INDEPENDENT FISCAL OFFICE

Second Floor, Rachel Carson State Office Building
400 Market Street
Harrisburg, Pennsylvania 17105

June 4, 2017

The Honorable Jake Corman
Majority Leader
Senate of Pennsylvania
350 Main Capitol Building
Harrisburg, PA 17120

Dear Senator Corman:

I am writing in response to your request of June 4, 2017 concerning an actuarial note for Senate Bill 1, Printer's Number 902. The legislation amends the Public School Employees' Retirement Code and the State Employees' Retirement Code to require that most employees hired after July 1, 2019 (PSERS) or January 1, 2019 (SERS) select one of three new plan design options for retirement benefits.

Under section 615-B of the Administrative Code of 1929, the Independent Fiscal Office (IFO) has the responsibility to review legislative changes that may affect public employee pension or retirement plans and to provide actuarial notes for such legislation. Per your request, the IFO reviewed Amendments A01354 and A01558 to Senate Bill 1, Printer's Number 853 and issued an actuarial note dated June 3, 2017 for those amendments.

The IFO has reviewed Senate Bill 1, Printer's Number 902 and determined that Amendments A01354 and A01558 constitute the entirety of the bill. Based on that determination, the June 3, 2017 actuarial note applies to this legislation, and the bill will not require a new actuarial note prior to further consideration by the General Assembly.

I trust this letter adequately responds to your request. If I may be of any further assistance, please feel free to contact me at (717) 230-8293.

Sincerely,

Matthew J. Knittel
Director

cc: Governor Tom Wolf
Members of the General Assembly

Actuarial Note Transmittal

Independent Fiscal Office

Amendments 01354 and 01558 to Senate Bill 1, Printer's Number 853
June 3, 2017

The Independent Fiscal Office (IFO) submits an actuarial note for Amendments 01354 and 01558 to Senate Bill 1, Printer's Number 853 in accordance with section 615-B of the Administrative Code of 1929. 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 33 of this transmittal document. In addition, this transmittal includes attached cost notes and supplemental letters prepared by Conduent, actuary for the Public School Employees' Retirement System (PSERS) and Korn Ferry Hay Group, actuary for the State Employees' Retirement System (SERS).

The proposal amends the retirement codes to (1) require most new employees to select one of three new plan design options and (2) make actuarial funding changes applicable to SERS. The plan design options include two hybrid plans consisting of defined benefit and defined contribution components. The third option is a stand-alone defined contribution plan. New employees not making an election are automatically assigned to one of the hybrid plans. Current members may elect to join one of the new plans. The actuarial funding changes for SERS include a revision to the normal cost computation and a schedule of additional employer contributions to accelerate payments applied to its unfunded accrued liability. See pages 2 to 7 for a summary of the legislation.

The analysis of the proposal is summarized below. Impacts are presented in nominal dollars (cash flow) and present values computed at a discount rate of 3.6%.

Employer Contributions For FYs 2018-19 through 2049-50, the proposal is projected to reduce employer contributions by $1.4 billion on a cash flow basis and $319 million on a present value basis. Benefit design changes account for $1.2 billion of the savings on a cash flow basis and $592 million on a present value basis. See pages 8 to 11 for details.

Unfunded Liabilities By the end of the projection period (2048 valuation), the financial position of PSERS and SERS is projected to improve by $4.2 billion on a cash flow basis and $1.4 billion on a present value basis. See page 11 for details.

Risk Transfer Two simulations estimate the amount of investment risk transferred under the proposal. An "all employee" simulation demonstrates that the risk transfer grows over time as employees under the new plan design comprise a greater share of the workforce. A "new employee" simulation estimates risk reduction of 53 percent for PSERS and 58 percent for SERS under the new plans. For a 100 basis point reduction in assumed rates of return, the risk reduction is valued at $6.5 billion on a cash flow basis and $2.9 billion on a present value basis. See pages 11 to 17 for details.

Employee Shared Risk/Shared Gain Expansion of shared-risk contributions and introduction of shared-gain contributions could change risk reduction estimates by 11 percentage points for PSERS and 8 percentage points for SERS. See pages 16 to 17 for details.

Investment Fees The Public Pension Management and Asset Investment Review Commission will recommend expenditure reductions to provide $3.0 billion in actuarial savings on a cash flow basis and $1.6 billion on a present value basis. See page 18 for details.

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. The Systems provide retirement benefits under the authority of the Public School Employees' Retirement Code and the State Employees' Retirement Code (Codes).

The following sections summarize the bill and discuss the impact of the proposal. The appendix and glossary at the end of this transmittal document provide context for these sections with additional material on the benefit and funding structure of the Systems. Some readers may prefer to review the appendix before proceeding to the next section.

Current Law (Act 120 of 2010)

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. The retirement benefits administered by the Systems are funded through employee contributions, investment earnings and employer contributions.

The general benefit designs of the Systems remained largely unchanged from the time the authorizing statutes were codified in the 1970s until the enactment of Act 9 of 2001. That 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%. However, Act 120 of 2010 implemented provisions that negated or reversed most of those changes. For 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), but retained the higher employee contribution rates.

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 rate, as a percent of compensation, is 7.5% (PSERS) or 6.25% (SERS). The employee may elect a higher contribution rate 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 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, 2019 (PSERS) or January 1, 2019 (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, 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. 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.

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 1 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 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 8.25% of compensation, which would be divided between the DB and DC components as follows: PSERS members 5.5% (DB) and 2.75% (DC); SERS members 5.0% (DB) and 3.25% (DC).

- For the DB component, the employer contribution rate would be actuarially determined. For the DC component, the employer contribution rate is 2.25% of compensation.

- A multiplier of 1.25% applies to the DB component of the plans.

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 DB component contains lower employee contribution and benefit accrual rates, and the DC component contains a lower employer contribution rate. Under this option:

Table 1: 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%	2.75% 3.25%	4.5% 4.0%	3.0% 3.5%	7.5%
Vesting Period	10 years	10 years	3 years	10 years	3 years	3 years
Benefit Accrual Rate	2.0%	1.25%	n.a.	1.0%	n.a.	n.a.
Superannuation	Age 65 with 3 years credit or service plus age that equals 92	Age 67 with 3 years credit or service plus age that equals 97		Age 67 with 3 years credit or service plus age that equals 97		n.a.
Final Average Salary	Highest 3 years	Highest 5 years		Highest 5 years		n.a.
Employer Contribution Rate	Actuarially determined	Actuarially determined	2.25%	Actuarially determined	2.0%	*PSERS* 2.0% *SERS* 3.5%

Notes: Current law employee contribution and benefit accrual rates exclude optional buy-up. Superannuation for Class T-H is age 67 with a minimum of 3 years of service credit (rule of 97 does not apply to this class).

- 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 1.0% 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 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 Applicable to New Members

In addition to modifications to 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 (except members who opt-in to the new plans).

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 earnings, fees and costs are credited or charged. Employees would have the option to invest more of their annual salary into the DC plan, up to the federal maximum.

Vesting Period

New members of the Systems would become vested in the DB component of the two hybrid plans after accumulating ten years of service credit. For the DC component of the two hybrid plans and the stand-alone DC plan, new members become 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, A-5 and A-6), the age for superannuation, or unreduced retirement benefits, is (1) age 67 with a minimum of three years of service credit or (2) any combination of age and service that totals 97 with a minimum of 35 years of service credit. For Class T-H, the age for superannuation is age 67 with a minimum of three years of service credit.

Early Retirement

Members who elect an early retirement prior to superannuation are subject to the following benefit reductions.

- Members who have 25 years of service credit receive a reduced benefit of 3.0% per annum for each year the member is under age 67. These members are eligible to receive the lower benefit at the following ages:
    - Class T-G at or after age 57. Class T-H at or after age 55.
    - Class A-5 at or after age 57. Class A-6 at or after age 62.
- Members who have less than 25 years of service credit and commence benefits at or after age 62 receive a lower benefit based on each System's actuarial equivalency factors.
- Members who have less than 25 years of service credit and commence benefits prior to age 62 receive a lower benefit based on each System's actuarial equivalency factors for the determination of the reduced benefit between the ages of 62 and 67, and a less favorable factor for the determination of the reduced benefit prior to age 62.

Final Average Salary

The final average salary for new members would be equal to the average compensation of the five highest non-overlapping periods of twelve consecutive months for PSERS, and the five highest calendar years for SERS. For SERS, the amount of voluntary overtime pay included for new hazardous duty members may not exceed 10 percent of the base salary paid during that same period.

Withdrawal of Employee Contributions

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 withdrawals of their own contributions plus statutory interest upon retirement.

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 assumed rate of return by more than 1.0 percentage point over specified look-back periods (10 years when fully phased-in). For new members, the shared-risk contribution rate would be adjusted in increments of 0.75 percentage points, with a maximum increase of 3.0 percentage points.

The bill adds a shared-gain provision for new members that allows a member's contribution rate to be reduced up to 3.0 percentage points below the member's initial rate, under the same conditions that the employee contribution rate can increase (except in reverse directions).

Other Plan Design Provisions Applicable to Current Members

Membership Election

Current members of the Systems would be eligible to opt-in to the new plans. For PSERS, the election period would last for 90 days after notification by the board that the member is eligible to make such election. For SERS, the election period would last from January 1, 2019 through March 31, 2019. Those employees who opt-in to the new plans would receive benefits on a prospective basis applicable to all future service beginning January 1, 2020 (PSERS) or July 1, 2019 (SERS) (past benefits would remain unchanged). Current employees of the Systems who opt-in to the new plans would retain the same employee contribution rate in effect at the time of their election; any post-election adjustment necessary to maintain that rate would be made to the DC plan contribution rate.

