the normal cost in SERS would eventually be changed to be based on all active members rather than the average new member. The impact of this method change for determining the normal cost reduces the additional employer contributions toward paying down the unfunded accrued liability faster.

Since the primary provisions of this Amendment impact future members, there is a small impact initially, which grows over time. The first valuation reflecting these changes is the December 31, 2017 valuation for SERS impacting the contributions paid during the 2018-2019 fiscal year and the June 30, 2019 valuation for PSERS impacting the contributions paid during the 2020-2021 fiscal year. Initial costs are higher due to the timing differences inherent in contributions paid towards the DB plan versus the DC plan. Contributions paid to the DC plan occur in the same fiscal year that the member contributes whereas DB plan contributions occur in the following fiscal year.

The primary provisions that would impact the actuarial valuations are summarized in more detail on the attached Exhibit I.

Discussion of the Amendment

Defined Contribution Plans – General Information

In the private sector, employers have been replacing traditional final average pay defined benefit pension plans with defined contribution plans for many years. Many private employers have been ending their existing final average pay retirement plan (via benefit freezes or plan terminations) and replacing it with a defined contribution plan or hybrid plan design in an attempt to control plan costs, reduce volatility, and shift some of the inherent risk associated with maintaining a defined benefit plan from the employer to the employee.

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Defined contribution plans shift inflation, investment, and longevity risks from the employer to the employee as the account balance is a function of earnings over the working lifetime of the employee and the investment yield of the funds selected by the employee. As employees typically withdraw account balances upon retirement, they bear the risk of outliving their retirement assets.

With a defined contribution plan, the employer contributions are typically a percentage of member compensation, and can be easily budgeted each year without the added risk of additional contributions due to investment and demographic losses. Forfeitures of non-vested employer contributions with interest from members who terminate employment prior to fully vesting would serve to slightly lower future employer contributions.

New Benefit Tiers

The benefit accrual rate currently applicable to new members in PSERS (Class T-E) and for most new members in SERS (Class A-3) is 2.0% with a member contribution rate of 7.50% in PSERS and 6.25% in SERS. This benefit structure provides retirement benefits using a traditional defined benefit formula reflecting a member's final three-year average salary and years of service. Also, new members currently have the option to buy-up to a higher accrual rate (2.5%) by paying higher member contributions (10.3% in PSERS and 9.3% in SERS).

The Amendment would establish new tiers of benefits and separate defined contribution plans for members entering PSERS (Class T-G) and most members entering SERS (Class T-H). The new tiers would be designed as a final average pay plan which has a lower accrual rate (1.25%), a longer averaging period for final compensation (5 years) and later retirement eligibility requirements. Members would be required to contribute 5.5% and 5% of compensation in PSERS and SERS, respectively.

New members in the lower accrual final average pay plan tiers would also be enrolled in a defined contribution plan. Members would be required to contribute 3% and 3.5% of compensation in PSERS and SERS, respectively, with the opportunity to make additional voluntary contributions. Employer contributions would be 2% of compensation. Members would be vested in the employer contributions and earnings thereon after 3 years of service.

New members would also have an option to make an irrevocable election to elect one of two alternative benefit designs – (a) a hybrid design with a lower DB benefit (1% accrual rate) and lower member contributions of 4.5% of compensation for Class T-H in PSERS and 4% of compensation for Class A-6 in SERS with the same DC benefits or (b) a DC plan with member contributions of 7.5% of compensation and employer contributions of

2% of compensation for PSERS members and 3.5% of compensation for SERS members with no DB plan component.

The following table compares the major differences in the provisions applicable to new hires under Act 120 with new hires if this Amendment is enacted. Note that the default option for new hires under the Amendment (Option 1 in the following table) requires higher member contributions than for current Act 120 new hires.

Major differences in provisions applicable to current Act 120 hires versus future new hires under the Amendment				
	Current hires (Class T-E in PSERS, Class A-3 in SERS)	Option 1 under Amendment (Class T-G in PSERS, Class A-5 in SERS)	Option 2 under Amendment (Class T-H in PSERS, Class A-6 in SERS)	Option 3 under Amendment (Class DC in PSERS, participant in SERS)
DB accrual rate	2%	1.25%	1%	None
DB earnings averaging period	3 years	5 years	5 years	n/a
Superannuation age	Age 65 with 3 years of service or Rule of 92	Age 67 with 3 years of service	Age 67 with 3 years of service	When vested
DB vesting requirement	10 years	5 years in PSERS, 10 years in SERS	5 years in PSERS, 10 years in SERS	n/a
Early retirement	When vested	Age 62	Age 62	When vested
DB member contribution rate	7.5% in PSERS, 6.25% in SERS	5.5% in PSERS, 5% in SERS	4.5% in PSERS, 4% in SERS	0%
DC participant contribution rate	0%	3% in PSERS, 3.5% in SERS	3% in PSERS, 3.5% in SERS	7.5%
Total employee contribution rate	7.5% in PSERS, 6.25% in SERS	8.5%	7.5%	7.5%
DC employer contribution rate	n/a	2%	2%	2% in PSERS, 3.5% in SERS

Major differences in provisions applicable to current Act 120 hires versus future new hires under the Amendment				
	Current hires (Class T-E in PSERS, Class A-3 in SERS)	Option 1 under Amendment (Class T-G in PSERS, Class A-5 in SERS)	Option 2 under Amendment (Class T-H in PSERS, Class A-6 in SERS)	Option 3 under Amendment (Class DC in PSERS, participant in SERS)
DC vesting requirement for employer contributions and earnings thereon	n/a	3 years	3 years	3 years

As indicated in the preceding table, currently members can start receiving retirement benefits as soon as they are vested or upon superannuation age if earlier. Under the Amendment, the earliest age at which new members could start receiving their retirement benefits is age 62. If members withdraw their DB accumulated member contributions prior to age 62, they forfeit any employer-provided DB benefit.

Past practice in the Commonwealth has been to provide generally the same benefits to PSERS members and general SERS members but different required member contributions. If the Amendment is enacted, the following table shows the differences between the benefits for new members in PSERS versus SERS. Prior to the Amendment's enactment, we suggest that these differences be reviewed to ensure that this is the intent of the Amendment's sponsors.

Differences between benefits for new members in PSERS versus SERS if Amendment is enacted		
	PSERS	SERS
DB member contribution rate for Options 1 and 2	5.5% for Option 1, 4.5% for Option 2	5% for Option 1, 4% for Option 2
DC participant contribution rate for Options 1 and 2	3%	3.5%
Vesting	5 years	10 years
Subsidized early retirement eligibility	Termination after age 55 with 25 years of service	Termination after 25 years of service
Disability benefit	Based on 2% accrual, with minimum benefit of up to 33.33% of final average	Based on 1.25% or 1% accrual as applicable, with minimum benefit of up to

Differences between benefits for new members in PSERS versus SERS if Amendment is enacted		
	PSERS	SERS
	earnings	33.33% of final average earnings
Period to elect Option 2 or Option 3 instead of default Option 1	90 days	45 days
Employer contribution rate for those who elect Option 3 (the DC only option)	2%	3.5%

Note that the PSERS disability benefit being provided at a 2% accrual rate rather than the 1.25% or 1% accrual rate provides an incentive for PSERS members to retire under disability if eligible rather than under early or superannuation retirement as members would receive a significantly higher benefit under disability retirement. This could be further exacerbated by members between ages 55 and 62 who could not receive an immediate pension benefit under the Amendment.

Having differing benefit accrual rates (and resulting pension amounts) for different groups of employees results a potential equity issue when two employees, one hired before the change and one after, have the exact same job but have different pension benefits resulting in potentially significant differences in total compensation. Please note that this situation already existed in PSERS and SERS when Act 120 was implemented.

New Member Benefit Adequacy

Depending on the level of employer contributions, projected retirement benefits expected to be received by members are typically lower when a portion of a traditional final average pay retirement plan is replaced with a defined contribution plan. Most notably, the expected reduction in retirement benefits typically impacts members who enter the system at older ages since the time available to accumulate substantial account balances is limited. In a traditional final average pay plan, the value of the retirement benefit increases significantly as members approach retirement and past years of service are based on current higher earnings. While this legislation continues the traditional final average pay plan but with a lower accrual, the addition of the defined contribution plan provides benefits that are earned more evenly over the working lifetime of a participant. Therefore, there is generally a decrease in the projected retirement benefits, depending on the relationship between past salary increases and the investment income earned on the defined contribution accounts.

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It was beyond the scope of our assignment to provide a comparison of the two benefit designs and the value to members. We note that each system's actuary provided some benefit comparisons in the cost estimates referenced later in this note. We understand that the IFO will be including some comparisons in their analysis of this Amendment. Readers should keep in mind the increase in the employee contribution rate from 7.5% for Class T-E members to 8.5% for Class T-G members and the increase in the employee contributions rate from 6.25% for Class A-3 members to 8.5% for Class A-5 members for the hybrid designs. Due to the increase, a member would have to decrease personal savings (if any) and this increased cost should also be considered in the benefit comparison as part of the three-legged stool of retirement savings. If a new member elected one of the two options instead of the default option, total member contributions would remain the same for PSERS members, but would still increase for SERS members. In addition, if the pension benefits are reduced, there may be pressure to increase other forms of compensation to provide for the same level of total compensation value as before.

Reform of Current Member Benefits on a Prospective Basis

Under the Amendment, a shared-gain provision for current Class T-E, T-F, A-3, and A-4 members would be added in parallel to the current shared-risk contribution. As a result, member contributions could change within a 4% corridor (up from the current 2% corridor) every three years depending on the System's investment performance. The member contributions could change in 0.5% increments in PSERS and up to 1% increments in SERS.

Since a shared gain provision did not previously exist, adding this provision would potentially decrease the savings projected by the analyses. However, since the current rate is in the middle of the corridor, there would be an equal chance of increases and decreases in the contribution rate that are currently not reflected in the actuarial accrued liability assuming the current assumptions used by the System are set at the median. We believe that no further adjustment is necessary.

With the addition of the shared-gain adjustment to the regular member contribution rate language in the SERS code, the maximum change in the member contribution rate for any one determination is up to 1% as compared to 0.5% in PSERS. If the intent is to have the change in the member contribution rate at any one time also be 0.5% in SERS, this potential drafting error should be fixed prior to the Amendment's enactment.

In addition, Class T-E and T-F members in PSERS and Class A-3 and A-4 members in SERS would be able to withdraw all member contributions and statutory interest under Option 4 on an actuarially cost neutral basis. Previously these members were not

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permitted to elect Option 4. Future new members would also be eligible for Option 4 withdrawals after termination of employment on an actuarially cost neutral basis, but beginning no earlier than age 62 rather than upon becoming vested. However, future new members do have the option to receive a refund of their contributions with interest after termination prior to age 62, but would forfeit any further DB benefit payable from the Systems.

Determination of Employer Cost for SERS and PSERS under the Amendment

Funding of the two Systems is currently based on the determination of the employer normal cost and an amortization charge attributable to unfunded liabilities, with the SERS' employer cost subject to contribution collars (the collars are no longer applicable to PSERS). The employer contribution is expressed as a percentage of active member payroll (i.e. appropriation payroll) and charged to the various employers. Additionally, under current law governing PSERS and SERS, the normal cost of the system is to reflect the cost of benefits provided to the average new member of the retirement system. However, the systems have interpreted the statute differently regarding the method used to determine the normal cost.

Normal Contribution and Accrued Liability Rates

Under the Amendment, the normal contribution rate determination would be revised to be determined based on "all active members", rather than the average new member. This change aligns with the prior PSERS interpretation and there would be no cost impact due to this change for PSERS. For SERS, this would reflect a change in methodology, but would not be reflected until the December 31, 2021 valuation, a four-year delay in implementation.

SERS methodology

Under the current SERS methodology, the normal cost for SERS would decrease upon enactment of this Amendment for valuations performed, beginning with the December 31, 2017 valuation, before the methodology is changed at December 31, 2021. However, the decrease is not due to the changes in benefits for current members, but rather due to the changes in benefits from future Class A-3 to future Class A-5 and Class A-6 members. Because benefits provided to current members would be significantly higher than the benefits provided to members of the new Class A-5 and Class A-6, the employer normal cost under SERS would be significantly lower than the average cost of the benefits provided to current members.

Under the SERS interpretation of the "average new member", the SERS' actuary currently

bases the normal cost calculation on new members in Class A-3, as the average new general employee member would enter this class. If the Amendment was enacted, the SERS' actuary would base the normal cost calculation on an assumed blend of new members in Class A-5 (50%) and Class A-6 (50%), which would result in a significant decrease in the normal contribution rate and a significant increase in the unfunded actuarial accrued liability. Reducing the benefit accrual rate for only the average new members would not affect the present value of benefits for current members, but would reduce the future normal costs payable on account of these current members. Since the actuarial accrued liability is the difference between the total present value of benefits for all members and the present value of future normal costs, decreasing the normal cost for current members would generate an offsetting increase in the actuarial accrued liability. This approach is known as "Ultimate Entry Age Normal" and is a non-recommended practice as stated in a white paper published by the Conference of Consulting Actuaries for funding public pension systems (please see page 16 on the document available at https://www.ccactuaries.org/Portals/0/pdf/CCA_PPC_White_Paper_on_Public_Pension_Funding_Policy.pdf). We concur with the CCA White Paper and do not believe this approach is preferable for determining costs under a tiered system.

However, the Amendment modifies the normal cost calculation to be based on all active members, not just on new members entering Class A-5 and Class A-6, beginning with the December 31, 2021 valuation. This normal cost determination is considered a model practice in the CCA White Paper mentioned in the previous paragraph. Furthermore, this method also complies with the GASB 67 requirements. We concur with the CCA White Paper and believe this approach is preferable for determining costs under a tiered system. Furthermore, we support adoption of the traditional entry age normal cost method absent any other changes.

Basing the normal contribution rate on "all active members" aligns the normal cost rate with the average costs being earned by current members during the year. This is the traditional way to calculate the normal cost under the entry age normal cost method. Under this method, the actuary develops a normal cost rate based on current active members and the benefits to which each member is entitled. Thus, the normal cost rate would be based on an average of each member reflecting the various benefit accrual rates, the special membership classes in SERS, and the various member contribution rates, depending on each member's date of hire and class of service. As a result, the normal cost rate would gradually decline as current members leave active service and are replaced by new members in Class A-5 or A-6.

This change in the normal cost method would decrease the unfunded liability as of December 31, 2021 The reader should note that the decrease as of December 31, 2021 would be an offset to the increase in the unfunded liability as of December 31, 2016.

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Under the Amendment, the change in the unfunded accrued liability as of December 31, 2017 would be amortized in equal dollar amounts over a 30 year period beginning July 1, 2018 (rather than the 10 year period specified in current statute). Because the change as of December 31, 2017 is an increase, extending the amortization period from 10 to 30 years would result in a smaller amortization payment increase until the December 31, 2021 valuation and would avoid a sharp increase in the first year.

In addition, the change in the unfunded accrued liability as of December 31, 2021 due to the change in the normal contribution rate determination would also be amortized in equal dollar amounts over a 30-year period beginning July 1, 2022. Because the actuarial accrued liability as of December 31, 2021 would decrease if this Amendment is enacted, extending the amortization period from 10 years to 30 years would result in a smaller amortization payment credit applied each year and would avoid a potentially sharp increase in employer contributions in 10 years if a 10-year amortization credit would have been created.

Please note that the change in the normal cost method impacts the additional employer contribution rates discussed in the next section.

Additional Employer Contribution Rate

Under this Amendment, an additional employer contribution would be payable specifically to pay down the unfunded liability for specified fiscal years (see table at end of Exhibit I). Such rates are equal to the projected reduction in the employer contribution rate due to the other changes contained in the Amendment for the years in which the employer contribution rate is projected to be lower, as shown in the System actuaries' cost estimates referenced later in this letter.

The PSERS cost estimate is based on the actuarial assumptions used in the June 30, 2015 valuation. In June 2016, the PSERS Board adopted new actuarial assumptions that will be used in the June 30, 2016 valuation, including a reduction in the investment return assumption from 7.5% to 7.25%. If the projected impact of this Amendment was measured using the new actuarial assumptions, the projected reductions would be different and may have led to different additional contribution rates. Please note that the savings estimated by Buck using a 6.5% assumption determined for the risk transfer analysis indicated additional savings, which would in turn would increase the additional contributions to be made due to this Amendment if they were determined reflecting the new assumptions. Estimating the impact on this Amendment using the new assumptions adopted by the PSERS Board is outside the scope of our assignment.

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For SERS, there would be no additional contribution rate during an 8-year period for the fiscal years beginning July 1, 2022 through July 1, 2029. This is due to the change in the normal cost method. Thus part of the savings of changes in benefits for future members is used to offset the cost of this change in funding method.

Amortization Period for Actuarial Gains or Losses

The CCA White Paper referenced earlier also indicates the amortization periods for gains and losses should range between 15 and 20 years. Therefore, we recommend shorter periods be used for all actuarial gains or losses for both systems (e.g. 15-20 years, but no more than a period in which the first year payment is greater than the expected interest on the payment to prevent negative amortization, rather than the 24 years used by PSERS and 30 years used by SERS).

Option 4 and Actuarial Equivalent Mortality

In producing the estimates for this Amendment, both PSERS and SERS assumed that the actuarial equivalent mortality used for determining the Option 4 offset would be consistent with the mortality assumption used in the actuarial valuation for all future years. We note that this is currently true for PSERS, but actuarial equivalence for SERS is still based on the 1983 Group Annuity Mortality table. If the actuarial equivalence is not updated for SERS, actuarial gains would occur if members elect the cost neutral Option 4 withdrawal. Hay did not reflect any potential actuarial gains in their analysis and we concur with this approach.

Alternative Retirement Plan such as TIAA-CREF

Certain public employees hired by state or school employers within the Commonwealth have the opportunity to waive membership in SERS / PSERS and elect an alternative retirement plan such as TIAA-CREF. Depending on the differences between the benefits for Class T-G, T-H, DC, A-5 and A-6 members and participants in SERS versus those provided by the alternative retirement plans, there could be a potential inequity for such eligible employees as the employer contribution rates could differ and potentially incent such eligible employees to join PSERS/SERS or the alternative retirement plan. If eligible new employees elect an alternative retirement plan, the anticipated membership within SERS and PSERS could slowly decline, impacting the appropriation payroll which could lead to increases in the employer unfunded liability rate, although not necessarily the dollar amount of the unfunded liability.

Review of Estimated Actuarial Cost Prepared by System Actuaries

The IFO provided us with a copy of the October 7, 2016 estimate by Buck Consultants for PSERS and the October 12, 2016 estimate by Hay Group for SERS with the projected impact of this Amendment. In addition, Buck Consultants and Hay Group have provided us with additional details regarding their projections. We appreciate their cooperation in providing this information on a timely basis to meet the accelerated timeframe for providing this cost note.

The cost estimates include multi-year projections of the employer contribution rate under the current law and if this Amendment was enacted. These estimates show the projected appropriation payroll and the employer contribution rate for the System as well as for the defined contribution plan portion of the hybrid plan. These projections are based on the latest actuarial valuations (June 30, 2015 for PSERS and December 31, 2015 for SERS), and assume that future experience will exactly match the actuarial assumptions used to prepare the valuation and projections. Please note that the actual cost of this Amendment, if enacted, would depend on the actual experience for the new Classes T-G, T-H, and DC in PSERS and the new Classes A-5 and A-6 and participants in SERS, including the class election of the new members. Actual costs could be higher or lower.

The multi-year projections reflect a single deterministic scenario assuming that all assumptions are exactly realized, including actual investment return on the market value of assets of 7.5% each and every year. Separately from the actuarial costs notes, they have also provided an alternative deterministic scenario in which the investment return assumption is reduced 1% to 6.5% and actual investment return on the market value of assets also equals 6.5% each year, which will be further discussed in the risk transfer section later in this analysis. In reality, actual investment returns will vary from year to year, which will have an impact on the future employer and member costs. Due to the scope and impact of this Amendment, we strongly recommend and feel it is most prudent that stochastic modeling be performed to analyze the impact of varying investment returns on the future employer costs, especially due to the transfer of risk due to the DC plan component and the fact that member contributions are impacted by varying investment returns via the shared-risk and shared-gain provisions for Act 120 and later members.

New Tier Election Assumptions

In order to estimate the cost impact of the Amendment, the system actuaries made assumptions regarding the percentage of members who would remain in the default hybrid tiers, referred to as Option 1 (Class T-G for PSERS and Class A-5 for SERS) versus electing either a) a reduced hybrid tier referred to as Option 2 (Class T-H for PSERS and Class A-6 for SERS) or b) a DC only option. The default option requires a

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total employee contribution rate of 8.5% whereas the alternative options require a lower contribution rate equal to 7.5%.

Under the reduced hybrid tier (Option 2), the member and employer contributions to the DC plan remain the same. The difference is that the member contributes 1% of pay less and receives an accrual rater of 1% versus 1.25%. Therefore, members who elect Option 1 are paying an additional 1% of pay for a 0.25% increase in the accrual rate. Under Act 120, PSERS and SERS members can elect to make an additional contribution and receive an increase in the accrual rate of 0.50% (from 2% to 2.5% for Class T-F in PSERS and Class A-4 in SERS). For PSERS, the additional contribution rate is 2.8% of pay or 1.4% per 0.25% increase in the accrual rate whereas for SERS, the additional contribution rate is 3.05% of pay or 1.525% per 0.25% increase in the accrual rate.

For the DC plan only option (Option 3), PSERS members would receive the same 2% employer contribution as if they elected one of the hybrid tiers. Therefore, PSERS members who elect the DC plan only would not receive a compensatory increase in the employer-provided benefit versus Options 1 and 2. Therefore, we would expect very few members to elect the DC plan only option under PSERS. For SERS members, the employer contribution under the DC plan only option would increase from 2% under Options 1 and 2 to 3.5%. Therefore, we would expect more members to elect the DC plan only option under SERS than PSERS. This is reflected in the assumptions used by Hay for SERS, as shown in the following table:

New Tier Election Percentages Assumed by System Actuaries		
	PSERS	SERS
Option 1 (DB+DC)	65%	40%
Option 2 (DB+DC)	30%	40%
DC Only Option	5%	20%

The cost of Option 1 is higher than the costs of the alternative options (see the cost comparison of the different designs discussed later in this analysis). As such and since it would be considered the default option, we would expect more members to remain in this option than elect the other options. This is consistent with the assumptions used by Buck for PSERS. Hay assumed a 50/50 split for members who elect a hybrid option. Although we might expect more members to remain in Option 1 versus Option 2, the cost differences between these options is very small and without any additional information, we believe the assumption is reasonable. The actual costs of the Amendment will be based on the actual elections of the members. These election percentages should be monitored over time to be used in future cost projections, if this Amendment is enacted.

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We do note that Buck indicated the impact of alternative assumptions of assuming a higher percentage of members electing Option 2 and/or the DC only option. Since Option 1 has the highest cost, these alternative assumptions produced higher estimated savings.

Additional commentary

The following represents Milliman's additional commentary on Buck's analyses for the Amendment's impact on PSERS:

- Buck completed this analysis, including the additional unfunded accrued liability contributions to be made in future years due to savings generated by the other changes contained in this Amendment, based on the actuarial assumptions used in the June 30, 2015 valuation and did not reflect the revision to the demographic and economic assumptions adopted by the PSERS Board in June 2016. In particular the investment return assumption was lowered from 7.5% to 7.25% and the salary growth was reduced from 5.5% to 5%. This experience review report is not yet publicly available. Absent other changes made in the experience study, we believe the reduction in the investment return assumption would increase the savings and the additional contribution rates to reduce the unfunded accrued liability determined for the Amendment. If the costs/savings of this Amendment were based on the updated assumptions, it is likely that the impact of the Amendment would be different.
- Buck's June 30, 2015 actuarial valuation stated "we believe that it would be inappropriate to claim that the annuitant mortality assumption now in use incorporates a provision for improvements in longevity beyond the measurement date". We believe if such provisions were made and included in these projections, the expected contributions to PSERS would increase under current provisions and would also increase, but to a lesser extent, under this Amendment due to a partial shifting of costs and benefits to a defined contribution plan. Since longevity risk in a defined contribution plan is borne by the participant, there would be no employer cost impact to this portion of the benefit. Therefore, we would expect the savings of the hybrid plan to increase (and the expected benefit levels provided by the defined contribution plan to decrease since they would be expected to cover a longer lifetime).
- Buck assumes that employees who became members of PSERS during the period July 1, 2012 through June 30, 2015 would be representative of members entering the system each year in the future. Based on our understanding of Buck's projection methodology, the new entrant cohort, which contains a mix of full-time and part-time members, replaces both full-time and part-time members who are expected to leave service. We note that we would expect the level of future full-time and part-time membership to remain constant over a projection period such that new full-time members are replacing exiting full-time members and new part-

time members are replacing exiting part-time members. If there is a greater proportion of part-time members relative to full-time members in the cohort versus the current population, the projections would lead to a different blend of full-time versus part-time membership over time. We recommend that the System and Buck review the methodology of the new entrant projection and the projection of future full-time versus part-time members to determine if it is representative of the expected ratio of long-term future membership of full-time versus part-time members.

- Buck assumed no change in the retirement patterns for members entering the new hybrid plan classes. The current assumptions for early retirement (which apply to members between ages 55 and 61 with at least 25 years of service) reflect that immediate early retirement is subsidized for current members (e.g. the 3% per year reduction factor is less than an actuarially equivalent reduction). The same retirement rates (which range from 12% to 25% depending on age) are being used for those who leave employment after age 55 with 25 years of service who would be entitled to the subsidized early retirement, but with commencement delayed until age 62 under the Amendment. We would anticipate current retirement rates to decrease for these members between ages 55 and 61 with an increased rate at age 62 when first eligible to collect benefits immediately. Accordingly, we believe the cost estimates are undervaluing the cost of the hybrid plan, which would lead to reduced savings. Although experience would not be known for Class T-G and T-H members for many years, it may be more appropriate to make an assumption regarding possible adjustments to the early retirement rates rather than maintaining the current early retirement rates.
- Buck also assumed no change in the disability incidence rates for the new hybrid plan class members under the Amendment. Given that disability benefits would be based on a 2% accrual rate (instead of 1.25% or 1%) for new hybrid plan class members, there would be an incentive for such members to apply for a disability retirement rather than early or superannuation retirement as a larger benefit would be received. An incentive does not exist for current members when eligible for superannuation retirement as the benefits are generally the same. Consideration should be given to estimating costs with higher disability incidence rates starting at ages 61 and later (the disability rates peak at age 60 and then decline). This would increase the Amendment's cost, reducing the savings.
- Under the Amendment, new members would not be able to commence benefits until age 62; however, they would have an option to withdraw their accumulated member contributions, which would forfeit any other DB benefit. Buck did not assume that any vested member would receive their accumulated member contributions in lieu of any other benefit. If such an assumption were made, the liabilities under the Amendment would be lower and thus the savings would be larger.

The following represents Milliman's additional commentary on Hay Group's analysis of the Amendment's impact on SERS:

- In Hay's 2015 experience study, the mortality assumption was updated to reflect a 10% margin, otherwise known as a static approach to mortality improvement in future years. As they indicated in the experience study, they preferred this approach rather than applying a generational ("built-in") mortality improvement scale. Although a static approach may be appropriate for a single valuation, the margin would be expected to decrease or be eliminated in the future valuations performed over the 30-year projection period as provided for in this analysis. If improvements in mortality were included in the projections beyond the current margins, the expected contributions to SERS would increase under current provisions and would also increase, but to a lesser extent, under this Amendment due to a partial shifting of costs and benefits to a defined contribution plan. Since longevity risk in a defined contribution plan is borne by the participant, there would be no employer cost impact to this portion of the benefit. Therefore, we would expect the savings of the hybrid plan to increase (and the expected benefit levels provided by the defined contribution plan to decrease since they would be expected to cover a longer lifetime).
- Under the Amendment, new members would not be able to commence benefits until age 62; however, they would have an option to withdraw their accumulated member contributions, which would forfeit any other DB benefit. Hay did not assume that any vested member would receive their accumulated member contributions in lieu of any other benefit. If such an assumption were made, the liabilities under the Amendment would be lower and thus the savings would be larger.
- Under the Amendment, the total DB+DC/DB contribution dollars included in Hay's projection summary do not include the additional contribution dollars used to offset the unfunded accrued liability as a result of savings due to the Amendment. However, the annual and cumulative dollar savings shown in Hay's summary do include the additional contribution dollars used to offset the unfunded accrued liability as a result of savings due to the Amendment.

Cost Projection Results

The PSERS and SERS estimates of this Amendment included the year-by-year cash flow cost/(savings) and the present value of such cash flow cost/(savings) using the System's investment return assumption of 7.5% over the projection period. The present value reflects the time value of money. The interest rate used to discount any savings would vary based on the user's perspective. The Commonwealth may want to use an inflation rate consistent with budget growth as increases in costs above that rate decrease

available dollars for other programs in future years, excluding any new revenue. The actuarial cost notes prepared by the System actuaries use the expected return, which is consistent with the development of the System's costs and liabilities.

If this Amendment is enacted, the following chart shows the expected accumulated nominal dollar cash flow costs/(savings) on the employer contributions for the fiscal years 2017-2018 through 2048-2049 as provided by the System actuaries. It is important to note that Hay displayed contributions through the 2051-2052 fiscal year for SERS and thus, the numbers shown below will differ from those reported by Hay in order to provide costs that are consistent with the period reported by Buck for PSERS.

The chart also shows the present value of the expected cash flow costs/(savings) as of June 30, 2017, assuming end of year payment, at 3.7% (a proxy for budget growth provided by the IFO) and 7.5% (the current investment return for the Systems).

Impact on Employer Contributions if Amendment 10699 to Senate Bill 1071, PN 1913 is enacted for Fiscal Years 2017-2018 through 2048-2049
(Amounts in millions and based on System actuary's projections)

	Cash Flow Costs / (Savings) as determined by System Actuary	Present Value of Cash Flow Costs / (Savings) at 3.7% as of June 30, 2017	Present Value of Cash Flow Costs / (Savings) at 7.5% as of June 30, 2017
PSERS	$(808.9)	$(240.0)	$(48.6)
SERS	(1,808.5)	(591.3)	(160.7)
Total	(2,617.4)	(831.3)	(209.3)

The System actuaries' cost estimates also indicated the costs/(savings) of the various provisions on a step by step basis. Note that the costs of each step is dependent on the order in which the changes were implemented. If a different order is used, the individual step results would vary but the total cost/(savings) would remain the same. Specifically, the cost of the DC plan is determined after the savings of reducing the DB plan benefit has been determined.

New Entrant Cost Comparison

As part of our review process, we requested the system actuaries provide the employer normal cost rates of the current and proposed benefit tiers. These normal cost rates provide a basis for comparison of the value of the proposed benefits versus the existing benefits. As shown in the following table, the value of benefits under the proposed benefit tiers are lower than the current Act 120 tiers. This reduction leads to the overall savings produced by the actuaries for this Amendment. Based on the differences in the benefit provisions of the proposed tiers versus the current tiers, we believe the results provided by the system actuaries are reasonable.

Comparison of Employer Normal Cost Rates
Under existing Act 120 and Proposed Benefit Tiers
As determined by System Actuaries

	PSERS	SERS [2]
Act 120 [1]	2.76%	4.92%
Option 1 (DB+DC)	2.29%	3.88%
Option 2 (DB+DC)	2.23%	3.70%
DC Option	2.00%	3.50%

[1] For PSERS, represents blend of Class T-E and T-F employees; for SERS, represents Class A-3 general employees.

[2] The SERS normal cost rates provided by Hay under the proposed benefit tiers reflect the proposed change in the Entry Age Normal cost method, which incorporates a 0.4% load for administrative expenses. This load has been added to the Act 120 normal cost rate for comparison purposes.

Please note that the preceding normal cost rates are based on the assumptions used in this analysis. To the extent that different assumptions are used, such as those adopted by the PSERS Board in June 2016, the relationships shown above could be different. Also, to the extent that investment return assumptions and/or mortality assumptions are reduced in the defined benefit plans, the costs of the defined benefit portion of the hybrid options would increase, but the DC costs would remain the same. This would be expected to result in a larger difference between the proposed benefit tiers and the current Act 120 tiers.

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Risk Transfer Analysis

Section 615-B of the Administrative Code requires that a "risk transfer analysis" be included in the actuarial note on any legislation that proposes substantial benefit design changes for members in PSERS and SERS.

Possible Approaches

The primary risks faced by retirement systems and participants are investment risk, longevity risk, and inflation risk. As we previously discussed, there are no actuarial standards regarding "risk transfer analysis". Within current actuarial practices, there are several approaches that could be used to help quantify the risk transfer.

One approach would be to value these risks stochastically under the current law and the proposed legislation – and should include the impact on the retirement system's costs as well as the benefits provided to several sample employees. This type of analysis is complex and typically takes significant time and money. This modeling process would be able to review the impact of the shared-risk and potential shared-gain member contributions for recent hires in PSERS and SERS as it would include the impact of varying returns from year to year as compared to the assumed return. The current deterministic scenarios do not adequately quantify the impact of the shared-risk and potential shared-gain member contributions as the year to year market returns are always assumed to equal the assumption resulting in no deviation.

A "stress test" alternative to a full stochastic approach would be to have results provided for a sample of, say, 10 different investment return paths to provide a limited measure of the impact of varying returns on the costs. To address longevity risk, a separate analysis could be modeled that reduces the mortality rates (which extends lifespan) or uses different mortality improvement scales.

Sensitivity Analysis

After discussions with legislators, the Systems, and their actuaries, the IFO defined a sensitivity analysis to be performed that would show the change in the costs/(savings) of the Amendment assuming that the investment return assumption and the annual actual return on the market value of assets were both lowered by 100 basis points (e.g. from 7.5% to 6.5%). This measurement provides information regarding the impact of the new benefit design at a lower investment return. Note that a lower investment return leads to larger liabilities and costs, and vice versa.

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The sensitivity analysis overview is as follows.

A. Start with the schedule of employer contributions for the current benefit package at the current assumed investment rate of return (7.5%). *(Current law)*

B. Also start with the schedule of employer contributions for the proposed benefit package at the current assumed investment rate of return (7.5%). *(Proposed law)*

Change the assumed investment rate of return for all years in the projection. When determining employer contributions this would be treated as a revision to the assumed rate and not an actual deviation from the assumed rate.

C. Determine the schedule of employer contributions for the current benefit package assuming a 6.5% investment rate of return (1 percentage point lower than the current 7.5% assumption). *(Current law with alternate investment assumptions)*

Substitute the proposed benefit structure for the benefits currently received by new employees.

D. Determine the schedule of employer contributions for the proposed benefit package assuming a 6.5% investment rate of return (1 percentage point lower than the current 7.5% assumption). *(Proposed law with alternate investment assumptions)*

The difference between the employer contributions in steps C and D under the alternative investment return assumptions is intended to reflect the impact on those contributions of the new benefit structure at the alternate investment return assumptions as compared to the difference in employers contributions in steps A and B of the new benefit structure at the current investment return assumption.

The following table summarizes the results of this sensitivity analysis. The employer contribution comparison is performed on a cash flow basis (e.g. without discounting for the time value of money) for the fiscal years 2017-2018 through 2048-2049.

Sensitivity Analysis for Amendment 10699 to Senate Bill 1071, PN 1913 based on Estimated Employer Contributions for Fiscal Years 2017-2018 through 2048-2049

(Amounts in millions and based on System actuary's projections)

	PSERS	SERS
A. Current law at 7.5%	$134,158.3	$65,398.3
B. Proposed law at 7.5% [1]	133,038.5	63,589.8
C. Current law at 6.5%	168,589.6	81,563.0
D. Proposed law at 6.5% [1]	163,782.0	79,471.7
E. Cost/(Savings) at 7.5% (B – A)	(1,119.8)	(1,808.5)
F. Cost/(Savings) at 6.5% (D – C)	(4,807.6)	(2,091.3)
Percentage increase in cost/(savings) due to lower investment return ({F ÷ E} – 1)	329%	16%

[1] PSERS amounts exclude the impact of the additional employer contributions to reduce the unfunded liability

As shown in the preceding table, the proposed law generates more savings from the current law when measured at a lower investment return assumption. One reason that the percentage of increase in savings for SERS is much lower than PSERS is due to the change in the normal cost methodology. As noted earlier, the cost impact of the change in methodology partially offsets the savings generated by the benefit design changes. At the 6.5% assumption, the cost impact of the change in methodology increases, creating a higher offset. However, the overall savings is still increased, but just not to the same extent if there was no change in normal cost methodology.