Withdrawal of Employee Contributions

Members of Classes T-E, T-F, A-3 and A-4 would be allowed to make actuarially equivalent withdrawals of their accumulated deductions (contributions plus statutory interest) upon retirement. Current law does not permit such withdrawals.

Shared-Gain Provision

The bill extends the shared-gain provision that would be applicable to new members under the proposal to post-Act 120 members. The same computation would be used by both the shared-risk and shared-gain features and the member's rate may deviate up to 2.0 percentage points from their base contribution rate, adjusted in increments of 0.5 percentage points.

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.

- Plow-back of savings For SERS, the bill provides a schedule of additional employer contributions. The schedule is based on the anticipated savings that result from this legislation. For each fiscal year in which there is a projected savings, that amount (assessed as a percentage of all covered compensation) is added to SERS' employer contribution rate. These additional contributions would not supplant any other employer contributions and range from 0.00% to 0.93%. No additional employer contributions are required after FY 2041-2042.

- 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. The bill requires SERS to amortize the unfunded actuarial gains and losses that result from (1) the new benefit changes, beginning July 1, 2019, and (2) the new normal cost method, beginning July 1, 2022, over a 30-year period on a level dollar basis. These provisions are not applicable to PSERS, which would continue to amortize all unfunded actuarial gains and losses from new benefit changes over a 10 -year period on a level percentage of pay basis.

- Asset smoothing For PSERS, the bill provides that the actuarial value of assets that results from the 10-year asset smoothing method cannot deviate more than 30 percent from the market value of assets.

Public Pension Management and Asset Investment Review Commission

The bill establishes the Public Pension Management and Asset Investment Review Commission. The commission is responsible for the study of (1) the performance of current investment strategies and procedures of the Systems, comparing realized rates of return to established benchmarks considering the associated fees paid for active and passive management, (2) the costs and benefits of active and passive investment strategies in relation to future investment activities and (3) alternative investment strategies that will maximize future rates of return net of fees. The commission must also recommend the lowest amount of investment fees necessary to achieve each System's current assumed rate of return and develop recommendations that reduce expenditures to generate actuarial savings of $1.5 billion for each System over 30 years (for a total savings of $3.0 billion on a cash flow basis).

Actuarial Cost Impact

Milliman submitted the attached actuarial note after reviewing Amendments 01354 and 01558 to Senate Bill 1, Printer's Number 853 and the actuarial cost estimates provided by Conduent, the consulting actuary for PSERS and Korn Ferry Hay Group, the consulting actuary for SERS (see attachments). The actuarial cost estimates for SERS are based on the December 31, 2015 actuarial valuation, which reflects an investment return assumption of 7.5%. On April 26, 2017, the SERS Board voted to reduce the investment return assumption to 7.25%, beginning with the December 31, 2016 actuarial valuation. The new investment return assumption of 7.25% is not reflected in the attached cost note provided by Korn Ferry Hay Group.

Impact on Employer Contributions

Table 2 displays the expected nominal dollar cash flow costs/(savings) for employer contributions for the fiscal years (FY) 2018-19 through 2049-50 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, 2018, assuming end of year payment, at 3.6% (a proxy for budget growth) and 7.25/7.5% (the investment return used in PSERS'/SERS' cost notes). The 3.6% proxy for budget growth is based on the average annual growth in projected General Fund revenue from FY 2017-18 to 2021-22 in the IFO's November 2016 five-year economic and budget outlook. Table 4 provides detail for each fiscal year.

Table 2 divides the projected costs/(savings) into three time periods: (1) FY 2018-19 to 2021-22, representing the short-term impact, (2) FY 2022-23 to 2033-34, representing the medium-term impact and (3) FY 2034-35 to 2049-50, representing the long-term impact. The total costs/(savings) shown in Table 2 differ from those in the cost note for SERS. The SERS cost note displays projections through FY 2051-52, and the last two years are excluded from the table to provide costs that are consistent with the period reported for PSERS. The outcomes for the three time periods were as follows:

- For FY 2018-19 to 2021-22, the Systems project an increase in employer contributions for PSERS and a slight decrease in employer contributions for SERS. The short-term increase for PSERS is due to the higher initial costs of the new retirement plans (see page 6 of the Milliman note). For SERS, the initial costs of the new retirement plans would be lower than

Table 2: Total Change in Employer Contributions for Fiscal Years 2018-19 to 2049-50

	Cash Flow			Present Value at 3.6%			Present Value at 7.25/7.5%		
FY Ending	PSERS	SERS	Total	PSERS	SERS	Total	PSERS	SERS	Total
2019 - 2022	$62	$(6)	$56	$55	$(5)	$50	$50	$(4)	$45
2023 - 2034	96	400	496	74	314	388	58	245	302
2035 - 2050	(374)	(1,573)	(1,948)	(146)	(612)	(758)	(59)	(231)	(290)
Total	**(217)**	**(1,180)**	**(1,396)**	**(16)**	**(303)**	**(319)**	**48**	**9**	**57**

Notes: Amounts in millions and based on Systems' actuarial projections. Present value as of June 30, 2018. Values expressed as costs/(savings). See page 10 for breakdown by fiscal year. The present value at 7.25/7.5% represents a discount rate of 7.25% for PSERS and 7.5% for SERS. Table omits the final two years of SERS' projections in order to present comparable periods for PSERS and SERS.

PSERS as their normal cost computation is still based on the average new member. As the proposal reduces benefits for new members, the normal cost for SERS decreases. However, savings from the lower normal cost calculation and the plow-back of those savings largely offset each other.

- For FY 2022-23 to 2033-34, employer contributions for the Systems are projected to increase. For PSERS, the higher initial costs of the new retirement plans continues. For SERS, the normal cost calculation will switch to the traditional Entry-Age Actuarial Cost Method, which will be based on all active members instead of the average new member, thereby increasing employer contributions.

- For FY 2034-35 to 2049-50, employer contributions for the Systems are projected to decline. For both PSERS and SERS, the decline is due to the lower long-term employer costs of the new retirement plans. In addition, for SERS, the plow-back of savings and the 30-year amortization period of any unfunded accrued liabilities that result from enactment of this bill expire during this time period, both of which result in additional savings.

Table 3 allocates the expected costs/(savings) for employer contributions (displayed in Table 2) between the proposed benefit reforms (i.e., the three plan design options) and the proposed funding reforms (e.g., the normal cost calculation). For PSERS, the benefit reforms comprise all of the projected costs/(savings). For SERS, the benefit reforms comprise the vast majority of the projected costs/(savings) when measured on a cash flow basis; however, those costs/(savings) are more evenly distributed between the benefit and funding reforms when measured on a present value basis. This occurs because the savings from the benefit reforms build over time and the higher savings at the back end of the projection period are discounted significantly. In addition, the funding reforms generate costs in the front end of the projection period, but the savings from those reforms are realized in later years, and are more heavily discounted.

Table 3: Allocation of Change in Employer Contributions for Fiscal Years 2018-19 to 2049-50

	Cash Flow			Present Value at 3.6%			Present Value at 7.25/7.5%		
Benefit Reforms									
FY Ending	**PSERS**	**SERS**	**Total**	**PSERS**	**SERS**	**Total**	**PSERS**	**SERS**	**Total**
2019 - 2022	$62	$(138)	$(76)	$55	$(124)	$(69)	$50	$(111)	$(62)
2023 - 2034	96	(410)	(314)	74	(291)	(217)	58	(206)	(148)
2035 - 2050	(374)	(410)	(784)	(146)	(161)	(306)	(59)	(63)	(122)
Total	**(217)**	**(958)**	**(1,175)**	**(16)**	**(576)**	**(592)**	**48**	**(381)**	**(332)**
Funding Reforms									
FY Ending	**PSERS**	**SERS**	**Total**	**PSERS**	**SERS**	**Total**	**PSERS**	**SERS**	**Total**
2019 - 2022	$0	$132	$132	$0	$119	$119	$0	$107	$107
2023 - 2034	0	810	810	0	605	605	0	451	451
2035 - 2050	0	(1,163)	(1,163)	0	(451)	(451)	0	(168)	(168)
Total	**0**	**(221)**	**(221)**	**0**	**273**	**273**	**0**	**389**	**389**

Notes: Amounts in millions and based on Systems' actuarial projections. Present value as of June 30, 2018. Values expressed as costs/(savings). The present value at 7.25/7.5% represents a discount rate of 7.25% for PSERS and 7.5% for SERS. Table omits the final two years of SERS' projections in order to present comparable periods for PSERS and SERS.