Another reason causing the percentage increase for SERS to be much lower than PSERS is the assumed percentage of new hires electing the DC only option. The SERS estimate assumes that 20% of newly eligible Class A-5 members elect to participate in the DC plan only. There is no additional savings generated for DC only participants as the investment return assumption is lowered. In addition, SERS would maintain a group of members that basically would be unaffected by the Amendment referred to as Class A-5 exempt members that will continue to receive benefits under the Class A3 (or Class A4) tiers. It is estimated that approximately 20% of new members would be identified as Class A-5 exempt members.

Please note that the additional contribution rates remained unchanged in performing this analysis for SERS. In other words, the additional contribution rates, as specified in the Amendment, were based on a 7.5% assumption not the alternative 6.5% assumption.

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Change in expected future liability

By providing lower DB benefits to new hires, the Commonwealth is reducing their exposure to investment risk, longevity risk, and inflation risk and transferring these risks to the employees. One measure of this reduction in exposure is a comparison of the expected future liabilities of the Systems at the end of the projection period for both Systems. The following table shows the expected liabilities as of the 2047 valuations as provided by the System actuaries and the percentage reduction (which serves as a measure of how much the Commonwealth's risk is expected to decline). For SERS, the expected present value of benefits was not available and the estimated accrued liability was determined by adding the unfunded accrued liability to the actuarial value of assets.

Estimated Liabilities as of the 2047 valuations under current law and if Amendment 10699 to Senate Bill 1071, PN 1913 is enacted
(Amounts in millions and based on System actuary's projections)

	PSERS		SERS
	Present Value of Benefits	Actuarial Accrued Liability	Actuarial Accrued Liability
Current law	$216,982	$187,236	$56,598
Proposed law (DB only)	178,189	162,754	45,538
Percentage reduction	17.9%	13.1%	19.5%

The above measure does not factor in the costs of the DC employer contributions. Once paid, the DC employer contributions do not provide any future risk to the Commonwealth (although if benefits provided to employees are inadequate, individuals may require additional assistance through the Commonwealth's welfare programs, which is beyond the scope of this analysis). All future risk is transferred to the employee. The above also does not factor in the investment-risk sharing with the members via the shared-risk and shared-gain provisions.

Future investment gains and losses

Each of the system's assets is assumed to earn the valuation investment return assumption each year of the projections prepared by the System actuaries. To the extent adverse (favorable) investment returns are experienced, the contribution rates would be higher (lower). Due to the transfer of investment risk to the participants in the DC portion of the hybrid plan, we would expect the employer cost impact of investment gains/losses would be greater under the current plan than under the hybrid plan approach contained in the Amendment. The employer cost impact of investment gains/losses is also mitigated by the shared-risk adjustment to member contributions under the current law and would

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be offset somewhat by the shared-gain adjustments that would be added under the Amendment.

Impact on employees

As mentioned earlier, this Amendment would transfer some of the investment risk, longevity risk, and inflation risk from the Commonwealth to future new members. Another approach for a risk transfer analysis would be to focus solely on the impact of the changes for a few hypothetical sample employees and how the benefits paid to the employee would change under the proposed legislation.

For example, sample employee C on Table 3-B of the PSERS cost estimate would have a current law benefit of $34,714 per year. Under the Amendment, this sample employee C, if a member of Class T-G, would have a DB benefit of $19,675 per year and an estimated DC benefit of $6,761 per year for a total annual benefit of $26,436. If the Amendment was enacted, this sample employee would:

- Have a reduction in the total benefit by 24% from $34,714 to $26,436.
- Be subject to inflation risk, investment risk, and longevity risk on the DC portion of the benefit (which is about 25% of the estimated total benefit).

This same approach can be used with the other sample employee comparisons that are contained in the System actuaries cost estimates and in the IFOs work product.

Note that any sample benefit comparison performed to analyze the transferred risk should also determine the impact of varying DC plan investment return as well as the annuity conversion rate.

Potential Impact on the Asset Allocation

Section 615-B of the Administrative Code requires that, if requested, “an analysis of the potential impact on the asset allocation and related costs for the systems” be included in the actuarial note on any legislation that proposes substantial benefit design changes for members in PSERS and SERS. We understand that such an analysis has been requested.

The System’s target asset allocation, which is part of the System’s investment policy, is based on many factors such as the Board and Commonwealth’s investment return objective and the ability and willingness to take risk, the System’s expected net cash flows, and how long the assets are expected to be invested. An asset liability study can be used to determine the target asset allocation and is typically done in conjunction with the System’s investment consultants and actuaries.

We recommend that the impact of a potential change in risk tolerance (e.g. the ability and willingness to take risk) not be combined when analyzing the cost impact of proposed changes in benefits as the change in the risk tolerance would apply to both the current estimated costs and the proposed estimated costs.

The Systems' Boards can change asset allocation strategy at any time, which could have an impact on the investment return assumption. A more conservative portfolio could result in a reduction in the expected investment return, but the variability of returns may be reduced. On the other hand, a more aggressive portfolio could result in an increase in the expectation, but the variability of returns may be increased. A larger variation of returns would result in more volatility in the annual contribution requirement. The question is, if a change in benefit design is made, would that <u>require</u> the Systems' Boards to modify the assumption? We believe that there is much uncertainty regarding the possible actions of the Boards in future years.

We note that neither System actuary reduced the investment return assumption in preparing their actuarial cost estimates of this Amendment. Buck recommended that PSERS' investment consultant perform an analysis in their cost note. Hay indicated in their cost estimate that it was not "necessary or appropriate to factor in any future reduction(s) to the annual investment return assumption" currently used.

Liquidity Ratio

In determining if the System's asset allocation should be modified due to the enactment of the Amendment, we reviewed each System's liquidity ratio to determine the percentage of assets to be used to cover a year of benefit payments. If this percentage increases over time, we would then potentially expect a shift in the plan's asset allocation to more liquid assets. Please note that liquid assets do not necessarily mean cash; it could be changes in how investment or dividend income is captured throughout the year. It is our understanding that a variety of methods can be used to cover additional cash outflows. Any such review of a shift to more liquid assets is outside the scope of our assignment.

For PSERS, as of June 30, 2015, expected benefit payments for the upcoming year represent approximately 12.9% of market value. If the Amendment is enacted, the expected benefit payments for the upcoming year represent approximately 7.4% of market value as of June 30, 2047. Therefore, the liquidity ratio, based on this metric, is expected to decrease from its current level assuming all current actuarial assumptions are met and all employers, including the Commonwealth makes the annual actuarial contribution.

For SERS, as of December 31, 2015, expected benefit payments for the upcoming year represent approximately 12.3% of market value. If the Amendment is enacted, the expected benefit payments for the upcoming year represent approximately 11.5% of market value as of December 31, 2047. Therefore, the liquidity ratio, based on this metric, is expected to decrease from its current level assuming all current actuarial assumptions are met and all employers, including the Commonwealth makes the annual actuarial contribution.

One of the reasons for the decline in the liquidity ratio under the Amendment is that new members would not be able to collect a retirement benefit or Option 4 withdrawal until age 62.

Because the liquidity ratio would decline for both Systems under the Amendment, we would not expect a change in the plan's asset allocation to more liquid assets.

Relationship to Commonwealth's budget

Investment risk is borne by the plan sponsor, which consists of the Commonwealth and the various state agencies and school districts participating in these plans. Since the Commonwealth subsidizes the budgets of many of these other participating entities, we can review the ability of the Commonwealth to absorb investment risk in the Systems. One way to perform this review is to compare the total liabilities of the Systems to the Commonwealth's budget. Our comments below reflect this measure at the current valuation dates and at the projected valuation dates 30 years in the future. This provides some sense of the Commonwealth's current risk tolerance and if that risk tolerance would change due to the enactment of this Amendment. The reader should note that this analysis does not take into consideration the assets that are available to pay for System benefits.

Currently the total liabilities of the combined Systems are over 5 times the Commonwealth's budget. Based on the assumptions used in this analysis under the baseline provisions and assuming a budget growth assumption of 3.7% per year (as provided by the IFO), the projected combined System liabilities are expected to be reduced to 3 times the projected budget in 30 years, reflecting the lower benefit tiers adopted under Act 120. Based on the assumptions used in this analysis by the System actuaries, if the Amendment is enacted, this ratio is expected to be reduced by approximately 20% to roughly 2.5 times the Commonwealth budget. Therefore as the size of the Systems are reduced, the DB plans become less of a risk to the Commonwealth. As a result, we would not expect that the risk tolerance of the Commonwealth would change as a result of this Amendment and believe the

Commonwealth could continue to manage the Systems at their current investment risk levels.

Basis for Analysis

Due to time constraints dictated by the IFO for providing this actuarial note by October 23, 2016, we are providing this letter on an accelerated basis. In particular, we were provided with the PSERS actuarial cost estimate on October 7, the SERS actuarial cost estimate on October 12, Amendment 10699 to Senate Bill 1071, Printer's Number 1913, on October 19 and some supplementary information provided by the Systems' actuaries as late as October 21. If additional time was available, some of the issues described in this letter could have been discussed with the Systems' actuaries in more detail, leading to potentially additional and/or different commentary. Additional time may have also afforded the possibility that issues that are not presented in this actuarial note could have been discovered, opined upon, and addressed further.

In performing this analysis, we have relied on the information provided by the IFO, PSERS, SERS, Buck Consultants, and Hay Group. We have not audited or verified this data and other information. If the data or information is inaccurate or incomplete, the results of this analysis may likewise be inaccurate or incomplete.

We performed a limited review of the projections prepared by Buck Consultants and Hay Group as provided by the IFO, PSERS, and SERS for reasonableness and consistency and, except as described above, have not found material defects. If there are material defects, it is possible that they would be uncovered by a detailed, systematic review and comparison to search for values that are questionable or for relationships that are materially inconsistent. Such a review was beyond the scope of our assignment.

Future actuarial measurements may differ significantly from the current measurements presented in this analysis due to actual plan experience deviating from the actuarial assumptions, the natural operation of the plan's actuarial cost method, and changes in plan provisions, actuarial assumptions, actuarial methods, and applicable law. An assessment of the potential range and cost effect of such differences is beyond the scope of this analysis.

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The consultants who worked on this assignment are pension actuaries. We have not explored any legal issues with respect to the proposed plan changes. We are not attorneys and cannot give legal advice on such issues. We suggest that you review this proposal with counsel.

We are members of the American Academy of Actuaries and meet its Qualification Standards to render this actuarial opinion.

Please let us know if we can provide any additional information regarding this Amendment.

Sincerely,

Timothy J. Nugent

Scott F. Porter

Katherine A. Warren

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Enclosure

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**Amendment A10699 to Senate Bill 1071, Printer's Number 1913 –
Primary Provisions that would impact Actuarial Valuations of PSERS and SERS**

Amendment A10699 to Senate Bill 1071, Printer's Number 1913, would amend both the Public School Employees' Retirement Code and the State Employees' Retirement Code to enact significant reforms applicable to both current and future members of the Public School Employees' Retirement System (PSERS) and the State Employees' Retirement System (SERS).

The primary provisions that would impact the actuarial valuations are summarized below.

Current members (including future State Police officers and most other hazardous duty members in SERS)

The following changes for current active members would apply prospectively. These changes would also apply to future State Police officers and most other hazardous duty members who would continue to be classified as Class A-3 or A-4 members in SERS.

- For current Class T-E and T-F members in PSERS and current Class A-3 and A-4 members in SERS, the following changes would occur.
  - For PSERS, the current shared-risk provision would be modified and for SERS a shared-gain provision would be added, to allow a member's contribution rate to be reduced by up to 2% below the member's basic contribution rate, under the same conditions which current member contribution rates could increase under Act 120. In PSERS, the decrease in the member contribution rate could not exceed 0.5% at any one time. In SERS, there are circumstances that could lead to a change in the member contribution rate by as much as 1% at one time.
  - The Option 4 withdrawal would become available on an actuarially neutral basis for all service. (Currently such members cannot elect Option 4.) Actuarially neutral refers to the interest rate used in the calculation, which would be changed to be consistent with the valuation interest rate assumption rather than the current 4% interest rate. This provision is effective upon enactment for PSERS and effective January 1, 2018 for SERS members.

- State Police and most other hazardous duty members hired on or after January 1, 2018 (e.g. those that would be Class A-3 or A-4 members in SERS) would have voluntary overtime in excess of 10% of base salary per pay period excluded from

**Amendment A10699 to Senate Bill 1071, Printer's Number 1913 –
Primary Provisions that would impact Actuarial Valuations of PSERS and SERS**

pensionable compensation.

- State Police would continue to be eligible for the DiLauro Award upon the completion of 20 eligibility points. However, any Class A-5 and Class A-6 service (such as from military service, purchased service, or other State service) would not count as eligibility service for the DiLauro Award. Instead any Class A-5 and Class A-6 service would result in additional benefits from the System based solely on Class A-5 and Class A-6 service.

Future members

Employees who join PSERS on or after July 1, 2018 and most employees who join SERS on or after January 1, 2018 would become members of Class T-G and Class A-5, respectively. State Police and most other hazardous duty members would be exempt from becoming Class A-5 members in SERS and instead would continue to be classified as Class A-3 or A-4 members. Future legislators and judiciary employees would become members of Class A-5. The new benefit tier within each System for each would continue to be a traditional defined benefit formula, as provided to current members, but with a lower accrual rate along with other changes. Such members would also be enrolled in a defined contribution plan maintained by the Board of each System.

In addition, new members could irrevocably elect two alternative benefit designs at first eligibility – (a) a lower defined benefit formula with lower member contributions with the same defined contribution plan – Class T-H in PSERS and Class A-6 in SERS - or (b) only the defined contribution plan – Class DC in PSERS and only a participant in SERS. The election period to opt into a different class is 90 days in PSERS and 45 days in SERS.

<u>Defined Benefit Plan for future members</u>

Except for the following changes, Class T-G and T-H members would have the same benefits as current Class T-E members in PSERS and Class A-5 and A-6 members would have the same benefits as current Class A-3 members in SERS.

- The accrual rate would be 1.25% for Class T-G and A-5 or 1% for Class T-H and A-6 (instead of 2%).
- The final average earnings would be determined over a 5-year period (instead of

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a 3-year period).

- Employer-provided benefits in PSERS for Class T-G and T-H members would vest after 5 years of service (instead of 10 years of service for Class T-E members). Class A-5 and A-6 members in SERS would continue to have the same 10 year vesting as for Class A-3 members.
- Mandatory member contributions would be 5.5%, 4.5%, 5%, and 4% of compensation for Class T-G, Class T-H, Class A-5, and Class A-6 members, respectively, subject to the same shared risk/gain adjustments as for Class T-E and A-3 members.
- Superannuation age would increase to age 67 with 3 years of service.
- Early retirement would be available beginning at age 62, with benefits generally subject to an actuarially equivalent reduction. PSERS members who leave employment after age 55 with 25 years of service and SERS members who leave employment after 25 years of service would be eligible for subsidized early retirement as the reduction factor would be 3% for each year retirement occurs prior to superannuation age.
- Disability benefits for Class T-G and Class T-H members would be based on a 2% accrual rather than the 1.25% or 1% accrual. Disability benefits for Class A-5 and A-6 members would reflect the 1.25% and 1% accrual, respectively.

<u>Defined Contribution Plan Portion for future participants</u>

The primary features of the new defined contribution plans are as follows:

- Mandatory participant contributions of 3% of compensation for Class T-G and T-H members, 3.5% of compensation for Class A-5 and Class A-6 members and 7.5% for Class DC members and DC-only participants in SERS.
- Voluntary participant contributions could be made on an after-tax basis, subject to applicable Federal limitations, or via an eligible roll-over or direct trustee-to-trustee transfer.
- The Board would have the authority to add an auto-escalation feature that would increase voluntary participant contributions that could apply even if no voluntary participant contributions were being made. Participants would be able to opt out of such feature.
- Employer contributions of 2% of compensation Class T-G, T-H, DC, A-5, and A-6 members and 3.5% of compensation for DC-only participants in SERS.

This exhibit is an attachment to an October 23, 2016 letter to Mr. Matthew Knittel. Please refer to that letter for more information, including explanatory notes and statements of reliance.

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- Participant contributions and earnings thereon are 100% vested immediately.
- Employer contributions and earnings thereon would become 100% vested after three years of service.
- Each member would have an individual investment account where all member and employer contributions would be accumulated and investment experience, fees, and costs are credited or charged.
- Upon termination of service, a member could elect a lump sum distribution of their individual investment account.
- Class DC participants who are receiving distributions from their individual investment account are potentially eligible for the PSERS healthcare premium assistance until the entire individual investment account is distributed.
- The receipt of any benefit from the defined contribution plan would not impact the receipt of any vested benefit from the defined benefit plan portion.

Funding

PSERS

The Amendment, if enacted, would change the following five items with regard to the employer contribution rate determination for PSERS.

1. The normal contribution rate in §8328(b) would be revised to be determined "as a level percentage of the compensation of all active members, which percentage, if contributed from the start of their employment on the basis of their prospective compensation through their entire period of active school service, would be sufficient to fund the liability for any prospective benefit payable to them, in excess of that portion funded by their prospective member contributions, excluding the shared-risk contributions." Previously the normal contribution rate was to be based on the "average new active member". The change in the wording is now more consistent with the methodology that has been employed in the actuarial valuations.
2. The employer's normal cost cannot be less than $0.
3. Beginning with the June 30, 2016 actuarial valuation, the actuarial value of assets cannot be less than 70% of the market value of assets nor more than 130% of the market value of assets.
4. The language in §8328(c)(4) would be clarified by the addition of the italicized phrase that any increases in the unfunded accrued liability due to legislation *as a*

**Amendment A10699 to Senate Bill 1071, Printer's Number 1913 –
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result of an increase in benefits determined on a total plan basis would be amortized beginning the July 1 second succeeding the date the legislation is enacted over a 10-year period using level percentage of pay amortization payments.

5. An additional employer contribution rate dedicated to pay off the unfunded accrued liability would be payable for the fiscal year beginning July 1, 2027 through the fiscal year beginning July 1, 2049 until such time as the system's actuarial funded status is 100% or more. See the chart at the end of this Exhibit for the additional employer contribution rates.

Under the Amendment, the employer contribution rate would be determined as a percentage of payroll for all active member and participants.

<u>SERS</u>

The Amendment, if enacted, would change the following four items with regard to the employer contribution rate determination for SERS.

1. The normal contribution rate in §5508(b) would be revised effective with fiscal year beginning July 1, 2022 to be determined "as a level percentage of the compensation of all active members, which percentage, if contributed from the start of their employment on the basis of their prospective compensation through their entire period of active State service, would be sufficient to fund the liability for any prospective benefit payable to them, in excess of that portion funded by their prospective member contributions, excluding the shared-risk member contributions and shared-gain adjustments to regular member contributions." Prior to the fiscal year beginning July 1, 2022, the normal contribution rate is based on the "average new active member". Unlike PSERS, this has a significant impact on the portion of the contribution attributable to normal cost versus unfunded liability.
2. The employer's normal contribution rate cannot be less than 0%.
3. The changes in the accrued liability as of December 31, 2016 and December 31, 2021 due to this Amendment would be amortized beginning July 1, 2018 and July 1, 2022, respectively, over a 30-year period using level annual dollar amortization payments, instead of the current 10-year amortization period for changes in the accrued liability due to legislation.
4. An additional accrued liability contribution would be payable for the fiscal year beginning July 1, 2017 through the fiscal year beginning July 1, 2040 until such

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**Amendment A10699 to Senate Bill 1071, Printer's Number 1913 –
Primary Provisions that would impact Actuarial Valuations of PSERS and SERS**

time as the accrued liability contribution rate determined under §5508(c) is zero or less. See the chart at the end of this Exhibit for the additional accrued liability contribution rates.

Also, §404 of the Bill indicates that the costs added by this legislation would not be considered costs added by legislation for purposes of the collared contribution rate.

Under the Amendment, the employer normal contributions would be as a percentage of compensation of active members and the accrued liability contributions as modified by the experience adjustment actor and supplemental annuity contributions would be as a percentage of compensation of active members and active participants.

Additional contributions

The following table shows the additional employer contribution rate dedicated to pay off the unfunded accrued liability for PSERS and the additional accrued liability contribution for SERS. Both rates would apply to the compensation of active members and active participants.

Fiscal year beginning July 1	Additional employer contribution rate dedicated to pay off the unfunded accrued liability for PSERS	Additional accrued liability contribution rate for SERS
2017	n/a	0.00%
2018	n/a	0.68
2019	n/a	0.64
2020	n/a	0.61
2021	n/a	0.58
2022	n/a	0.00
2023	n/a	0.00
2024	n/a	0.00
2025	n/a	0.00
2026	n/a	0.00
2027	0.01%	0.00
2028	0.02	0.00
2029	0.05	0.00

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Amendment A10699 to Senate Bill 1071, Printer's Number 1913 –
Primary Provisions that would impact Actuarial Valuations of PSERS and SERS

Fiscal year beginning July 1	Additional employer contribution rate dedicated to pay off the unfunded accrued liability for PSERS	Additional accrued liability contribution rate for SERS
2030	0.06	0.06
2031	0.08	0.19
2032	0.11	0.31
2033	0.11	0.42
2034	0.14	0.53
2035	0.14	0.63
2036	0.17	0.73
2037	0.19	0.82
2038	0.21	0.90
2039	0.23	0.98
2040	0.26	1.05
2041	0.25	n/a
2042	0.30	n/a
2043	0.31	n/a
2044	0.33	n/a
2045	0.35	n/a
2046	0.38	n/a
2047	0.38	n/a
2048	0.40	n/a
2049	0.42	n/a

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October 21, 2016

Mr. Matthew Knittel
Director
Pennsylvania Independent Fiscal Office
2nd Floor Rachel Carson State Office Building
400 Market Street
Harrisburg, PA 17105

Re: Three Way Hybrid Plan

Dear Matthew,

We are writing with regard to the proposed Three Way Hybrid Plan for the State Employees' Retirement System (SERS) and the Public School Employees' Retirement System (PSERS) collectively referred to as the Systems. As requested, our analysis focuses primarily on the asset allocation implications of the Three Way Hybrid Plan.

Overview and Implications of the Three Way Hybrid Plan

For SERS effective January 1, 2018 and PSERS effective July 1, 2018, the Three Way Hybrid Plan (hereafter referred to as the hybrid plan) creates new membership classes. These new members and any members returning to active membership will be covered under the hybrid plan that allows these members to elect from one of three options. Two of the options are a defined benefit (DB) plan, with lower multipliers than the current plan, with a defined contribution (DC) component, and the other option is a DC only plan.

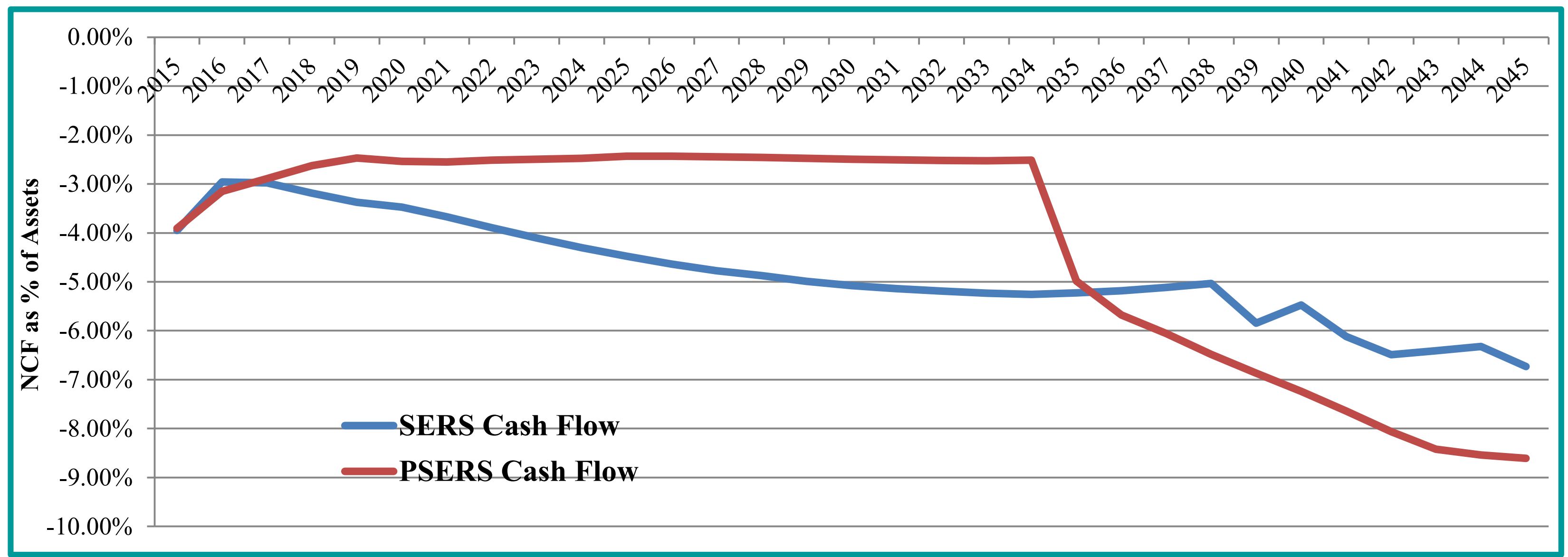
The implications of the hybrid plan are:

- To reduce the overall costs of the Systems through lower benefits to new members.
- To add to the potential savings by transferring a portion of investment risk and longevity risk of providing retirement income to these new membership classes which will provide lower retirement security for future employees. At the same time the employees gain only limited upside investment risk from the DB plan.

- To fund the accrued liability contribution over the total payroll of all active DB members and DC participants, even for those members in the DC only plan. Therefore, the DC participant employers would be paying not only their employer contributions for the DC plan, but also part of the unfunded actuarial liability of the DB plan.
- Provide downside investment risk protection by providing for direct transfer of the cost of lower than expected investment returns with future increases in member contributions.
- To provide a level of retirement security for participants who elect to be covered under one of the two DB/DC options.
- To reduce the unfunded actuarial liability of the Systems by requiring additional employer contributions to the DB plan equal to the savings from the three way hybrid plan for the next 30 years, or until the Systems are 100% funded.

However, because the Three Way Hybrid Plan continues to include new entrants in their respective Systems under a defined benefit program, there is nothing in the plan design or projected future cash flows that would necessarily drive the Systems' Boards to change their current allocation of assets immediately. Over time, as an increasing portion of retirement security will be subject to the DC benefit component, the asset allocations in the DC plan will be, we assume, somewhat discretionary with the individual participant bearing all the risks and rewards of making their own asset allocation decisions.

Over time, we could expect the asset allocation to face increased pressure in the management of cash as benefit payments will continue to increase as contributions to the Systems decrease, resulting in what we call negative net cash flow. Such negative cash flow results from more funds going out of the fund then are being contributed calling for demands from investments to produce cash income and/or liquidation of assets to meet the benefit payments. This can have an impact on asset allocation as more income producing assets are needed to meet the net cash flow out of the Systems. The nature of having a negative net cash flow can also affect more conservative investment strategies to reduce downside risk, because recovery from down markets is imparted and slowed when there is a negative net cash flow (the funds that go out are in excess of funds coming back in and do not contribute to investment return recovery).



As a function of the funding policy, negative cash flow is not an issue for PSERS until after 2035, when the expected contributions decline as a function of fully amortizing the 2010 unfunded liability; whereas for SERS, by 2023, when negative cash flows represent 4% or more of the projected assets, asset allocations may need to change to address the need for additional cash each year.

Below we provide a detailed description of the hybrid plan, and projections of the implications of this new benefit structure on the funded status of the Systems. From our projections the bulk of the savings is through cost reductions in the future, anticipated by the emerging new entrant classes for each System.

Summary of the Three Way Hybrid Plan

The Three Way Hybrid Plan creates new membership classes for SERS and PSERS for employees hired on or after January 1, 2018 for SERS and July 1, 2018 for PSERS and for former active members returning to active service. However, most hazardous duty employees in SERS will remain in the existing DB plan. In addition, the hybrid plan would revise certain funding provisions of SERS and PSERS and would establish a defined contribution (DC) plan for these new membership classes.

In general, it is our understanding from the plan design memos received from IFO and the cost notes prepared by the PSERS and SERS actuaries, the following provisions would apply to the new membership classes:

- Benefit formula – Members can elect one of three options:
    - DB/DC Plan where the DB benefit is 1.25% of 5-year final average salary multiplied by service (1.25% multiplier). This is the default option is no election is made.
    - DB/DC Plan where the DB benefit is 1.00% of 5-year final average salary multiplied by service (1.00% multiplier)
    - DC Only Plan (DC only)
- DB member contributions
    - 1.25% multiplier – 5.5% of salary for PSERS and 5.00% of salary for SERS
    - 1.00% multiplier – 4.5% of salary for PSERS and 4.0% of salary for SERS
- DC member contributions
    - 1.25% multiplier – 3.0% of salary for PSERS and 3.5% for SERS
    - 1.00% multiplier – 3.0% of salary for PSERS and 3.5% for SERS
    - DC only – 7.5% of salary for PSERS and SERS
- DC employer contributions
    - 1.25% multiplier – 2.0% for PSERS and SERS
    - 1.00% multiplier – 2.0% for PSERS and SERS
    - DC only – 2.0% for PSERS and 3.5% for SERS
- "Shared-risk" – Members would be subject to "shared-risk/gain" contributions if investment returns are lower/greater than certain thresholds, although member contributions cannot be more than 2% greater or below the basic member rate.
- Eligibility for DB superannuation – Age 67 with 3 years of service.
- Eligibility for DB early retirement – Age 55 with 25 years of service for PSERS and age 62 with 10 years of service for SERS. Benefits will be actuarially reduced for early retirement.
- DB Vesting – 5 years of service for PSERS and 10 years of service for SERS.

In general, the following funding provisions will apply:

- The accrued liability contribution will be funded over the total payroll of all active DB members and DC participants. Therefore, the DC only participant employers would be paying not only their employer contributions for the DC plan, but also part of the unfunded liability of the DB plan.
- The employers will be required to make additional contributions to the DB plan equal to the savings from the Three Way Hybrid Plan for the next 30 years, or until the Systems are 100% funded.
- The normal contribution rate cannot be less than zero.
- For SERS, the funding method will be changed to individual entry age normal beginning with the December 31, 2021 actuarial valuation. This approach move from a severely backloaded approach producing artificially low normal costs to one where the normal costs are more representative of the cost of benefits accruing evenly over a working lifetime.
- For SERS, the change in liability resulting from the hybrid plan will be funded over 30 years as a level dollar amount.
- For PSERS, the 10 year asset smoothing method would be constrained to be within 30% of the market value of assets.

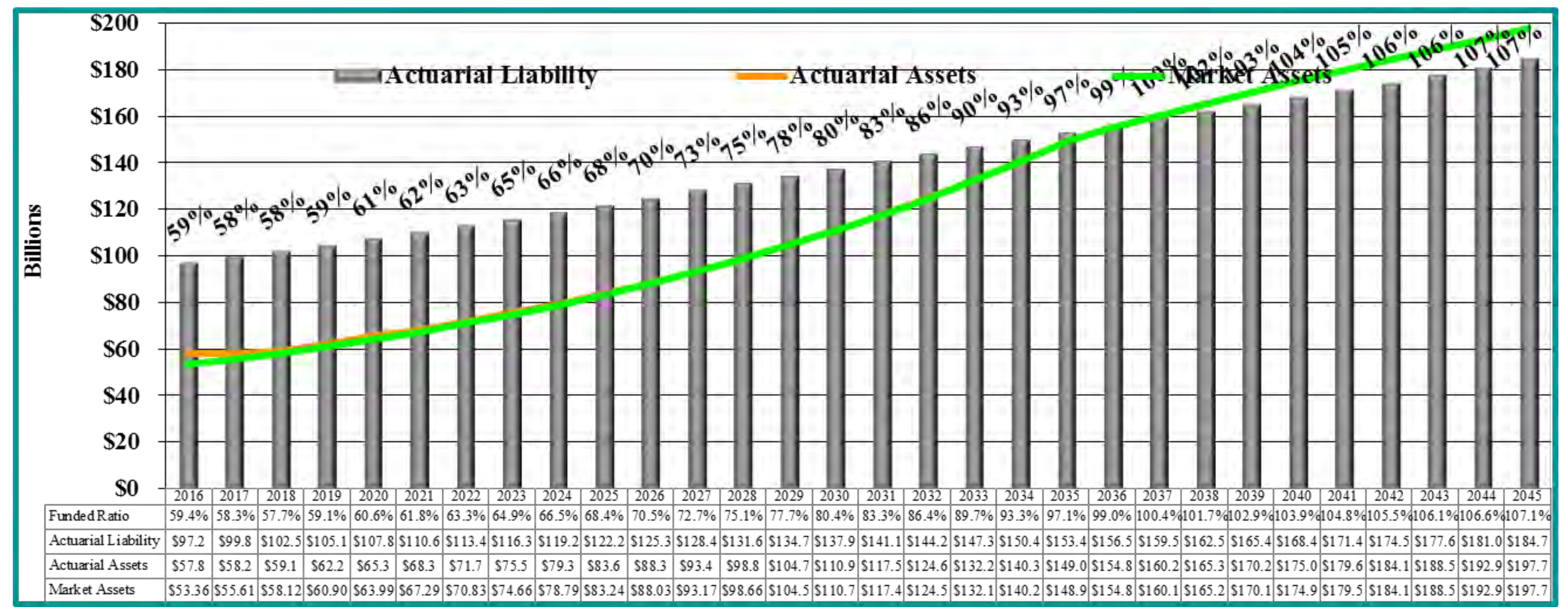
Analysis

The implications of the Three Way Hybrid Plan are to change the cost of pension benefits over time and improve the funded status. To illustrate the implications we were provided with the projected salary from the PSERS and SERS actuaries to prepare our own model projections. We did not have actual census data and our methodologies in projection will be different from the PSERS and SERS actuaries which will result in numerical differences in values. However, the projections are effective in confirming the trends provided by each of the Systems' actuaries as well as providing insight into the long term trends of the Systems.

Our first set of graphs are to set the stage in projecting the assets and liabilities based on a stationary population (which assumes as members retire they are replaced with members of the same average age of the new entrants) and assuming new members continue to participate in PSERS and SERS under the existing law. The first of two types of graphs we will be using in our analysis represent the liabilities, shown as the bars and assets shown as the lines over time. The numbers at the top of the bars show the funded status as the actuarial assets divided by the liabilities over time. Our projections show PSERS and SERS reaching 100% funded in 2037 and 2038, respectively, by the end of the 30 year projection if all of the assumptions including the current 7.5% investment return are exactly realized each year. This is also predicated on the actuarially determined contribution being contributed each year.

We have included tables at the end of this report showing the results in tabular form for comparative purposes.

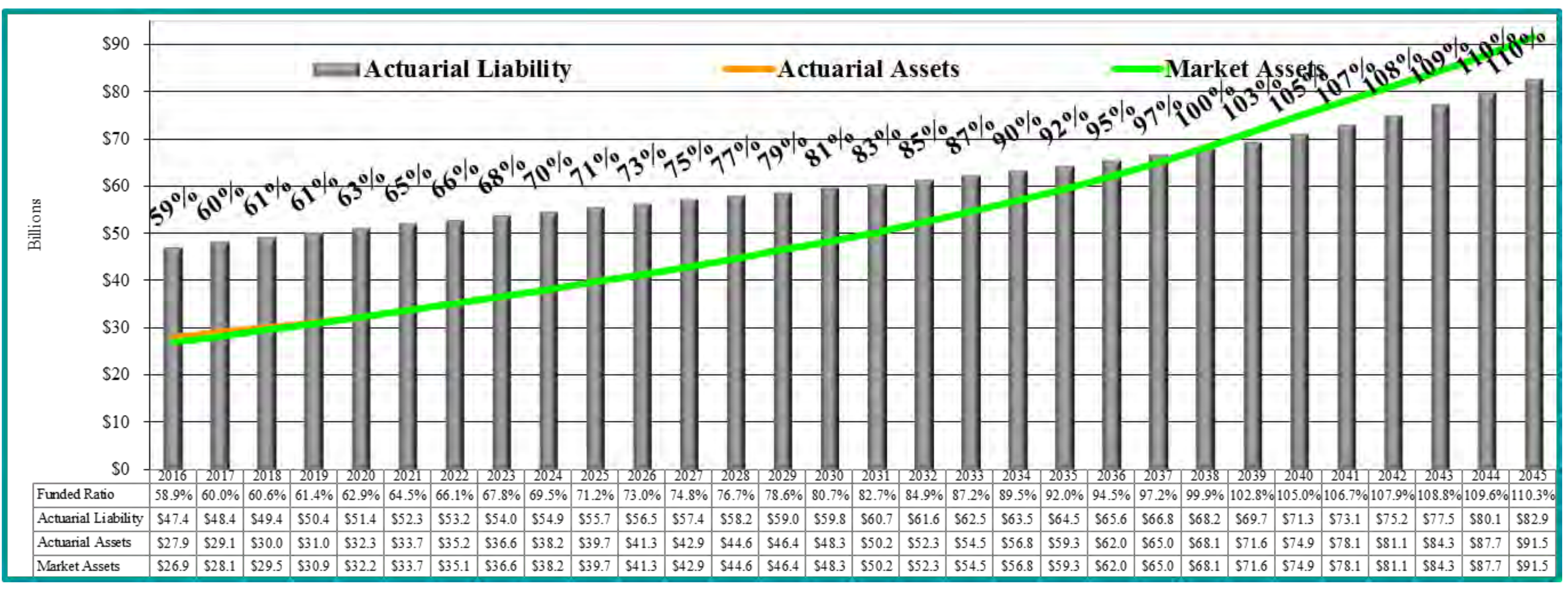
Graph 1A – Public School Employees' Retirement System – Existing Law



	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Funded Ratio	59.4%	58.3%	57.7%	59.1%	60.6%	61.8%	63.3%	64.9%	66.5%	68.4%	70.5%	72.7%	75.1%	77.7%	80.4%
Actuarial Liability	$97.2	$99.8	$102.5	$105.1	$107.8	$110.6	$113.4	$116.3	$119.2	$122.2	$125.3	$128.4	$131.6	$134.7	$137.9
Actuarial Assets	$57.8	$58.2	$59.1	$62.2	$65.3	$68.3	$71.7	$75.5	$79.3	$83.6	$88.3	$93.4	$98.8	$104.7	$110.9
Market Assets	$53.36	$55.61	$58.12	$60.90	$63.99	$67.29	$70.83	$74.66	$78.79	$83.24	$88.03	$93.17	$98.66	$104.5	$110.7

	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045
Funded Ratio	83.3%	86.4%	89.7%	93.3%	97.1%	99.0%	100.4%	101.7%	102.9%	103.9%	104.8%	105.5%	106.1%	106.6%	107.1%
Actuarial Liability	$141.1	$144.2	$147.3	$150.4	$153.4	$156.5	$159.5	$162.5	$165.4	$168.4	$171.4	$174.5	$177.6	$181.0	$184.7
Actuarial Assets	$117.5	$124.6	$132.2	$140.3	$149.0	$154.8	$160.2	$165.3	$170.2	$175.0	$179.6	$184.1	$188.5	$192.9	$197.7
Market Assets	$117.4	$124.5	$132.1	$140.2	$148.9	$154.8	$160.1	$165.2	$170.1	$174.9	$179.5	$184.1	$188.5	$192.9	$197.7

Graph 1B - State Employees' Retirement System – Existing Law



	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Funded Ratio	58.9%	60.0%	60.6%	61.4%	62.9%	64.5%	66.1%	67.8%	69.5%	71.2%	73.0%	74.8%	76.7%	78.6%	80.7%
Actuarial Liability	$47.4	$48.4	$49.4	$50.4	$51.4	$52.3	$53.2	$54.0	$54.9	$55.7	$56.5	$57.4	$58.2	$59.0	$59.8
Actuarial Assets	$27.9	$29.1	$30.0	$31.0	$32.3	$33.7	$35.2	$36.6	$38.2	$39.7	$41.3	$42.9	$44.6	$46.4	$48.3
Market Assets	$26.9	$28.1	$29.5	$30.9	$32.2	$33.7	$35.1	$36.6	$38.2	$39.7	$41.3	$42.9	$44.6	$46.4	$48.3

	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045
Funded Ratio	82.7%	84.9%	87.2%	89.5%	92.0%	94.5%	97.2%	99.9%	102.8%	105.0%	106.7%	107.9%	108.8%	109.6%	110.3%
Actuarial Liability	$60.7	$61.6	$62.5	$63.5	$64.5	$65.6	$66.8	$68.2	$69.7	$71.3	$73.1	$75.2	$77.5	$80.1	$82.9
Actuarial Assets	$50.2	$52.3	$54.5	$56.8	$59.3	$62.0	$65.0	$68.1	$71.6	$74.9	$78.1	$81.1	$84.3	$87.7	$91.5
Market Assets	$50.2	$52.3	$54.5	$56.8	$59.3	$62.0	$65.0	$68.1	$71.6	$74.9	$78.1	$81.1	$84.3	$87.7	$91.5

The next graphs in our analysis show the projection of contributions breaking out the member contributions and the employer contributions each year under the existing law. The total normal cost rate represents the cost of the benefits earned each year as a percent of payroll. The existing law rate represents the current employer total cost as a percent of payroll to provide a comparison with projections that demonstrate costs under the Three Way Hybrid Plan.

For SERS, the total normal cost rate remains at 10.8% of pay over the projection period. For PSERS, the traditional individual entry age normal cost method is used to calculate the normal cost. Therefore, for PSERS, the normal cost decreases slowly over time as more members are covered under the Act 120 plan provisions with lower benefits.

The balance of the cost represents the amortization of the unfunded liability. On a projected basis this amount is expected to decrease as a percent of payroll each year for SERS as the unfunded liability is amortized as a level dollar amount. For PSERS, the projected employer contribution is expected to increase slightly until the initial unfunded liability base is amortized because the unfunded liability

is being amortized over 24 years as a level percent of pay. In each System the costs drop off as the current unfunded bases get amortized ultimately reducing the cost to the normal cost amounts.

Graph 1C – Public School Employees' Retirement System – Existing Law

Percent of Pay

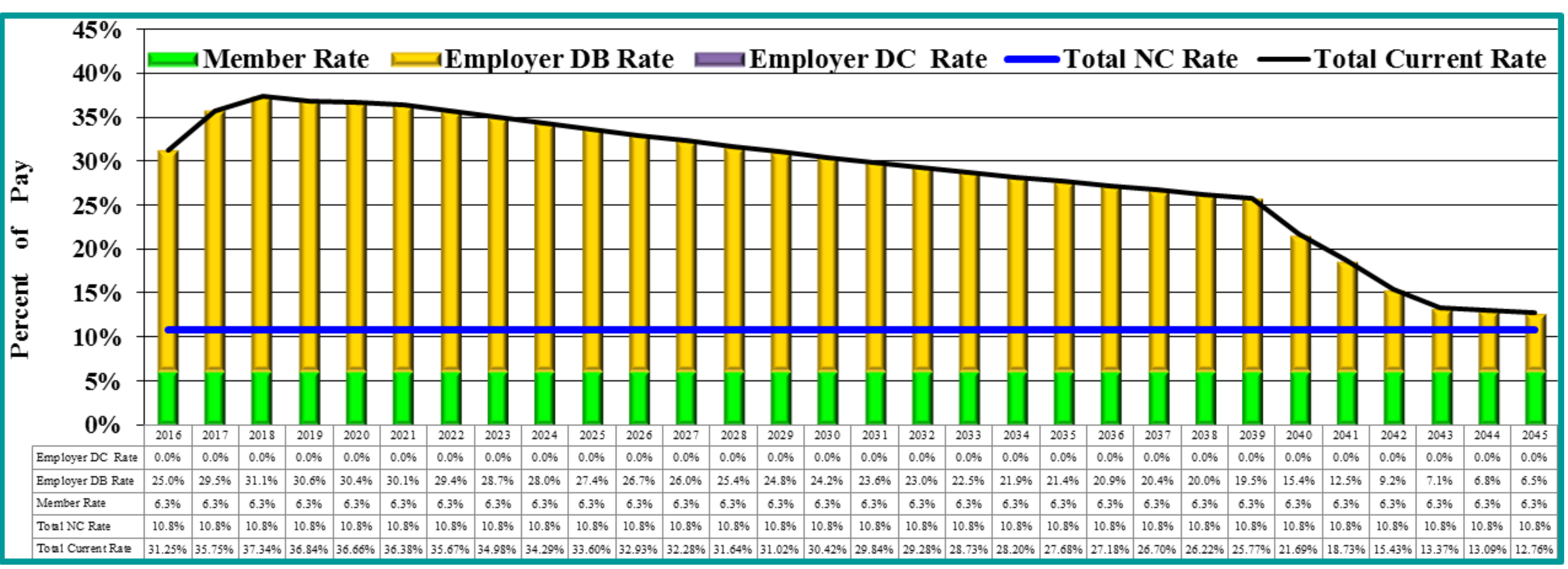
60%
50%
40%
30%
20%
10%
0%

Member Rate | Employer DB Rate | Employer DC Rate | Total NC Rate | Total Current Rate

	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Employer DC Rate	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Employer DB Rate	25.0%	29.2%	30.6%	32.2%	33.1%	33.1%	33.1%	33.3%	33.5%	33.6%	33.9%	34.0%	34.1%	34.3%	34.5%
Member Rate	7.5%	7.5%	7.5%	7.5%	7.5%	7.5%	7.5%	7.5%	7.5%	7.5%	7.5%	7.5%	7.5%	7.5%	7.5%
Total NC Rate	15.9%	15.9%	15.8%	15.7%	15.5%	15.3%	15.2%	15.0%	14.9%	14.7%	14.6%	14.4%	14.3%	14.1%	13.9%
Total Current Rate	32.46%	36.67%	38.14%	39.70%	40.61%	40.58%	40.62%	40.88%	40.99%	41.12%	41.39%	41.53%	41.68%	41.83%	42.02%

	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045
Employer DC Rate	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Employer DB Rate	34.7%	34.9%	35.1%	35.3%	35.5%	20.1%	16.1%	14.3%	12.2%	10.5%	9.0%	7.5%	5.8%	4.5%	4.5%
Member Rate	7.5%	7.5%	7.5%	7.5%	7.5%	7.5%	7.5%	7.5%	7.5%	7.5%	7.5%	7.5%	7.5%	7.5%	7.5%
Total NC Rate	13.8%	13.6%	13.4%	13.2%	13.0%	12.8%	12.6%	12.4%	12.2%	12.0%	11.8%	11.6%	11.4%	11.2%	11.0%
Total Current Rate	42.20%	42.41%	42.62%	42.85%	43.08%	27.62%	23.65%	21.81%	19.74%	18.06%	16.57%	15.02%	13.39%	12.08%	12.02%

Graph 1D – State Employees' Retirement System – Existing Law



	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Employer DC Rate	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Employer DB Rate	25.0%	29.5%	31.1%	30.6%	30.4%	30.1%	29.4%	28.7%	28.0%	27.4%	26.7%	26.0%	25.4%	24.8%	24.2%
Member Rate	6.3%	6.3%	6.3%	6.3%	6.3%	6.3%	6.3%	6.3%	6.3%	6.3%	6.3%	6.3%	6.3%	6.3%	6.3%
Total NC Rate	10.8%	10.8%	10.8%	10.8%	10.8%	10.8%	10.8%	10.8%	10.8%	10.8%	10.8%	10.8%	10.8%	10.8%	10.8%
Total Current Rate	31.25%	35.75%	37.34%	36.84%	36.66%	36.38%	35.67%	34.98%	34.29%	33.60%	32.93%	32.28%	31.64%	31.02%	30.42%

	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045
Employer DC Rate	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Employer DB Rate	23.6%	23.0%	22.5%	21.9%	21.4%	20.9%	20.4%	20.0%	19.5%	15.4%	12.5%	9.2%	7.1%	6.8%	6.5%
Member Rate	6.3%	6.3%	6.3%	6.3%	6.3%	6.3%	6.3%	6.3%	6.3%	6.3%	6.3%	6.3%	6.3%	6.3%	6.3%
Total NC Rate	10.8%	10.8%	10.8%	10.8%	10.8%	10.8%	10.8%	10.8%	10.8%	10.8%	10.8%	10.8%	10.8%	10.8%	10.8%
Total Current Rate	29.84%	29.28%	28.73%	28.20%	27.68%	27.18%	26.70%	26.22%	25.77%	21.69%	18.73%	15.43%	13.37%	13.09%	12.76%

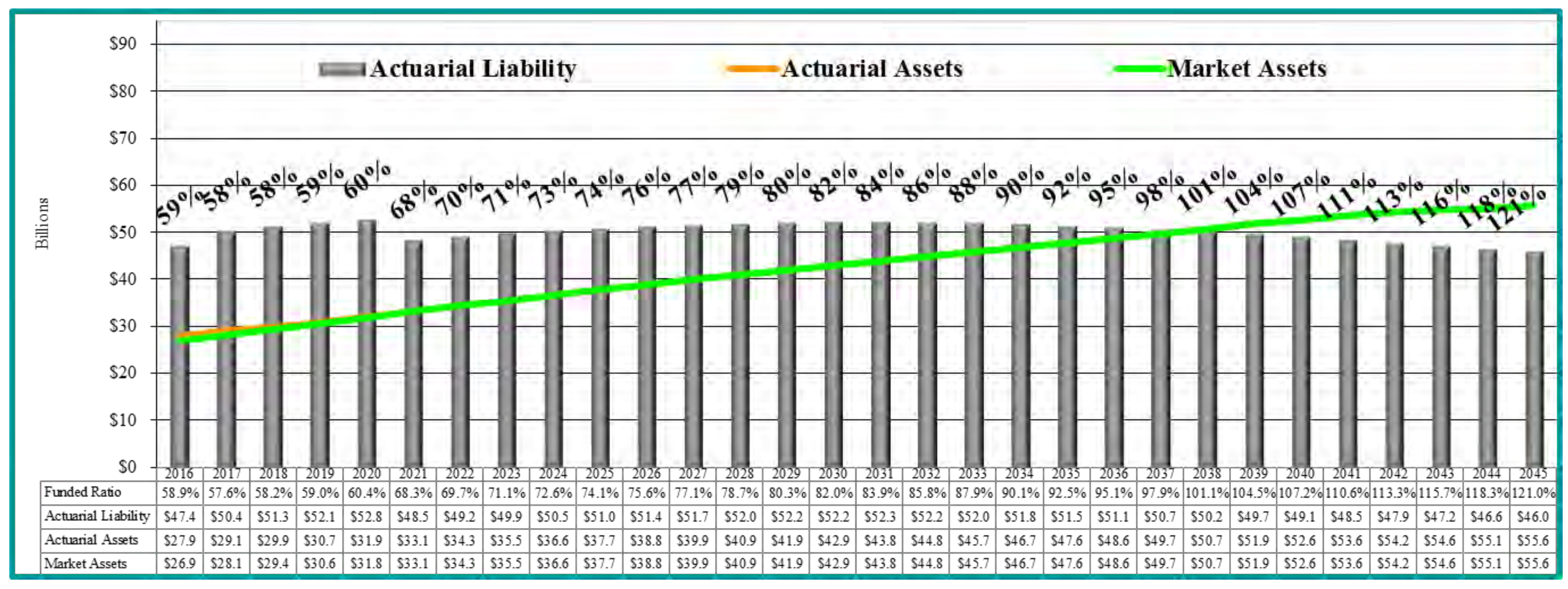
With the current status of PSERS and SERS as background we then apply the provisions of the Three Way Hybrid Plan for the new membership classes, including the addition of the DC plan costs, as a percent of the combined plan payroll. We have analyzed the Three Way Hybrid Plan assuming various employee elections. The following graphs show scenarios assuming 100% of the employees elect the 1.25% multiplier and alternatively, 100% elect the DC only plan. These graphs are before any savings from the three way hybrid are put into the DB plan. Under this scenario, PSERS and SERS would be 100% funded in 2037 and 2038, respectively.

Graph 2A – Public School Employees' Retirement System – Three Way Hybrid – 100% Elect 1.25% Multiplier

	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Funded Ratio	59.4%	58.3%	57.7%	59.1%	60.6%	61.7%	63.2%	64.8%	66.3%	68.1%	70.1%	72.3%	74.7%	77.2%	79.9%
Actuarial Liability	$97.2	$99.8	$102.5	$105.1	$107.8	$110.4	$113.1	$115.8	$118.5	$121.2	$123.9	$126.6	$129.2	$131.7	$134.2
Actuarial Assets	$57.8	$58.2	$59.1	$62.2	$65.3	$68.1	$71.5	$75.0	$78.5	$82.6	$86.9	$91.5	$96.4	$101.7	$107.2
Market Assets	$53.36	$55.62	$58.13	$60.90	$63.96	$67.16	$70.56	$74.19	$78.07	$82.20	$86.62	$91.30	$96.27	$101.5	$107.0

	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045
Funded Ratio	82.8%	85.9%	89.3%	92.9%	96.9%	98.9%	100.5%	101.9%	103.2%	104.3%	105.4%	106.3%	107.1%	107.8%	108.5%
Actuarial Liability	$136.6	$138.8	$140.9	$142.8	$144.6	$146.2	$147.7	$148.9	$150.0	$150.8	$151.5	$152.0	$152.4	$152.7	$153.0
Actuarial Assets	$113.0	$119.2	$125.8	$132.7	$140.1	$144.6	$148.3	$151.7	$154.7	$157.4	$159.7	$161.6	$163.2	$164.6	$166.1
Market Assets	$112.9	$119.1	$125.7	$132.7	$140.1	$144.5	$148.3	$151.7	$154.7	$157.3	$159.6	$161.6	$163.2	$164.5	$166.0

Graph 2B – State Employees' Retirement System – Three Way Hybrid – 100% Elect 1.25% Multiplier

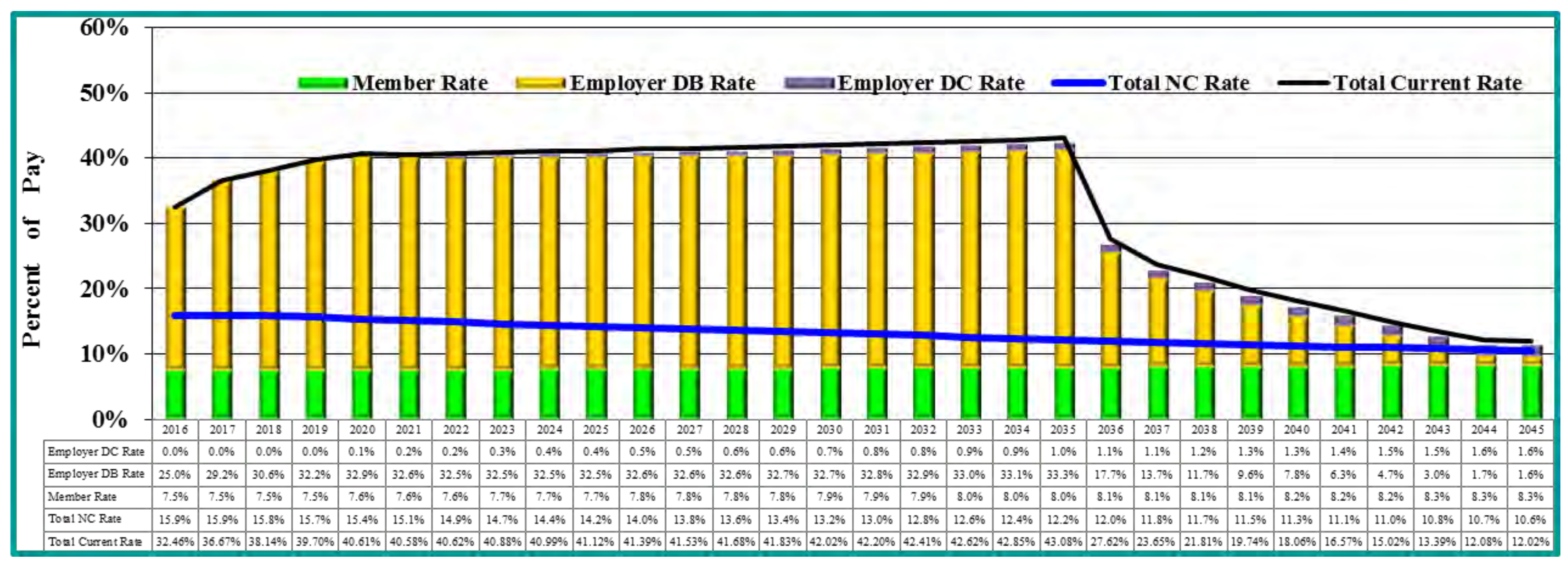


	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Funded Ratio	58.9%	57.6%	58.2%	59.0%	60.4%	68.3%	69.7%	71.1%	72.6%	74.1%	75.6%	77.1%	78.7%	80.3%	82.0%
Actuarial Liability	$47.4	$50.4	$51.3	$52.1	$52.8	$48.5	$49.2	$49.9	$50.5	$51.0	$51.4	$51.7	$52.0	$52.2	$52.2
Actuarial Assets	$27.9	$29.1	$29.9	$30.7	$31.9	$33.1	$34.3	$35.5	$36.6	$37.7	$38.8	$39.9	$40.9	$41.9	$42.9
Market Assets	$26.9	$28.1	$29.4	$30.6	$31.8	$33.1	$34.3	$35.5	$36.6	$37.7	$38.8	$39.9	$40.9	$41.9	$42.9

	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045
Funded Ratio	83.9%	85.8%	87.9%	90.1%	92.5%	95.1%	97.9%	101.1%	104.5%	107.2%	110.6%	113.3%	115.7%	118.3%	121.0%
Actuarial Liability	$52.3	$52.2	$52.0	$51.8	$51.5	$51.1	$50.7	$50.2	$49.7	$49.1	$48.5	$47.9	$47.2	$46.6	$46.0
Actuarial Assets	$43.8	$44.8	$45.7	$46.7	$47.6	$48.6	$49.7	$50.7	$51.9	$52.6	$53.6	$54.2	$54.6	$55.1	$55.6
Market Assets	$43.8	$44.8	$45.7	$46.7	$47.6	$48.6	$49.7	$50.7	$51.9	$52.6	$53.6	$54.2	$54.6	$55.1	$55.6

Looking at the funding requirements we now add the emerging DC plan costs along with the DB plan cost components. By the end of the 30 year projection, the employer DC plan contribution as a percent of total employee payroll represents 1.7% and 1.3% of PSERS and SERS payroll, respectively. The black line shows the level of costs under existing law to illustrate how the cost savings is anticipated to emerge. Member contributions are now combined to represent the DB and DC member contribution rates. Also of note is the gradual decline of the normal cost (both DB and DC) rate due to the lower overall benefits. For SERS, the normal cost rate drops substantially when the three way hybrid is introduced and then increases when they change to the traditional individual entry age normal funding method. The results show that the employer contribution rate is slightly lower under the Three Way Hybrid Plan, than under the existing law. Also note that the members are paying for most of the benefits under the Three Way Hybrid Plan assuming 100% elect the 1.25% multiplier. Keep in mind these contribution rates are calculated under the combined projected payroll under both DB and DC plans.

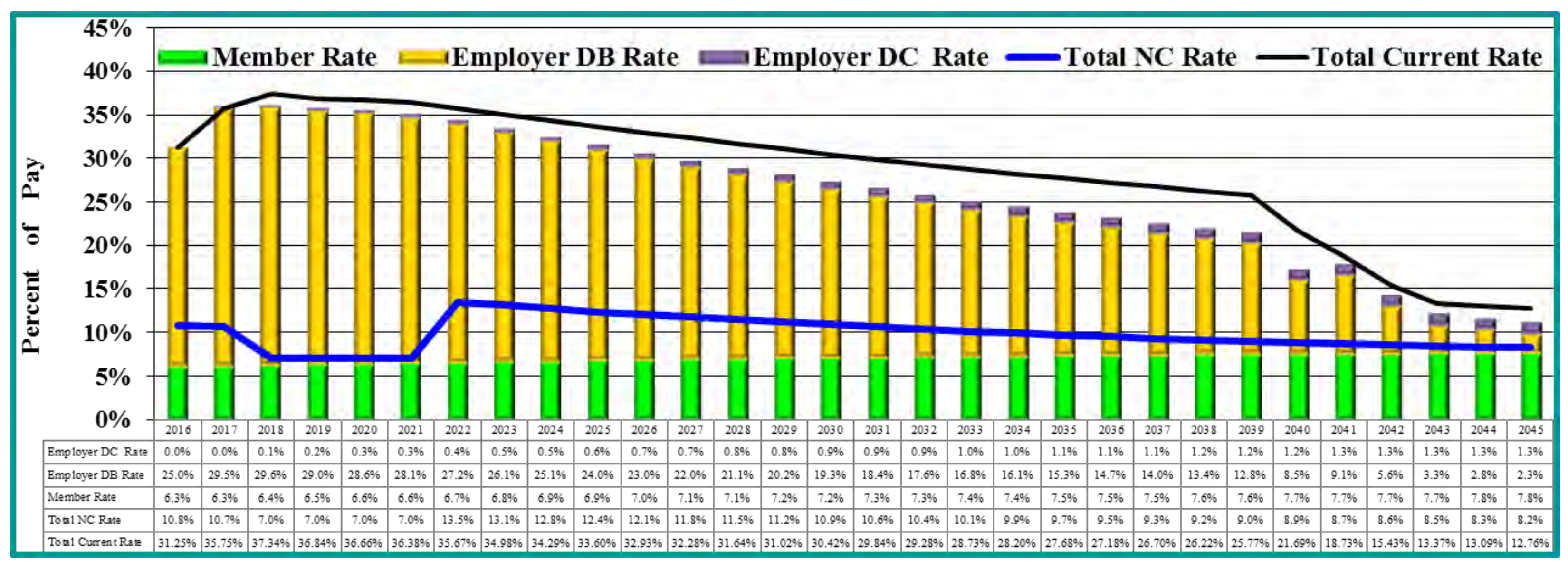
Graph 2C – Public School Employees' Retirement System – Three Way Hybrid – 100% Elect 1.25% Multiplier



	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Employer DC Rate	0.0%	0.0%	0.0%	0.0%	0.1%	0.2%	0.2%	0.3%	0.4%	0.4%	0.5%	0.5%	0.6%	0.6%	0.7%
Employer DB Rate	25.0%	29.2%	30.6%	32.2%	32.9%	32.6%	32.5%	32.5%	32.5%	32.5%	32.6%	32.6%	32.6%	32.7%	32.7%
Member Rate	7.5%	7.5%	7.5%	7.5%	7.6%	7.6%	7.6%	7.7%	7.7%	7.7%	7.8%	7.8%	7.8%	7.8%	7.9%
Total NC Rate	15.9%	15.9%	15.8%	15.7%	15.4%	15.1%	14.9%	14.7%	14.4%	14.2%	14.0%	13.8%	13.6%	13.4%	13.2%
Total Current Rate	32.46%	36.67%	38.14%	39.70%	40.61%	40.58%	40.62%	40.88%	40.99%	41.12%	41.39%	41.53%	41.68%	41.83%	42.02%

	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045
Employer DC Rate	0.8%	0.8%	0.9%	0.9%	1.0%	1.1%	1.1%	1.2%	1.3%	1.3%	1.4%	1.5%	1.5%	1.6%	1.6%
Employer DB Rate	32.8%	32.9%	33.0%	33.1%	33.3%	17.7%	13.7%	11.7%	9.6%	7.8%	6.3%	4.7%	3.0%	1.7%	1.6%
Member Rate	7.9%	7.9%	8.0%	8.0%	8.0%	8.1%	8.1%	8.1%	8.1%	8.2%	8.2%	8.2%	8.3%	8.3%	8.3%
Total NC Rate	13.0%	12.8%	12.6%	12.4%	12.2%	12.0%	11.8%	11.7%	11.5%	11.3%	11.1%	11.0%	10.8%	10.7%	10.6%
Total Current Rate	42.20%	42.41%	42.62%	42.85%	43.08%	27.62%	23.65%	21.81%	19.74%	18.06%	16.57%	15.02%	13.39%	12.08%	12.02%

Graph 2D – State Employees' Retirement System – Three Way Hybrid – 100% Elect 1.25% Multiplier

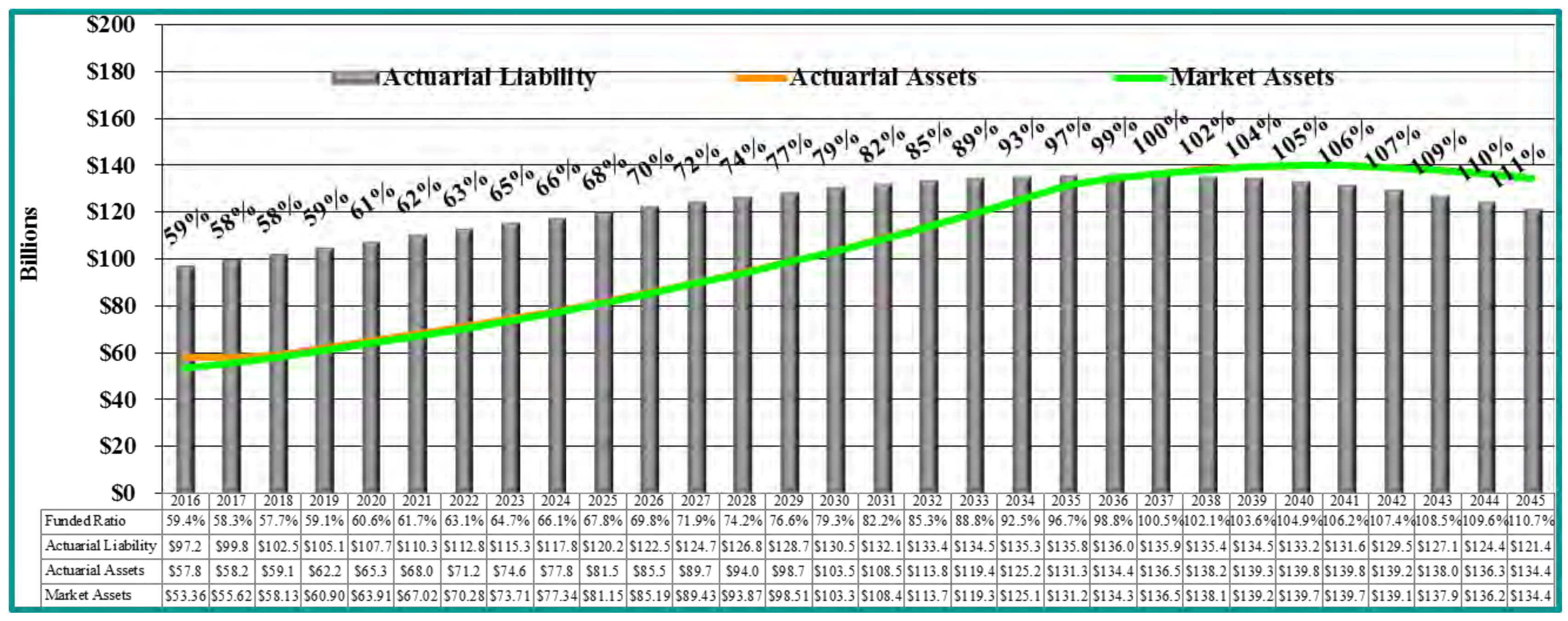


	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Employer DC Rate	0.0%	0.0%	0.1%	0.2%	0.3%	0.3%	0.4%	0.5%	0.5%	0.6%	0.7%	0.7%	0.8%	0.8%	0.9%
Employer DB Rate	25.0%	29.5%	29.6%	29.0%	28.6%	28.1%	27.2%	26.1%	25.1%	24.0%	23.0%	22.0%	21.1%	20.2%	19.3%
Member Rate	6.3%	6.3%	6.4%	6.5%	6.6%	6.6%	6.7%	6.8%	6.9%	6.9%	7.0%	7.1%	7.1%	7.2%	7.2%
Total NC Rate	10.8%	10.7%	7.0%	7.0%	7.0%	7.0%	13.5%	13.1%	12.8%	12.4%	12.1%	11.8%	11.5%	11.2%	10.9%
Total Current Rate	31.25%	35.75%	37.34%	36.84%	36.66%	36.38%	35.67%	34.98%	34.29%	33.60%	32.93%	32.28%	31.64%	31.02%	30.42%

	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045
Employer DC Rate	0.9%	0.9%	1.0%	1.0%	1.1%	1.1%	1.1%	1.2%	1.2%	1.2%	1.3%	1.3%	1.3%	1.3%	1.3%
Employer DB Rate	18.4%	17.6%	16.8%	16.1%	15.3%	14.7%	14.0%	13.4%	12.8%	8.5%	9.1%	5.6%	3.3%	2.8%	2.3%
Member Rate	7.3%	7.3%	7.4%	7.4%	7.5%	7.5%	7.5%	7.6%	7.6%	7.7%	7.7%	7.7%	7.7%	7.8%	7.8%
Total NC Rate	10.6%	10.4%	10.1%	9.9%	9.7%	9.5%	9.3%	9.2%	9.0%	8.9%	8.7%	8.6%	8.5%	8.3%	8.2%
Total Current Rate	29.84%	29.28%	28.73%	28.20%	27.68%	27.18%	26.70%	26.22%	25.77%	21.69%	18.73%	15.43%	13.37%	13.09%	12.76%

The following set of graph shows a similar analysis assuming 100% of the employees elect the DC only option. For PSERS, there are slight savings under this scenario and the members are paying for most of their benefit. For SERS, while there are slight savings to the employer, the overall cost of the Three Way Hybrid Plan (employer and member) is higher than the existing plan, Note that for SERS, hazardous duty members remain in the current plan.