Table 4: Change in Employer Contributions for Fiscal Years 2017-18 to 2049-50

	Cash Flow			Present Value at 3.6%			Present Value at 7.25/7.5%		
FYE	**PSERS**	**SERS**	**Total**	**PSERS**	**SERS**	**Total**	**PSERS**	**SERS**	**Total**
2018	$0	$0	$0	$0	$0	$0	$0	$0	$0
2019	0	2	2	0	2	2	0	2	2
2020	13	0	13	12	0	12	11	0	12
2021	25	(2)	23	23	(2)	21	21	(2)	19
2022	23	(6)	17	20	(5)	15	18	(4)	13
2023	20	93	114	17	78	95	14	65	79
2024	18	81	99	15	66	80	12	53	65
2025	17	71	87	13	55	68	10	43	53
2026	12	60	71	9	45	54	7	33	40
2027	11	49	59	8	35	43	6	25	31
2028	8	37	46	6	26	32	4	18	22
2029	4	26	30	3	18	20	2	12	14
2030	5	14	19	3	9	12	2	6	8
2031	3	3	6	2	2	4	1	1	2
2032	2	(10)	(8)	1	(6)	(5)	1	(4)	(3)
2033	(1)	(12)	(13)	(0)	(7)	(8)	(0)	(4)	(4)
2034	(3)	(12)	(16)	(2)	(7)	(9)	(1)	(4)	(5)
2035	(4)	(14)	(18)	(2)	(7)	(10)	(1)	(4)	(5)
2036	(8)	(16)	(24)	(4)	(9)	(13)	(2)	(4)	(7)
2037	(10)	(20)	(29)	(5)	(10)	(15)	(3)	(5)	(8)
2038	(12)	(24)	(36)	(6)	(12)	(18)	(3)	(6)	(9)
2039	(12)	(30)	(42)	(6)	(14)	(20)	(3)	(7)	(9)
2040	(15)	(37)	(52)	(7)	(17)	(24)	(3)	(7)	(11)
2041	(17)	(45)	(62)	(8)	(20)	(28)	(3)	(8)	(12)
2042	(21)	(53)	(74)	(9)	(23)	(32)	(4)	(9)	(13)
2043	(23)	(199)	(222)	(10)	(82)	(92)	(4)	(33)	(37)
2044	(27)	(217)	(244)	(11)	(87)	(97)	(4)	(33)	(37)
2045	(29)	(231)	(260)	(11)	(89)	(100)	(4)	(33)	(37)
2046	(35)	(244)	(279)	(13)	(91)	(104)	(5)	(32)	(37)
2047	(35)	(129)	(165)	(13)	(46)	(59)	(5)	(16)	(21)
2048	(39)	(120)	(160)	(14)	(42)	(55)	(5)	(14)	(19)
2049	(40)	(114)	(154)	(13)	(38)	(51)	(5)	(12)	(17)
2050	(47)	(81)	(128)	(15)	(26)	(41)	(5)	(8)	(13)
Total	**(217)**	**(1,180)**	**(1,396)**	**(16)**	**(303)**	**(319)**	**48**	**9**	**57**

Notes: Amounts in millions and based on Systems' actuarial projections. Present value as of June 30, 2018. Values expressed as costs/(savings). The present value at 7.25/7.5% represents a discount rate of 7.25% for PSERS and 7.5% for SERS. Table omits the final two years of SERS' projections in order to present comparable periods for PSERS and SERS.

For further detail on the projected costs/(savings) and the impact on employer contribution rates and amounts, see the actuarial note provided by Milliman and graphs beginning on page 44 of that note. The graphs show the estimated employer contribution rates and amounts, funded ratio and unfunded accrued liability of each System over the projection period under current law and the proposal.

Change to Unfunded Accrued Liabilities

Table 5 displays the change in the unfunded accrued liabilities of the Systems under current law and the proposal at the end of the projection period used by the Systems' actuaries. The proposal would result in a $4.3 billion improvement compared to current law measured on a nominal basis, and $1.4 billion measured on a present value basis using a 3.6% discount rate. The majority of the change for SERS, which comprises nearly all of the total change, is due to the new normal cost methodology scheduled to begin with the 2021 actuarial valuation.

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 IFO, in consultation with its actuary, has determined that the changes proposed in Amendments 01354 and 01558 to Senate Bill 1, Printer's Number 853, 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, 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 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).

Table 5: Unfunded Accrued Liabilities under Current Law and Proposal at 2048 Valuation

	Cash Flow			Present Value at 3.6%			Present Value at 7.25/7.5%		
	PSERS	SERS	Total	PSERS	SERS	Total	PSERS	SERS	Total
Current Law	$610	$2,280	$2,890	$197	$735	$932	$65	$225	$290
Proposed Law	600	(1,960)	(1,360)	193	(632)	(439)	64	(194)	(130)
Change	**(10)**	**(4,240)**	**(4,250)**	**(3)**	**(1,367)**	**(1,370)**	**(1)**	**(419)**	**(420)**

Notes: Amounts in millions and based on Systems' actuarial projections. Present value as of June 30, 2018. The present value at 7.25/7.5% represents a discount rate of 7.25% for PSERS and 7.5% for SERS.

[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.

- 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.

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 two investment return sensitivity analyses 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 a sensitivity analysis is a reasonable method that could be used to quantify the shift of investment risk.

Investment Risk Transfer Analysis

For this analysis, the IFO performed two simulations for employer contributions in order to evaluate the amount of risk that potentially would be transferred from the employer to the employee. The first simulation, using total employer contributions for all employees, considers a 100 basis point (1.0 percentage point) reduction in the investment rate of return assumption, and estimates the impact on total employer contributions under current and proposed law. The second simulation utilizes the employer normal cost for new employees to consider the impact of a 100 and 200 basis point reduction in the investment rate of return assumptions. The data for the simulations were provided by PSERS and SERS based on a request made by the IFO.

It should 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 participa-

tion rates: default hybrid (50 percent), alternative hybrid (25 percent) and DC-only (25 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 to employees would increase because the risk transfer for DC plans is 100 percent. In particular, the risk transfer analysis would be responsive to the assumption regarding the PSERS DC-only plan participation rate.

All-Employee Simulation

The all-employee simulation evaluates the risk transfer for total employer contributions, including current and new members. It allows the assumed rate of return under current law (CL) and proposed law (PL) to fall by 100 basis points (1.0 percentage point). Based on this simulation, the investment risk transfer due to adoption of the proposal is equal to the difference in employer contributions when the assumed rate of return declines by 1.0 percentage point under current and proposed law.

PSERS: (PL at 6.25% - PL at 7.25%) – (CL at 6.25% - CL at 7.25%) = risk transfer

SERS: (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 reduced by 100 basis points.

Table 6 shows the risk transfer computation for SERS and PSERS based on simulations performed by the Systems. The simulation shows that under current law, total employer contributions would increase by $49 billion or 19.2 percent over the 32-year projection period. Under the proposal, total employer contributions would increase by $45 billion or 18.1 percent over the same period. The differential between those figures is -$4.0 billion (-7.8 percent), which quantifies the higher sensitivity of total employer contributions under the current system from a 100 basis 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. The risk shift is reduced due to the exclusion of hazardous duty employees from the proposal. Those employees comprise approximately one-quarter of payroll for SERS over the projection period.

The analysis also reviewed 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 the computed investment risk transfer increases to nearly 40 percent.

Table 6: Impact of Lower Returns on Employer Contributions for Fiscal Years 2018-19 to 2049-50

	Current Law	Proposed Law	Dollar Change
Current Assumed Rate of Return	$208	$206	$(2)
100 Basis Point Reduction	257	251	(6)
Difference	**49**	**45**	**(4)**

Notes: Amounts in billions. Cash flow basis.
Source: Simulation data provided by PSERS and SERS. Computations by IFO.

The simulation used a deterministic approach, where the realized rate of return is known with certainty (and equals the assumed rate) and remains constant in all future years. An alternate approach would use a stochastic analysis that allows the assumed and average realized rates of return to decline by 100 basis points, but employs a simulation allowing returns to vary randomly over the 30-year horizon based on a specified (normal) distribution. However, this approach 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 may increase both the absolute and relative size of the risk transfer compared to the more general approach used for this note.

New Employee Simulation

The second simulation isolates the risk transfer for new employees who become members or participants in one of the three plans available under the proposal. This method utilizes the employer normal cost (ENC) for new employees under current and proposed law. The ENC is the contribution employers must make in order to fully fund the benefits earned by employees, and is based on the demographic and economic assumptions (e.g., inflation and the investment rate of return) that are adopted by the Systems. The ENC is expressed as a percentage, and it does not include any additional rate to amortize the unfunded liabilities.

This simulation considers the impact of two investment return scenarios: a 100 basis point reduction (1.0 percentage points) and a 200 basis point reduction (2.0 percentage points) to each System's assumed rate of return. For each investment return scenario, the analysis measures the ENC increase under current law and compares it to the ENC increase under proposed law. This approach is more conservative than simulations in which investment returns fall below assumed levels because it requires that additional employer contributions associated with a lower rate of return begin earlier than they would otherwise.

The results of the new employee simulation are displayed in Table 7, which shows the methodology for the computations step-by-step. The analysis reveals that the proposed plan design could mitigate increases in those contributions by 53 percent for PSERS and 58 percent for SERS under both scenarios.

The scale of the risk mitigation over the long-term can be estimated in dollar terms by applying the increase in the ENC under current and proposed law for each scenario to salary projections for new employees over the 32-year projection period (FY 2018-19 to 2049-50). The differential between current and proposed law represents the potential saving to employer contributions under the two lower return scenarios. The results of that analysis are presented in Table 8 on a cash flow and present value basis.

The analysis finds that employer contributions would increase less under the proposal compared to current law if the investment rates of return are reduced below current assumptions. This result occurs because the new benefit design is less sensitive to changes in investment returns than the current benefit design. Similar to the all-employee simulation, this method does not directly address employee shared-risk contributions, which are discussed separately in the next subsection.