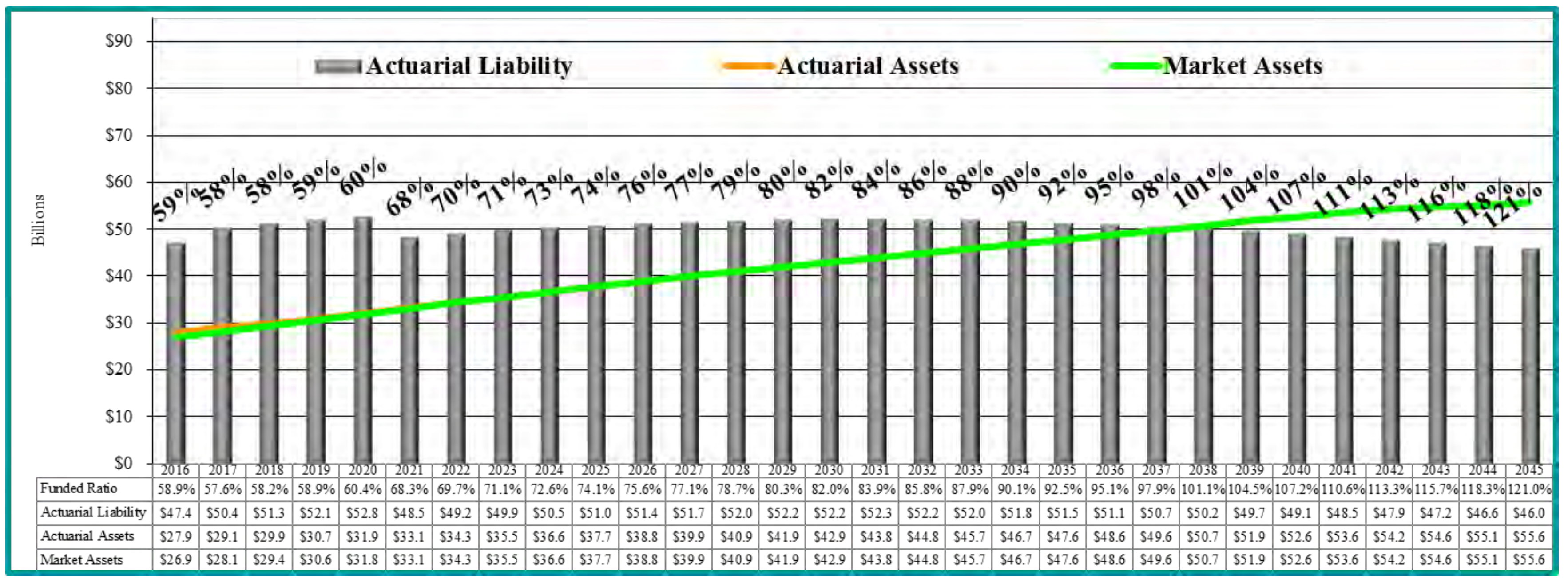
Graph 3A – Public School Employees' Retirement System – Three Way Hybrid –-100% Elect DC Only



	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Funded Ratio	59.4%	58.3%	57.7%	59.1%	60.6%	61.7%	63.1%	64.7%	66.1%	67.8%	69.8%	71.9%	74.2%	76.6%	79.3%
Actuarial Liability	$97.2	$99.8	$102.5	$105.1	$107.7	$110.3	$112.8	$115.3	$117.8	$120.2	$122.5	$124.7	$126.8	$128.7	$130.5
Actuarial Assets	$57.8	$58.2	$59.1	$62.2	$65.3	$68.0	$71.2	$74.6	$77.8	$81.5	$85.5	$89.7	$94.0	$98.7	$103.5
Market Assets	$53.36	$55.62	$58.13	$60.90	$63.91	$67.02	$70.28	$73.71	$77.34	$81.15	$85.19	$89.43	$93.87	$98.51	$103.3

	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045
Funded Ratio	82.2%	85.3%	88.8%	92.5%	96.7%	98.8%	100.5%	102.1%	103.6%	104.9%	106.2%	107.4%	108.5%	109.6%	110.7%
Actuarial Liability	$132.1	$133.4	$134.5	$135.3	$135.8	$136.0	$135.9	$135.4	$134.5	$133.2	$131.6	$129.5	$127.1	$124.4	$121.4
Actuarial Assets	$108.5	$113.8	$119.4	$125.2	$131.3	$134.4	$136.5	$138.2	$139.3	$139.8	$139.8	$139.2	$138.0	$136.3	$134.4
Market Assets	$108.4	$113.7	$119.3	$125.1	$131.2	$134.3	$136.5	$138.1	$139.2	$139.7	$139.7	$139.1	$137.9	$136.2	$134.4

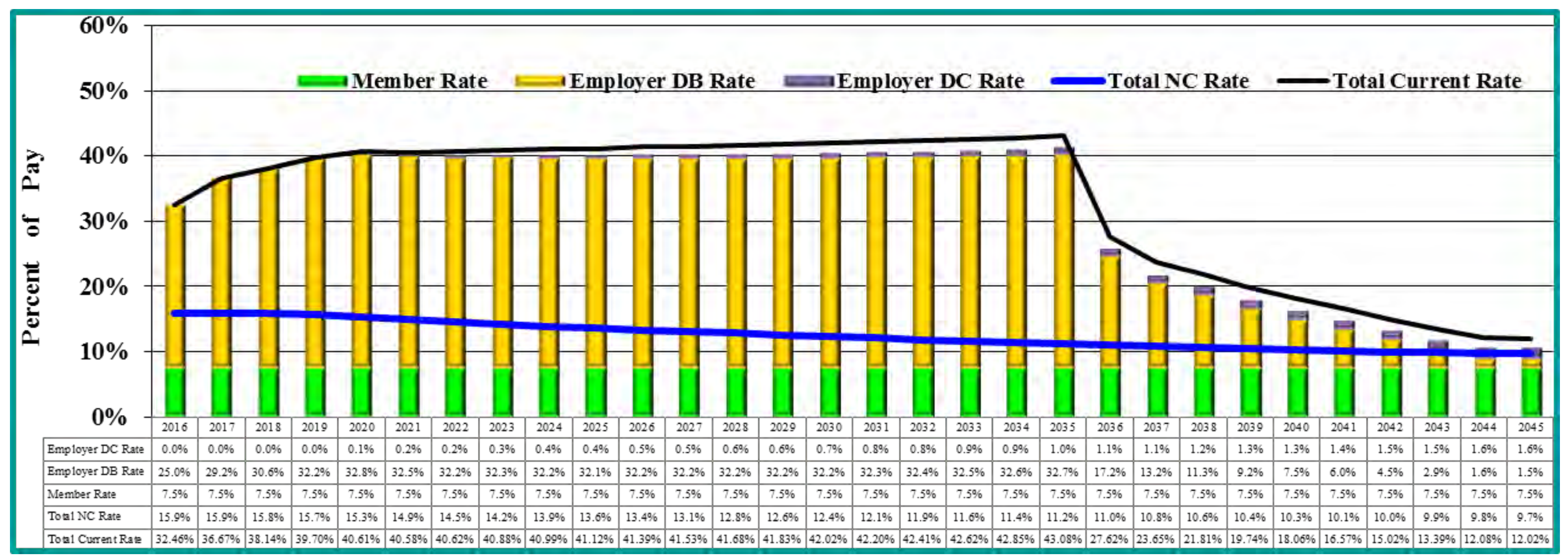
Graph 3B – State Employees' Retirement System – Three Way Hybrid – 100% Elect DC Only



	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Funded Ratio	58.9%	57.6%	58.2%	58.9%	60.4%	68.3%	69.7%	71.1%	72.6%	74.1%	75.6%	77.1%	78.7%	80.3%	82.0%
Actuarial Liability	$47.4	$50.4	$51.3	$52.1	$52.8	$48.5	$49.2	$49.9	$50.5	$51.0	$51.4	$51.7	$52.0	$52.2	$52.2
Actuarial Assets	$27.9	$29.1	$29.9	$30.7	$31.9	$33.1	$34.3	$35.5	$36.6	$37.7	$38.8	$39.9	$40.9	$41.9	$42.9
Market Assets	$26.9	$28.1	$29.4	$30.6	$31.8	$33.1	$34.3	$35.5	$36.6	$37.7	$38.8	$39.9	$40.9	$41.9	$42.9

	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045
Funded Ratio	83.9%	85.8%	87.9%	90.1%	92.5%	95.1%	97.9%	101.1%	104.5%	107.2%	110.6%	113.3%	115.7%	118.3%	121.0%
Actuarial Liability	$52.3	$52.2	$52.0	$51.8	$51.5	$51.1	$50.7	$50.2	$49.7	$49.1	$48.5	$47.9	$47.2	$46.6	$46.0
Actuarial Assets	$43.8	$44.8	$45.7	$46.7	$47.6	$48.6	$49.6	$50.7	$51.9	$52.6	$53.6	$54.2	$54.6	$55.1	$55.6
Market Assets	$43.8	$44.8	$45.7	$46.7	$47.6	$48.6	$49.6	$50.7	$51.9	$52.6	$53.6	$54.2	$54.6	$55.1	$55.6

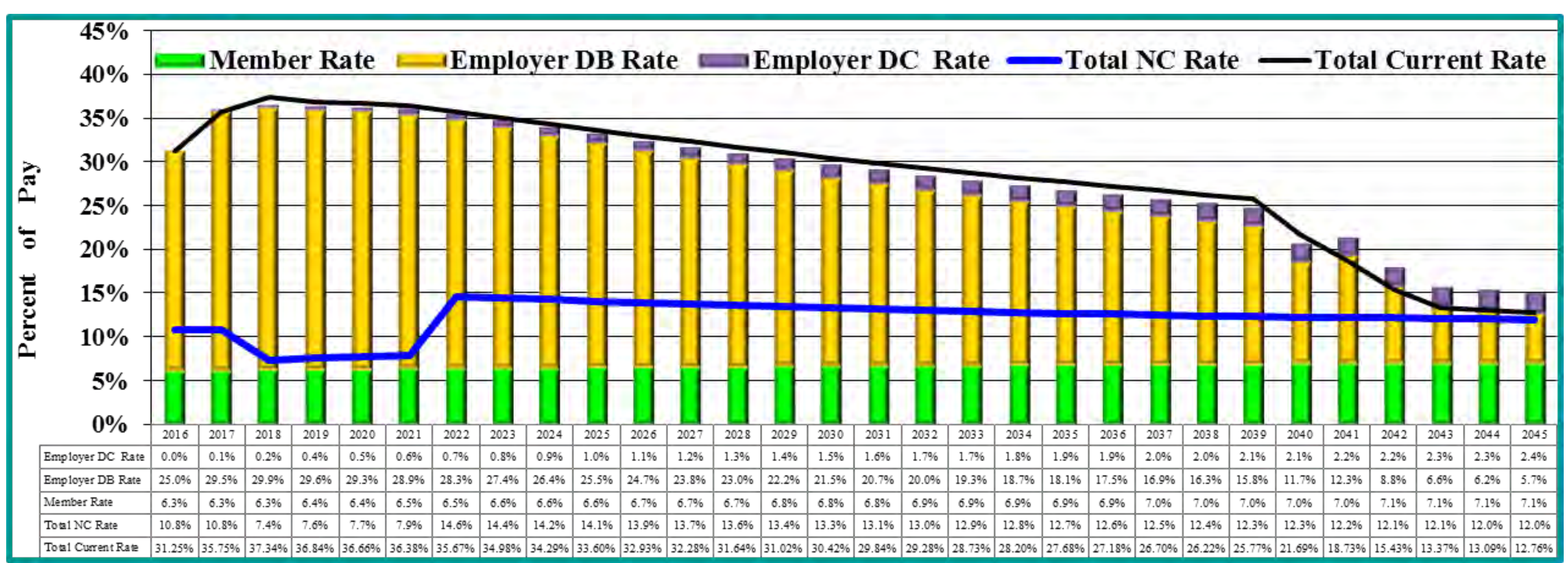
Graph 3C – Public School Employees' Retirement System – Three Way Hybrid – 100% Elect DC Only



	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Employer DC Rate	0.0%	0.0%	0.0%	0.0%	0.1%	0.2%	0.2%	0.3%	0.4%	0.4%	0.5%	0.5%	0.6%	0.6%	0.7%
Employer DB Rate	25.0%	29.2%	30.6%	32.2%	32.8%	32.5%	32.2%	32.3%	32.2%	32.1%	32.2%	32.2%	32.2%	32.2%	32.2%
Member Rate	7.5%	7.5%	7.5%	7.5%	7.5%	7.5%	7.5%	7.5%	7.5%	7.5%	7.5%	7.5%	7.5%	7.5%	7.5%
Total NC Rate	15.9%	15.9%	15.8%	15.7%	15.3%	14.9%	14.5%	14.2%	13.9%	13.6%	13.4%	13.1%	12.8%	12.6%	12.4%
Total Current Rate	32.46%	36.67%	38.14%	39.70%	40.61%	40.58%	40.62%	40.88%	40.99%	41.12%	41.39%	41.53%	41.68%	41.83%	42.02%

	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045
Employer DC Rate	0.8%	0.8%	0.9%	0.9%	1.0%	1.1%	1.1%	1.2%	1.3%	1.3%	1.4%	1.5%	1.5%	1.6%	1.6%
Employer DB Rate	32.3%	32.4%	32.5%	32.6%	32.7%	17.2%	13.2%	11.3%	9.2%	7.5%	6.0%	4.5%	2.9%	1.6%	1.5%
Member Rate	7.5%	7.5%	7.5%	7.5%	7.5%	7.5%	7.5%	7.5%	7.5%	7.5%	7.5%	7.5%	7.5%	7.5%	7.5%
Total NC Rate	12.1%	11.9%	11.6%	11.4%	11.2%	11.0%	10.8%	10.6%	10.4%	10.3%	10.1%	10.0%	9.9%	9.8%	9.7%
Total Current Rate	42.20%	42.41%	42.62%	42.85%	43.08%	27.62%	23.65%	21.81%	19.74%	18.06%	16.57%	15.02%	13.39%	12.08%	12.02%

Graph 3D – State Employees' Retirement System – Three Way Hybrid – 100% Elect DC Only



	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Employer DC Rate	0.0%	0.1%	0.2%	0.4%	0.5%	0.6%	0.7%	0.8%	0.9%	1.0%	1.1%	1.2%	1.3%	1.4%	1.5%
Employer DB Rate	25.0%	29.5%	29.9%	29.6%	29.3%	28.9%	28.3%	27.4%	26.4%	25.5%	24.7%	23.8%	23.0%	22.2%	21.5%
Member Rate	6.3%	6.3%	6.3%	6.4%	6.4%	6.5%	6.5%	6.6%	6.6%	6.6%	6.7%	6.7%	6.7%	6.8%	6.8%
Total NC Rate	10.8%	10.8%	7.4%	7.6%	7.7%	7.9%	14.6%	14.4%	14.2%	14.1%	13.9%	13.7%	13.6%	13.4%	13.3%
Total Current Rate	31.25%	35.75%	37.34%	36.84%	36.66%	36.38%	35.67%	34.98%	34.29%	33.60%	32.93%	32.28%	31.64%	31.02%	30.42%

	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045
Employer DC Rate	1.6%	1.7%	1.7%	1.8%	1.9%	1.9%	2.0%	2.0%	2.1%	2.1%	2.2%	2.2%	2.3%	2.3%	2.4%
Employer DB Rate	20.7%	20.0%	19.3%	18.7%	18.1%	17.5%	16.9%	16.3%	15.8%	11.7%	12.3%	8.8%	6.6%	6.2%	5.7%
Member Rate	6.8%	6.9%	6.9%	6.9%	6.9%	6.9%	7.0%	7.0%	7.0%	7.0%	7.0%	7.1%	7.1%	7.1%	7.1%
Total NC Rate	13.1%	13.0%	12.9%	12.8%	12.7%	12.6%	12.5%	12.4%	12.3%	12.3%	12.2%	12.1%	12.1%	12.0%	12.0%
Total Current Rate	29.84%	29.28%	28.73%	28.20%	27.68%	27.18%	26.70%	26.22%	25.77%	21.69%	18.73%	15.43%	13.37%	13.09%	12.76%

Implications for Asset Allocation

The cost implications of any asset allocation should be defined more in terms of achieving the Board's risk tolerances over some target investment return. It should not be about an allocation that maximizes a return within a poorly defined risk range. As a result, the cost of alternative asset allocations is not defined in terms of additional contributions needed or reduced but in terms of costs staying within an acceptable and sustainable range and/or making meaningful funding progress within a time horizon.

With this in mind, our analysis compared projections of assets, liabilities, funded status, and contributions of the current plan design with the Three Way Hybrid Plan. It should first be noted that these results are estimates based on the underlying assumptions. Actual

results will be based on the valuations performed each year by the Systems' actuaries. What is becoming increasingly apparent among public plans is the inability to respond to the risk volatility of the underlying investments backing the benefit promises. This coupled with the increasing number of members eligible to retire in the near future have contributed to the strain on resources. Any projected cost savings can be impacted by the Systems' experience. It can be anticipated that these new tiers will also change retirement patterns as they become a larger portion of the overall active population. Therefore, when new tiers are added, future experience studies should look at plan experience separately for these tiers and consider using different termination and retirement assumptions, if necessary. Any projected cost savings can be impacted by the Systems' experience.

Under existing law and the Three Way H-hybrid Plan, it is the unfunded liability (i.e., the difference between the assets and the liability) that is driving the cost. The normal cost (i.e., the value of the current benefit accruals) is low in comparison to the unfunded liability cost. Over time, most of the members in the DB plan will be covered under Act 120 and Three Way Hybrid Plan. As shown on the graphs, for both Act 120 members and members under the three way hybrid, the members are paying for a significant portion of their benefits. Therefore, what is driving the cost and the reason why contributions are high and reaching over 30% for PSERS and SERS, is the cost of paying for the unfunded liability. The unfunded liability will need to be paid regardless of the plan design. Under the three way hybrid, the employers will contribute towards the unfunded liability cost based on the total DB and DC payroll. Therefore, the DC only participant employers will be paying not only their employer contributions for the DC plan, but also part of the unfunded liability of the DB plan. In addition, the employer is required to make additional contributions to the DB plan equal to the savings from the Three Way Hybrid Plan for the next 30 years, or until the Systems are 100% funded. Thus, the unfunded liability will be paid off faster under the Three Way Hybrid Plan than under existing law. When comparing projected funding progress and contributions of the existing plan design to the three way hybrid, we find no reason to anticipate immediate changes in the asset allocation of PSERS or SERS.

The scope of this analysis was to focus on asset allocation implications of the Three Way Hybrid Plan. We have not quantified the intended savings potential measured in terms of the risk transfer from the Systems to these new classes of members or the total increase in risk of the retirement delivery system for the Commonwealth in the partial transfer of benefits to the DC plan. There is downside investment risk and longevity risk as part or all of the benefit is provided under the DC portion of the Three Way Hybrid Plan. Risk transfers do not easily have a discernable cost because the cost is born in different ways. In turn it creates a level of risk to the individual that is much greater than the risk transferred because the individual cannot achieve the same investment return and their cost to cover the longevity risk on their own becomes difficult. At the same time, the Three Way Hybrid Plan will not deliver the same level of benefits of the current DB plan.

Conclusions

Over the projection period studied, the results show small, but measurable, anticipated employer savings under the Three Way Hybrid Plan for both Systems regardless of employee elections. Also, given the expected funding progress under the Three Way Hybrid Plan, we find no reason to anticipate immediate changes to the asset allocations of the Systems due to the plan design change.

The financial results shown here are illustrations of a number of likely scenarios of projected costs resulting from the Three Way Hybrid Plan. However, actual future costs will be determined by future actuarial valuations. Consideration should be given, not only to the short term cost savings, but also to the long term implications. In addition, given the long term nature of SERS and PSERS, it is imperative to consider this analysis using conservative assumptions to determine the potential savings.

Future actuarial measurements may differ significantly from the current measurements due to such factors as the following: plan experience differing from that anticipated by the economic or demographic assumptions; changes in economic or demographic assumptions; and, changes in plan provisions or applicable law.

In preparing our projections we relied on cost notes prepared by the Systems' actuaries, the PSERS June 30, 2015 actuarial valuation report, and the SERS December 31, 2015 actuarial valuation report. We were not working from original census data and relied on generally accepted actuarial techniques in the development of the model to make our projections. Reliance on our projected values should be for purposes of the nature of the long term trends and not the specific values as the nature of any projection has an increasing degree of uncertainty the further into the future a projection is taken.

This analysis was prepared exclusively for the Pennsylvania Independent Fiscal Office. It is not intended to benefit any third party and Cheiron assumes no duty or liability to any such party.

To the best of our knowledge, this report and its contents have been prepared in accordance with generally recognized and accepted actuarial principles and practices which are consistent with the Code of Professional Conduct and applicable Actuarial Standards of Practice set out by the Actuarial Standards Board. Furthermore, as credentialed actuaries we meet the Qualification Standards of the American Academy of Actuaries to render the opinion contained in this report. This report does not address any contractual or legal issues. We are not attorneys and our firm does not provide any legal services or advice.

Sincerely,
Cheiron, Inc.

Kenneth A. Kent, FSA, EA, FCA, MAAA
Principal Consulting Actuary

Janet H. Cranna, FSA, EA, FCA, MAAA
Principal Consulting Actuary

cc: Mark Ryan

Three Way Hybrid Plan
Supplemental Statistics of Projected Financial Impact
(results shown exclude the additional contributions from the three way hybrid savings)

Public School Employees' Retirement System
Projection of Funded Ratio

Fiscal Year	Existing Law	3 Way Hybrid 1.25 Multiplier	3 Way Hybrid 1.00 Multiplier	DC Only
2016	59.4%	59.4%	59.4%	59.4%
2017	58.3%	58.3%	58.3%	58.3%
2018	57.7%	57.7%	57.7%	57.7%
2019	59.1%	59.1%	59.1%	59.1%
2020	60.6%	60.6%	60.6%	60.6%
2021	61.8%	61.7%	61.7%	61.7%
2022	63.3%	63.2%	63.2%	63.1%
2023	64.9%	64.8%	64.8%	64.7%
2024	66.5%	66.3%	66.2%	66.1%
2025	68.4%	68.1%	68.1%	67.8%
2026	70.5%	70.1%	70.1%	69.8%
2027	72.7%	72.3%	72.2%	71.9%
2028	75.1%	74.7%	74.6%	74.2%
2029	77.7%	77.2%	77.1%	76.6%
2030	80.4%	79.9%	79.8%	79.3%
2031	83.3%	82.8%	82.7%	82.2%
2032	86.4%	85.9%	85.8%	85.3%
2033	89.7%	89.3%	89.2%	88.8%
2034	93.3%	92.9%	92.9%	92.5%
2035	97.1%	96.9%	96.9%	96.7%
2036	99.0%	98.9%	98.9%	98.8%
2037	100.4%	100.5%	100.5%	100.5%
2038	101.7%	101.9%	101.9%	102.1%
2039	102.9%	103.2%	103.3%	103.6%
2040	103.9%	104.3%	104.5%	104.9%
2041	104.8%	105.4%	105.6%	106.2%
2042	105.5%	106.3%	106.5%	107.4%
2043	106.1%	107.1%	107.4%	108.5%
2044	106.6%	107.8%	108.1%	109.6%
2045	107.1%	108.5%	108.9%	110.7%

Public School Employees' Retirement System
Projection of Unfunded Liability
(in billions)

Fiscal Year	Existing Law	3 Way Hybrid 1.25 Multiplier	3 Way Hybrid 1.00 Multiplier	DC Only
2016	$ 39.462	$ 39.454	$ 39.454	$ 39.454
2017	$ 41.673	$ 41.664	$ 41.664	$ 41.664
2018	$ 43.325	$ 43.316	$ 43.316	$ 43.316
2019	$ 42.954	$ 42.945	$ 42.945	$ 42.945
2020	$ 42.461	$ 42.452	$ 42.452	$ 42.452
2021	$ 42.283	$ 42.273	$ 42.273	$ 42.273
2022	$ 41.640	$ 41.631	$ 41.631	$ 41.631
2023	$ 40.767	$ 40.758	$ 40.758	$ 40.758
2024	$ 39.965	$ 39.956	$ 39.956	$ 39.956
2025	$ 38.654	$ 38.645	$ 38.645	$ 38.645
2026	$ 37.016	$ 37.007	$ 37.007	$ 37.007
2027	$ 35.052	$ 35.043	$ 35.043	$ 35.043
2028	$ 32.746	$ 32.737	$ 32.737	$ 32.737
2029	$ 30.080	$ 30.072	$ 30.072	$ 30.072
2030	$ 27.021	$ 27.014	$ 27.014	$ 27.014
2031	$ 23.532	$ 23.525	$ 23.525	$ 23.525
2032	$ 19.577	$ 19.571	$ 19.571	$ 19.571
2033	$ 15.116	$ 15.109	$ 15.109	$ 15.109
2034	$ 10.103	$ 10.098	$ 10.098	$ 10.098
2035	$ 4.494	$ 4.490	$ 4.490	$ 4.490
2036	$ 1.637	$ 1.633	$ 1.633	$ 1.633
2037	$ (0.671)	$ (0.674)	$ (0.674)	$ (0.674)
2038	$ (2.836)	$ (2.838)	$ (2.838)	$ (2.838)
2039	$ (4.778)	$ (4.778)	$ (4.778)	$ (4.778)
2040	$ (6.557)	$ (6.557)	$ (6.557)	$ (6.557)
2041	$ (8.191)	$ (8.189)	$ (8.189)	$ (8.189)
2042	$ (9.643)	$ (9.641)	$ (9.641)	$ (9.641)
2043	$ (10.862)	$ (10.860)	$ (10.860)	$ (10.860)
2044	$ (11.898)	$ (11.895)	$ (11.895)	$ (11.895)
2045	$ (13.047)	$ (13.044)	$ (13.044)	$ (13.044)

Public School Employees' Retirement System
Projection of Employer Contributions

Fiscal	Existing	3 Way Hybrid		
Year	Law	1.25 Multiplier	1.00 Multiplier	DC Only
2016	25.0%	25.0%	25.0%	25.0%
2017	29.2%	29.2%	29.2%	29.2%
2018	30.6%	30.6%	30.6%	30.6%
2019	32.2%	32.2%	32.2%	32.2%
2020	33.1%	32.9%	32.9%	32.9%
2021	33.1%	32.8%	32.7%	32.6%
2022	33.1%	32.7%	32.6%	32.5%
2023	33.3%	32.8%	32.8%	32.5%
2024	33.5%	32.9%	32.8%	32.5%
2025	33.6%	32.9%	32.8%	32.5%
2026	33.9%	33.1%	33.0%	32.6%
2027	34.0%	33.1%	33.0%	32.7%
2028	34.1%	33.2%	33.1%	32.7%
2029	34.3%	33.3%	33.2%	32.8%
2030	34.5%	33.4%	33.3%	32.9%
2031	34.7%	33.6%	33.4%	33.0%
2032	34.9%	33.7%	33.6%	33.2%
2033	35.1%	33.9%	33.7%	33.3%
2034	35.3%	34.1%	33.9%	33.5%
2035	35.5%	34.3%	34.1%	33.8%
2036	20.1%	18.8%	18.6%	18.3%
2037	16.1%	14.8%	14.6%	14.3%
2038	14.3%	12.9%	12.8%	12.5%
2039	12.2%	10.9%	10.7%	10.5%
2040	10.5%	9.2%	9.0%	8.8%
2041	9.0%	7.7%	7.6%	7.4%
2042	7.5%	6.2%	6.0%	5.9%
2043	5.8%	4.5%	4.4%	4.4%
2044	4.5%	3.3%	3.2%	3.2%
2045	4.5%	3.2%	3.1%	3.2%

Public School Employees' Retirement System
Projection of Employer Contributions
(in billions)

Fiscal	Existing	3 Way Hybrid					
Year	Law	1.25 Multiplier	Inc./Dec.	1.00 Multiplier	Inc./Dec.	DC Only	Inc./Dec.
2016	$ 3.429	$ 3.429	$ -	$ 3.429	$ -	$ 3.429	$ -
2017	$ 3.971	$ 3.966	$ (0.004)	$ 3.966	$ (0.004)	$ 3.966	$ (0.004)
2018	$ 4.220	$ 4.220	$ (0.001)	$ 4.220	$ (0.001)	$ 4.220	$ (0.001)
2019	$ 4.471	$ 4.470	$ (0.001)	$ 4.470	$ (0.001)	$ 4.470	$ (0.001)
2020	$ 4.718	$ 4.696	$ (0.022)	$ 4.693	$ (0.025)	$ 4.683	$ (0.035)
2021	$ 4.837	$ 4.797	$ (0.040)	$ 4.791	$ (0.046)	$ 4.772	$ (0.065)
2022	$ 4.975	$ 4.915	$ (0.060)	$ 4.906	$ (0.069)	$ 4.879	$ (0.095)
2023	$ 5.150	$ 5.071	$ (0.079)	$ 5.060	$ (0.090)	$ 5.026	$ (0.125)
2024	$ 5.309	$ 5.211	$ (0.097)	$ 5.197	$ (0.111)	$ 5.156	$ (0.152)
2025	$ 5.470	$ 5.356	$ (0.115)	$ 5.340	$ (0.131)	$ 5.292	$ (0.178)
2026	$ 5.657	$ 5.527	$ (0.131)	$ 5.508	$ (0.149)	$ 5.455	$ (0.202)
2027	$ 5.828	$ 5.681	$ (0.147)	$ 5.661	$ (0.167)	$ 5.602	$ (0.225)
2028	$ 5.999	$ 5.836	$ (0.163)	$ 5.814	$ (0.185)	$ 5.751	$ (0.248)
2029	$ 6.169	$ 5.993	$ (0.177)	$ 5.969	$ (0.201)	$ 5.902	$ (0.267)
2030	$ 6.346	$ 6.154	$ (0.192)	$ 6.128	$ (0.218)	$ 6.058	$ (0.288)
2031	$ 6.523	$ 6.316	$ (0.207)	$ 6.289	$ (0.234)	$ 6.216	$ (0.307)
2032	$ 6.704	$ 6.483	$ (0.221)	$ 6.454	$ (0.250)	$ 6.380	$ (0.324)
2033	$ 6.890	$ 6.655	$ (0.235)	$ 6.625	$ (0.265)	$ 6.550	$ (0.340)
2034	$ 7.079	$ 6.831	$ (0.248)	$ 6.800	$ (0.279)	$ 6.725	$ (0.354)
2035	$ 7.273	$ 7.012	$ (0.261)	$ 6.981	$ (0.292)	$ 6.907	$ (0.366)
2036	$ 4.193	$ 3.921	$ (0.272)	$ 3.889	$ (0.304)	$ 3.818	$ (0.375)
2037	$ 3.434	$ 3.152	$ (0.282)	$ 3.120	$ (0.314)	$ 3.053	$ (0.382)
2038	$ 3.104	$ 2.813	$ (0.291)	$ 2.781	$ (0.323)	$ 2.720	$ (0.384)
2039	$ 2.709	$ 2.410	$ (0.299)	$ 2.378	$ (0.331)	$ 2.323	$ (0.385)
2040	$ 2.385	$ 2.079	$ (0.306)	$ 2.049	$ (0.336)	$ 2.003	$ (0.382)
2041	$ 2.089	$ 1.778	$ (0.311)	$ 1.748	$ (0.341)	$ 1.712	$ (0.377)
2042	$ 1.768	$ 1.454	$ (0.313)	$ 1.426	$ (0.341)	$ 1.402	$ (0.365)
2043	$ 1.412	$ 1.095	$ (0.317)	$ 1.069	$ (0.343)	$ 1.058	$ (0.354)
2044	$ 1.122	$ 0.803	$ (0.319)	$ 0.779	$ (0.343)	$ 0.782	$ (0.340)
2045	$ 1.135	$ 0.814	$ (0.321)	$ 0.792	$ (0.343)	$ 0.810	$ (0.325)
Total			$ (5.430)		$ (6.036)		$ (7.248)

State Employees' Retirement System
Projection of Funded Ratio

Fiscal Year	Existing Law	3 Way Hybrid 1.25 Multiplier	3 Way Hybrid 1.00 Multiplier	DC Only
2016	58.9%	58.9%	58.9%	58.9%
2017	60.0%	57.6%	57.6%	57.6%
2018	60.6%	58.2%	58.2%	58.2%
2019	61.4%	59.0%	59.0%	58.9%
2020	62.9%	60.4%	60.4%	60.4%
2021	64.5%	68.3%	68.3%	68.3%
2022	66.1%	69.7%	69.7%	69.7%
2023	67.8%	71.1%	71.1%	71.1%
2024	69.5%	72.6%	72.6%	72.6%
2025	71.2%	74.1%	74.1%	74.1%
2026	73.0%	75.6%	75.6%	75.6%
2027	74.8%	77.1%	77.1%	77.1%
2028	76.7%	78.7%	78.7%	78.7%
2029	78.6%	80.3%	80.3%	80.3%
2030	80.7%	82.0%	82.0%	82.0%
2031	82.7%	83.9%	83.9%	83.9%
2032	84.9%	85.8%	85.8%	85.8%
2033	87.2%	87.9%	87.9%	87.9%
2034	89.5%	90.1%	90.1%	90.1%
2035	92.0%	92.5%	92.5%	92.5%
2036	94.5%	95.1%	95.1%	95.1%
2037	97.2%	97.9%	97.9%	97.9%
2038	99.9%	101.1%	101.1%	101.1%
2039	102.8%	104.5%	104.5%	104.5%
2040	105.0%	107.2%	107.2%	107.2%
2041	106.7%	110.6%	110.6%	110.6%
2042	107.9%	113.3%	113.3%	113.3%
2043	108.8%	115.7%	115.7%	115.7%
2044	109.6%	118.3%	118.3%	118.3%
2045	110.3%	121.0%	121.0%	121.0%

State Employees' Retirement System
Projection of Unfunded Liability
(in billions)

Fiscal Year	Existing Law	3 Way Hybrid 1.25 Multiplier	3 Way Hybrid 1.00 Multiplier	DC Only
2016	$ 19.495	$ 19.495	$ 19.495	$ 19.495
2017	$ 19.368	$ 21.358	$ 21.360	$ 21.366
2018	$ 19.460	$ 21.424	$ 21.426	$ 21.432
2019	$ 19.460	$ 21.381	$ 21.383	$ 21.389
2020	$ 19.047	$ 20.922	$ 20.924	$ 20.930
2021	$ 18.554	$ 15.381	$ 15.382	$ 15.388
2022	$ 18.007	$ 14.914	$ 14.915	$ 14.921
2023	$ 17.402	$ 14.395	$ 14.396	$ 14.402
2024	$ 16.742	$ 13.827	$ 13.829	$ 13.835
2025	$ 16.030	$ 13.215	$ 13.216	$ 13.222
2026	$ 15.263	$ 12.555	$ 12.556	$ 12.562
2027	$ 14.437	$ 11.845	$ 11.846	$ 11.852
2028	$ 13.550	$ 11.081	$ 11.083	$ 11.089
2029	$ 12.596	$ 10.260	$ 10.262	$ 10.267
2030	$ 11.570	$ 9.378	$ 9.379	$ 9.385
2031	$ 10.467	$ 8.429	$ 8.430	$ 8.436
2032	$ 9.281	$ 7.409	$ 7.410	$ 7.416
2033	$ 8.007	$ 6.312	$ 6.314	$ 6.319
2034	$ 6.637	$ 5.134	$ 5.135	$ 5.140
2035	$ 5.164	$ 3.866	$ 3.868	$ 3.873
2036	$ 3.581	$ 2.504	$ 2.505	$ 2.510
2037	$ 1.879	$ 1.040	$ 1.041	$ 1.046
2038	$ 0.049	$ (0.535)	$ (0.533)	$ (0.529)
2039	$ (1.918)	$ (2.227)	$ (2.226)	$ (2.221)
2040	$ (3.540)	$ (3.554)	$ (3.553)	$ (3.549)
2041	$ (4.916)	$ (5.121)	$ (5.120)	$ (5.117)
2042	$ (5.955)	$ (6.366)	$ (6.365)	$ (6.361)
2043	$ (6.786)	$ (7.418)	$ (7.417)	$ (7.414)
2044	$ (7.650)	$ (8.520)	$ (8.519)	$ (8.516)
2045	$ (8.536)	$ (9.661)	$ (9.660)	$ (9.657)

State Employees' Retirement System
Projection of Employer Contributions

Fiscal Year	Existing Law	1.25 Multiplier	3 Way Hybrid 1.00 Multiplier	DC Only
2016	25.0%	25.0%	25.0%	25.0%
2017	29.5%	29.5%	29.5%	29.6%
2018	31.1%	29.7%	29.8%	30.1%
2019	30.6%	29.2%	29.3%	29.9%
2020	30.4%	28.9%	29.0%	29.7%
2021	30.1%	28.4%	28.6%	29.5%
2022	29.4%	27.7%	27.9%	28.9%
2023	28.7%	26.6%	26.9%	28.1%
2024	28.0%	25.6%	25.9%	27.2%
2025	27.4%	24.6%	24.9%	26.4%
2026	26.7%	23.7%	24.0%	25.6%
2027	26.0%	22.7%	23.1%	24.9%
2028	25.4%	21.8%	22.2%	24.1%
2029	24.8%	21.0%	21.4%	23.4%
2030	24.2%	20.1%	20.6%	22.7%
2031	23.6%	19.3%	19.8%	22.1%
2032	23.0%	18.6%	19.0%	21.4%
2033	22.5%	17.8%	18.3%	20.8%
2034	21.9%	17.1%	17.6%	20.2%
2035	21.4%	16.4%	17.0%	19.7%
2036	20.9%	15.8%	16.3%	19.1%
2037	20.4%	15.1%	15.7%	18.6%
2038	20.0%	14.5%	15.1%	18.1%
2039	19.5%	14.0%	14.6%	17.6%
2040	15.4%	9.8%	10.4%	13.5%
2041	12.5%	10.4%	11.0%	14.2%
2042	9.2%	6.9%	7.5%	10.7%
2043	7.1%	4.6%	5.3%	8.6%
2044	6.8%	4.2%	4.8%	8.2%
2045	6.5%	3.6%	4.3%	7.7%

State Employees' Retirement System
Projection of Employer Contributions
(in billions)

Fiscal Year	Existing Law	1.25 Multiplier	Inc./Dec.	3 Way Hybrid 1.00 Multiplier	Inc./Dec.	DC Only	Inc./Dec.
2016	$ 1.587	$ 1.254	$ (0.333)	$ 1.587	$ -	$ 1.587	$ -
2017	$ 1.930	$ 1.482	$ (0.449)	$ 1.933	$ 0.003	$ 1.935	$ 0.004
2018	$ 2.097	$ 1.722	$ (0.375)	$ 2.008	$ (0.089)	$ 2.029	$ (0.068)
2019	$ 2.126	$ 1.716	$ (0.409)	$ 2.039	$ (0.087)	$ 2.074	$ (0.052)
2020	$ 2.178	$ 1.719	$ (0.458)	$ 2.077	$ (0.100)	$ 2.128	$ (0.050)
2021	$ 2.223	$ 1.722	$ (0.501)	$ 2.109	$ (0.114)	$ 2.174	$ (0.049)
2022	$ 2.237	$ 1.726	$ (0.512)	$ 2.119	$ (0.119)	$ 2.198	$ (0.039)
2023	$ 2.251	$ 1.729	$ (0.522)	$ 2.105	$ (0.146)	$ 2.199	$ (0.052)
2024	$ 2.264	$ 1.733	$ (0.531)	$ 2.090	$ (0.174)	$ 2.200	$ (0.064)
2025	$ 2.276	$ 1.738	$ (0.538)	$ 2.073	$ (0.203)	$ 2.199	$ (0.077)
2026	$ 2.288	$ 1.743	$ (0.545)	$ 2.057	$ (0.231)	$ 2.199	$ (0.089)
2027	$ 2.300	$ 1.748	$ (0.552)	$ 2.040	$ (0.259)	$ 2.199	$ (0.101)
2028	$ 2.312	$ 1.754	$ (0.558)	$ 2.024	$ (0.288)	$ 2.199	$ (0.113)
2029	$ 2.325	$ 1.761	$ (0.564)	$ 2.007	$ (0.318)	$ 2.199	$ (0.126)
2030	$ 2.338	$ 1.768	$ (0.570)	$ 1.990	$ (0.348)	$ 2.199	$ (0.138)
2031	$ 2.351	$ 1.776	$ (0.575)	$ 1.972	$ (0.379)	$ 2.200	$ (0.151)
2032	$ 2.365	$ 1.791	$ (0.574)	$ 1.955	$ (0.410)	$ 2.201	$ (0.163)
2033	$ 2.379	$ 1.804	$ (0.575)	$ 1.938	$ (0.441)	$ 2.204	$ (0.175)
2034	$ 2.393	$ 1.818	$ (0.576)	$ 1.922	$ (0.472)	$ 2.206	$ (0.187)
2035	$ 2.409	$ 1.833	$ (0.576)	$ 1.906	$ (0.503)	$ 2.210	$ (0.199)
2036	$ 2.424	$ 1.849	$ (0.575)	$ 1.890	$ (0.534)	$ 2.214	$ (0.210)
2037	$ 2.440	$ 1.867	$ (0.573)	$ 1.875	$ (0.565)	$ 2.219	$ (0.221)
2038	$ 2.456	$ 1.887	$ (0.570)	$ 1.860	$ (0.596)	$ 2.224	$ (0.232)
2039	$ 2.473	$ 1.908	$ (0.565)	$ 1.846	$ (0.627)	$ 2.231	$ (0.242)
2040	$ 2.017	$ 1.923	$ (0.094)	$ 1.358	$ (0.658)	$ 1.764	$ (0.252)
2041	$ 1.679	$ 1.939	$ 0.259	$ 1.480	$ (0.200)	$ 1.907	$ 0.228
2042	$ 1.273	$ 1.480	$ 0.208	$ 1.041	$ (0.232)	$ 1.491	$ 0.218
2043	$ 1.017	$ 1.142	$ 0.125	$ 0.753	$ (0.264)	$ 1.225	$ 0.207
2044	$ 1.008	$ 0.735	$ (0.273)	$ 0.711	$ (0.297)	$ 1.205	$ 0.197
2045	$ 0.987	$ 0.478	$ (0.509)	$ 0.657	$ (0.330)	$ 1.174	$ 0.187
Total	$ 0.847		$(12.858)		$ (8.980)		$ (2.010)

xerox

October 7, 2016

David L. Driscoll, FSA
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Mr. Glen R. Grell
Executive Director
Pennsylvania Public School Employees' Retirement System
5 North 5th Street
Harrisburg, PA 17101

Dear Glen:

Re: Amendments to 11092 (as provided by PSERS staff)

As requested, we have examined the provisions of Amendments to 11092 (as provided by PSERS staff, hereafter simply referred to as Amendments), which would create a new Class T-G membership under the Pennsylvania Public School Employees' Retirement System (PSERS) for future new members on or after July 1, 2018. Any employee who becomes a member of the Retirement System effective July 1, 2018 would have the option of electing Class T-H membership or Class DC participation within 90 days of becoming a member. Former PSERS members returning to active service cannot elect Class T-G or Class T-H membership or Class DC participation. In addition, the bill would establish a defined contribution plan for future new members effective July 1, 2018 and would provide for a cost neutral option 4 distribution of accumulated deductions for T-E and T-F members for their total member balances effective July 1, 2018.

The benefit provisions of the Amendments are summarized as follows:

<u>Employees who become a member of the System on or after July 1, 2018</u>

a. Class T-G Membership - Hybrid Plan

1. Defined Benefit Plan Provisions

- Members would contribute 5.50% of pay.

- The annual benefit at retirement would be 1.25% of the highest five-year average pay multiplied by the number of years of service.

- Eligibility for superannuation or unreduced retirement benefits would be reached at attainment of age 67 with three years of service.

- Members would vest after five years of service and would be eligible to apply for commencement of benefits at or after age 62. Benefits of members electing to commence payment at or after age 62 but prior to superannuation would be reduced by the PSERS' actuarial equivalence factors.

- Members who terminate on or after attaining age 55 with at least 25 years of service would be able to commence benefits at or after age 62. Benefits commencing prior to eligibility for superannuation would be reduced by 3% for each year the commencement occurs prior to superannuation.

- Members with five years of service would be eligible for disability benefits.

- Members would be eligible to elect a cost neutral Option 4 lump sum partial or full distribution of accumulated deductions at benefit commencement.

- Members would be subject to a shared risk/gain provision under which the member's rate would be no more than 2% below or 2% above the member's basic contribution rate.

- Members would be eligible for the Health Care Premium assistance.

2. Defined Contribution (DC) Plan Provisions

- DC plan mandatory participant contributions would be 3.00% of pay. Mandatory participant contributions are intended to be pre-tax "pickup" contributions.

- The DC plan employer contribution would be 2.00% of pay.

- Participant contributions to the DC plan would vest immediately. Employer contributions would vest after completion of three years of service.

b. Class T-H Membership - Hybrid Plan

1. Defined Benefit Plan Provisions

- Members would contribute 4.50% of pay.

- The annual benefit at retirement would be 1.00% of the highest five-year average pay multiplied by the number of years of service.

- Eligibility for superannuation or unreduced retirement benefits would be reached at attainment of age 67 with three years of service.

- Members would vest after five years of service and would be eligible to apply for commencement of benefits at or after age 62. Benefits of members electing to commence payment at or after age 62 but prior to superannuation would be reduced by the PSERS' actuarial equivalence factors.

- Members who terminate on or after attaining age 55 with at least 25 years of service would be able to commence benefits at or after age 62. Benefits commencing prior to eligibility for superannuation would be reduced by 3% for each year the commencement occurs prior to superannuation.

- Members with five years of service would be eligible for disability benefits.

- Members would be eligible to elect a cost neutral Option 4 lump sum partial or full distribution of accumulated deductions at benefit commencement.

- Members would be subject to a shared risk/gain provision under which the member's rate would be no more than 2% below or 2% above the member's basic contribution rate.

- Members would be eligible for the Health Care Premium assistance.

2. Defined Contribution (DC) Plan Provisions

   - DC plan mandatory participant contributions would be 3.00% of pay. Mandatory participant contributions are intended to be pre-tax "pickup" contributions.
   - The DC plan employer contribution would be 2.00% of pay.
   - Participant contributions to the DC plan would vest immediately. Employer contributions would vest after completion of three years of service.

c. Class Defined Contribution (DC) Participant - DC Only Plan

   - DC plan mandatory participant contributions would be 7.50%% of pay. Mandatory participant contributions are intended to be pre-tax "pickup" contributions.
   - The DC plan employer contribution would be 2.00% of pay.
   - Participant contributions to the DC plan would vest immediately. Employer contributions would vest after completion of three years of service.

Under each DC plan design alternative, each participant will have an individual investment account where all participant and employer contributions are accumulated and investment experience, fees and costs are credited or charged

Benefit reform provisions applicable to Class T-E and T-F members

- Effective July 1, 2018, members would be eligible to elect a cost neutral Option 4 lump sum partial or full distribution of accumulated deductions at benefit commencement for all service.
- Members would be subject to a shared risk/gain provision under which the member's rate would be no more than 2% below or 2% above the member's basic contribution rate.

The Amendments funding provisions are summarized as follows:

- The accrued liability contribution rate would be computed as a level percentage of total compensation of all active PSERS members and active DC participants using a closed (i.e., for each subsequent valuation, the amortization period shall decrease by one year) amortization period of 24 years.
- For each year after the establishment of the accrued liability contribution rate, any increase or decrease in the unfunded accrued liability due to the System's experience would be calculated as a level percentage of the total compensation of all active PSERS members and active DC participants using a closed (i.e., for each subsequent valuation, the amortization period shall decrease by one year) 24-year amortization period.
- Changes in the accrued liability of PSERS resulting from legislation are to be funded as a level percentage of the total compensation of all active PSERS members and active DC participants using a closed (i.e., for each subsequent valuation, the amortization period shall decrease by one year) 10-year amortization period.
- DC participant employers would be surcharged the PSERS accrued liability contribution rate in addition to the employer defined-contribution payments made to the DC plan.

- The normal contribution rate would be determined as a level percentage of total compensation of active PSERS members. In no event would the normal contribution rate be less than 0.00%.

- The results of the 10-year asset-averaging method would be constrained to remain within 30% of the market value of assets.

- Section 8328(j) of the Amendments provides a schedule of additional employer contributions in order to pay off the System's unfunded accrued liability (UAL).

The projected employer contributions under the DC plan do not reflect offsets for forfeitures from participants who terminate prior to completing three years of service.

It should be noted that under the Amendments, the portion of the benefits provided to Class T-G and Class T-H members and Class DC participants by the DC plan is subject to investment risk that would be fully borne by participants. Under PSERS, only Class T-E, Class T-F and now proposed Class T-G and Class T-H members share responsibility for the fund's investment risk through the Act 2010-120 and the Amendments "shared-risk" additional member contributions. Class T-C and T-D members are not subject to "shared-risk" contributions. Additionally, participants would bear the full cost associated with "longevity risk" (i.e., the chance of running out of money in retirement) for benefits provided by the DC plan, while under PSERS, longevity risk is borne by the System except in the case of members who elect an Option 4 lump sum withdrawal at retirement. For these members, longevity risk is borne on the lump sum withdrawal while PSERS bears the longevity risk only on the residual annuity payable to the member.

Estimates of the potential financial impact of the Amendments are presented in the attached tables. In determining the base costs/(savings), it has been assumed that for new school employees hired on or after July 1, 2018, 65% will become Class T-G members, 30% will elect Class T-H membership, and 5% will elect Class DC participation.

In addition, to illustrate the sensitivity of the costs/(savings) to different election patterns, we have also provided costs/(savings) based on three sets of alternative election percentages but without regard to additional employer UAL contributions under the proposed Section 8328(j):

1. 55% Class T-G membership, 35% Class T-H membership and 10% Class DC Participation - Savings of $1,200,593,000

2. 45% T-G membership, 40% Class T-H membership and 15% Class DC participation - Savings of $1,270,316,000

3. 40% Class T-G membership, 40% Class T-H membership and 20% Class DC participation - Savings of $1,333,556,000

These alternate scenarios are provided solely to illustrate the sensitivity of the cost/(savings) to possible different election patterns by new members. Based on the provisions of each of the plans and the fact that Class T-G membership is the default option, our best estimate of the new member elections are the percentages assumed in the base scenario outlined above of 65% for Class T-G membership, 30% for Class T-H membership and 5% for Class DC participation. It should be noted that the difference in the savings between the four scenarios over the 32-year projection period is relatively small in value and in comparison to the total estimated contributions to be made over the projection period. Since Class DC participation is the least costly plan among the three plan options, projected overall savings also increases as the assumed election percentage for Class DC participation increases. Conversely, Class

T-G membership is the most costly of the three plan options and an increase in the election percentage for Class T-G membership decreases the projected savings.

We should emphasize that the values for “funded ratio” and “unfunded accrued liability” presented here are measured on the basis of the System’s actuarial value of assets. It should be noted that if the same measurements were made using the market value of the System’s assets, different funded ratios and unfunded accrued liabilities would result. Moreover, the funded ratios presented are appropriate for evaluating the need for and level of future contributions but not for assessment of the funded status of the plan in terms of its ability to settle (i.e., purchase annuities) all or a portion of its liabilities.

The attached Table 1 illustrates the potential expected employer savings through fiscal year 2049 for the proposed plan based on the base election percentages outlined above when compared to the current plan. However, the proposed additional employer UAL contribution schedule under Section 8328(j) of the Amendments has not been provided but based on discussions with PSERS staff, the schedule should reflect the savings presented in Table 1A. It should be noted that employers will only realize contribution savings to the extent that the UAL is paid off faster than required by the 24-year amortization period as established in the statutes.

The attached Table 1A illustrates the estimated potential savings from pension reform changes through the 2049 fiscal year for the proposed plans based on the base election percentages outlined above. As noted above, the attached Table 1 provides the projection of employer contributions reflecting the additional employer contributions to the System equal to the savings outlined in Table 1A. Table 1A indicates savings of $1.1billion solely due to pension reform changes while Table 1 indicates savings of $.8 billion which reflects the additional contributions to be made by employers beginning in fiscal year 2027 to pay off the UAL. As the UAL is being paid off sooner than required by current law, additional savings are expected to continue beyond 2049.

The legislation states that the PSERS normal contribution rate is to be determined as a level percentage of compensation of active PSERS members. However, to provide consistency in the comparison made, the results are shown as a percentage of total compensation of all active PSERS members and active DC participants.

Note that Table 1A shows an initial increase in the employer rates and contributions for the fiscal years 2019 to 2026 and then increasing projected savings through the remainder of the projection period, which is explained by the following aspects of the proposed changes:

a. In the initial years of the projection, the employer DC contribution for new members is greater than the decrease in the System’s overall normal cost for anticipated members who would have otherwise been assumed to be Class T-E members under the current plan. Therefore, there are additional costs to employers in the early years of the projection.

b. In later years, the 2% employer DC rate plus the employer normal cost rates for Class T-H members and Class T-G members are less than the projected T-E members’ employer normal cost rate under the current plan. Therefore savings are realized in later years of the projection and are expected to continue beyond 2049.

Table 2 allocates the total projected cost/(savings) between the proposed benefit and funding reforms of the Amendments. In addition, Table 2 provides the estimated effect of investment risk sharing on the plan under a 6.5% annual investment return scenario for all years of the projection.

Tables 3A, 3B and 3C present comparisons of the estimated current benefits provided under PSERS for Class T-E members to those that would be provided under Class T-H membership, Class T-G membership and Class DC participation, respectively, for the following eight cases: three hypothetical members retiring at age 65 with 20 years of service, three hypothetical members retiring at age 65 with 35 years of service, one hypothetical member retiring at age 57 with 35 years of service and deferring commencement of the DB benefit to age 62, and one hypothetical member retiring at age 67 with 35 years of service. The eighth benefit example has been provided for T-G and T-H member age 67 with 35 years of service with no comparison to a T-E member's benefit. In all of the other seven comparisons presented, benefits under the Amendments are projected to be lower than those provided by current law.

Also included are Exhibits I through IV which show graphical comparisons of the projected contribution amounts, contribution rates, unfunded accrued liabilities and funded percentages under the current plan provisions and those projected under the base scenario for the Amendments.

Proposed Class T-G and T-H members, along with members of Classes T-E and T-F, would share responsibility for the fund's investment risk through the Act 2010-120 and the Amendments "shared-risk" additional member contributions. The purpose of the shared-risk provision is to offset employer contribution requirements during extended periods of unfavorable investment experience and to offset member contributions during extended periods of favorable investment experience, in effect requiring certain PSERS members to "share the risk" of investment experience with the employer. Table 2 and Exhibit V A show the projected impact of the shared-risk provision if annual investment returns on the System's assets throughout the projection period were 6.5%, which is 1% less than the System's current 7.5% return assumption. Exhibit V B shows the projected impact of the shared-risk provision if annual investment returns on the System's assets throughout the projection period were 8.5%, which is 1% more than the System's current 7.5% return assumption

As outlined in the note at the bottom of Exhibit V A and on Table 2, there is a decrease in total employer contributions due to the Class T-E, Class T-F, Class T-G and Class T-H members' proposed plan design provisions under the base scenario of the Amendments assuming an annual return on assets of 6.50% when compared to current law. Employer contributions are increased due to a decrease in member risk-share contributions as a result of a shift of members to the DC plan. Conversely, Exhibit V B shows an increase in total employer contributions should the funds earn an annual 8.50% during the covered projection period. The rate-of-return scenarios upon which these projections are based are not ones that are likely to develop over the projection period, and accordingly these projections must be viewed as an indication of the range of possible outcomes rather than as predictions that are likely to be fulfilled.

The calculations presented here are based on the data, methods and assumptions used in the June 30, 2015 actuarial valuation of PSERS as well as the following assumptions for the projected actuarial valuations:

- The workforce size is assumed to remain constant over the projection period; and
- Future new employees are assumed to have similar demographic characteristics (age/gender/salary) to those of new members who entered PSERS for in the period July 1, 2012 through June 30, 2015.

These results may be used as estimates of the likely pattern of emerging costs and liabilities resulting from the proposed changes but should not be viewed as a guarantee of actual costs. Actual future funding obligations will be determined by actuarial valuations made on future valuation dates and will likely differ from the estimates provided in these analyses.

We note that the PSERS Board met on June 10th and, at that time, adopted new assumptions for the System's annual actuarial valuation, which are to be reflected initially in the June 30, 2016 valuation, which has not yet been completed. The new assumptions have **not** been reflected in this cost note.

A noteworthy difficulty in the estimation of liabilities arising under the Amendments is that we would expect the retirement patterns to change as a result of the reduced benefit entitlements. In general, decreasing benefits (especially, deferring benefit commencement to no earlier than age 62) may lead to postponed retirements among affected members, who may need to remain in service longer than would have previously been necessary to earn sufficient benefits to meet their financial needs in retirement. However, the nature and extent of such postponements will not be identified until affected members retire under the new benefit design and a formal experience study is prepared. Therefore, in our cost estimates, we have assumed that there would be no immediate changes in members' retirement patterns.

There are some additional funding concerns that would have to be addressed if the Amendments were to move forward:

1. This analysis is based on an assumed 7.50% annual discount rate. However, under the Amendments, it is possible that liquidity issues may arise due to the shift in liability towards retirees and that the PSERS Board may change the asset allocation to reduce the risk of the portfolio and reflect the need to hold a growing proportion of its assets in more liquid, less volatile asset classes. In general, lowering the risk of the portfolio lowers the discount rate used in the System's valuation. This generally increases the accrued liabilities and contribution requirements of the System. The cost impact of the Amendments could thus change, potentially significantly, if there is a change in the asset allocation and expected asset return. We recommend that an analysis be performed by PSERS' investment consultant using projected cash flows of the System based on the provisions of the Amendments to determine whether such a reduction in the future assumed long-term rate of return on assets may be warranted. If so, the projections shown on the attachments should be recalculated accordingly.

2. The projected contributions for future fiscal years may differ from those to be determined in actual future actuarial valuations due to demographic and financial experience different from those assumed. This will certainly be the case if the workforce and/or payroll continue to decrease over the next few years. In addition, it is outside the scope of this assignment to determine if the assumptions used in the June 30, 2015, actuarial valuation will remain reasonable for use in future valuations. As noted previously, on June 10, 2016, PSERS' Board adopted new actuarial assumptions to be reflected in the June 30, 2016 actuarial valuation. Accordingly, these results should not be used for any purpose other than providing an estimate of future employer pension cost obligations under the Amendments.

3. Based on discussions with PSERS staff, it is Buck's understanding that the additional employer contribution rates as outlined in Tables 1 and 1A will be included in the Amendments as required additional employer contributions for future years through the end of the projection period outlined in Tables 1 and 1A. As stated throughout this cost note, the projections of future contributions are based on many assumptions (future asset returns, withdrawal, retirement and death, new member profiles and constant population, percentage election of each of the plan alternatives) and any deviation of actual experience from the assumptions used in this cost note will change the actual future cost savings from that illustrated in Tables 1 and 1A.

This analysis only provides information with regard to future funding contributions of the System. It does not provide any information with regard to the impact any changes may have on financial disclosures under applicable GASB standards.

This analysis was prepared under my supervision. I am a Fellow of the Society of Actuaries and a Member of the American Academy of Actuaries. I meet the Academy's qualification Standards to issue this Statement of Actuarial Opinion. This report has been prepared in accordance with all applicable Actuarial Standards of Practice and I am available to answer questions about it.

Finally, care should be exercised in using the projections and communicating any results to third parties to ensure that the above caveats and underlying bases of the projections are clearly communicated to any possible recipients.

Please let me know if you have any questions.

Very truly yours,

David L. Driscoll

David L. Driscoll, FSA, MAAA, EA, FCA
Principal, Consulting Actuary

Enc.
Pc: Brian Carl

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TABLE 1
Pennsylvania Public School Employees' Retirement System
Projection of Contribution Rates and Funded Ratios As of June 30, 2015
PSERS (Current) vs. the Amendments

Fiscal Year Ending June	Appropriation Payroll (thousands) Current	Appropriation Payroll (thousands) Amendments DB Plan	Appropriation Payroll (thousands) Amendments Members Enrolled in DC	Fiscal Year Market Rate of Return	Pension Rate Floor Current	Pension Rate Floor Amendments DB	Employee Contribution Rate Current	Employee Contribution Rate Amendments DB	Employer Normal Cost Rate Current	Employer Normal Cost Rate Amendments DB	Employer Normal Cost Rate Amendments DC	Employer Unfunded Liability Rate Current	Employer Unfunded Liability Rate Amendments DB Regular Rate - w/o Reflecting Section 8328(j) Additional Rate	Employer Unfunded Liability Rate Amendments DB Section 8328(j) Additional Employer Rate
2014	$ 13,720,000	$ 13,720,000		14.91 %	4.00 %	4.00 %	7.43 %	7.43 %	8.57 %	8.57 %		15.25 %	15.25 %	0.00 %
2015	13,482,000	13,482,000		3.04	4.00	4.00	7.46	7.46	8.46	8.46		17.51	17.51	0.00
2016	13,375,000	13,375,000		7.50	4.00	4.00	7.49	7.49	8.38	8.38		19.44	19.44	0.00
2017	**13,549,000**	**13,549,000**		7.50	8.31	8.31	**7.52**	**7.52**	**8.31**	**8.31**		**20.89**	**20.89**	**0.00**
2018	13,658,010	13,658,010		7.50	8.14	8.14	7.52	7.52	8.14	8.14		23.07	23.07	0.00
2019	14,012,675	14,012,675	$ 553,562	7.50	7.98	7.98	7.52	7.52	7.98	7.98	0.08 %	24.47	24.47	0.00
2020	14,385,408	14,385,408	1,098,647	7.50	7.81	7.81	7.53	7.53	7.81	7.81	0.15	25.59	25.59	0.00
2021	14,775,522	14,775,522	1,653,267	7.50	7.66	7.56	7.53	7.43	7.66	7.56	0.22	25.06	25.06	0.00
2022	15,181,732	15,181,732	2,221,156	7.50	7.51	7.32	7.53	7.34	7.51	7.32	0.29	25.23	25.23	0.00
2023	15,592,952	15,592,952	2,786,752	7.50	7.36	7.08	7.53	7.25	7.36	7.08	0.36	25.63	25.63	0.00
2024	16,006,876	16,006,876	3,350,939	7.50	7.21	6.85	7.53	7.16	7.21	6.85	0.42	25.89	25.89	0.00
2025	16,425,303	16,425,628	3,911,373	7.50	7.06	6.61	7.53	7.08	7.06	6.61	0.48	26.16	26.16	0.00
2026	16,849,867	16,850,289	4,500,113	7.50	6.90	6.37	7.53	7.01	6.90	6.37	0.53	26.56	26.56	0.00
2027	17,269,991	17,270,517	5,114,389	7.50	6.74	6.14	7.53	6.93	6.74	6.14	0.59	26.87	26.87	0.01
2028	17,684,009	17,684,642	5,755,266	7.50	6.56	5.89	7.54	6.86	6.56	5.89	0.65	27.19	27.19	0.02
2029	18,092,525	18,093,258	6,424,584	7.50	6.40	5.64	7.54	6.78	6.40	5.64	0.71	27.52	27.52	0.05
2030	18,496,390	18,496,579	7,123,252	7.50	6.22	5.39	7.54	6.70	6.22	5.39	0.77	27.88	27.88	0.06
2031	18,901,232	18,900,351	7,853,568	7.50	6.04	5.13	7.54	6.63	6.04	5.13	0.83	28.25	28.25	0.08
2032	19,306,605	19,304,611	8,620,783	7.50	5.86	4.86	7.54	6.55	5.86	4.86	0.89	28.64	28.63	0.11
2033	19,711,447	19,708,283	9,422,806	7.50	5.67	4.59	7.54	6.47	5.67	4.59	0.96	29.04	29.03	0.11
2034	20,119,213	20,114,839	10,262,186	7.50	5.48	4.32	7.54	6.38	5.48	4.32	1.02	29.46	29.44	0.14
2035	20,534,465	20,528,477	11,141,760	7.50	5.28	4.04	7.54	6.30	5.28	4.04	1.09	29.88	29.85	0.14
2036	20,959,917	20,952,030	12,062,615	7.50	5.08	3.76	7.54	6.21	5.08	3.76	1.15	14.66	14.62	0.17
2037	21,392,675	21,382,786	13,022,898	7.50	4.87	3.46	7.54	6.13	4.87	3.46	1.22	10.91	10.86	0.19
2038	21,836,128	21,824,111	14,023,912	7.50	4.67	3.17	7.54	6.04	4.67	3.17	1.29	9.28	9.22	0.21
2039	22,293,310	22,279,261	15,069,630	7.50	4.46	2.88	7.54	5.95	4.46	2.88	1.35	7.41	7.33	0.23
2040	22,765,638	22,749,093	16,159,571	7.50	4.26	2.58	7.54	5.86	4.26	2.58	1.42	5.95	5.85	0.26
2041	23,256,592	23,237,205	17,288,901	7.50	4.05	2.30	7.54	5.77	4.05	2.30	1.49	4.65	4.54	0.25
2042	23,771,462	23,749,077	18,450,228	7.50	3.86	2.01	7.54	5.68	3.86	2.01	1.55	2.58	2.45	0.30
2043	24,320,134	24,294,539	19,641,644	7.50	3.67	1.74	7.54	5.59	3.67	1.74	1.62	1.04	0.89	0.31
2044	24,918,450	24,889,555	20,863,737	7.50	3.50	1.49	7.54	5.51	3.50	1.49	1.68	(0.16)	(0.34)	0.33
2045	25,575,198	25,542,858	22,119,591	7.50	3.34	1.26	7.54	5.43	3.34	1.26	1.73	0.79	0.59	0.35
2046	26,301,180	26,265,168	23,412,637	7.50	3.22	1.06	7.53	5.36	3.22	1.06	1.78	0.81	0.57	0.38
2047	27,097,844	27,057,826	24,740,301	7.50	3.11	0.90	7.53	5.29	3.11	0.90	1.83	0.55	0.28	0.00
2048	27,966,454	27,922,071	26,091,240	7.50	3.02	0.75	7.53	5.24	3.02	0.75	1.87	0.48	0.19	0.00
2049	28,911,941	28,862,967	27,459,711	7.50	2.97	0.65	7.52	5.18	2.97	0.65	1.90	0.42	0.13	0.00

Fiscal Year Ending June	Preliminary Employer Pension Rate Current	Preliminary Employer Pension Rate Amendments DB	Health Care Contribution	Total Employer Contribution Rate Current	Total Employer Contribution Rate Amendments DB + DC	Total Employer Contribution (thousands) Current	Total Employer Contribution (thousands) HB 1499 DB + DC	Cost/(Savings) Cash Flow Basis	Cost/(Savings) Present Value as of June 30, 2016	Funded Ratio (Actuarial Value of Assets basis) Current	Funded Ratio (Actuarial Value of Assets basis) Amendments DB	Unfunded Accrued Liability (Actuarial Value of Assets basis and in millions) Current	Unfunded Accrued Liability (Actuarial Value of Assets basis and in millions) Amendments DB
2014	23.82 %	23.82 %	0.93 %	16.93 %	16.93 %					62.0 %	62.0 %	$ 35,121.2	$ 35,121.2
2015	25.97	25.97	0.90	21.40	21.40					**60.6**	**60.6**	**37,335.8**	**37,335.8**
2016	27.82	27.82	0.84	25.84	25.84	$ 3,456,100	$ 3,456,100	$ 0	$ 0	58.2	58.2	40,620.5	40,621.0
2017	**29.20**	**29.20**	**0.83**	**30.03**	**30.03**	**4,068,765**	**4,068,765**	**0**	**0**	56.8	56.8	43,159.9	43,160.4
2018	31.21	31.21	0.83	32.04	32.04	4,376,026	4,376,026	0	0	56.1	56.1	45,087.7	45,088.2
2019	32.45	32.45	0.82	33.27	33.35	4,662,017	4,673,088	11,071	8,912	58.6	58.6	43,551.4	43,551.9
2020	33.40	33.40	0.80	34.20	34.35	4,919,810	4,941,782	21,973	16,453	60.1	60.1	43,104.1	43,104.6
2021	32.72	32.62	0.79	33.51	33.63	4,951,277	4,969,567	18,290	12,740	61.2	61.2	43,070.0	43,070.4
2022	32.74	32.55	0.77	33.51	33.61	5,087,398	5,102,976	15,578	10,094	62.6	62.5	42,587.3	42,587.6
2023	32.99	32.71	0.76	33.75	33.83	5,262,621	5,274,696	12,075	7,278	64.1	64.1	41,893.2	41,893.5
2024	33.10	32.74	0.74	33.84	33.90	5,416,727	5,426,121	9,394	5,267	65.5	65.4	41,290.2	41,290.4
2025	33.22	32.77	0.72	33.94	33.97	5,574,748	5,579,170	4,422	2,307	67.3	67.1	40,199.8	40,200.0
2026	33.46	32.93	0.72	34.18	34.18	5,759,285	5,760,125	840	408	69.2	69.0	38,808.0	38,808.1
2027	33.61	33.02	0.69	34.30	34.30	5,923,607	5,924,179	572	258	71.2	71.0	37,123.3	37,121.6
2028	33.75	33.10	0.69	34.44	34.44	6,090,373	6,090,746	373	157	73.4	73.1	35,136.3	35,130.7
2029	33.92	33.21	0.69	34.61	34.61	6,261,823	6,262,106	283	111	75.7	75.4	32,832.9	32,817.6
2030	34.10	33.33	0.69	34.79	34.79	6,434,894	6,435,001	107	39	78.2	77.9	30,172.9	30,145.4
2031	34.29	33.46	0.69	34.98	34.98	6,611,651	6,611,541	(110)	(37)	80.8	80.5	27,122.1	27,077.9
2032	34.50	33.60	0.69	35.19	35.18	6,793,994	6,791,967	(2,028)	(637)	83.6	83.3	23,647.6	23,580.1
2033	34.71	33.73	0.69	35.40	35.38	6,977,852	6,972,047	(5,805)	(1,698)	86.6	86.4	19,712.1	19,620.1
2034	34.94	33.90	0.69	35.63	35.61	7,168,476	7,162,967	(5,509)	(1,499)	89.8	89.6	15,274.8	15,151.5
2035	35.16	34.03	0.69	35.85	35.81	7,361,606	7,350,322	(11,283)	(2,855)	93.3	93.2	10,293.8	10,138.1
2036	19.74	18.55	0.69	20.43	20.39	4,282,111	4,272,423	(9,688)	(2,281)	94.9	94.8	8,000.0	7,804.7
2037	15.78	14.51	0.69	16.47	16.42	3,523,374	3,510,641	(12,732)	(2,788)	96.1	96.0	6,272.1	6,031.4
2038	13.95	12.60	0.69	14.64	14.58	3,196,809	3,180,903	(15,907)	(3,240)	97.1	97.1	4,721.2	4,429.4
2039	11.87	10.44	0.69	12.56	12.48	2,800,040	2,781,074	(18,965)	(3,594)	97.9	98.0	3,426.6	3,077.8
2040	10.21	8.69	0.69	10.90	10.80	2,481,455	2,457,056	(24,398)	(4,301)	98.6	98.8	2,332.7	1,918.4
2041	8.70	7.09	0.69	9.39	9.27	2,183,794	2,153,633	(30,161)	(4,946)	99.2	99.4	1,427.6	948.6
2042	6.44	4.76	0.69	7.13	7.00	1,694,905	1,663,329	(31,576)	(4,817)	99.5	99.8	922.8	366.0
2043	4.71	2.94	0.69	5.40	5.25	1,313,287	1,274,725	(38,563)	(5,472)	99.6	99.9	740.0	100.8
2044	3.34	1.48	0.69	4.19	4.19	1,044,083	1,042,003	(2,080)	(275)	99.6	100.0	795.6	20.9
2045	4.13	2.20	0.69	4.82	4.62	1,232,725	1,180,580	(52,144)	(6,403)	99.6	100.1	653.2	(221.1)
2046	4.03	2.01	0.69	4.72	4.48	1,241,416	1,177,412	(64,003)	(7,311)	99.7	100.3	490.4	(490.4)
2047	3.66	1.18	0.69	4.35	3.70	1,178,756	1,000,787	(177,969)	(18,910)	99.8	100.4	379.5	(603.4)
2048	3.50	0.94	0.69	4.19	3.50	1,171,794	976,955	(194,840)	(19,258)	99.9	100.4	274.2	(701.0)
2049	3.39	0.78	0.69	4.08	3.37	1,179,607	973,480	(206,127)	(18,952)	99.9	100.5	174.0	(790.2)
				Total:		$ 141,683,205	$ 140,874,294	$ (808,911)	$ (45,249)				

This is an attachment to Buck's October 7, 2016 cost note on the Amendments. Please refer to that cost note for more information.