Table 7: New Employee Risk Transfer Computations		
	PSERS[1]	SERS[2]
Employer Normal Cost (DB only) - Current Law/Act 120[3]		
A. At the assumed rate of return (7.25% for PSERS; 7.50% for SERS)	2.90%	5.48%
B. 100 basis points below the assumed rate	5.38%	7.74%
C. 200 basis points below the assumed rate	7.86%	10.00%
Employer Normal Cost + DC Contribution - Proposed Law[4]		
D. At the assumed rate of return (7.25% for PSERS; 7.50% for SERS)	2.68%	3.75%
E. 100 basis points below the assumed rate	3.83%	4.71%
F. 200 basis points below the assumed rate	4.99%	5.66%
Current Law Change in Employer Cost		
G. 100 basis point reduction (B - A)	2.48%	2.26%
H. 200 basis point reduction (C - A)	4.96%	4.52%
Proposed Law Change in Employer Cost		
I. 100 basis point reduction (E - D)	1.16%	0.96%
J. 200 basis point reduction (F - D)	2.32%	1.92%
Percentage Risk Reduction		
100 basis point reduction (1-(I/G))	53%	58%
200 basis point reduction (1-(J/H))	53%	58%
Employer Costs With 100 Basis Point Reduction		
Current law cost from FYE 2019 to 2050	$7.9	$4.0
Proposed law cost from FYE 2019 to 2050	$3.7	$1.7
Employer cost reduction	$4.2	$2.3
Employer Costs With 200 Basis Point Reduction		
Current law cost from FYE 2019 to 2050	$15.8	$8.0
Proposed law cost from FYE 2019 to 2050	$7.4	$3.4
Employer cost reduction	$8.4	$4.6
Addendum: New Entrant Payroll FYE 2019 to 2050	$317.6	$176.1

Notes: Amounts in billions. Cash flow basis.

[1] Blended rates for classes T-E and T-F for current law and classes T-G, T-H and DC for proposed law. Blended rates computed using the membership election rates in the Conduent cost note.

[2] Blended rates for classes A-3 and A-4 for current law and classes A-5, A-6 and DC for proposed law. Blended rates computed using the membership election rates in the Korn Ferry Hay Group cost note.

[3] The employer normal cost under Act 120.

[4] Includes the employer normal cost of the DB plan for new hires under the proposal plus the employer's contribution to the DC plan.

Source: System actuaries and IFO calculations.

Employee Shared-Risk Contributions

The proposed legislation modifies the employee shared-risk contributions authorized under current law, and introduces shared-gain provisions that provide for the possibility of lower employee contributions if investment returns exceed the assumed rates. The all-employee simulation and the new employee simulation each focus on the interaction between lower investment return assumptions and benefit design changes, but they exclude the potential impact of shared-risk/gain contributions. However, it is useful to consider this provision as part of a risk transfer analysis because shared-risk/gain contributions, if triggered, would affect employer contributions on a dollar-for-dollar basis.

New employee payrolls are projected to be $317 billion for PSERS and $176 billion for SERS over the 32-year projection period. The present values of the payrolls, discounted at 3.6%, would be $148 billion and $83 billion, respectively. Analysis of the payroll data reveals that one increment of the shared-risk/gain contributions, applied to every fiscal year in which the provision applies, would change new employee contributions (higher for shared-risk, lower for shared-gain) by $2.4 billion for PSERS and $1.3 billion for SERS on a cash flow basis. The present values discounted at 3.6% would be $1.1 billion and $0.6 billion, respectively.

If one shared-risk/gain increment (0.75 percentage point) is implemented after the first look-back period and an additional increment is added every three years up to the maximum (3.0 percentage points), it would change new employee contributions by $9.0 billion for PSERS and $4.8 billion for SERS on a cash flow basis. The present values discounted at 3.6% would be $4.0 billion and $2.1 billion, respectively.

The percentage of risk mitigation computed under the new employee simulation would be affected by any employee shared-risk/gain contributions. If one increment of shared-risk/gain contributions was in effect and applied to one-half of the projection period in the 100 basis point reduction scenario, the risk mitigation estimated for that scenario would change by 11 percentage points for PSERS and 8 percentage points for SERS. The impact is greater for PSERS because its actuary assumed that only 5 percent of new members would elect the DC-only option, while SERS' actuary assumed that 25 percent of its new members would elect that option. Higher participation in the DC-only plan makes the SERS' employer contributions less sensitive to investment risk than would otherwise occur.

It is possible that shared-risk/gain contributions would not be triggered during the projection period, and the impact on employee and employer contributions would be zero. The impact of the provision will depend upon the relationship between realized investment returns and the assumed rate of re-

Table 8: Potential New Employee Risk Reduction for Fiscal Years 2018-19 to 2049-50

	Cash Flow			Present Value at 3.6%			Present Value at 7.25/7.5%		
ARR Reduction	**PSERS**	**SERS**	**Total**	**PSERS**	**SERS**	**Total**	**PSERS**	**SERS**	**Total**
100 basis points	$4,196	$2,294	$6,490	$1,884	$1,040	$2,924	$926	$494	$1,420
200 basis points	8,392	4,589	12,981	3,768	2,079	5,847	1,853	988	2,841

Notes: Amounts in millions. Present value as of June 30, 2018. ARR is the assumed rate of return. Basis point reduction is applied to the ARR for the respective system.

turn. Investment returns for the most recent ten-year period suggest that a single increment adjustment is possible, but multiple increments are much less likely. Over the long term, the implementation of employee shared-gain contributions may partially offset the higher increment and corridor for shared-risk contributions.

If one believes that the Systems' assumed rates of return will exceed the actual returns likely to be realized over the next several decades, then shared-risk contributions will be more probable than shared-gain contributions. This analysis does not make an assumption regarding the proper level for the assumed investment rate of return. However, a demonstration of the potential impacts of the proposed expansion of the shared-risk/gain provision may be useful to policymakers to establish upper and lower bounds for its effects, and it will allow them to evaluate the provision based on their assessment of the current assumed rates of return.

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 disbursements. The DB plan can ensure lifetime incomes to retirees because pooled funds essentially transfer a portion of projected benefits away from members with shorter 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 may 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 a recent edition of the *Annuity Shopper Buyer's Guide* (April 2017), 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.

Investment Fees

The proposal establishes the Public Pension Management and Asset Investment Review Commission, which must develop recommendations to reduce expenditures to generate actuarial savings of $1.5 billion for each System over 30 years. This analysis presents those savings on a present value basis as of June 30, 2018, assuming end of year payment, at 3.6% (a proxy for budget growth) and 7.25/7.5% (the investment return used in PSERS'/SERS' cost notes) discount rates. The analysis assumes that the savings will occur between FY 2018-19 and 2047-48, and are spread proportionately across all years based on the projected investment income of each System. For PSERS, the recommended amount would be $1.5 billion on a cash flow basis, $769 million at a 3.6% discount rate and $435 million at a 7.25% discount rate. For SERS, the recommended amount would be $1.5 billion on a cash flow basis, $805 million at a 3.6% discount rate and $461 million at a 7.5% discount rate. The combined total would be $3.0 billion on a cash flow basis, $1.6 billion at a 3.6% discount rate and $896 million at a 7.25/7.5% discount rate. The somewhat lower savings for PSERS on a present value basis is due to a greater proportion of the savings occurring near the end of the projection period, which results in PSERS savings being more heavily discounted compared to SERS.

Comparison of Benefits

The proposal implements changes to the 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 includes a defined contribution (DC) plan for new members. The complex nature of this shift in the benefit design makes it difficult to assess how the cumulative effects of the changes could impact future benefits.

This section compares 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 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 computed retirement benefits. Table 9 displays the results of the comparison.

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

Table 9: Comparison of Annual 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	$33,173	$34,048	$21,530	$22,071	$11,815	$12,230
DB Component	$24,420	$24,420	$16,127	$16,127	$8,821	$8,937
DC Component	$8,753	$9,629	$5,403	$5,943	$2,994	$3,293
Percentage Change in Employee Contributions	10%	32%	10%	32%	10%	32%
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	82%	84%	75%	77%	69%	72%
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	55%	57%	36%	37%	20%	20%
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 reduction of 6.0% for employees with 25 years of credited service, and 12.0% (PSERS) or 13.14% (SERS) for employees with 15 years of credited service.

total employee contribution rates. This outcome 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) is the same between the Systems regardless of the employee contribution.

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 reflects those costs. See the notes at the bottom of Table 9 for detail regarding other assumptions incorporated into the analysis.

Separations Prior to Vesting

Data from the Systems show that a relatively high percentage of separations is attributable to employees with less than 10 years of service. For SERS, the figure for CY 2015 is 47 percent, and for PSERS, the figure for FY 2015-16 is 61 percent. These figures are overstated by an unknown amount because some employees who leave prior to vesting will return after a period of separation.

For the large share of employees who separate prior to vesting, the benefit comparison across the plan designs is quite different than the comparison shown in Table 9 (which assumes retirement at age 65). For example, a SERS employee with a starting salary of $30,000 who separates after seven years of service would receive or have access to $2,250 more in benefits (cash flow basis, $1,990 discounted at 3.6%) under the DC-only option compared to the default hybrid option. That outcome occurs for two reasons. First, the contributions that the employee will have access to is higher under the DC-only option (11.0% of annual salary; 7.5% employee DC and 3.5% employer DC) than the default hybrid option (10.5% of salary; 5.0% employee DB, 3.25% employee DC and 2.25% employer DC). Second, the employee would receive a 4.0% annual return on the employee DB contributions, but the analysis assumes a 6.0% average return for DC contributions. Therefore, under the default hybrid option, roughly half of the investment to which the employee is entitled to upon separation is assumed to earn a lower rate of return. For the SERS DC-only plan, the entire investment is assumed to earn a 6.0% annual return.

For a SERS member who anticipates separation prior to vesting, the attractiveness of the DC-only plan would be greater if the employee managed to make the same annual contribution as under the default hybrid option (i.e., saves the same percentage of salary). Under the default hybrid option, the employee contributes 8.25% of compensation (5.0% DB, 3.25% DC), but 7.5% under the DC-only plan. If the same employee from the previous example managed to save the 0.75 percentage point differential, then the DC-only plan yields $4,380 more in benefits on a cash flow basis ($3,850 discounted at 3.6%).

These results do not hold for a similar PSERS employee due to the much lower employer contribution rate for the DC-only plan. In that case, the default hybrid option yields a higher level of benefits despite the difference in the rate of return for employee DB contributions (4.0%) versus DC contributions (6.0%).