TABLE 1 A
Pennsylvania Public School Employees' Retirement System
Projection of Contribution Rates and Funded Ratios As of June 30, 2015
PSERS (Current) vs. the Amendments
Determination of the Amendments Section 8328(j) Additional Unfunded Accrued Liability Employer Contribution Rate

Fiscal Year Ending June	Appropriation Payroll (thousands)			Fiscal Year Market Rate of Return	Pension Rate Floor		Employee Contribution Rate		Employer Normal Cost Rate			Employer Unfunded Liability Rate	
	Current	Amendments: DB Plan	Amendments: Members Enrolled in DC		Current	Amendments DB	Current	Amendments DB	Current	Amendments DB	Amendments DC	Current	Amendments DB - w/o Reflecting 8328(j)
2014	$ 13,720,000	$ 13,720,000		14.91 %	4.00 %	4.00 %	7.43 %	7.43 %	8.57 %	8.57 %		15.25 %	15.25 %
2015	13,482,000	13,482,000		3.04	4.00	4.00	7.46	7.46	8.46	8.46		17.51	17.51
2016	13,375,000	13,375,000		7.50	4.00	4.00	7.49	7.49	8.38	8.38		19.44	19.44
2017	**13,549,000**	**13,549,000**		7.50	8.31	8.31	**7.52**	**7.52**	**8.31**	**8.31**		**20.89**	**20.89**
2018	13,658,010	13,658,010		7.50	8.14	8.14	7.52	7.52	8.14	8.14		23.07	23.07
2019	14,012,675	14,012,675	$ 553,562	7.50	7.98	7.98	7.52	7.52	7.98	7.98	0.08 %	24.47	24.47
2020	14,385,408	14,385,408	1,098,647	7.50	7.81	7.81	7.53	7.53	7.81	7.81	0.15	25.59	25.59
2021	14,775,522	14,775,522	1,653,267	7.50	7.66	7.56	7.53	7.43	7.66	7.56	0.22	25.06	25.06
2022	15,181,732	15,181,732	2,221,156	7.50	7.51	7.32	7.53	7.34	7.51	7.32	0.29	25.23	25.23
2023	15,592,952	15,592,952	2,786,752	7.50	7.36	7.08	7.53	7.25	7.36	7.08	0.36	25.63	25.63
2024	16,006,876	16,006,876	3,350,939	7.50	7.21	6.85	7.53	7.16	7.21	6.85	0.42	25.89	25.89
2025	16,425,303	16,425,628	3,911,373	7.50	7.06	6.61	7.53	7.08	7.06	6.61	0.48	26.16	26.16
2026	16,849,867	16,850,289	4,500,113	7.50	6.90	6.37	7.53	7.01	6.90	6.37	0.53	26.56	26.56
2027	17,269,991	17,270,517	5,114,389	7.50	6.74	6.14	7.53	6.93	6.74	6.14	0.59	26.87	26.87
2028	17,684,009	17,684,642	5,755,266	7.50	6.56	5.89	7.54	6.86	6.56	5.89	0.65	27.19	27.19
2029	18,092,525	18,093,258	6,424,584	7.50	6.40	5.64	7.54	6.78	6.40	5.64	0.71	27.52	27.52
2030	18,496,390	18,496,579	7,123,252	7.50	6.22	5.39	7.54	6.70	6.22	5.39	0.77	27.88	27.88
2031	18,901,232	18,900,351	7,853,568	7.50	6.04	5.13	7.54	6.63	6.04	5.13	0.83	28.25	28.25
2032	19,306,605	19,304,611	8,620,783	7.50	5.86	4.86	7.54	6.55	5.86	4.86	0.89	28.64	28.64
2033	19,711,447	19,708,283	9,422,806	7.50	5.67	4.59	7.54	6.47	5.67	4.59	0.96	29.04	29.05
2034	20,119,213	20,114,839	10,262,186	7.50	5.48	4.32	7.54	6.38	5.48	4.32	1.02	29.46	29.46
2035	20,534,465	20,528,477	11,141,760	7.50	5.28	4.04	7.54	6.30	5.28	4.04	1.09	29.88	29.89
2036	20,959,917	20,952,030	12,062,615	7.50	5.08	3.76	7.54	6.21	5.08	3.76	1.15	14.66	14.66
2037	21,392,675	21,382,786	13,022,898	7.50	4.87	3.46	7.54	6.13	4.87	3.46	1.22	10.91	10.91
2038	21,836,128	21,824,111	14,023,912	7.50	4.67	3.17	7.54	6.04	4.67	3.17	1.29	9.28	9.28
2039	22,293,310	22,279,261	15,069,630	7.50	4.46	2.88	7.54	5.95	4.46	2.88	1.35	7.41	7.41
2040	22,765,638	22,749,093	16,159,571	7.50	4.26	2.58	7.54	5.86	4.26	2.58	1.42	5.95	5.95
2041	23,256,592	23,237,205	17,288,901	7.50	4.05	2.30	7.54	5.77	4.05	2.30	1.49	4.65	4.66
2042	23,771,462	23,749,077	18,450,228	7.50	3.86	2.01	7.54	5.68	3.86	2.01	1.55	2.58	2.58
2043	24,320,134	24,294,539	19,641,644	7.50	3.67	1.74	7.54	5.59	3.67	1.74	1.62	1.04	1.04
2044	24,918,450	24,889,555	20,863,737	7.50	3.50	1.49	7.54	5.51	3.50	1.49	1.68	(0.16)	(0.16)
2045	25,575,198	25,542,858	22,119,591	7.50	3.34	1.26	7.54	5.43	3.34	1.26	1.73	0.79	0.79
2046	26,301,180	26,265,168	23,412,637	7.50	3.22	1.06	7.53	5.36	3.22	1.06	1.78	0.81	0.81
2047	27,097,844	27,057,826	24,740,301	7.50	3.11	0.90	7.53	5.29	3.11	0.90	1.83	0.55	0.55
2048	27,966,454	27,922,071	26,091,240	7.50	3.02	0.75	7.53	5.24	3.02	0.75	1.87	0.48	0.48
2049	28,911,941	28,862,967	27,459,711	7.50	2.97	0.65	7.52	5.18	2.97	0.65	1.90	0.42	0.42

Fiscal Year Ending June	Preliminary Employer Pension Rate		Health Care Contribution	Total Employer Contribution Rate		Total Employer Contribution (thousands)				Funded Ratio (Actuarial Value of Assets basis)		Unfunded Accrued Liability (Actuarial Value of Assets basis and in millions)		Amendments - Section 8328(j) Additional Employer Unfunded Accrued Liability Rate
	Current	Amendments DB		Current	Amendments DB + DC	Current	HB 1499 DB + DC	Cost/(Savings): Cash Flow Basis	Cost/(Savings): Present Value as of June 30, 2016	Current	Amendments DB	Current	Amendments DB	
2014	23.82 %	23.82 %	0.93 %	16.93 %	16.93 %					62.0 %	62.0 %	$ 35,121.2	$ 35,121.2	
2015	25.97	25.97	0.90	21.40	21.40					**60.6**	**60.6**	**37,335.8**	**37,335.8**	
2016	27.82	27.82	0.84	25.84	25.84	$ 3,456,100	$ 3,456,100	$ 0	$ 0	58.2	58.2	40,620.5	40,621.0	
2017	**29.20**	**29.20**	**0.83**	**30.03**	**30.03**	**4,068,765**	**4,068,765**	**0**	**0**	56.8	56.8	43,159.9	43,160.4	
2018	31.21	31.21	0.83	32.04	32.04	4,376,026	4,376,026	0	0	56.1	56.1	45,087.7	45,088.2	
2019	32.45	32.45	0.82	33.27	33.35	4,662,017	4,673,088	11,071	8,912	58.6	58.6	43,551.4	43,551.9	0.00 %
2020	33.40	33.40	0.80	34.20	34.35	4,919,810	4,941,782	21,973	16,453	60.1	60.1	43,104.1	43,104.6	0.00
2021	32.72	32.62	0.79	33.51	33.63	4,951,277	4,969,567	18,290	12,740	61.2	61.2	43,070.0	43,070.4	0.00
2022	32.74	32.55	0.77	33.51	33.61	5,087,398	5,102,976	15,578	10,094	62.6	62.5	42,587.3	42,587.6	0.00
2023	32.99	32.71	0.76	33.75	33.83	5,262,621	5,274,696	12,075	7,278	64.1	64.1	41,893.2	41,893.5	0.00
2024	33.10	32.74	0.74	33.84	33.90	5,416,727	5,426,121	9,394	5,267	65.5	65.4	41,290.2	41,290.4	0.00
2025	33.22	32.77	0.72	33.94	33.97	5,574,748	5,579,170	4,422	2,307	67.3	67.1	40,199.8	40,200.0	0.00
2026	33.46	32.93	0.72	34.18	34.18	5,759,285	5,760,125	840	408	69.2	69.0	38,808.0	38,808.1	0.00
2027	33.61	33.01	0.69	34.30	34.29	5,923,607	5,922,452	(1,155)	(521)	71.2	71.0	37,123.3	37,123.3	0.01
2028	33.75	33.08	0.69	34.44	34.42	6,090,373	6,087,209	(3,164)	(1,328)	73.4	73.1	35,136.3	35,136.3	0.02
2029	33.92	33.16	0.69	34.61	34.56	6,261,823	6,253,060	(8,763)	(3,423)	75.7	75.4	32,832.9	32,832.9	0.05
2030	34.10	33.27	0.69	34.79	34.73	6,434,894	6,423,903	(10,991)	(3,993)	78.2	77.9	30,172.9	30,172.9	0.06
2031	34.29	33.38	0.69	34.98	34.90	6,611,651	6,596,421	(15,230)	(5,147)	80.8	80.5	27,122.1	27,122.1	0.08
2032	34.50	33.50	0.69	35.19	35.08	6,793,994	6,772,662	(21,332)	(6,707)	83.6	83.3	23,647.6	23,647.6	0.11
2033	34.71	33.64	0.69	35.40	35.29	6,977,852	6,954,310	(23,543)	(6,885)	86.6	86.3	19,712.1	19,712.1	0.11
2034	34.94	33.78	0.69	35.63	35.49	7,168,476	7,138,829	(29,647)	(8,065)	89.8	89.6	15,274.8	15,274.8	0.14
2035	35.16	33.93	0.69	35.85	35.71	7,361,606	7,329,794	(31,812)	(8,051)	93.3	93.1	10,293.8	10,293.8	0.14
2036	19.74	18.42	0.69	20.43	20.26	4,282,111	4,245,185	(36,926)	(8,693)	94.9	94.7	8,000.0	8,000.0	0.17
2037	15.78	14.37	0.69	16.47	16.28	3,523,374	3,480,706	(42,668)	(9,344)	96.1	95.9	6,272.1	6,272.1	0.19
2038	13.95	12.45	0.69	14.64	14.43	3,196,809	3,148,166	(48,643)	(9,909)	97.1	96.9	4,721.2	4,721.2	0.21
2039	11.87	10.29	0.69	12.56	12.33	2,800,040	2,747,655	(52,384)	(9,927)	97.9	97.8	3,426.6	3,426.6	0.23
2040	10.21	8.53	0.69	10.90	10.64	2,481,455	2,420,658	(60,797)	(10,717)	98.6	98.5	2,332.7	2,332.7	0.26
2041	8.70	6.96	0.69	9.39	9.14	2,183,794	2,123,424	(60,370)	(9,899)	99.2	99.1	1,427.6	1,427.6	0.25
2042	6.44	4.59	0.69	7.13	6.83	1,694,905	1,622,956	(71,949)	(10,975)	99.5	99.4	922.8	922.8	0.30
2043	4.71	2.78	0.69	5.40	5.09	1,313,287	1,235,853	(77,434)	(10,988)	99.6	99.5	740.0	740.0	0.31
2044	3.34	1.33	0.69	4.19	3.86	1,044,083	959,867	(84,216)	(11,116)	99.6	99.5	795.6	795.6	0.33
2045	4.13	2.05	0.69	4.82	4.47	1,232,725	1,142,266	(90,458)	(11,107)	99.6	99.6	653.2	653.2	0.35
2046	4.03	1.87	0.69	4.72	4.34	1,241,416	1,140,641	(100,775)	(11,511)	99.7	99.7	490.4	490.5	0.38
2047	3.66	1.45	0.69	4.35	3.97	1,178,756	1,073,843	(104,913)	(11,147)	99.8	99.8	379.5	379.5	0.38
2048	3.50	1.23	0.69	4.19	3.79	1,171,794	1,057,929	(113,866)	(11,254)	99.9	99.8	274.2	274.3	0.40
2049	3.39	1.07	0.69	4.08	3.66	1,179,607	1,057,182	(122,425)	(11,256)	99.9	99.9	174.0	174.0	0.42
				Total:		$ 141,683,205	$ 140,563,389	$ (1,119,816)	$ (128,505)					

This is an attachment to Buck's October 7, 2016 cost note on the Amendments. Please refer to that cost note for more information.

Table 2

Pennsylvania Public School Employees' Retirement System

A. Cost/(Savings) Allocation of Table 1 - Total Potential Projected Cost/(Savings) Due to the Amendments

	Amounts in millions*	
	Cash Flow Basis	Present Value As of June 30, 2016
Amendments Benefit Reforms		
Employees who first become a member on or after July 1, 2018	$ (1,124)	$ (130)
Class TE/TF cost neutral option 4	4	1
Total Cost/(Savings)	$ (1,120)	$ (129)
Amendments Funding Reforms (application of reform savings towards UAL)	$ 311	$ 84
Total Amendments Cost/(Savings)	$ (809)	$ (45)
Total Amendments Cost/(Savings) as a Percent of the Total 34-Year Employer Contributions to be Made Under the Current PSERS Plan and Funding Provisions	(0.57%)	
Cost due to shift from Defined Benefit to Defined Contribution	**	**

* Estimated cost/(savings) are presented on two bases: a cash flow basis and a present value basis. Cost/(savings) shown on a cash flow basis are the sums of the dollar amounts of (reductions)/increases in the projected contributions the employers would have to make in future years if the proposed changes in System provisions are enacted. The calculation of cost/(savings) on this basis makes no distinction between a dollar of projected cost/(savings) in one future year and a dollar of cost/(savings) in some other year in the nearer or more distant future. The calculation of cost/(savings) on a present value basis, on the other hand, involves discounting projected reductions in contributions from the times they are expected to occur to June 30, 2015, at a rate of 7.50% (the assumed interest rate presently used in the annual actuarial valuations of the System) to reflect the time value of money. It is useful to compare cost/(savings) measured on a present value basis with those measured on a cash flow basis because a dollar of cost/(savings) in future years has a lower value in today's dollars than a dollar that must be paid today.

** Please refer to Item 1 on page 7 of the cost note. This cost note does not include an analysis of the potential costs to the System due to the shift of assets and liabilities from the defined benefit plan to a defined contribution plan.

B. Investment Risk-Sharing Analysis assuming a 6.5% annual investment return

	$ Millions
a. Reduction in cumulative Employer contributions due to the Amendments assuming a 6.50% return (see Exhibit V)	$ (895)
b. Cumulative Employer cost/(savings) under the Amendments assuming a 7.50% return (see Table 1)	(809)
c. Net reduction in cumulative Employer contributions due to Class T-G/T-H/DC only members' DB/DC plan design = a - b	$ (86)
Net reduction in cumulative Employer contributions due to the Amendments assuming a 6.50% return as a Percent of the total 34-Year Employer Contributions to be Made Under the Current PSERS Plan and Funding Provisions	(0.06%)

The effect of a 6.50% return on System assets results in insignificant changes to employer contributions when compared to total employer contributions over the examination period.

The net reduction in cumulative Employer contributions due to the Amendments plan design reflects the following reduction in expected Class T-G and Class T-H risk share contributions due to the shift of some members electing the DC plan only alternative.

Cumulative member risk-share contributions - reduction due to the Amendments assuming a 6.50% return (see Exhibit V A)	$ 285

This is an attachment to Buck's October 7, 2016 cost note on the Amendments. Please refer to that cost note for more information.

Table 3 A

Pennsylvania Public School Employees' Retirement System

Comparison of Annual Benefits

PSERS Class T-E members vs. T-H Member Under Hybrid DB Design: 1.00% accrual, 4.50% member contribution Plus DC Plan: 2.00% employer contribution, 3.00% member contribution

Employee	A	B	C	D	E	F	G		H
Service at Termination	20	20	20	35	35	35	35		35
Age at Hire	45	45	45	30	30	30	22		32
Age at Termination	65	65	65	65	65	65	57		67
Retirement Age	65	65	65	65	65	65	57		67
Salary at Termination	$ 50,000	$ 70,000	$ 90,000	$ 50,000	$ 70,000	$ 90,000	$ 70,000		$ 70,000
For Ages	65 and after	65 and after	65 and after	65 and after	65 and after	65 and after	57 through 61	62 and after	67 and after
PSERS Benefit	$ 19,286	$ 27,000	$ 34,714	$ 33,750	$ 47,250	$ 60,750	$ 47,236	$ 47,236	Not determined
Side by Side Hybrid Proposal: DB	$ 8,745	$ 12,242	$ 15,740	$ 15,303	$ 21,424	$ 27,545	$ 0	$ 19,338	$ 22,792
Side by Side Hybrid Proposal: DC	3,756	5,258	6,761	7,136	9,991	12,845	7,088	7,088	10,863
Side by Side Hybrid Proposal: Total	$ 12,501	$ 17,500	$ 22,501	$ 22,439	$ 31,415	$ 40,390	$ 7,088	$ 26,426	$ 33,655
Side by Side Hybrid Proposal / PSERS Benefit	65%	65%	65%	66%	66%	66%	15%	56%	Not determined

Note: For Employee G, benefit under Hybrid DB plan can not commence prior to age 62.

Hybrid Design

Defined Benefit Design

Benefit Accrual Rate	**1.00%**
Member DB Contribution	**4.50%**
Final Average Salary	**5 years**
Vesting	**5 years**
Cost Neutral Option 4	**Yes**
Superannuation	**Age 67 with 3 years of service**
Earliest commencment age	**62**

Defined Contribution Design

Participant DC Contribution	**3.00%**
Employer DC Contributions	**2.00%**
Assumed Rate of Return	**6.00%**
Assumed Conversion Rate	**3.00%**
Mortality Table for Conversion	**RP-2014 White Collar (75% female, 25% male)**

This is an attachment to Buck's October 7, 2016 cost note on the Amendments. Please refer to that cost note for more information.

Table 3 B

Pennsylvania Public School Employees' Retirement System

Comparison of Annual Benefits

PSERS Class T-E members vs. T-G Member Under Hybrid DB Design: 1.25% accrual, 5.50% member contribution Plus DC Plan: 2.00% employer contribution, 3.00% member contribution

Employee	A	B	C	D	E	F	G		H
Service at Termination	20	20	20	35	35	35	35		35
Age at Hire	45	45	45	30	30	30	22		32
Age at Termination	65	65	65	65	65	65	57		67
Retirement Age	65	65	65	65	65	65	57		67
Salary at Termination	$ 50,000	$ 70,000	$ 90,000	$ 50,000	$ 70,000	$ 90,000	$ 70,000		$ 70,000
For Ages	65 and after	65 and after	65 and after	65 and after	65 and after	65 and after	57 through 61	62 and after	67 and after
PSERS Benefit	$ 19,286	$ 27,000	$ 34,714	$ 33,750	$ 47,250	$ 60,750	$ 47,236	$ 47,236	Not determined
Side by Side Hybrid Proposal: DB	$ 10,931	$ 15,303	$ 19,675	$ 19,129	$ 26,780	$ 34,432	$ 0	$ 24,173	$ 28,490
Side by Side Hybrid Proposal: DC	3,756	5,258	6,761	7,136	9,991	12,845	7,088	7,088	10,863
Side by Side Hybrid Proposal: Total	$ 14,687	$ 20,561	$ 26,436	$ 26,265	$ 36,771	$ 47,277	$ 7,088	$ 31,261	$ 39,353
Side by Side Hybrid Proposal / PSERS Benefit	76%	76%	76%	78%	78%	78%	15%	66%	Not determined

Note: For Employee G, benefit under Hybrid DB plan can not commence prior to age 62.

Hybrid Design

Defined Benefit Design

Benefit Accrual Rate	**1.25%**
Member DB Contribution	**5.50%**
Final Average Salary	**5 years**
Vesting	**5 years**
Cost Neutral Option 4	**Yes**
Superannuation	**Age 67 with 3 years of service**
Earliest commencment age	**62**

Defined Contribution Design

Participant DC Contribution	**3.00%**
Employer DC Contributions	**2.00%**
Assumed Rate of Return	**6.00%**
Assumed Conversion Rate	**3.00%**
Mortality Table for Conversion	**RP-2014 White Collar (75% female, 25% male)**

This is an attachment to Buck's October 7, 2016 cost note on the Amendments. Please refer to that cost note for more information.

Table 3 C

Pennsylvania Public School Employees' Retirement System

Comparison of Annual Benefits

PSERS Class T-E members vs. DC Participant: 2.00% employer contribution, 7.50% member contribution

Employee	A	B	C	D	E	F	G	H
Service at Termination	20	20	20	35	35	35	35	35
Age at Hire	45	45	45	30	30	30	22	32
Age at Termination	65	65	65	65	65	65	57	67
Retirement Age	65	65	65	65	65	65	57	67
Salary at Termination	$ 50,000	$ 70,000	$ 90,000	$ 50,000	$ 70,000	$ 90,000	$ 70,000	$ 70,000
PSERS Benefit	$ 19,286	$ 27,000	$ 34,714	$ 33,750	$ 47,250	$ 60,750	$ 47,236	Not determined
DC Plan Proposal	$ 7,136	$ 9,991	$ 12,845	$ 13,559	$ 24,406	$ 14,176	$ 13,467	$ 20,641
Side by Side Hybrid Proposal / PSERS Benefit	37%	37%	37%	40%	40%	30%	29%	Not determined

DC Plan Only Design

Defined Benefit Design

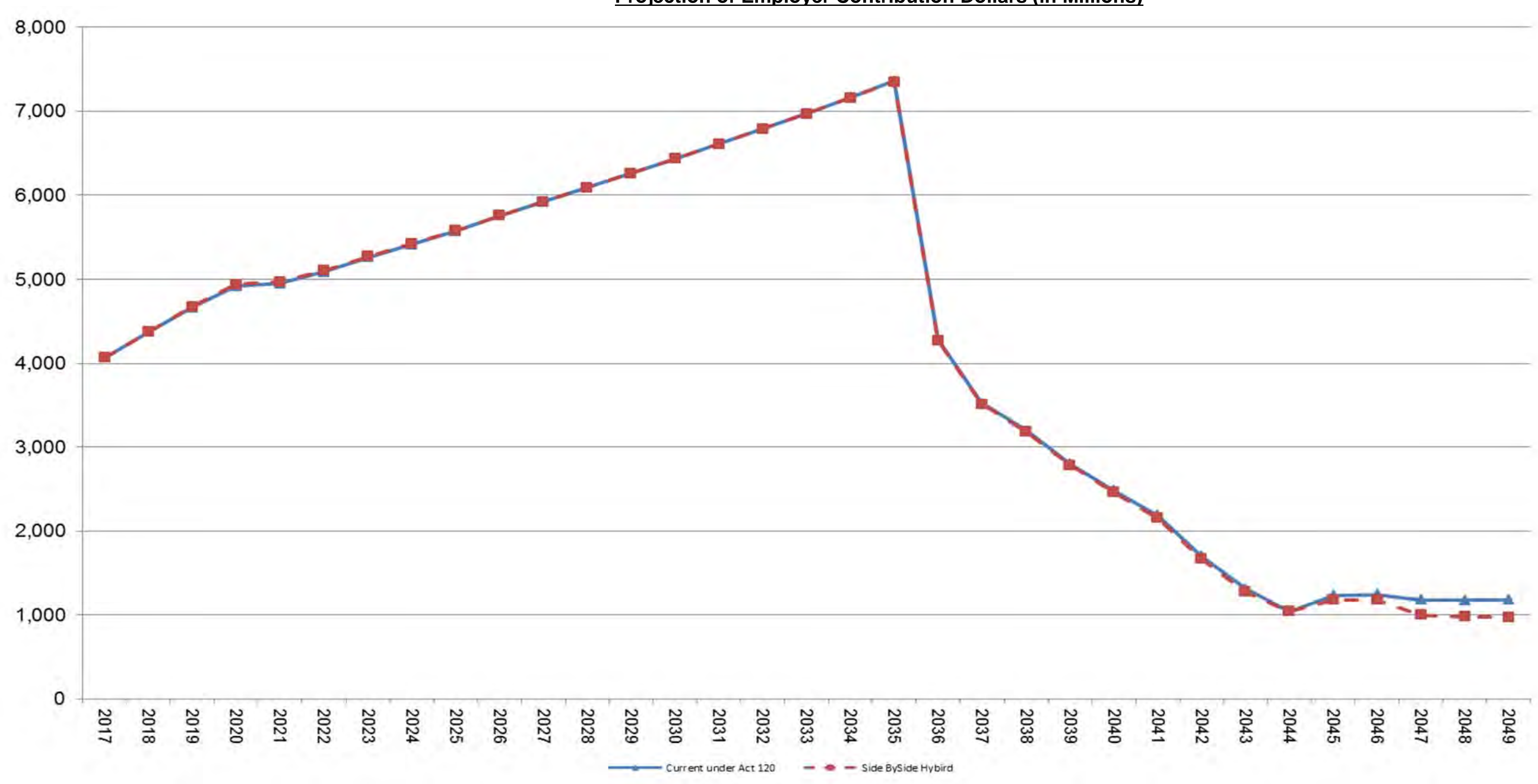
Benefit Accrual Rate	**N/A**
Member DB Contribution	**N/A**
Final Average Salary	**N/A**
Vesting	**N/A**
Cost Neutral Option 4	**N/A**
Superannuation	**N/A**
Earliest commencment age	**N/A**

Defined Contribution Design

Participant DC Contribution	**7.50%**
Employer DC Contributions	**2.00%**
Assumed Rate of Return	**6.00%**
Assumed Conversion Rate	**3.00%**
Mortality Table for Conversion	**RP-2014 White Collar (75% female, 25% male)**

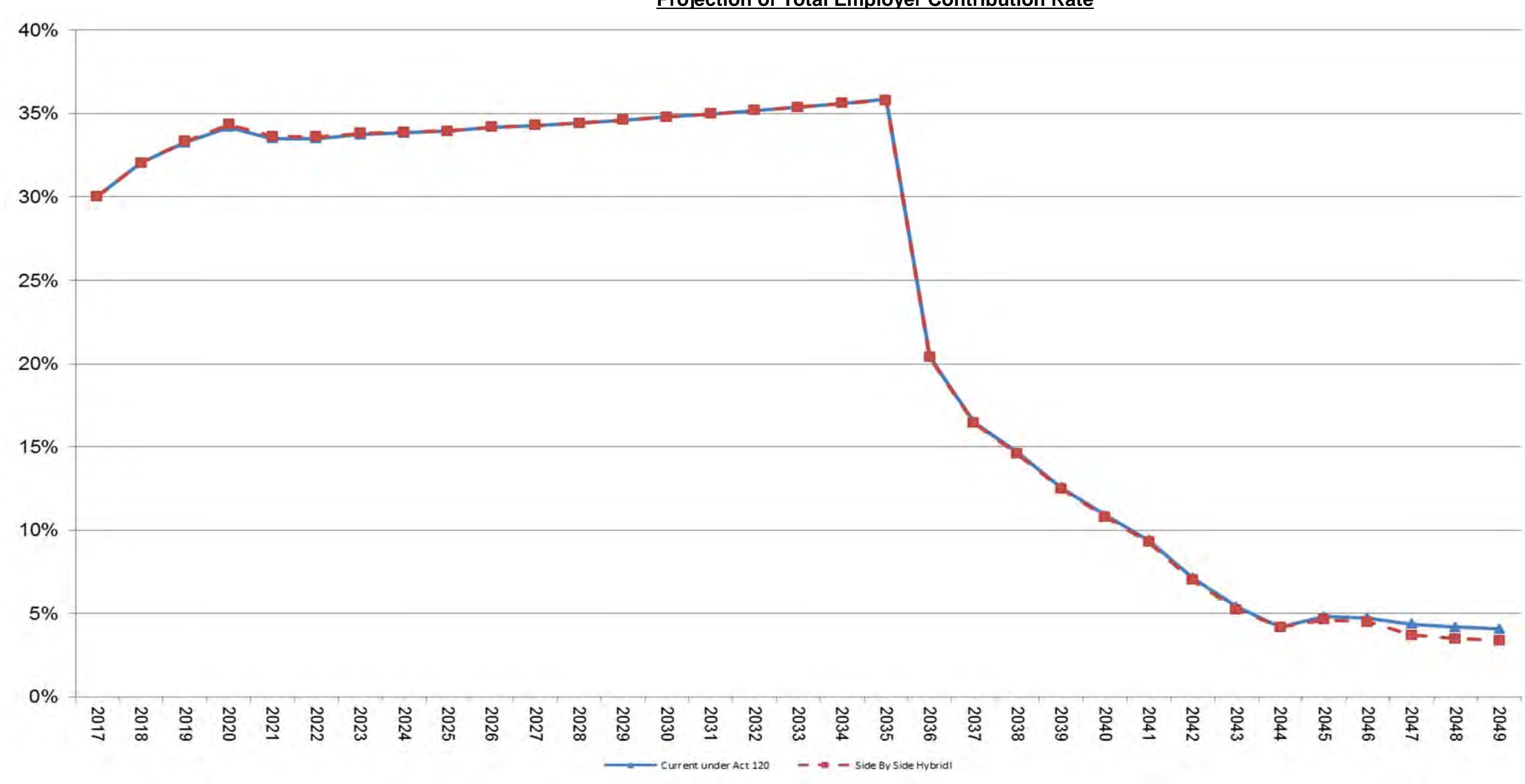
This is an attachment to Buck's October 7, 2016 cost note on the Amendments. Please refer to that cost note for more information.

EXHIBIT I
Pennsylvania Public School Employees' Retirement System
PSERS (Current) vs. the Amendments



This is an attachment to Buck's October 7, 2016 cost note on the Amendments. Please refer to that cost note for more information.

EXHIBIT II
Pennsylvania Public School Employees' Retirement System
PSERS (Current) vs. the Amendments



This is an attachment to Buck's October 7, 2016 cost note on the Amendments. Please refer to that cost note for more information.

EXHIBIT III
Pennsylvania Public School Employees' Retirement System
PSERS (Current) vs. the Amendments

Projection of Unfunded Liability (Actuarial Value of Assets basis and in millions)

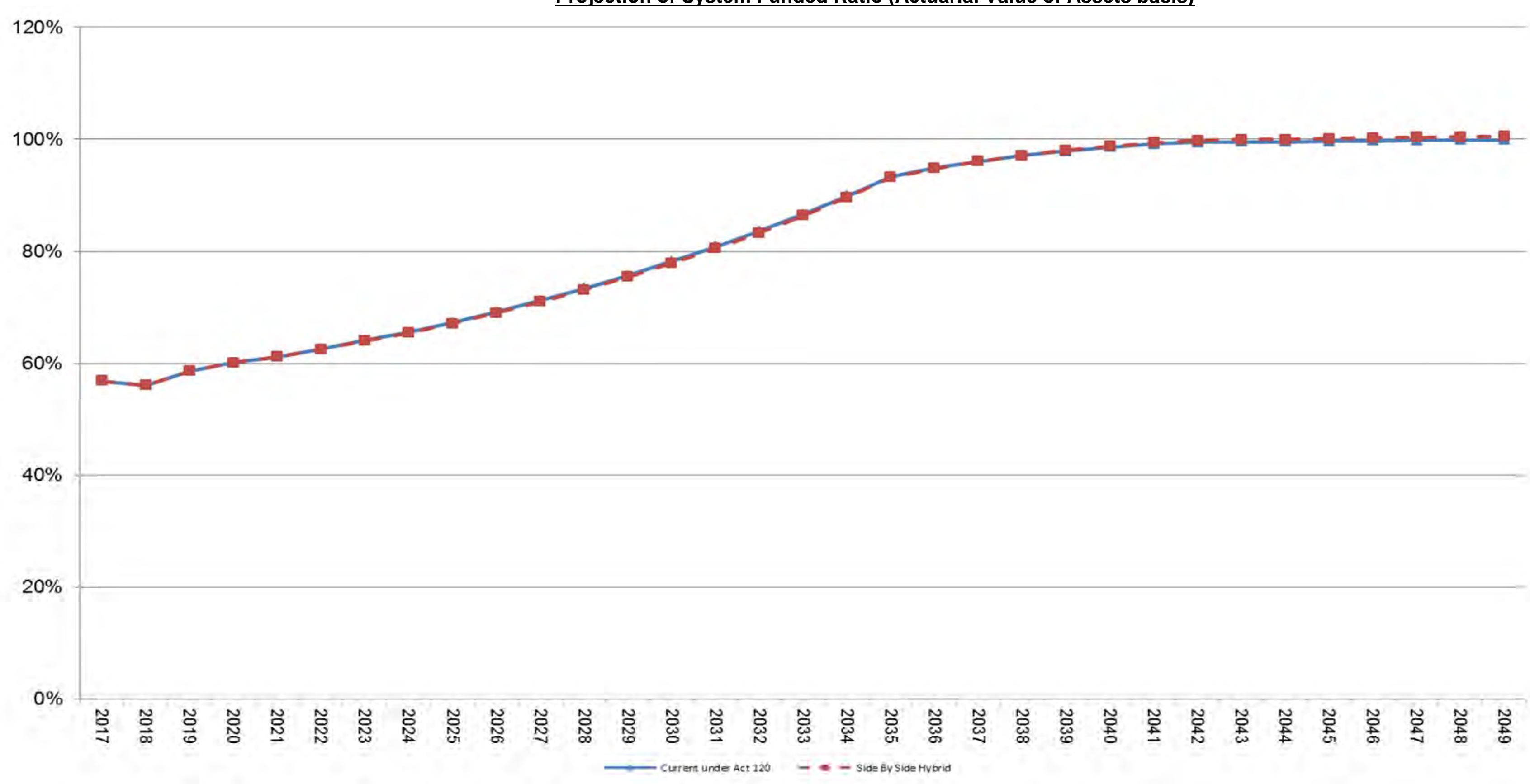
50,000
40,000
30,000
20,000
10,000
0
-10,000

2017 2018 2019 2020 2021 2022 2023 2024 2025 2026 2027 2028 2029 2030 2031 2032 2033 2034 2035 2036 2037 2038 2039 2040 2041 2042 2043 2044 2045 2046 2047 2048 2049

Current under Act 120 — Side By Side Hybrid

This is an attachment to Buck's October 7, 2016 cost note on the Amendments. Please refer to that cost note for more information.

EXHIBIT IV
Pennsylvania Public School Employees' Retirement System
PSERS (Current) vs. the Amendments



This is an attachment to Buck's October 7, 2016 cost note on the Amendments. Please refer to that cost note for more information.