Sensitivity to Lower Rates

Table 10 (next page) shows the results of a 1.0 percentage point reduction in investment returns, from 6.0% to 5.0%, on retirement benefits for the default hybrid plan (DC component only) 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 in the financial 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.

Table 10: Comparison of Annual 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%	$33,173	$34,048	$21,530	$22,071	$11,815	$12,230
Default Hybrid Plan at 5.0%	$31,807	$32,546	$20,928	$21,408	$11,612	$12,007
Change to DC Plan	-$1,366	-$1,503	-$603	-$663	-$203	-$223
Percent Change to DC	-15.6%	-15.6%	-11.2%	-11.2%	-6.8%	-6.8%
Percent Change to Total	-4.1%	-4.4%	-2.8%	-3.0%	-1.7%	-1.8%
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	-$2,596	-$3,005	-$1,145	-$1,326	-$385	-$446
Percent Change	-15.6%	-15.6%	-11.2%	-11.2%	-6.8%	-6.8%

Appendix

This appendix provides information on the benefit and funding structure of the Public School Employees' Retirement System (PSERS) and the State Employees' Retirement System (SERS) (Systems). It provides additional context for changes proposed in the amendments to Senate Bill 1.

Introduction

Employers offer pension plans to attract and retain employees because workers place a relatively high premium on retirement security. Public sector employers may offer defined benefit (DB) or defined contribution (DC) plans, or some combination of the two. In general, most public sector pension plans are DB plans, and the plans for Pennsylvania public school and state employees are also of that variety. The text that follows provides a brief description of plan types.

Defined Benefit Plans

Public sector pension plans have traditionally been based on a DB design. Participants in such plans receive a defined or fixed benefit (i.e., payment) upon retirement. The plans are designed to prefund the benefits through a designated fund that is composed of employee contributions, investment earnings and employer contributions. Employee contributions are usually fixed and expressed as a percentage of salary or compensation (e.g., 6% of compensation). These contributions are pooled together and invested in various financial instruments. Employer contributions are computed after taking account of employee contributions and investment earnings.

Retirement benefits under these plans are usually paid to retirees through monthly annuities (i.e., a stream of monthly payments made to an individual), which are calculated using a formula based on factors such as age, duration of employment with the employer and compensation. Another important factor is the benefit accrual rate, or multiplier, which is applied to determine the monthly benefit. For example, a retiree with 30 years of employment, compensation 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.

As noted, the promised benefit payment is fixed, whereas the employer contributions made to the plan vary based on the experience of the fund. As a result, participants are largely insulated from the losses and gains that occur from the fund's assets being invested in volatile markets.

Defined Contribution Plans

An alternative to a DB pension plan is a DC plan. In a DC plan, each participant has a separate, individual account (e.g., a 401(k) plan). Under these plans, employee and employer contributions (both fixed and expressed as a percentage of compensation) are made to an individual account. The accounts are typically managed by an independent, third-party administrator, and employees direct how their accounts are distributed among a variety of investment options.

Upon retirement or separation from an employer, participants in these plans are entitled to the balance of their individual account, which is determined by accumulated contributions and investment income, less any fees or expenses. As a result, market performance has a direct impact on the value

of the individual account and thus the benefit that will be provided at retirement. Retirement benefits are paid in a lump sum or as an annuity, or a combination of the two. Unlike a DB plan, the employer is not responsible for providing the benefit payment once an employee retires or otherwise separates from employment.

Hybrid Plans

Hybrid plans combine DB and DC plan features and are often designed around an approach that uses separate, but coordinated, DB and DC plans. There are three main types of hybrid plans: "side-by-side" plans, "stacked" plans and cash balance plans.

Side-by-side and stacked plans combine a DB pension with a DC retirement account. In a side-by-side plan, employee and employer contributions are made to both a DB and DC plan, regardless of the employee's compensation. In a stacked plan, contributions are made to a DB plan, up to a specified level of compensation. After that point, contributions are made to a DC plan.

Under these two types of hybrid plans, the contributions made to the DB and DC plans, and the benefits that derive from them, have the same features as their corresponding stand-alone plans, albeit with lower contribution rates and less generous benefits at retirement. Although this may result in lower benefit payments from each plan separately compared to a stand-alone plan, participants are entitled to both a DB pension and the balance of their DC retirement account.

A cash balance plan is a type of DB plan, but retirement benefits are not based on a formula. Instead, each employee receives an annual credit (expressed as a percentage of income plus a set interest rate) to a hypothetical account. Upon retirement, the balance in the account is converted into a lump sum payment or monthly annuity. This type of DB plan can be combined with a DC plan.

In the private sector, hybrid plans have been replacing traditional retirement plans for many years. More recently, some public sector employers have also switched to hybrid systems for new employees. Employers move to such plans in an attempt to (1) control plan costs, (2) reduce the volatility of employer contributions and (3) shift some of the inherent risk associated with the operation of a DB plan from the employer to the employee.

Portability of Benefits

A major distinction between DB and DC plans is portability. A DB plan is more valuable to employees that remain with the same employer for an extended period of time. Retirement benefits under DB plans generally do not transfer between different employers. In addition, the value of the benefit increases each year an employee remains with the same employer, because the formula used to calculate the benefit is based on the duration of employment with the employer. As a result, an employee who remains with the same employer earns a greater benefit than an employee who is employed for the same number of years by multiple employers.

For example, a retiree with 30 years of employment with one employer, compensation 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. In comparison, a retiree with 30 years of employment that is split evenly between two employers would receive a lower benefit. Typically, employees earn a lower salary in the beginning of their career. The

employee would therefore receive an annual retirement benefit of $45,000 x 15 x 0.020 = $13,500 from the first employer and $60,000 x 15 x 0.020 = $18,000 from the second employer, for a total annual retirement benefit of $31,500.

Due to portability, a DC plan is more valuable to employees in the early stages of their careers or those who are employed by multiple employers. DC plan assets are in separate, individual accounts that are usually portable and can move from one employer to the next.

Public Pension Plans in Pennsylvania

In Pennsylvania, the Public School Employees' Retirement System (PSERS) and the State Employees' Retirement System (SERS) (Systems) administer governmental, cost-sharing, multiple-employer DB 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.

PSERS and SERS have a long history of providing retirement benefits to Pennsylvania employees. For PSERS, enabling legislation was enacted in 1917; for SERS, 1923. As of June 30, 2016, there were 781 participating employers in PSERS; with 257,080 active members and 226,009 annuitant members. As of December 31, 2015, there were 104 participating employers in SERS; with 105,025 active members and 124,689 annuitant members.

The Systems provide retirement benefits under the authority of the Public School Employees' Retirement Code and the State Employees' Retirement Code (Codes). The Codes contain multiple membership classes, which are used to define the parameters of a member's retirement benefit. PSERS has four membership classes: Class T-C, Class T-D, Class T-E and Class T-F. SERS has seven main membership classes: Class A-3, Class A-4, Class A, Class AA, Class D-4, Class E1 and Class E2. Membership classes are defined by the following characteristics:

- **Vesting Period** — Members of the Systems are entitled to a retirement benefit upon vesting. In general, vesting is based on the number of years employed and typically ranges between 5 and 10 years. If an employee does not meet the vesting requirements of their membership class, they are entitled to their contributions plus four percent interest.
- **Retirement Age** — Normal retirement, also known as superannuation or full retirement, entitles members to receive a retirement benefit without penalty. Normal retirement requirements are based on age and/or employment length. Early retirement is available to vested members who do not meet the normal retirement requirements. Disability retirement is also available to members who qualify.
- **Employee Contributions** — Employee contributions are withheld as a fixed percentage of compensation.

- **Shared Risk** — Based on the investment earnings of the pension fund, the base employee contribution rate for certain membership classes may increase or decrease by 0.5 percentage points within a specified range once every three years. The employee contribution rate cannot fall below the base contribution rate or rise above the specified maximum.
- **Benefit Accrual Rate** — Used to determine the retirement benefit. The benefit accrual rate is multiplied by the member's final average salary (highest three years of pay) and number of years of employment. Also referred to as the multiplier.
- **Maximum Single Life Annuity** — Retirement option that provides the maximum monthly benefit amount available. Other retirement options provide a reduced benefit in exchange for survivor benefits or the withdrawal of the member's contributions plus four percent interest.

In most cases, membership classes are determined by the employee's date of hire. Table A1 presents a benefit design comparison for PSERS and SERS 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.

- **Act 9 of 2001** — Covers new entrants to the Systems hired (1) after 6/30/2001 and before 7/1/2011 (PSERS) or (2) after 12/31/2001 and before 1/1/2011 (SERS). The act established new classes of membership and increased pension benefits for school and state employees through an 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 12/31/2010 (SERS). The act established new classes of membership and reduced the basic benefit accrual rate and restored the 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.

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	*PSERS*	(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
	SERS	(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

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.

Pension Funding

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. The Systems are funded through employer contributions, employee contributions and returns on investments. The employer contribution requirements are based on the employer normal cost, plus any contributions necessary to amortize the unfunded liabilities of the Systems over the statutorily-specified amortization time periods. The Boards of the Systems, in consultation with their actuaries, establish the employer contribution rates annually. Figure A1 displays the employer contribution rates from 1980 to 2017.

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. A pension trust fund in which the value of the actuarial accrued liabilities exceeds the actuarial value of assets has an unfunded actuarial accrued liability. 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 2017.

An unfunded liability represents a long-term debt that must be paid off, or amortized, over time through installment payments. The unfunded liability will fluctuate in response to plan experience. Favorable plan experience, such as an extended period of investment returns that exceed the pension

fund's assumed rate of return, would result in an actuarial gain, and reduce the unfunded liability and improve the funded condition of the plan. Conversely, a period of unfavorable plan experience would result in an actuarial loss, causing the unfunded liability to grow and ultimately resulting in the need for additional funding to offset those losses.

The amount and timing of payments applied to the unfunded actuarial accrued liability will be determined by: (1) amortization methods and periods, (2) asset smoothing periods and (3) limits on employer contribution rates (collars). These items are discussed in the following paragraphs.

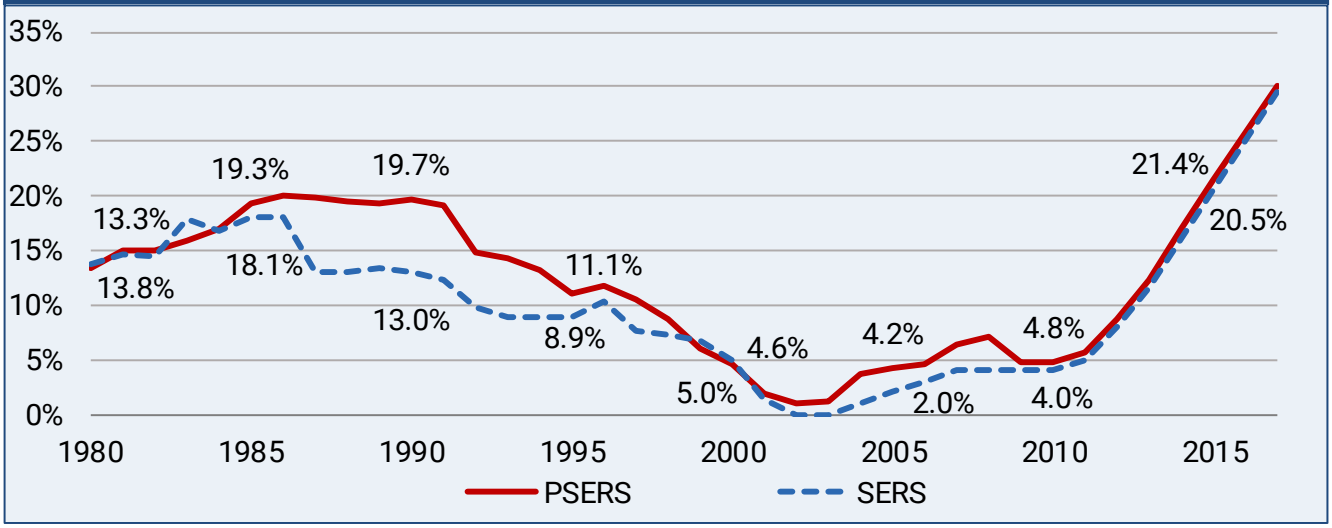
Amortization Methods and Periods

Unfunded accrued liabilities generally are amortized using (1) level dollar amortization or (2) level percentage of projected payroll amortization. Currently, SERS uses the level dollar method over 30 years and PSERS uses the level percentage of projected payroll method over 24 years.

Under level dollar amortization, the amount to be amortized is divided into equal dollar amounts to be paid over a specified number of years. Because annual covered payroll of active members can be expected to increase in future years as a result of inflation, level dollar payments generally represent a decreasing percentage of annual payroll. Under level percentage of projected payroll amortization, the percentage remains constant, but payment amounts increase each year at the same rate as the increases in annual covered payroll of active members. The level dollar method will result in higher initial payments compared to the level percentage of payroll method if the amortization periods are the same and payrolls are projected to increase.

Depending on the source of the unfunded liability, the statutes governing PSERS and SERS specify different amortization periods. For example, PSERS and SERS use a 24-year period and 30-year period, respectively, to amortize changes to their unfunded liabilities due to factors such as: experience differing from actuarial assumptions, differences between employer contributions and actuarially recommended contributions, and active members making shared-risk contributions. However, the Systems use a 10-year period to amortize changes to their unfunded liabilities due to legislative changes, including ad-hoc supplemental annuities.

Figure A1: Employer Contribution Rates



Asset Smoothing

In public pension systems, asset smoothing involves the gradual recognition of investment gains and losses over time (most commonly, three to five years) rather than immediately and is part of the method used to determine the actuarial value of assets in a pension trust fund. PSERS and SERS currently use a 10-year and 5-year asset smoothing period, respectively.

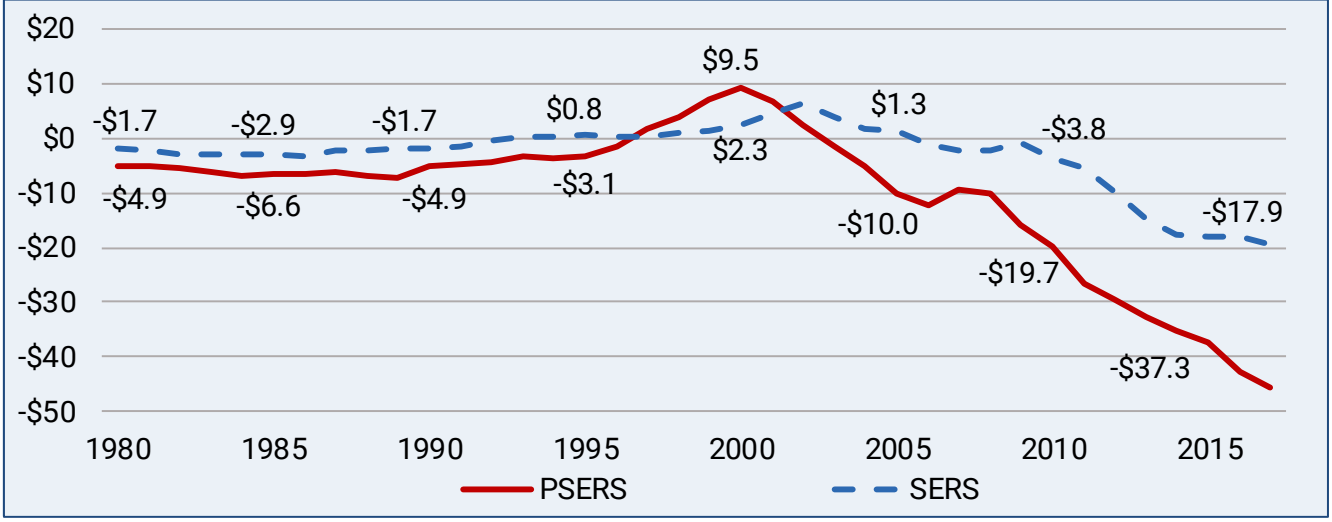
Asset smoothing and amortization periods each impact the recognition of investment gains and losses. Under current law, investment gains and losses are fully recognized over a 34-year period (PSERS) and 35-year period (SERS). This reflects both the smoothing of gains and losses to determine the unfunded accrued liabilities of the Systems and the amortization of those gains and losses. For PSERS, the 34-year period is divided between a 10-year smoothing period and 24-year amortization period. For SERS, the 35-year period is divided between a 5-year smoothing period and 30-year amortization period.

A primary goal of the various smoothing and amortization methods is to avoid large year-to-year fluctuations in employer contributions that may otherwise result from volatility in the investment markets. In the short-term, the smoothing period mitigates the positive and negative effects of major investment gains and losses. However, the delay may cause the actuarial value of assets to deviate significantly from the market value of those assets.

Rate Collars

Limits on the rate at which employer contributions increase from one year to the next are referred to as "collars." Act 120 of 2010 imposed collars to manage the increases in employer contributions caused by significant investment losses in the 2008-2009 recession. Currently, the collars apply if the actuarially determined employer contribution rate would increase by more than four and one-half percentage points compared to the prior year. For FY 2017-18 employer contributions, neither PSERS' nor SERS' employer contribution rates are impacted by the collars.

Figure A2: Unfunded Liability History ($ billions)



Employer Contribution Rates

Table A2 decomposes employer contribution rates from FY 2015-16 to FY 2017-18. The employer contribution rate is comprised of three components: (1) the employer normal cost rate, (2) the unfunded accrued liability rate and (3) the application of a statutorily-specified minimum or maximum pension rate (e.g., collars).

The normal cost is the amount of contributions necessary to fund pension benefits earned in the prior year. For example, the normal cost rate for PSERS in FY 2017-18 is 15.24%; meaning contributions equal to 15.24% of PSERS' appropriated payroll must be made in that year in order to fund the benefits earned by current plan members. The employer normal cost rate is determined by subtracting employee contributions from the total normal cost rate. On average, members of PSERS contributed 7.54% of compensation in FY 2017-18; therefore, the employer normal cost rate is 15.24% - 7.54% = 7.70%.

As noted, any unfunded liabilities of the Systems must be paid off over time through installment payments. The unfunded accrued liability rate is attributable to these payments, which are added onto the employer normal cost rate. For FY 2017-18, the unfunded accrued liability rate for PSERS is 24.04%, for a total pension employer contribution rate of 7.70% + 24.04% = 31.74%, which represents the employer contribution rate necessary to fund the benefits earned in that year and pay down the unfunded liability of the System.

If a statutorily-specified minimum or maximum pension rate is applicable, then the employer contribution rate is adjusted upward or downward. For FY 2017-18, no adjustment to the PSERS' or SERS' employer contribution rate is required.