Exhibit V A
Pennsylvania Public School Employees' Retirement System
PSERS (Current) vs. the Amendments
Additional Member and Employer Contributions Assuming a 6.50% Investment Return (1.00% below the assumed annual discount rate)

Fiscal Year	(x1,000) Current Plan Employer Contributions @ 6.5%	(x1,000) Amendments Employer Contributions @6.5% return	(x1,000) Total Additional Employer Contributions	(x1,000) Additional T-E/T-F Act 120 Member Risk Share Contributions	(x1,000) Additional T-E/T-F/T-G Amendments Member Risk Share Contributions	(x1,000) Total Additional Member Contributions
2016	$ 3,456,100	$ 3,456,100	$ -	$ -	$ -	$ -
2017	4,068,765	4,068,765	-	-	-	-
2018	4,380,124	4,380,124	-	-	-	-
2019	4,673,227	4,684,298	11,071	-	-	-
2020	4,944,265	4,966,238	21,973	-	-	-
2021	4,992,649	5,010,939	18,290	-	-	-
2022	5,151,162	5,166,739	15,577	-	-	-
2023	5,356,179	5,368,254	12,075	-	-	-
2024	5,546,383	5,555,777	9,394	-	-	-
2025	5,748,856	5,753,282	4,426	-	-	-
2026	5,986,758	5,987,603	845	-	-	-
2027	6,212,016	6,210,870	(1,146)	-	-	-
2028	6,444,053	6,444,439	386	35,758	34,577	(1,181)
2029	6,688,806	6,689,107	301	39,167	37,825	(1,342)
2030	6,937,996	6,938,108	112	42,732	41,217	(1,515)
2031	7,199,479	7,197,452	(2,027)	92,953	89,562	(3,391)
2032	7,469,725	7,467,628	(2,097)	100,811	97,041	(3,770)
2033	7,746,599	7,738,699	(7,900)	109,045	104,879	(4,166)
2034	8,035,614	8,029,916	(5,698)	176,490	169,617	(6,873)
2035	8,336,993	8,323,372	(13,621)	189,966	182,435	(7,531)
2036	5,367,835	5,353,548	(14,287)	203,994	195,772	(8,222)
2037	4,725,642	4,708,077	(17,565)	291,475	279,545	(11,930)
2038	4,524,446	4,501,261	(23,185)	311,716	298,774	(12,942)
2039	4,255,793	4,229,226	(26,567)	332,603	318,610	(13,993)
2040	4,072,773	4,038,118	(34,655)	354,110	339,012	(15,098)
2041	3,921,061	3,875,509	(45,552)	376,191	359,936	(16,255)
2042	3,577,605	3,525,257	(52,348)	398,855	381,392	(17,463)
2043	3,339,154	3,276,595	(62,559)	422,124	403,408	(18,716)
2044	3,169,627	3,095,391	(74,236)	445,872	425,867	(20,005)
2045	3,537,050	3,451,340	(85,710)	469,970	448,642	(21,328)
2046	3,679,535	3,578,049	(101,486)	494,205	471,516	(22,689)
2047	3,742,212	3,622,691	(119,521)	518,319	494,227	(24,092)
2048	3,853,777	3,716,110	(137,667)	542,367	516,826	(25,541)
2049	3,972,501	3,810,709	(161,792)	566,090	539,060	(27,030)
Total	**$ 175,114,760**	**$ 174,219,591**	**$ (895,169)**	**$ 6,514,813**	**$ 6,229,740**	**$ (285,073)**

Note:

	x $1,000
a. Cumulative Employer contributions under the Amendments assuming a 6.50% return	$ 174,219,591
b. Cumulative Employer contributions under the current PSERS plan assuming a 6.50% return	175,114,760
c. Reduction in cumulative Employer contributions due to the Amendments assuming a 6.50% return = a - b	$ (895,169)
d. Cumulative Employer cost/(savings) under the Amendments assuming a 7.50% return = Table 1	(808,911)
e. Net reduction in cumulative Employer contributions due to Class T-G/T-H/DC only members' DB/DC plan design = c - d	$ (86,258)

This is an attachment to Buck's October 7, 2016 cost note on the Amendments. Please refer to that cost note for more information.

Exhibit V B
Pennsylvania Public School Employees' Retirement System
PSERS (Current) vs. the Amendments
Additional Member and Employer Contributions Assuming a 8.50% Investment Return (1.00% above the assumed annual discount rate)

Fiscal Year	(x1,000) Current Plan Employer Contributions @ 8.5%	(x1,000) Amendments Employer Contributions @8.5% return	(x1,000) Total Additional Employer Contributions	(x1,000) Additional T-E/T-F Act 120 Member Risk Share Contributions	(x1,000) Additional T-E/T-F/T-G Amendments Member Risk Share Contributions	(x1,000) Total Additional Member Contributions
2016	$ 3,456,100	$ 3,456,100	$ -	$ -	$ -	$ -
2017	4,068,765	4,068,765	-	-	-	-
2018	4,373,295	4,373,295	-	-	-	-
2019	4,650,807	4,661,878	11,071	-	-	-
2020	4,895,354	4,918,766	23,412	-	-	-
2021	4,909,906	4,928,196	18,290	-	-	-
2022	5,020,599	5,037,695	17,096	-	-	-
2023	5,164,386	5,176,460	12,074	-	-	-
2024	5,280,668	5,290,062	9,394	-	-	-
2025	5,392,427	5,396,846	4,419	-	(25,736)	(25,736)
2026	5,521,701	5,522,535	834	-	(28,529)	(28,529)
2027	5,617,928	5,620,218	2,290	-	(31,476)	(31,476)
2028	5,711,935	5,715,831	3,896	-	(69,153)	(69,153)
2029	5,802,273	5,807,965	5,692	-	(75,650)	(75,650)
2030	5,883,702	5,896,751	13,049	-	(82,435)	(82,435)
2031	5,963,339	5,980,270	16,931	-	(134,343)	(134,343)
2032	6,037,175	6,060,322	23,147	-	(145,562)	(145,562)
2033	6,102,664	6,134,445	31,781	-	(157,318)	(157,318)
2034	6,164,527	6,209,523	44,996	-	(226,156)	(226,156)
2035	6,217,836	6,272,577	54,741	-	(243,247)	(243,247)
2036	2,988,884	3,063,491	74,607	-	(261,029)	(261,029)
2037	2,064,393	2,118,622	54,229	-	(279,545)	(279,545)
2038	1,561,283	1,631,391	70,108	-	(298,774)	(298,774)
2039	1,148,105	1,096,762	(51,343)	-	(318,610)	(318,610)
2040	1,126,899	1,067,087	(59,812)	-	(339,012)	(339,012)
2041	1,102,362	1,040,570	(61,792)	-	(359,936)	(359,936)
2042	1,081,602	1,010,230	(71,372)	-	(381,392)	(381,392)
2043	1,060,358	983,190	(77,168)	-	(403,408)	(403,408)
2044	1,044,083	959,867	(84,216)	-	(425,867)	(425,867)
2045	1,030,680	940,478	(90,202)	-	(448,642)	(448,642)
2046	1,028,376	927,893	(100,483)	-	(471,516)	(471,516)
2047	1,029,718	925,025	(104,693)	-	(494,227)	(494,227)
2048	1,037,555	923,903	(113,652)	-	(516,826)	(516,826)
2049	1,058,177	935,958	(122,219)	-	(539,060)	(539,060)
Total	**$ 124,597,862**	**$ 124,152,967**	**$ (444,895)**	**$ -**	**$ (6,757,449)**	**$ (6,757,449)**

Note:

		x $1,000
a. Cumulative Employer contributions under the Amendments assuming a 8.50% return	$	124,152,967
b. Cumulative Employer contributions under the current PSERS plan assuming a 8.50% return		124,597,862
c. Reduction in cumulative Employer contributions due to the Amendments assuming a 8.50% return = a - b	$	(444,895)
d. Cumulative Employer cost/(savings) under the Amendments assuming a 7.50% return = Table 1		(808,911)
e. Net reduction in cumulative Employer contributions due to Class T-G/T-H/DC only members' DB/DC plan design = c - d	$	364,016

This is an attachment to Buck's October 7, 2016 cost note on the Amendments. Please refer to that cost note for more information.

Actuarial Cost Note - Projected Impact of Three-Way Hybrid/DC Pension Design Proposed by Senator Browne

As requested, in connection with the new pension design proposed by Senator Browne, whereby most employees who first join SERS on or after January 1, 2018 would have the option to choose from among three alternative pension designs (the details of which are fully described herein), we have performed cost projections to approximate the impact on the future funding of the Pennsylvania State Employees' Retirement System (SERS) if this proposal were to become law. This proposal calls for most new hires after 2017 to choose either one of two hybrid defined benefit (DB)/defined contribution (DC) plan designs or a third design that is DC only, with no DB component. That is, under this proposed design (hereafter referred to as the "Three-Way Hybrid/DC Proposal"), most employees who join SERS on or after January 1, 2018 would no longer be covered by SERS' current DB only design, but rather, would be covered by the design of their choosing: either a hybrid DB/DC plan design or a DC only design, including key features as described in the pages that follow.

The Three-Way Hybrid/DC Proposal would not change any of the current SERS DB accrual or salary provisions for members of SERS who enter before January 1, 2018. However, effective January 1, 2018, significant changes would occur for most new entrants of both of Pennsylvania's statewide retirement systems. This note addresses only the changes applicable to SERS.

Exemption for Most Hazardous Duty Employees

Under this Three-Way Hybrid/DC Proposal, most hazardous duty employees (including Pennsylvania State Police, correction officers, enforcement officers and all other hazardous duty employees, other than psychiatric security aides) would be exempt from the provisions of the proposed new plan design. That is, hazardous duty members hired after 2017 would be exempt from the Three-Way Hybrid/DC Proposal provision that requires all post-2017 first-time hires to choose either a hybrid DB/DC plan design or a DC only design; rather, they would continue to become members of the current SERS DB system, subject to a slight modification in the current SERS DB provisions (further discussed later in this cost note) whereby the amount of voluntary overtime pay includable in retirement covered compensation would be limited.

References hereafter in this note to "all employees hired after the Three-Way Hybrid/DC plan start date" being subject to the proposed new provisions should be understood, if not specifically excepted, to exclude the exempt hazardous duty employees.

Summary

For those non-exempt employees hired after December 31, 2017, the Three-Way Hybrid/DC Proposal calls for implementation of a revised SERS Defined Benefit (DB) system and a new

SERS Defined Contribution (DC) plan. Descriptions of the key features of the Three-Way Hybrid/DC Proposal follow.

Benefit Provision Changes Applicable to Class A-3 & Class A-4 Members

Under the Three-Way Hybrid/DC Proposal there would be changes, effective January 1, 2018, to make an actuarially cost neutral Option 4 lump sum withdrawal (of member contributions and statutory interest) available to Class A-3 and Class A-4 members upon their retirement. This option is not currently available to A-3's and A-4's. For these two classes of members, the cost neutral Option 4 calculation would be applicable to all member contributions and statutory interest thereon, whether they occurred before or after the January 1, 2018 effective date. Note that this particular provision of the Three-Way Hybrid/DC Proposal has no cost consequences for SERS and thus, had no impact on the costs/savings results presented in this Cost Note and in the attachments.

Also for Class A-3 and Class A-4 members, for whom a new Shared-Risk provision became applicable under Act 120 (subjecting them to a potential increase in their employee contribution rate by as much as 2.0% in the event of under-performance of SERS investments), the Three-Way Hybrid/DC Proposal has introduced a new Shared-Gain provision that would become effective July 1, 2017. This Shared-Gain provision mirrors the Shared-Risk provision, in that it subjects these same classes of members to a potential decrease in their employee contribution rate by as much as 2%, in the event of over-performance of SERS investments. Given that the assumption used in our Three-Way Hybrid/DC Proposal cost analyses is that the SERS fund will consistently earn 7.5% annual investment returns in all years after December 31, 2015 (consistent with our current actuarial valuation assumptions), neither the Shared-Gain nor the Shared-Risk provisions have any cost implications of relevance for this Cost Note.

Transition to the Three-Way Hybrid/DC Design

The Three-Way Hybrid/DC Proposal would create (i) two new hybrid tiers of benefits and (ii) a stand-alone defined contribution (DC) plan. All non-exempt SERS employees who are first hired after December 31, 2017 would have the option to choose one of the two hybrid plans or the stand-alone DC plan. Because the hybrid plans include both DB and DC components, this means that, under the Three-Way Hybrid/DC Proposal, all non-exempt employees first hired after the hybrid/DC start date (January 1, 2018), become participants in a new Board administered DC plan, which would be separate from the SERS DB system. It is anticipated that each new DC plan participant (whether in the DC plan as a hybrid or stand-alone participant) would have established for him/her an individual investment account within a Board managed DC trust fund, which would be separate from the SERS DB fund.

The two new hybrid tiers of benefits would include:

- Class A-5, a DB hybrid benefit tier offering a 1.25% of final average pay annual benefit accrual (which would be the default option if a new hire made no election) and
- Class A-6, a DB hybrid benefit tier offering a 1.00% of final average pay annual benefit accrual.

These classes would be new tiers within the existent SERS DB system; the DB portion of the new hybrid structure would not be a separate plan and would not have a separate fund. Under this proposal, SERS would certainly not be closed to new members; SERS would remain open into the future to members who join the SERS DB system via the two new hybrid membership classes, A-5 and A-6. Additionally, the approximately 20 percent of new employees who will be exempt hazardous duty employees, will continue to be members of the SERS legacy DB classes of service. Note: Current SERS members (hired prior to 2018) would not have an option to leave their existing classes of service and join the hybrid plan.

Whereas some past pension reform proposals put forth by the Commonwealth legislature have mandated that all, or a high percentage of, future new entrants, no longer be covered by a DB system (thus calling for full or near closure of the SERS DB system), that is not the case under this Three-Way Hybrid/DC Proposal. Therefore, in our cost analyses relating to this proposal, Korn Ferry Hay Group does not consider it necessary or appropriate to factor in any future reduction(s) to the annual investment return assumption (of 7.50 percent) currently used for the funding of SERS.

Specifics of the Three-Way Hybrid/DC Proposed Design

This summarizes our understanding of the key features of this proposed hybrid/DC design:

1. Formula for Single Life Annuity at Superannuation for New Hybrid DB members:

   Option 1 = 1.25% X 5-Year Final Average Salary (including overtime) X Total Credited Service

   Option 2 = 1.00% X 5-Year Final Average Salary (including overtime) X Total Credited Service

   Option 3 = No DB accrual applies; this option provides a Stand-Alone DC Plan only

   Under Options 1 and 2, no “buy-up” to a higher benefit accrual rate would be available, as under Act 120. The Final Average Salary (FAS) would generally be calculated by averaging the five highest calendar years of compensation, including overtime pay as applicable.

2. Contribution Rates under Three-Way Hybrid/DC Proposed Design: See the tables that follow for a summary of the Three-Way Hybrid/DC proposed contribution rates, expressed as a percentage of payroll.

Option 1 (Default) Class A-5: Three-Way Hybrid Defined Benefit (DB)/ Defined Contribution (DC) Design With 1.25% of Final Average Pay Annual DB Accrual Mandatory Contribution Rates (As % of Payroll)	
Defined Benefit (DB)	
Employee	5.00%
Employer	Actuarially Determined
Defined Contribution (DC)	
Employee	3.50%
Employer	2.00%

Option 2 Class A-6: Three-Way Hybrid Defined Benefit (DB)/ Defined Contribution (DC) Design With 1.00% of Final Average Pay Annual DB Accrual Mandatory Contribution Rates (As % of Payroll)	
Defined Benefit (DB)	
Employee	4.00%
Employer	Actuarially Determined
Defined Contribution (DC)	
Employee	3.50%
Employer	2.00%

Option 3 Stand-Alone Defined Contribution (DC) Design Mandatory Contribution Rates (As % of Payroll)	
Defined Benefit (DB)	
Employee	Not Applicable
Employer	Not Applicable
Defined Contribution (DC)	
Employee	7.50%
Employer	3.50%

3. Hybrid DB Superannuation (i.e., Normal Retirement Age): Superannuation age is 67, with three years of service, for all members of the proposed Three-Way Hybrid DB System. Members would no longer be eligible for unreduced benefits at a younger superannuation age if he or she had met the “Rule of 92” and had at least 35 years of service.

4. Hybrid DB Early Retirement: Eligibility for early retirement is age 62 with 10 years of service. Benefit reductions for early commencement would be determined as follows:
   a. Based upon actuarial equivalent factors measured from superannuation age of 67 if service is less than 25 years or
   b. Reduced by ¼ percent per month for each month under superannuation age of 67 if service is 25 years or more.

5. Hybrid DB Vesting: 10-year cliff. Refund of accumulated deductions (member contributions + 4% statutory interest) would be available, upon non-vested termination.

6. Hybrid DB Disability and Death Benefits: Eligibility and benefits would generally be consistent with the Act 120 provisions applicable to members of the same class and category.

7. Hybrid DB Shared-Risk/Gain Provision: If DB fund investment returns are low/high relative to actuarial assumptions, hybrid DB members could be subject to higher/lower employee contribution rates, with the potential maximum deviation from the usual mandatory contribution rate being + or - 2% of pay. Projections attached to this note are based on an assumption that the target investment returns (of 7.5% annually) are earned in all future years; therefore, for purposes of this cost note, this provision would not impact future SERS costs.

8. Hybrid DB Option 4: Upon retirement, hybrid DB members will be eligible for an actuarially cost neutral Option 4 full withdrawal of their accumulated deductions.

9. Hybrid DC Vesting: 3-year cliff for employer contributions and related earnings/losses; immediate vesting for employee contributions and related earnings/losses.

10. Hybrid DC Disability and Death Benefits: Vested account balances would generally be available.

Prospective Change Applicable to New Exempt Employees (Hired After 2017)

This Three-Way Hybrid/DC Proposal also includes a change that would become effective January 1, 2018 to certain benefit provisions applicable to new exempt employees, who join SERS after the Three-Way Hybrid/DC plan start date, as follows:

Limitation on Voluntary Overtime Pay That May Be Included as DB Compensation for Exempt Employees Post-2017: In any pay period included in the post-2017 FAS calculation, the amount of voluntary overtime pay included may not exceed 10% of the base salary paid during that same period.

Changes to Current SERS Financing Provisions Under Three-Way Hybrid/DC Proposal

In accordance with our interpretation of the draft provisions of the Three-Way Hybrid/DC Proposal:

- This proposal calls for a change to occur, effective with the December 31, 2021 actuarial valuation, in the actuarial funding method being utilized for the determination of the SERS normal cost rate from the current funding method (a variation of the Entry-Age Actuarial Cost Method) to the traditional Entry-Age Actuarial Cost Method. The significant difference between the method currently used for SERS and the method proposed under the Three-Way Hybrid/DC Proposal (for valuations on and after December 31, 2021) is that the normal cost is currently based upon the benefits and contributions for the average new employee whereas, under the proposed method, the normal cost will be based upon the benefits and contributions for all covered employees from their date of entry.
- If the legislation resulting from this proposal causes there to be a change in the SERS unfunded accrued liability (UAL) (and it most certainly would), then under current law, that change in liability would be funded using a 10-year, level-dollar amortization. However, under this Three-Way Hybrid/DC Proposal, the change in UAL that would result if enacted would be amortized on a level-dollar basis over a longer period, namely 30 years.
- This proposed legislation includes a "plow-back" financing feature whereby, in order to accelerate the funding of SERS, in any future year in which there is projected to be savings as a result of this legislation, additional employer contributions equal to the amount of that annual savings would be assessed as a percentage of all DB and DC covered compensation. By "plowing back" into the SERS fund many years of projected savings, rather than using that savings to meet non-pension obligations, the funding of SERS is enhanced, in the form of an accelerated decline in the unfunded actuarial accrued liability and an accelerated increase in the SERS funded ratio. This is akin to making extra payments on a mortgage to accelerate pay off of the outstanding principal.

Estimated Initial Cost Impact of Three-Way Hybrid/DC Proposal on SERS DB System

If the Three-Way Hybrid/DC Proposal were to become law, we project that, effective in fiscal 2018/2019, the SERS employer normal cost rate, as a consequence of the less generous provisions of the Three-Way Hybrid DB design (relative to the current SERS DB design for Class A-3 members), would decline to an estimated 0.79% of payroll. Therefore, in conjunction with our projected December 31, 2017 actuarial valuation, approximately $2.3 billion of SERS liability, previously scheduled to be funded via future employer normal cost payments, would instead be funded via UAL amortization payments. The net effect of the higher UAL amortization funding pattern and the lower normal cost funding pattern (on a cash flow basis) over the following years of our projection is a savings, since the decrease in future normal cost payments is of greater magnitude than the increase in future UAL amortization payments over that period.

Under the Three-Way Hybrid/DC Proposal, the new traditional Entry-Age Actuarial Cost Method (as described in the first bullet above) would be implemented as a financing provision change effective with the December 31, 2021 actuarial valuation. Under this new method, the resulting normal cost rate for the projected December 31, 2021 active population (consisting of a smaller proportion of Class AA members and a larger proportion of Class A-3 members than exists today, as well about the same proportion of exempt hazardous duty employees and four years of new Class A-5/A-6 members) is 8.13% of payroll, a considerably higher rate than the 4.52% of payroll normal cost rate in fiscal 2016/2017. Therefore, in conjunction with our projected December 31, 2021 actuarial valuation, approximately $5 billion of SERS liability, previously scheduled to be funded via UAL amortization payments, would instead be funded via future employer normal cost payments. The net effect of the higher normal cost funding pattern and the lower UAL amortization funding pattern (on a cash flow basis) over the following years of our projection is a cost, since the increase in future normal cost payments is of greater magnitude than the decrease in future UAL amortization payments over that period.

It should be noted that (i) the increase in UAL projected to occur at the time of the December 31, 2017 valuation would cause the SERS funded status to decrease by about 2.7 percent and (ii) the decrease in UAL projected to occur at the time of the December 31, 2021 valuation would cause the SERS funded status to increase by about 6 percent. These changes are reflected (though somewhat masked by the impact of other changes) in our Three-Way Hybrid/DC Proposal funding projections attached to this note.

Projection of Future Costs Under the Three-Way Hybrid/DC Proposal

Starting with the census data, asset data and actuarial assumptions underlying our December 31, 2015 actuarial valuation (including an assumed investment return of 7.5 percent per year, compounded annually) and projecting our December 31, 2015 valuation results forward to December 31, 2017 and incorporating the new Hybrid DB plan designs outlined above for new hires on or after January 1, 2018 and incorporating the new Hybrid DC plan designs outlined above for new entrants to SERS on or after January 1, 2018 and incorporating the new stand-alone DC plan design outlined above for new entrants to SERS on or after January 1, 2018 and reflecting the two changes to the current SERS financing provisions as described in the second and third bullets above and implementing the new traditional Entry-Age Actuarial Cost Method for the December 31, 2021 and all subsequent actuarial valuations, Korn Ferry Hay Group has projected the future employer contributions required to fund SERS and the new DC plan in accordance with the Three-Way Hybrid/DC Proposal.

It is important to note that, in order to perform the cost projections described above, Korn Ferry Hay Group utilized an assumed set of election percentages which we predicted would result from the three pension design options available under this proposed legislation to employees first hired on or after January 1, 2018, as follows:

- 40% were assumed to elect Option 1: Hybrid DB/DC with 1.25% annual DB accrual
- 40% were assumed to elect Option 2: Hybrid DB/DC with 1.00% annual DB accrual
- 20% were assumed to elect Option 3: Stand-Alone DC Plan Only

Rather than predict, based upon new entrant characteristics, which Option (1, 2 or 3) each would likely elect, we applied the 40%/40%/20% assumption to each individual new entrant. By using this approach, we did not attempt to capture the impact of each new entrant electing the plan most beneficial to him/her individually, nor did we feel that this impact would materially affect our analysis results. While some new entrants may successfully "select against" the DB system and/or the DC plan thereby adding employer cost, others will make decisions that lower employer costs, and overall, we felt that employee decisions/behavior would not result in any significant net addition to employer costs.

As stated above, Option 1 is the default option, which would be assigned automatically if a first-time new hire made no election. Since the relative costs of Option 1 compared to the costs of the other two options do not differ significantly, we did not consider it necessary to assume any level of default election bias. The approximate total employer cost (expressed as a percentage of payroll) of Option 1 is 3.88%, of Option 2 is 3.70%, and of Option 3 is 3.50%

Schedules Attached to This Cost Note

We have attached to this note the results of our funding projections and other relevant cost information, as follows:

- **Three-Way Hybrid/DC Proposal Projection Results, Prior to Last Step: Plow-Back of Savings :** This one-page cost projection shows our projected annual funding of SERS if the Three-Way Hybrid/DC Proposal (including the benefit and contribution provisions described previously) were to be enacted, including the change in Unfunded Actuarial Liability (UAL) resulting from this proposal being amortized on a level dollar basis over 30 years and the revision to the traditional Entry-Age Actuarial Cost Method, including the (savings)/cost relative to baseline funding. Note that this table presents our projections of future SERS funding through fiscal year 2051/2052, all of which reflect the impact of the Three-Way Hybrid/DC Proposal.
- **Three-Way Hybrid/DC Proposal Projection Results, After Plow-Back of Savings :** This one-page cost projection shows our projected annual funding of SERS if the Three-Way Hybrid/DC Proposal (including the benefit and contribution provisions described previously) were to be enacted, including the change in Unfunded Actuarial Liability (UAL) resulting from this proposal being amortized on a level dollar basis over 30 years and the revision to the traditional Entry-Age Actuarial Cost Method, including the (savings)/cost relative to baseline funding. Last, we added the projected "plow-back" contributions in all years in which savings were projected to determine the somewhat lower net savings that results. Note that this table presents our projections of future SERS funding through fiscal year 2051/2052, all of which reflect the impact of the Three-Way Hybrid/DC Proposal.
- **Baseline Projection:** This table presents, for purposes of comparison, the results of our December 31, 2015 actuarial valuation and our projection of future funding through fiscal year 2051/2052, assuming no changes to any of the current SERS benefit provisions or financing methodologies.

Also attached is a Summary Table, which provides a breakdown of the long-term cumulative (savings)/cost by the key components of the proposal, including the estimated impact of a change to the traditional Entry-Age Actuarial Cost Method effective with the December 31, 2021 actuarial valuation (i.e., a revised normal cost approach) and the estimated impact of "plowing back" savings resulting from this proposal, as additional employer contributions to enhance the funding of SERS.

This Summary Table includes three columns of financial impact results, as follows:

- The left column is the cost/(savings) calculated on an undiscounted, cashflow basis;
- The middle column is the cost/(savings) calculated on a present value basis & discounted at a 7.5% annual interest rate and
- The right column is the cost/(savings) calculated on a present value basis & discounted at a 3.5% annual interest rate.

Our Cost Results in Brief

As shown in our attached cost projections for this proposed Three-Way Hybrid/DC design, if this proposal were to become law, we estimate that it would result in a cumulative cost/(savings) relative to our current plan baseline projected costs through the end of FY 2052, as follows:

	Cash Flow Basis
• Before "plow-back" of savings resulting from the proposal:	$(2,188.1) million
• After "plow-back" of savings to accelerate SERS funding:	$(2,099.6) million

Or, expressed in discounted present value terms:

	7.5% Interest Basis
• Before "plow-back" of savings resulting from the proposal:	$(301.3) million
• After "plow-back" of savings to accelerate SERS funding:	$(192.6) million

In addition to the cumulative savings described above, it is important to note the eventual "transfer of risk" that would occur if this Three-Way Hybrid/DC Proposal were to become law. That is, the conversion of SERS from the pure DB system that it is today to a hybrid design with an ever-growing DC component, including participant-directed investments, would result in a gradual transfer of investment risk from SERS' employers to SERS' members (employees). By the end of the projection period (fiscal 2052), this DB/DC design would result in a substantial reduction of investment risk being borne by SERS employers, relative to the level of risk they currently bear.

The future net savings that would result if this Three-Way Hybrid/DC Proposal were to become law should come as no surprise. From reviewing the specific provisions that apply under this proposal and comparing them to the current SERS provisions, one can readily observe that this proposal calls overall for (i) employee contributions to be increased and (ii) aggregate benefits to be decreased. When changes of this nature occur under a retirement plan, the level of employer contributions required to fund the plan necessarily will decrease.

Important Notes

Please note the following regarding our handling of the attached funding projections:

1. In performing our cost analyses and preparing this cost note and the attachments hereto, Korn Ferry Hay Group has applied these proposed changes to current law as presented to us via design memoranda and oral directions, and not based upon having the full text of a bill. Furthermore, we have not reviewed or opined on the legality of any aspect of this proposal.

2. Korn Ferry Hay Group's past convention of showing results for employer cost projections such as these as percentages of payroll to two decimal places may be somewhat misleading. This level of precision is not really possible for estimates of this nature.

3. In performing these analyses, Korn Ferry Hay Group has assumed that future new entrants who will become eligible for the Three-Way Hybrid/DC plan will all be first time hires of the Commonwealth. However, this will not always be true. There will be future new entrants who had prior SERS service and who therefore would benefit from the "footprint rule" (and be somewhat more costly to SERS than Korn Ferry Hay Group will project). Because we are comfortable that the "footprint rule" will apply to a relatively small percentage of the population of future hires, we do not feel that this approach will result in any material misstatement of costs.

4. Certain Educational Employees: We understand that the availability of the option of certain educational employees to elect membership in either SERS, PSERS or an independent retirement program approved by the employer (such as TIAA-CREF) would continue if the Three-Way Hybrid/DC Plan were enacted. Absent information that would indicate otherwise, Korn Ferry Hay Group has performed our cost analysis of this proposal assuming that these educational employees hired after 2017 (after the Three-Way Hybrid/DC Plan is in effect) will opt to join SERS at approximately the same rate (i.e., with about the same likelihood) as they have in the past (pre-2018).

5. Although Korn Ferry Hay Group acknowledges that experience gains and losses associated with member withdrawals of contributions will be occurring on an ongoing basis, we assume that gains will tend to cancel losses and that therefore this will have no material financial impact on our actuarial projection results.

6. All of these projections are based upon the expectation that (i) for all years after 2015, the actual economic and demographic experience of SERS will be consistent with the underlying actuarial valuation assumptions and (ii) all employer contribution amounts shown in the "Expected FY Contribution" columns will, in fact, be contributed.

7. The attached projection schedules include a particularly important column of information that may warrant further explanation: "Cumulative (Savings) / Cost Relative to Baseline" shows the projected cumulative cost or savings in employer contributions (in millions of

dollars) that would result under the Three-Way Hybrid/DC Proposal versus under the current law (Baseline).

8. The cost estimates included herein were based upon our December 31, 2015 actuarial valuation results, including the underlying census data, assets and actuarial assumptions.

Actuarial Standards of Practice

Korn Ferry Hay Group anticipates that, at some time in coming years, the Actuarial Standards of Practice (ASOP's) will cease to allow us to use the variation of the Entry Age Normal Cost Method that is currently used by SERS. If that were to occur prior to when the SERC implements the Traditional Entry Age Normal Cost Method for SERS, we may be required to disclose and quantify the cost impact of the two different methods.

Actuarial Certification

To the best of our knowledge, the information we are presenting herein is complete and accurate and all costs and liabilities have been determined in conformance with generally accepted actuarial principles and on the basis of actuarial assumptions and methods which are reasonable (taking into account the past experience of SERS and reasonable expectations) and which represent our best estimate of anticipated experience under the plan.

The actuaries certifying to this valuation are members of the Society of Actuaries or other professional actuarial organizations, and meet the General Qualification Standards of the American Academy of Actuaries for purposes of issuing Statements of Actuarial Opinion.

Please let us know if you have any questions on any of this.

Respectfully submitted,
Korn Ferry Hay Group, Inc.

By: ______________________
Brent M. Mowery, F.S.A.
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October 12, 2016

Summary Table

Pennsylvania State Employees' Retirement System
Allocation of Potential Projected (Savings)/Cost Through FY 2052
Due to Three-Way Hybrid/DC Proposal
(Amounts in millions)

	Cash Flow	PV 1	PV 2
Benefit Reforms	No Interest	7.5% Interest	3.5% Interest
Amendment - 1.0% or 1.25% DB Accrual for most hires after December 31, 2017	$ (6,931.5)	$ (1,562.3)	$ (3,208.2)
Amendment - DC Plan (Er 2.0% or 3.5%) for most hires after December 31, 2017	$ 4,793.5	$ 1,020.0	$ 2,187.2
Sub-total Benefit Reforms	$ (2,138.0)	$ (542.3)	$ (1,021.0)
Total Hybrid Plan: (Savings)/Cost through FY 2052 without Financing Reforms	$ (2,138.0)	$ (542.3)	$ (1,021.0)
Financing Reforms			
New Entry Age Normal Cost Approach	$ (50.2)	$ 241.0	$ 172.8
Future savings due to reforms are contributed to the plan ("plow-back")	$ 88.6	$ 108.7	$ 115.8
Sub-total Finance Reforms	$ 38.4	$ 349.8	$ 288.6
Total Hybrid Plan: (Savings)/Cost through FY 2052 with Financing (Normal Cost Method) Reform	$ (2,099.6)	$ (192.6)	$ (732.5)

Notes:

The potential (savings)/cost was valued in the following order:

Hybrid DB/DC Design:

1.0% or 1.25% accrual DB design generally effective after December 31, 2017
- DB employee contribution rate: 4% for 1.0% accrual or 5% for 1.25% accrual
- No DB accrual if member elects DC-only option
- Hybrid DB superannuation: Age 67 or 3% early retirement reduction with 25 years credited service
- State Police and other hazardous duty employees exempt from both new DB and DC plans
- Voluntary overtime limited to 10% for pensionable earnings purposes for exempt new hires

DC Plan generally effective after December 31, 2017
- DC employer contribution rate: 2.0% for hybrid DC; 3.5% for DC-only option
- DC employee contribution rate: 3.5% for hybrid DC; 7.5% for DC-only option
- State Police and other hazardous duty employees exempt from both new DB and DC plans

Actuarial Costing Approaches:

Assumed 40% of new entrants elect 1.25% DB Hybrid, 40% elect 1.00% DB Hybrid, and 20% DC-only elections

Implementation of the Traditional Entry Age Normal Cost Method (replacing current method) effective with the December 31, 2021 actuarial valuation.

Future savings from reforms are calculated now and an amount equal to those savings is contributed in the future (based on a fixed % of payroll each year)

If a different order is used, the cost impact will vary from what is shown above.

Any plan changes above that result in liability changes are amortized over 30 years.

10/12/2016

SERS Projected Employer Contributions
(Based Upon Final December 31, 2015 Valuation)

Three-Way Hybrid/DC Proposal, Including New 1% or 1.25% Accrual DB Tier, Plus New DC Plan (DC/DB) with Employer Contribution at 2.0% OR DC-Only Plan with Employer Contribution at 3.5%; Most Hazardous Duty Employees Remain in Current DB Plan; Age 67 Superannuation; No Rule of 92 and 35 YOS unreduced; Special 3% per Year Early Reduction for 25 YOS; 10% OT Limit on Exempt Groups; In 5 Years, Change to Traditional Entry Age Normal Cost Method

Year	Investment Return	Fiscal Year	Floor Contribution	Projected DB Percent Contribution	Expected DB Plan FY Payroll ($ in millions)	Expected FY DB Contribution ($ in millions)	Expected DC/DB Plan FY Payroll ($ in millions)	Expected FY DC/DB Contribution ($ in millions)	Total DB+DC/DB Contribution ($ in millions)	Total DB+DC/DB Contribution as a % of DB+DC/DB Pay	Annual (Savings) / Cost Relative to Baseline	Cumulative (Savings) / Cost Relative to Baseline	Funded Ratio (AV%)	UAL ($ in billions)	Funded Ratio (MV%)	Baseline: Baseline Percent	Baseline: Baseline $ ($ in millions)
2011	2.70%	2012/2013	5.10%	11.50	5,890.7	677.4	-	-	677.4	11.50	-	-	65.3	14.69	57.6	11.50	677.4
2012	12.00%	2013/2014	5.01%	16.00	5,836.4	933.8	-	-	933.8	16.00	-	-	58.7	17.78	58.9	16.00	933.8
2013	13.60%	2014/2015	5.00%	20.50	5,897.6	1,209.0	-	-	1,209.0	20.50	-	-	59.2	17.90	62.4	20.50	1,209.0
2014	6.40%	2015/2016	4.95%	25.00	6,021.7	1,505.4	-	-	1,505.4	25.00	-	-	59.4	18.17	61.1	25.00	1,505.4
2015	0.40%	2016/2017	4.52%	29.50	6,255.2	1,845.3	-	-	1,845.3	29.50	-	-	58.0	19.45	56.2	29.50	1,845.3
2016	7.50%	2017/2018	4.52%	31.70	6,305.9	2,037.0	140.1	8.3	2,045.3	31.73	2.0	2.0	58.8	19.46	56.7	31.70	2,043.3
2017	7.50%	2018/2019	0.79%	30.40	6,221.4	2,015.8	421.2	12.3	2,028.1	30.53	(45.1)	(43.1)	56.9	21.71	55.0	31.21	2,073.2
2018	7.50%	2019/2020	0.79%	30.24	6,145.5	2,064.7	699.7	20.5	2,085.2	30.46	(44.1)	(87.2)	57.1	21.95	56.1	31.11	2,129.3
2019	7.50%	2020/2021	0.79%	29.98	6,072.9	2,107.2	981.1	28.8	2,136.0	30.28	(43.2)	(130.4)	57.4	22.09	57.2	30.89	2,179.2
2020	7.50%	2021/2022	0.79%	29.28	6,002.5	2,118.7	1,266.6	37.1	2,155.8	29.66	(42.5)	(172.9)	58.4	21.83	58.3	30.24	2,198.3
2021	7.50%	2022/2023	8.13%	30.35	5,931.6	2,146.9	1,559.2	158.4	2,305.3	30.77	88.4	(84.5)	65.6	16.59	65.5	29.59	2,216.9
2022	7.50%	2023/2024	7.88%	29.47	5,859.0	2,128.0	1,860.3	184.2	2,312.2	29.95	77.4	(7.1)	66.8	16.20	66.7	28.95	2,234.8
2023	7.50%	2024/2025	7.63%	28.59	5,788.1	2,109.1	2,166.6	209.2	2,318.3	29.14	66.3	59.2	68.1	15.76	68.0	28.31	2,252.0
2024	7.50%	2025/2026	7.39%	27.74	5,719.1	2,090.6	2,478.2	233.4	2,324.0	28.35	54.8	114.0	69.3	15.28	69.3	27.68	2,269.2
2025	7.50%	2026/2027	7.17%	26.91	5,653.1	2,073.2	2,794.2	256.9	2,330.1	27.58	43.4	157.4	70.7	14.76	70.7	27.07	2,286.7
2026	7.50%	2027/2028	6.95%	26.11	5,591.0	2,056.8	3,114.0	279.5	2,336.3	26.84	31.6	189.0	72.0	14.20	72.0	26.48	2,304.7
2027	7.50%	2028/2029	6.75%	25.34	5,528.7	2,041.0	3,441.8	301.9	2,342.9	26.12	19.7	208.7	73.4	13.59	73.4	25.90	2,323.2
2028	7.50%	2029/2030	6.54%	24.59	5,463.8	2,025.7	3,780.3	324.0	2,349.7	25.42	7.4	216.0	74.8	12.94	74.8	25.34	2,342.3
2029	7.50%	2030/2031	6.35%	23.86	5,396.9	2,010.8	4,129.1	345.8	2,356.6	24.74	(5.3)	210.7	76.2	12.25	76.2	24.79	2,361.9
2030	7.50%	2031/2032	6.16%	23.16	5,327.9	1,996.5	4,488.7	367.5	2,364.0	24.08	(18.2)	192.5	77.8	11.50	77.8	24.27	2,382.2
2031	7.50%	2032/2033	5.99%	22.48	5,256.6	1,982.8	4,859.4	389.3	2,372.1	23.45	(31.0)	161.5	79.3	10.69	79.3	23.76	2,403.1
2032	7.50%	2033/2034	5.82%	21.82	5,187.9	1,970.0	5,236.6	410.8	2,380.8	22.84	(43.8)	117.7	81.0	9.83	81.0	23.26	2,424.6
2033	7.50%	2034/2035	5.66%	21.19	5,126.8	1,958.4	5,615.7	431.7	2,390.1	22.25	(56.8)	60.9	82.8	8.89	82.8	22.78	2,446.9
2034	7.50%	2035/2036	5.51%	20.58	5,072.0	1,947.8	5,998.1	452.2	2,400.0	21.68	(69.8)	(8.8)	84.7	7.89	84.7	22.31	2,469.8
2035	7.50%	2036/2037	5.37%	20.00	5,021.4	1,938.0	6,386.4	472.5	2,410.5	21.13	(83.0)	(91.8)	86.7	6.82	86.7	21.86	2,493.5
2036	7.50%	2037/2038	5.24%	19.43	4,973.6	1,928.8	6,782.1	492.8	2,421.6	20.60	(96.3)	(188.2)	88.9	5.66	88.9	21.42	2,517.9
2037	7.50%	2038/2039	5.12%	18.89	4,929.4	1,920.4	7,184.8	513.2	2,433.6	20.09	(109.4)	(297.6)	91.3	4.42	91.3	20.99	2,543.0
2038	7.50%	2039/2040	5.00%	18.37	4,888.7	1,912.8	7,595.0	533.9	2,446.7	19.60	(122.3)	(419.9)	93.9	3.08	93.9	20.58	2,569.0
2039	7.50%	2040/2041	4.90%	14.18	4,851.6	1,431.5	8,012.9	554.9	1,986.4	15.44	(135.0)	(555.0)	96.7	1.64	96.7	16.49	2,121.4
2040	7.50%	2041/2042	4.80%	11.13	4,818.1	1,069.8	8,438.7	576.1	1,645.9	12.42	(147.8)	(702.8)	98.9	0.57	98.9	13.53	1,793.7
2041	7.50%	2042/2043	4.70%	7.73	4,789.2	638.9	8,872.0	597.0	1,235.9	9.05	(161.4)	(864.2)	100.5	(0.22)	100.5	10.23	1,397.3
2042	7.50%	2043/2044	4.61%	5.59	4,765.9	358.4	9,311.9	617.5	975.9	6.93	(176.0)	(1,040.2)	101.3	(0.65)	101.3	8.18	1,151.9
2043	7.50%	2044/2045	4.51%	5.27	4,749.8	324.1	9,757.4	637.9	962.0	6.63	(191.1)	(1,231.3)	101.7	(0.84)	101.7	7.95	1,153.1
2044	7.50%	2045/2046	4.43%	4.89	4,742.3	278.8	10,207.4	658.5	937.3	6.27	(206.2)	(1,437.5)	102.1	(1.01)	102.1	7.65	1,143.5
2045	7.50%	2046/2047	4.35%	4.35	4,744.6	206.2	10,661.1	679.3	885.5	5.75	(161.3)	(1,598.9)	102.5	(1.16)	102.5	6.79	1,046.8
2046	7.50%	2047/2048	4.28%	4.28	4,758.4	203.4	11,117.1	700.4	903.8	5.69	(152.4)	(1,751.2)	102.6	(1.19)	102.6	6.65	1,056.2
2047	7.50%	2048/2049	4.21%	4.21	4,785.8	201.6	11,573.9	721.9	923.5	5.65	(145.9)	(1,897.1)	102.8	(1.26)	102.8	6.54	1,069.4
2048	7.50%	2049/2050	4.16%	4.16	4,826.6	200.7	12,032.1	744.0	944.7	5.60	(113.1)	(2,010.2)	102.8	(1.25)	102.8	6.27	1,057.8
2049	7.50%	2050/2051	4.11%	4.11	4,879.7	200.6	12,493.2	766.5	967.1	5.57	(86.7)	(2,096.9)	103.0	(1.32)	103.0	6.07	1,053.8
2050	7.50%	2051/2052	4.07%	4.07	4,945.0	201.2	12,957.8	789.7	990.9	5.53	(91.2)	(2,188.1)	103.2	(1.38)	103.2	6.04	1,082.1

SERS Projected Employer Contributions
(Based Upon Final December 31, 2015 Valuation)

10/12/2016

Year	Investment Return	Fiscal Year	Floor Contribution	Three-Way Hybrid/DC Proposal, Including New 1% or 1.25% Accrual DB Tier, Plus New DC Plan (DC/DB) with Employer Contribution at 2.0% OR DC-Only Plan with Employer Contribution at 3.5%; Most Hazardous Duty Employees Remain in Current DB Plan; Age 67 Superannuation; No Rule of 92 and 35 YOS unreduced; Special 3% per Year Early Reduction for 25 YOS; 10% OT Limit on Exempt Groups; In 5 Years, Change to Traditional Entry Age Normal Cost Method; Savings Plowed Back into Trust													Baseline	
				Projected DB Percent Contribution	Expected DB Plan FY Payroll ($ in millions)	Expected FY DB Contribution ($ in millions)	Expected DC/DB Plan FY Payroll ($ in millions)	Expected FY DC/DB Contribution ($ in millions)	Total DB+DC/DB Contribution ($ in millions)	Total DB+DC/DB Contribution as a % of DB+DC/DB Pay	Extra Contributions to Return Savings as a % of DB+DC/DB Pay	Annual (Savings) / Cost Relative to Baseline	Cumulative (Savings) / Cost Relative to Baseline	Funded Ratio (AV%)	UAL ($ in billions)	Funded Ratio (MV%)	Baseline Percent	Baseline $ ($ in millions)
2011	2.70%	2012/2013	5.10%	11.50	5,890.7	677.4	-	-	677.4	11.50		-	-	65.3	14.69	57.6	11.50	677.4
2012	12.00%	2013/2014	5.01%	16.00	5,836.4	933.8	-	-	933.8	16.00		-	-	58.7	17.78	58.9	16.00	933.8
2013	13.60%	2014/2015	5.00%	20.50	5,897.6	1,209.0	-	-	1,209.0	20.50		-	-	59.2	17.90	62.4	20.50	1,209.0
2014	6.40%	2015/2016	4.95%	25.00	6,021.7	1,505.4	-	-	1,505.4	25.00		-	-	59.4	18.17	61.1	25.00	1,505.4
2015	0.40%	2016/2017	4.52%	29.50	6,255.2	1,845.3	-	-	1,845.3	29.50		-	-	58.0	19.45	56.2	29.50	1,845.3
2016	7.50%	2017/2018	4.52%	31.70	6,305.9	2,037.0	140.1	8.3	2,045.3	31.73	-	2.0	2.0	58.8	19.46	56.7	31.70	2,043.3
2017	7.50%	2018/2019	0.79%	30.40	6,221.4	2,015.8	421.2	12.3	2,028.1	30.53	0.68	0.1	2.1	56.9	21.71	55.0	31.21	2,073.2
2018	7.50%	2019/2020	0.79%	30.22	6,145.5	2,062.8	699.7	20.5	2,083.3	30.43	0.64	(2.2)	(0.1)	57.1	21.93	56.1	31.11	2,129.3
2019	7.50%	2020/2021	0.79%	29.90	6,072.9	2,101.5	981.1	28.8	2,130.3	30.20	0.61	(5.9)	(6.0)	57.5	22.03	57.3	30.89	2,179.2
2020	7.50%	2021/2022	0.79%	29.16	6,002.5	2,109.3	1,266.6	37.1	2,146.4	29.53	0.58	(9.7)	(15.7)	58.6	21.72	58.5	30.24	2,198.3
2021	7.50%	2022/2023	8.13%	30.18	5,931.6	2,133.9	1,559.2	158.4	2,292.3	30.60	-	75.4	59.7	65.9	16.44	65.8	29.59	2,216.9
2022	7.50%	2023/2024	7.88%	29.27	5,859.0	2,113.3	1,860.3	184.2	2,297.5	29.76	-	62.7	122.4	67.1	16.03	67.1	28.95	2,234.8
2023	7.50%	2024/2025	7.63%	28.41	5,788.1	2,094.3	2,166.6	209.2	2,303.5	28.96	-	51.5	173.9	68.4	15.59	68.4	28.31	2,252.0
2024	7.50%	2025/2026	7.39%	27.56	5,719.1	2,075.9	2,478.2	233.4	2,309.3	28.17	-	40.1	214.0	69.7	15.11	69.7	27.68	2,269.2
2025	7.50%	2026/2027	7.17%	26.74	5,653.1	2,058.4	2,794.2	256.9	2,315.3	27.41	-	28.6	242.5	71.0	14.59	71.0	27.07	2,286.7
2026	7.50%	2027/2028	6.95%	25.95	5,591.0	2,042.0	3,114.0	279.5	2,321.5	26.67	-	16.8	259.4	72.3	14.03	72.3	26.48	2,304.7
2027	7.50%	2028/2029	6.75%	25.18	5,528.7	2,026.3	3,441.8	301.9	2,328.2	25.95	-	5.0	264.3	73.7	13.43	73.7	25.90	2,323.2
2028	7.50%	2029/2030	6.54%	24.43	5,463.8	2,011.0	3,780.3	324.0	2,335.0	25.26	-	(7.3)	257.0	75.1	12.79	75.1	25.34	2,342.3
2029	7.50%	2030/2031	6.35%	23.71	5,396.9	1,996.1	4,129.1	345.8	2,341.9	24.58	0.06	(14.3)	242.7	76.5	12.09	76.5	24.79	2,361.9
2030	7.50%	2031/2032	6.16%	23.00	5,327.9	1,981.5	4,488.7	367.5	2,349.0	23.93	0.19	(14.5)	228.2	78.1	11.34	78.1	24.27	2,382.2
2031	7.50%	2032/2033	5.99%	22.32	5,256.6	1,966.8	4,859.4	389.3	2,356.1	23.29	0.31	(15.7)	212.5	79.7	10.53	79.7	23.76	2,403.1
2032	7.50%	2033/2034	5.82%	21.65	5,187.9	1,951.9	5,236.6	410.8	2,362.7	22.66	0.42	(18.1)	194.4	81.4	9.64	81.4	23.26	2,424.6
2033	7.50%	2034/2035	5.66%	20.99	5,126.8	1,937.1	5,615.7	431.7	2,368.8	22.05	0.53	(21.2)	173.2	83.2	8.68	83.2	22.78	2,446.9
2034	7.50%	2035/2036	5.51%	20.35	5,072.0	1,922.3	5,998.1	452.2	2,374.5	21.45	0.63	(25.5)	147.7	85.2	7.63	85.2	22.31	2,469.8
2035	7.50%	2036/2037	5.37%	19.73	5,021.4	1,907.1	6,386.4	472.5	2,379.6	20.86	0.73	(30.6)	117.1	87.4	6.50	87.4	21.86	2,493.5
2036	7.50%	2037/2038	5.24%	19.11	4,973.6	1,891.4	6,782.1	492.8	2,384.2	20.28	0.82	(37.4)	79.8	89.7	5.27	89.7	21.42	2,517.9
2037	7.50%	2038/2039	5.12%	18.52	4,929.4	1,875.4	7,184.8	513.2	2,388.6	19.72	0.90	(45.4)	34.4	92.2	3.95	92.2	20.99	2,543.0
2038	7.50%	2039/2040	5.00%	17.94	4,888.7	1,859.1	7,595.0	533.9	2,393.0	19.17	0.98	(53.7)	(19.3)	95.0	2.52	95.0	20.58	2,569.0
2039	7.50%	2040/2041	4.90%	13.69	4,851.6	1,368.0	8,012.9	554.9	1,922.9	14.95	1.05	(63.5)	(82.8)	98.1	0.98	98.1	16.49	2,121.4
2040	7.50%	2041/2042	4.80%	10.57	4,818.1	995.4	8,438.7	576.1	1,571.5	11.85	-	(222.2)	(305.0)	100.4	(0.21)	100.4	13.53	1,793.7
2041	7.50%	2042/2043	4.70%	7.15	4,789.2	558.8	8,872.0	597.0	1,155.8	8.46	-	(241.5)	(546.5)	102.1	(1.06)	102.1	10.23	1,397.3
2042	7.50%	2043/2044	4.61%	5.02	4,765.9	278.3	9,311.9	617.5	895.8	6.36	-	(256.1)	(802.6)	103.0	(1.47)	103.0	8.18	1,151.9
2043	7.50%	2044/2045	4.51%	4.72	4,749.8	244.0	9,757.4	637.9	881.9	6.08	-	(271.2)	(1,073.8)	103.4	(1.64)	103.4	7.95	1,153.1
2044	7.50%	2045/2046	4.43%	4.43	4,742.3	209.9	10,207.4	658.5	868.4	5.81	-	(275.1)	(1,349.0)	103.7	(1.79)	103.7	7.65	1,143.5
2045	7.50%	2046/2047	4.35%	4.35	4,744.6	206.2	10,661.1	679.3	885.5	5.75	-	(161.3)	(1,510.3)	104.1	(1.91)	104.1	6.79	1,046.8
2046	7.50%	2047/2048	4.28%	4.28	4,758.4	203.4	11,117.1	700.4	903.8	5.69	-	(152.4)	(1,662.7)	104.3	(1.99)	104.3	6.65	1,056.2
2047	7.50%	2048/2049	4.21%	4.21	4,785.8	201.6	11,573.9	721.9	923.5	5.65	-	(145.9)	(1,808.5)	104.7	(2.13)	104.7	6.54	1,069.4
2048	7.50%	2049/2050	4.16%	4.16	4,826.6	200.7	12,032.1	744.0	944.7	5.60	-	(113.1)	(1,921.7)	104.9	(2.18)	104.9	6.27	1,057.8
2049	7.50%	2050/2051	4.11%	4.11	4,879.7	200.6	12,493.2	766.5	967.1	5.57	-	(86.7)	(2,008.4)	105.3	(2.31)	105.3	6.07	1,053.8
2050	7.50%	2051/2052	4.07%	4.07	4,945.0	201.2	12,957.8	789.7	990.9	5.53	-	(91.2)	(2,099.6)	105.7	(2.45)	105.7	6.04	1,082.1

SERS Projected Employer Contributions
(Based Upon Final December 31, 2015 Valuation)

9/9/2016

Baseline: December 31, 2015 Data and Assets; Current Entry Age Funding Method; Level Dollar Amortization; 5-Year Smoothing of Assets; 4.50% FY 16 Collar; 4.50% FY 17 Collar; 4.50% FY 18 Collar; 4.50% FY 19 Collar; 4.50% FY 20 Collar; 4.50% FY 21+ Collar; No Asset Fresh Start; Act 120 Benefit Provisions; 7.50% Liability Interest Rate Assumption; No Liability Fresh Start

Year	Investment Return	Fiscal Year	Ceiling Contribution	Floor Contribution	Projected Percent Contribution	Expected FY Payroll ($ in millions)	Expected FY Contribution ($ in millions)	(Savings) / Cost Relative to Current Law Contribution	GASB Compliant (Fiscal Year Contribution)	Funded Ratio (AV%)	UAL ($ in billions)	Funded Ratio (MV%)
2013	13.60%	2014/2015	NA	5.00%	20.50	5,897.6	1,209.0	-	N	59.2	17.90	62.4
2014	6.40%	2015/2016	NA	4.95%	25.00	6,021.7	1,505.4	-	Y	59.4	18.17	61.1
2015	0.40%	2016/2017	NA	4.52%	29.50	6,255.2	1,845.3	-	Y	58.0	19.45	56.2
2016	7.50%	2017/2018	NA	4.52%	31.70	6,446.0	2,043.3	-	Y	58.8	19.46	56.7
2017	7.50%	2018/2019	NA	4.52%	31.21	6,642.6	2,073.2	-	Y	59.6	19.42	57.7
2018	7.50%	2019/2020	NA	4.52%	31.11	6,845.2	2,129.3	-	Y	59.8	19.66	58.8
2019	7.50%	2020/2021	NA	4.52%	30.89	7,054.0	2,179.2	-	Y	60.2	19.79	60.0
2020	7.50%	2021/2022	NA	4.52%	30.24	7,269.1	2,198.3	-	Y	61.4	19.52	61.2
2021	7.50%	2022/2023	NA	4.52%	29.59	7,490.8	2,216.9	-	Y	62.6	19.22	62.5
2022	7.50%	2023/2024	NA	4.52%	28.95	7,719.3	2,234.8	-	Y	63.8	18.87	63.8
2023	7.50%	2024/2025	NA	4.52%	28.31	7,954.7	2,252.0	-	Y	65.1	18.48	65.0
2024	7.50%	2025/2026	NA	4.52%	27.68	8,197.3	2,269.2	-	Y	66.4	18.05	66.4
2025	7.50%	2026/2027	NA	4.52%	27.07	8,447.3	2,286.7	-	Y	67.7	17.58	67.7
2026	7.50%	2027/2028	NA	4.52%	26.48	8,705.0	2,304.7	-	Y	69.1	17.06	69.1
2027	7.50%	2028/2029	NA	4.52%	25.90	8,970.5	2,323.2	-	Y	70.5	16.51	70.5
2028	7.50%	2029/2030	NA	4.52%	25.34	9,244.1	2,342.3	-	Y	72.0	15.91	72.0
2029	7.50%	2030/2031	NA	4.52%	24.79	9,526.0	2,361.9	-	Y	73.5	15.26	73.5
2030	7.50%	2031/2032	NA	4.52%	24.27	9,816.6	2,382.2	-	Y	75.0	14.56	75.0
2031	7.50%	2032/2033	NA	4.52%	23.76	10,116.0	2,403.1	-	Y	76.7	13.80	76.7
2032	7.50%	2033/2034	NA	4.52%	23.26	10,424.5	2,424.6	-	Y	78.4	12.98	78.4
2033	7.50%	2034/2035	NA	4.52%	22.78	10,742.5	2,446.9	-	Y	80.2	12.09	80.2
2034	7.50%	2035/2036	NA	4.52%	22.31	11,070.1	2,469.8	-	Y	82.0	11.13	82.0
2035	7.50%	2036/2037	NA	4.52%	21.86	11,407.8	2,493.5	-	Y	84.0	10.09	84.0
2036	7.50%	2037/2038	NA	4.52%	21.42	11,755.7	2,517.9	-	Y	86.0	8.97	86.0
2037	7.50%	2038/2039	NA	4.52%	20.99	12,114.2	2,543.0	-	Y	88.1	7.77	88.1
2038	7.50%	2039/2040	NA	4.52%	20.58	12,483.7	2,569.0	-	Y	90.3	6.46	90.3
2039	7.50%	2040/2041	NA	4.52%	16.49	12,864.5	2,121.4	-	Y	92.5	5.06	92.5
2040	7.50%	2041/2042	NA	4.52%	13.53	13,256.8	1,793.7	-	Y	94.2	4.01	94.2
2041	7.50%	2042/2043	NA	4.52%	10.23	13,661.2	1,397.3	-	Y	95.4	3.24	95.4
2042	7.50%	2043/2044	NA	4.52%	8.18	14,077.8	1,151.9	-	Y	96.1	2.83	96.1
2043	7.50%	2044/2045	NA	4.52%	7.95	14,507.2	1,153.1	-	Y	96.5	2.65	96.5
2044	7.50%	2045/2046	NA	4.52%	7.65	14,949.7	1,143.5	-	Y	96.8	2.49	96.8
2045	7.50%	2046/2047	NA	4.52%	6.79	15,405.7	1,046.8	-	Y	97.0	2.34	97.0
2046	7.50%	2047/2048	NA	4.52%	6.65	15,875.5	1,056.2	-	Y	97.2	2.31	97.2
2047	7.50%	2048/2049	NA	4.52%	6.54	16,359.7	1,069.4	-	Y	97.3	2.29	97.3
2048	7.50%	2049/2050	NA	4.52%	6.27	16,858.7	1,057.8	-	Y	97.4	2.28	97.4
2049	7.50%	2050/2051	NA	4.52%	6.07	17,372.9	1,053.8	-	Y	97.4	2.31	97.4
2050	7.50%	2051/2052	NA	4.52%	6.04	17,902.8	1,082.1	-	Y	97.4	2.38	97.4

Pennsylvania State Employees' Retirement System (SERS)

Annual Annuity Estimates–Current Law Vs. Three-Way Hybrid/DC Proposal Assuming New Member Elects Option 1: Hybrid Plan With 1.25% DB Accrual

(See the following page for supporting details and related clarifications.)

Class A3, Category 0 - Pay in Final Year is $50,000 **Current Plan Superannuation Age = 65; Proposed DB Plan Superannuation Age = 67**			
	10 Years of Service	**20 Years of Service**	**30 Years of Service**
Current Plan Payable at Age 65	$9,455	$19,060	$28,884
Three-Way Hybrid/DC Proposal: **Hybrid DB + Hybrid DC Plan Annuity Payable at Age 67 Superannuation:**			
• **Unreduced DB Annuity**	$5,585	$11,355	$17,365
• **DC Annuity**	$2,161	$4,575	$7,657
• **Total Payable at Age 67**	$7,746	$15,929	$25,022
Payable at Age 65 Early Retirement:			
• **Reduced DB Benefit**	$4,852	$9,863	$16,323
• **DC Annuity**	$2,050	$4,339	$7,264
• **Total Payable at Age 65**	$6,902	$14,202	$23,587
At Age 65, Proposed as % of Current	73%	75%	82%

Class A3, Category 1 - Pay in Final Year is $50,000, Assumed Retirement Age is 55			
	10 Years of Service	**20 Years of Service**	**30 Years of Service**
Current Plan	$9,455	$19,060	$28,884
EXEMPT from Proposed Hybrid DB & Hybrid DC, therefore Three-Way Hybrid/DC Proposal = Current Plan	9,455	19,060	28,884

Judges - Pay in Final Year is $150,000* **Assumed Retirement Age is 70** **Current Plan Superannuation Age = 60; Proposed DB Plan Superannuation Age = 67**			
	10 Years of Service	**20 Years of Service**	**30 Years of Service**
Current Plan (Assuming Class E-1)	$56,728	$100,064	$144,418
Three-Way Hybrid/DC Proposal: **Hybrid DB + Hybrid DC Plan Annuity Payable at Age 70:**			
• **DB Annuity**	$16,756	$34,065	$52,094
• **DC Annuity**	$7,082	$14,991	$25,094
• **Total Payable at Age 70**	$23,838	$49,056	$77,188
At Age 70, Proposed as % of Current	42%	49%	53%

* The benefits shown do not include estimated SSI benefits that Judges are currently eligible to receive.

State Police – Pay in Final Year is $50,000, Assumed Retirement Age is 55		
	20 Years of Service	**25 Years of Service**
Current Plan	$25,000	$37,500
EXEMPT from Proposed Hybrid DB & Hybrid DC, therefore Three-Way Hybrid/DC Proposal = Current Plan	25,000	37,500

Pennsylvania State Employees' Retirement System (SERS)

Annual Annuity Estimates
Current Law Vs. Three-Way Hybrid/DC Proposal
Assuming New Member Elects Option 1: Hybrid Plan With 1.25% DB Accrual

Basis for Determination of Annual Annuity Estimates & Related Clarifications

- Pay in the final year before retirement was assumed to be $50,000 ($150,000 for Judges). Pay was projected backward using valuation salary scale assumptions.
- Hybrid Defined Benefit (DB) Plan Annual Benefit Accrual Rate: 1.25%
- Hybrid DB Plan Superannuation Age = 67; DB annuities commencing prior to age 67 will be actuarially reduced if service is less than 25 years; reduced 3% per year if service is 25 years or more
- Contribution assumptions included:
    - Hybrid DB Plan: 5.00% employee contributions
    - Hybrid Defined Contribution (DC) Plan: 3.50% employee contributions and 2.0% employer contribution rate

  Note: Under this Three-Way Hybrid/DC Proposal, members of the PA State Police and all other hazardous duty employees (except psychiatric security aides) are exempt. Thus, they will continue their SERS benefits as-is.
- Annual investment return assumption: DC – 6% per year
- The DC account balances were annuitized using the following conversion basis: 4% interest and RP-2014 unisex mortality.
- To determine how much the above annual annuities replace as a percentage of final pay, divide the benefit amount by $50,000 (or $150,000 for Judges). This result is the replacement ratio, the portion of final income replaced by the plan benefit).
- Figures above are neither audited nor certified. Calculations reflect certain assumptions and are not based on any existing legislative language. Final actuarial results will vary from these estimates based on actual final legislative outcomes and underlying details.

Pennsylvania State Employees' Retirement System (SERS)

Annual Annuity Estimates–Current Law Vs. Three-Way Hybrid/DC Proposal
Assuming New Member Elects Option 2: Hybrid Plan With 1% DB Accrual

(See the following page for supporting details and related clarifications.)

Class A3, Category 0 - Pay in Final Year is $50,000 **Current Plan Superannuation Age = 65; Proposed DB Plan Superannuation Age = 67**			
	10 Years of Service	**20 Years of Service**	**30 Years of Service**
Current Plan Payable at Age 65	$9,455	$19,060	$28,884
Three-Way Hybrid/DC Proposal: **Hybrid DB + Hybrid DC Plan Annuity Payable at Age 67 Superannuation:**			
• **Unreduced DB Annuity**	$4,468	$9,084	$13,892
• **DC Annuity**	$2,161	$4,575	$7,657
• **Total Payable at Age 67**	$6,629	$13,658	$21,549
Payable at Age 65 Early Retirement:			
• **Reduced DB Benefit**	$3,881	$7,891	$13,058
• **DC Annuity**	$2,050	$4,339	$7,264
• **Total Payable at Age 65**	$5,931	$12,230	$20,322
At Age 65, Proposed as % of Current	63%	64%	70%

Class A3, Category 1 - Pay in Final Year is $50,000, Assumed Retirement Age is 55			
	10 Years of Service	**20 Years of Service**	**30 Years of Service**
Current Plan	$9,455	$19,060	$28,884
EXEMPT from Proposed Hybrid DB & Hybrid DC, therefore Three-Way Hybrid/DC Proposal = Current Plan	9,455	19,060	28,884

Judges - Pay in Final Year is $150,000* **Assumed Retirement Age is 70** **Current Plan Superannuation Age = 60; Proposed DB Plan Superannuation Age = 67**			
	10 Years of Service	**20 Years of Service**	**30 Years of Service**
Current Plan (Assuming Class E-1)	$56,728	$100,064	$144,418
Three-Way Hybrid/DC Proposal: **Hybrid DB + Hybrid DC Plan Annuity Payable at Age 70:**			
• **DB Annuity**	$13,405	$27,252	$41,675
• **DC Annuity**	$7,082	$14,991	$25,094
• **Total Payable at Age 70**	$20,487	$42,243	$66,769
At Age 70, Proposed as % of Current	36%	42%	46%

* The benefits shown do not include estimated SSI benefits that Judges are currently eligible to receive.

State Police – Pay in Final Year is $50,000, Assumed Retirement Age is 55		
	20 Years of Service	**25 Years of Service**
Current Plan	$25,000	$37,500
EXEMPT from Proposed Hybrid DB & Hybrid DC, therefore Three-Way Hybrid/DC Proposal = Current Plan	25,000	37,500

Pennsylvania State Employees' Retirement System (SERS)

Annual Annuity Estimates
Current Law Vs. Three-Way Hybrid/DC Proposal
Assuming New Member Elects Option 2: Hybrid Plan With 1% DB Accrual

Basis for Determination of Annual Annuity Estimates & Related Clarifications

- Pay in the final year before retirement was assumed to be $50,000 ($150,000 for Judges). Pay was projected backward using valuation salary scale assumptions.

- Hybrid Defined Benefit (DB) Plan Annual Benefit Accrual Rate: 1.00%

- Hybrid DB Plan Superannuation Age = 67; DB annuities commencing prior to age 67 will be actuarially reduced if service is less than 25 years; reduced 3% per year if service is 25 years or more

- Contribution assumptions included:
  - Hybrid DB Plan: 4.00% employee contributions
  - Hybrid Defined Contribution (DC) Plan: 3.50% employee contributions and 2.0% employer contribution rate

  Note: Under this Three-Way Hybrid/DC Proposal, members of the PA State Police and all other hazardous duty employees (except psychiatric security aides) are exempt. Thus, they will continue their SERS benefits as-is.

- Annual investment return assumption: DC – 6% per year

- The DC account balances were annuitized using the following conversion basis: 4% interest and RP-2014 unisex mortality.

- To determine how much the above annual annuities replace as a percentage of final pay, divide the benefit amount by $50,000 (or $150,000 for Judges). This result is the replacement ratio, the portion of final income replaced by the plan benefit).

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Pennsylvania State Employees' Retirement System (SERS)

Annual Annuity Estimates–Current Law Vs. Three-Way Hybrid/DC Proposal
Assuming New Member Elects Option 3: DC-Only Plan

(See the following page for supporting details and related clarifications.)

Class A3, Category 0 - Pay in Final Year is $50,000 **Current Plan Superannuation Age = 65; Proposed DB Plan Superannuation Age = 67**			
	10 Years of Service	**20 Years of Service**	**30 Years of Service**
<u>Current Plan</u> Payable at Age 65	$9,455	$19,060	$28,884
<u>Three-Way Hybrid/DC Proposal:</u> **DC-Only Plan Annuity** **Payable at Age 67 Superannuation:** • **Unreduced DB Annuity** • **DC Annuity** • **Total Payable at Age 67** **Payable at Age 65 Early Retirement:** • **Reduced DB Benefit** • **DC Annuity** • **Total Payable at Age 65**	 N/A $4,322 $4,322 N/A $4,100 $4,100	 N/A $9,149 $9,149 N/A $8,679 $8,679	 N/A $15,315 $15,315 N/A $14,527 $14,527
At Age 65, Proposed as % of Current	43%	46%	50%

Class A3, Category 1 - Pay in Final Year is $50,000, Assumed Retirement Age is 55			
	10 Years of Service	**20 Years of Service**	**30 Years of Service**
<u>Current Plan</u>	$9,455	$19,060	$28,884
EXEMPT from Proposed Hybrid DB & Hybrid DC, therefore <u>Three-Way Hybrid/DC Proposal = Current Plan</u>	9,455	19,060	28,884

Judges - Pay in Final Year is $150,000* **Assumed Retirement Age is 70** **Current Plan Superannuation Age = 60; Proposed DB Plan Superannuation Age = 67**			
	10 Years of Service	**20 Years of Service**	**30 Years of Service**
<u>Current Plan (Assuming Class E-1)</u>	$56,728	$100,064	$144,418
<u>Three-Way Hybrid/DC Proposal:</u> **DC-Only Plan Annuity** **Payable at Age 70:** • **DB Annuity** • **DC Annuity** • **Total Payable at Age 70**	 N/A $14,165 $14,165	 N/A $29,982 $29,982	 N/A $50,188 $50,188
At Age 70, Proposed as % of Current	25%	30%	35%

* The benefits shown do not include estimated SSI benefits that Judges are currently eligible to receive.

State Police – Pay in Final Year is $50,000, Assumed Retirement Age is 55		
	20 Years of Service	**25 Years of Service**
<u>Current Plan</u>	$25,000	$37,500
EXEMPT from Proposed Hybrid DB & Hybrid DC, therefore <u>Three-Way Hybrid/DC Proposal = Current Plan</u>	25,000	37,500

Pennsylvania State Employees' Retirement System (SERS)

Annual Annuity Estimates
Current Law Vs. Three-Way Hybrid/DC Proposal
Assuming New Member Elects Option 3: DC-Only Plan

Basis for Determination of Annual Annuity Estimates & Related Clarifications

- Pay in the final year before retirement was assumed to be $50,000 ($150,000 for Judges). Pay was projected backward using valuation salary scale assumptions.

- Hybrid Defined Benefit (DB) Plan Annual Benefit Accrual Rate: N/A, since under the DC-Only Plan option, there will be no DB Plan.

- Contribution assumptions included:
  - Hybrid DB Plan: N/A
  - Hybrid Defined Contribution (DC) Plan: 7.50% employee contributions and 3.5% employer contribution rate

  Note: Under this Three-Way Hybrid/DC Proposal, members of the PA State Police and all other hazardous duty employees (except psychiatric security aides) are exempt. Thus, they will continue their SERS benefits as-is.

- Annual investment return assumption: DC – 6% per year

- The DC account balances were annuitized using the following conversion basis: 4% interest and RP-2014 unisex mortality.

- To determine how much the above annual annuities replace as a percentage of final pay, divide the benefit amount by $50,000 (or $150,000 for Judges). This result is the replacement ratio, the portion of final income replaced by the plan benefit).

- Figures above are neither audited nor certified. Calculations reflect certain assumptions and are not based on any existing legislative language. Final actuarial results will vary from these estimates based on actual final legislative outcomes and underlying details.