Table A2: Employer Contribution Rates Decomposed

	2015-16	2016-17	2017-18
PSERS			
Normal Cost Rate	8.38%	8.31%	7.70%
Unfunded Liability Rate	19.44%	20.89%	24.04%
Act 120 Collar Adjustment	-2.82%	0.00%	0.00%
Total Pension Employer Contribution Rate	**25.00%**	**29.20%**	**31.74%**
SERS			
Normal Cost Rate	4.95%	4.52%	4.91%
Unfunded Liability Rate	26.56%	27.62%	28.31%
Act 120 Collar Adjustment	-6.51%	-2.64%	0.00%
Total Pension Employer Contribution Rate	**25.00%**	**29.50%**	**33.22%**

Notes: Employer contribution rates for PSERS exclude health insurance contributions. For PSERS, the normal cost represents the weighted average employer rate for both pre- and post-Act 120 employees. For SERS, the normal cost represents the employer rate for post-Act 120 employees only.

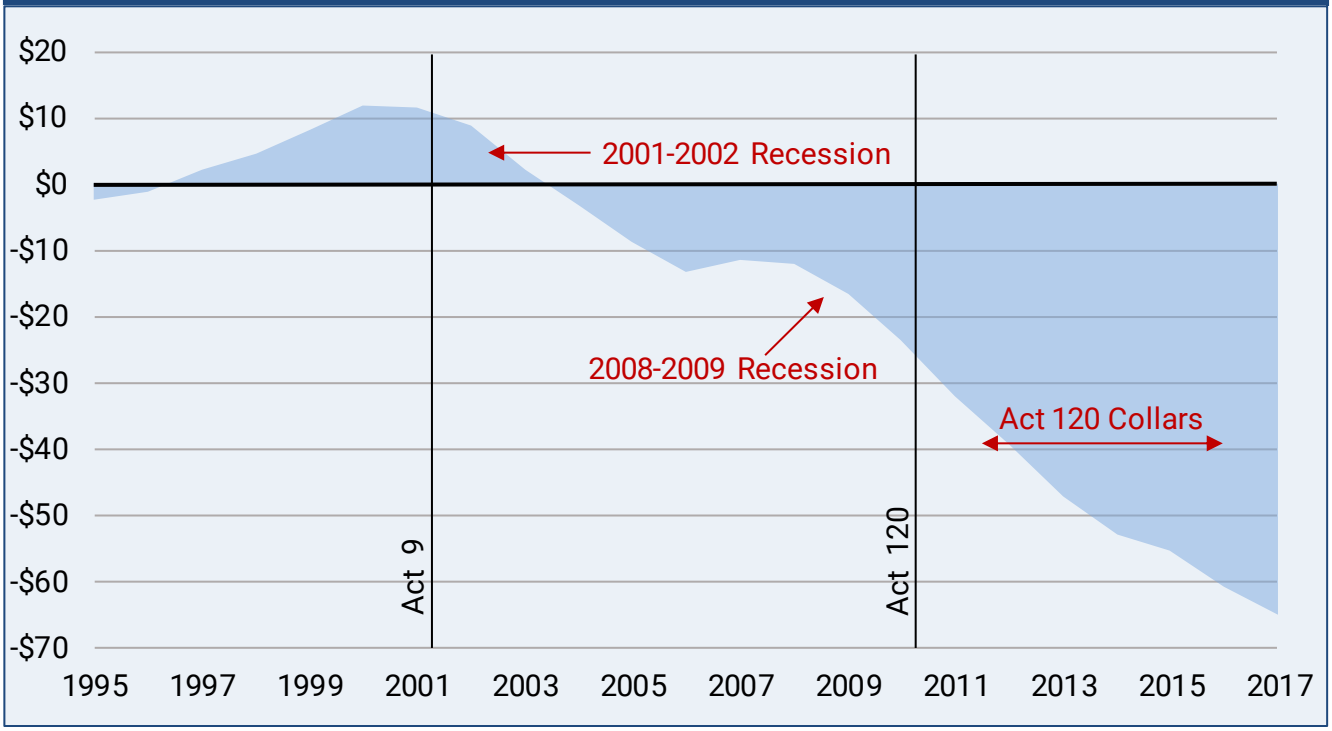
History of Pension Funding in Pennsylvania

Figure A3 displays the combined actuarial surpluses and unfunded liabilities of each System from 1995 to 2017. The time period begins with a small net unfunded liability, but by the late 1990s, the unfunded liabilities were eliminated, and the Systems reported actuarial surpluses. This result was made possible by strong investment returns related to the "dot com" bubble and the corresponding economic expansion. Influenced by strong investment returns and actuarial surpluses, Act 9 of 2001 increased pension benefits for school and state employees through a 25 percent retroactive increase to the benefit accrual rate, while Act 38 of 2002 provided an ad-hoc cost-of-living adjustment to retired school and state employees. Those benefit enhancements significantly increased the Systems' pension obligations. At the same time, the strong investment returns produced computed employer contribution rates that were at or near zero for multiple years.

Following the recession and market downturn of 2001, employer contribution rates increased, but were artificially suppressed by statutory changes to the funding of the Systems. For example, Act 40 of 2003 (1) reset the amortization period for the increased liabilities resulting from Act 9 of 2001, (2) recognized pre-Act 9 gains more quickly by amortizing them over a 10-year period and (3) delayed the recognition of post-Act 9 losses by amortizing them over a 30-year period. These changes contributed to the unfunded liabilities by effectively reducing employer contribution rates for 10 years. However, strong investment returns for several years in the middle of the decade helped to stabilize the unfunded liabilities.

The 2008 recession and market downturn resulted in sizable investment losses for the Systems, and the unfunded liabilities grew dramatically. Act 120 of 2010 implemented changes to respond to the anticipated increase in employer contribution rates. For new employees, it retained the higher Act 9

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



employee contribution rates and (1) reduced the benefit accrual rate, (2) increased the vesting period, (3) increased the normal retirement age and (4) abolished the lump-sum distribution of accumulated employee pension contributions as a retirement option. Act 120 also re-amortized the unfunded actuarial accrued liabilities of the Systems over a 24-year period, at level percentage of pay (PSERS) and 30-year period at level dollars (SERS) and imposed collars on the employer contribution rate.

Since the enactment of Act 120, both employer contribution rates and the unfunded accrued liabilities of the Systems have continued to increase. The two are interrelated because the majority of each employer contribution rate is dedicated to amortizing the unfunded accrued liability. The application of rate collars helped the Commonwealth meet budget constraints, but held employer contribution rates below the actuarially determined rates for a number of years. This practice increased the unfunded accrued liabilities of the Systems, and ultimately such unfunded liabilities must be amortized and paid through employer contributions and investment returns. Act 120 was designed to eventually eliminate the unfunded liabilities and reduce employer contributions, but the deferrals from the rate collars and the length of the amortization periods imply that those results will not occur for many years.

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.
Market Value of Assets	The value of the pension fund based on the value of the assets as they would trade on an open market, including accrued income and expenses.
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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June 2, 2017

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Director
Pennsylvania Independent Fiscal Office
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Re: Amendment A01354 to Senate Bill 1, Printer's Number 853, as amended by Amendment A01558

Dear Mr. Knittel:

As requested, we have prepared an actuarial note on Amendment A01354 to Senate Bill 1, Printer's Number 853 (Amendment) as amended by Amendment A01558. 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, Conduent (formerly Buck Consultants) for PSERS and Korn Ferry Hay Group (KFHG) for SERS, are included throughout this actuarial note, which contains the following sections.

This actuarial note assumes that Amendment A01558 will be enacted in conjunction with Amendment A01354 to Senate Bill 1, Printer's Number 853. Unless otherwise specified, all further references to the Amendment are to the amended version.

The actuarial cost note provided by KFHG incorporated two variations of possible early retirement provisions. Only Variation 1 is consistent with this Amendment. As such, our review was solely on Variation 1 and we did not review Variation 2.

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

Executive Summary

This actuarial note on Amendment A01354 to Senate Bill 1, Printer's Number 853, as amended, contains several items that we believe are important to the reader. The significant items are summarized below, followed by other items. All are addressed in further detail throughout this actuarial note.

- The modifications made by Amendment A01558 for PSERS include two early retirement provisions that would add additional costs to the original Amendment based on Conduent's May 23, 2017 cost estimate. In order to preserve the cash flow savings of $217 million estimated in that analysis, Amendment A01558 instructs Conduent to develop new "cost neutral" early retirement reduction factors such that the additional costs are completely offset and the estimated savings remains the same. These factors would apply to the benefits of Class T-G and T-H members who retire prior to age 62 with less than 25 years of service. Such determination could lead to a higher, potentially unreasonable, interest rate to be used for the "cost-neutral" early retirement reduction factors. (See page 19 for discussion.)
- Conduent's June 2, 2017 addendum letter provides insight into the methodology expected to determine the "cost neutral" early retirement reduction factor. We recommend that this determination be carefully reviewed with the Amendment's sponsors along with the PSERS Board prior to adoption for reasonableness. (See page 20 for discussion.) Different retirement patterns may emerge to the extent that the determination of the "cost-neutral" early retirement reduction factors are unreasonable and/or unfavorable from the perspective of the member, resulting in costs/(savings) that could be significantly different than those estimated by Conduent. Excluding the development of these "cost-neutral" early retirement reduction factors, Conduent notes in their June 2, 2017 supplement letter that the savings estimated in the May 23 analysis "would be reduced, possibly eliminated entirely or changed to an overall cost to the System".
- The proposed Amendment includes a "plowback" provision for SERS providing for any savings resulting from the other changes included in this Amendment to

increase the funding of the plan and decrease the projected unfunded liability. (See page 15 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. This change will align the annual costs of the plan with the benefits provided to each member resulting in, along with the projected plowback contributions, a projected funded ratio of 100% and no projected unfunded liability towards the end of the projection period. (See page 13 for discussion.)
- The SERS cost analysis performed by KFHG, including the additional contributions to be made in future years due to savings estimated for this Amendment and the determination of the "cost-neutral" interest rate of 7.375% used in §5702(f), did not reflect the revised actuarial assumptions adopted by the SERS Board in April 2017. (See page 21 for discussion.)
- The proposed Amendment provides lower DB benefits and includes a DC plan supplement to new hires who also have the option to elect a DC only plan. Thereby, the Commonwealth is gradually reducing its exposure in an increasing fashion over time to investment risk, longevity risk, and inflation risk and transferring these risks to the employee. There is an approximate 12% reduction in expected future DB accrued liabilities and risk exposure for PSERS and an approximate 18% reduction in expected future DB accrued liabilities and risk exposure for SERS at the end of the projection period. (See pages 29 to 30 for discussion.)
- In the sensitivity analysis under the risk transfer analysis section, the savings estimated due to the Amendment would be expected to be greater by 1,708% for PSERS and 22% for SERS if measured at a 6.25% or 6.5% investment return assumption versus the current 7.25% or 7.5% assumption, respectively. The primary reason for the different impact for each system is the percentage of future members assumed to elect the DC only plan. (See pages 27 to 29 for discussion.)

Other items for consideration include:

- We believe consideration should be given to reducing the amortization period used for all future actuarial gains or losses for both systems. (See page 16 for discussion.)
- The mortality assumption used by KFHG 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 page 21 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 11 for discussion.)

- By applying the existing disability assumptions to new PSERS members, the liabilities if this Amendment is enacted may be understated. (See page 21 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 10 for discussion.) In particular,
    - The Rule of 97 superannuation age condition applies to only one new class in PSERS, but both classes in SERS.
    - There are differences in the eligibility requirements for determining the different reductions that apply for benefit commencement prior to superannuation age. The different reductions include subsidized 3% annual reductions, actuarial equivalent reductions using a 4% interest rate and actuarial equivalent reductions using a 7.375% interest rate for SERS and an interest rate to be determined for PSERS.
    - The disability benefit provided 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.
- 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 17 for discussion.)
- Based on a measure of the liquidity ratio for each, we would not expect a change in the Systems' asset allocation due to the enactment of the Amendment. (See pages 32 to 33 for discussion.)

In general, the actual costs/(savings) as a result of this Amendment will be dictated by actual experience that emerges over time. The actuarial cost estimates are provided based on a single set of assumptions to provide a reasonable estimate of costs that may come due. It is certain that actual experience will be different, which may lead to significant differences in the cost/(savings) presented by the System actuaries.

Summary of the Amendment

Amendment A01354 to Senate Bill 1, Printer's Number 853, as amended, 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, employees hired under the provisions of Act 120 (Class T-C, T-D, A-3, and A-4 members) would become eligible for Option 4 (which allows for the withdrawal of employee contributions while retaining a reduced employer provided benefit) on a cost neutral basis. These members would also become subject to a shared gain adjustment (along with the current shared risk adjustment) on their member contributions.

Also, employees who join PSERS on or after July 1, 2019 and most employees, including general employees, judges, and legislators, who join SERS on or after January 1, 2019 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.

Current active members, except for State Police and most other hazardous duty members in SERS, would have a one-time opportunity to elect one of the three new benefit designs for prospective service.

In addition to the benefit design changes, two major financing changes for SERS 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 SERS than the amortization schedules would dictate, referred to as the "plowback". Second, the method for determining the normal cost in SERS would eventually be changed to be based on benefits provided to 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 actuarial valuation for the DB plans reflecting these changes is the December 31, 2018 valuation for SERS impacting the contributions paid during the 2019-2020 fiscal year and the June 30, 2020 valuation for

PSERS impacting the contributions paid during the 2021-2022 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 first year DC contributions would be paid is during the 2018-2019 fiscal year for SERS and 2019-2020 for PSERS, which is 1 year and 2 years earlier, respectively, than the impact on the DB plans.

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.

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 A-5). 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 2.75% and 3.25% of compensation in PSERS and SERS, respectively, with the opportunity to make additional voluntary contributions. Employer contributions would be 2.25% 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 slightly different DC benefits (actually total contributions to the DC plan would be the same, but employer DC contributions would be reduced by 0.25% of compensation and member DC contributions would be increased by 0.25% of compensation) 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 or Rule of 97	Age 67 with 3 years of service or, in SERS only, Rule of 97	When vested
Early retirement with actuarial equivalent reduction factors	When vested	When vested, reduced from superannuation age using 4% actuarial equivalent factors but, for members with less than 25 years of service, subject to "cost-neutral" actuarially equivalent factors for ages prior to age 62	When vested, reduced from superannuation age using 4% actuarial equivalent factors but subject to "cost-neutral" actuarially equivalent factors for ages prior to age 62	When vested
Early retirement with subsidized reduction factors (e.g. 3% per year)	Age 55 with 25 years of service in PSERS, none in SERS	Termination after age 57 with 25 years of service in PSERS, age 57 with 25 years of	Termination after age 55 with 25 years of service in PSERS, age 62 with 25 years of	n/a

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)
		service in SERS	service in SERS	
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	n/a	2.75% in PSERS, 3.25% in SERS	3% in PSERS, 3.5% in SERS	7.5%
Total employee contribution rate	7.5% in PSERS, 6.25% in SERS	8.25%	7.5%	7.5%
Shared risk/gain contribution adjustment	0.5% per adjustment, 4% corridor [1]	0.75% per adjustment, 6% corridor	0.75% per adjustment, 6% corridor	n/a
DC employer contribution rate	n/a	2.25%	2%	2% in PSERS, 3.5% in SERS
DC vesting requirement for employer contributions and earnings thereon	n/a	3 years	3 years	3 years

[1] Reflects the shared gain adjustments for current Act 120 hires contained in the Amendment

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, vested members would continue to be able to commence their benefits immediately. Unless eligible for the subsidized early retirement, the reduction factors for

commencement prior to age 62 (and less than 25 years of service in PSERS) would be larger than the current statutory actuarially equivalent factors (which use a 4% interest rate). In SERS, a 7.375% interest rate would be used. In PSERS, the interest rate is to be determined by the System's actuary such that the cost savings outlined in their cost estimate for the Amendment (un-amended) would be preserved. Please see the *Impact of Amendment A01558* section on page 19 for more information regarding the interest rate determination for PSERS.

Current Act 120 hires are subject to shared risk contributions and this Amendment would add a corresponding shared gain provision. As a result, Act 120 member contributions could change by 0.5% increments within a 4% corridor every three years depending on the System's investment performance. Under this Amendment, new members in Class T-G, T-H, A-5, and A-6 would also be subject to the shared risk/gain contribution adjustments, but the member contributions could change by 0.75% increments within a 6% corridor.

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	2.75% for Option 1, 3% for Option 2	3.25% for Option 1, 3.5% for Option 2
Superannuation age	Age 67 with 3 years of service or, for Option 1 only, Rule of 97	Age 67 with 3 years of service or Rule of 97
Subsidized early retirement eligibility	Termination after age 57 for Option 1 and age 55 for Option 2 with 25 years of service	Termination after 25 years of service
Larger "cost neutral" early retirement reduction factors	Members with less than 25 years of service retiring before age 62	Members not eligible for subsidized early retirement retiring before age 62

Differences between benefits for new members in PSERS versus SERS if Amendment is enacted		
	PSERS	SERS
Disability benefit	Based on 2% accrual, with minimum benefit of up to 33.33% of final average earnings	Based on 1.25% or 1% accrual as applicable, with minimum benefit of up to 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.

Having differing benefit accrual rates (and resulting pension amounts) for different groups of employees may result in 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.

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 8.25% for Class T-G members and the increase in the employee contributions rate from 6.25% for Class A-3 members to 8.25% 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 from 6.25% to 7.5% 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.

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.

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 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.

Most current active members (excluding State Police and most other hazardous duty members in SERS) would have a one-time opportunity to elect one of the three new benefit tiers for new members. Such election must be made within a 90 day period and would apply on a prospective basis to all service on or after January 1, 2020 for PSERS and July 1, 2019 for SERS. The member's total contribution rate would remain the same, with the allocation to the defined benefit portion the same as new hires and the allocation to the defined contribution portion equaling the difference. In PSERS, members currently subject to the shared risk/gain provisions would be subject to the provisions applicable to their new class of service. In SERS, members currently subject to the shared risk/gain provisions would remain subject to the same provisions applicable to their current class of service.

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 three-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, 2018 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 (2/3) and Class A-6 (1/3), which would result in a significant decrease in the normal contribution rate resulting in a corresponding significant increase in the unfunded actuarial accrued liability. Reducing the benefit accrual rate for only the average new member 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 of the document available at https://www.ccactuaries.org/Portals/0/pdf/CCA_PPC_White_Paper_on_Public_Pension_Funding_Policy.pdf).

However, the Amendment modifies the normal cost calculation to be based on the benefits provided to all active members, not just those provided to 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 over time 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 then result in a decrease in the unfunded liability as of December 31, 2021. The reader should note that the decrease as of December 31, 2021, estimated to be $(4.8) billion, would be an offset to the increase in the unfunded liability as of December 31, 2018, estimated to be $2.2 billion, resulting in a net decrease of $2.6 billion (this is a simplistic difference that does not reflect differences in the time period). Under the Amendment, the change in the unfunded accrued liability as of December 31, 2018 would be amortized in equal dollar amounts over a 30 year period beginning July 1, 2019 (rather than the 10 year period specified in current statute). Because the change as of December 31, 2018 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 when the credit would be fully recognized 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 (Plowback) for SERS

Under this Amendment, an additional employer contribution would be payable to SERS specifically to pay down the unfunded accrued 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.

The SERS cost estimate is based on the actuarial assumptions used in the December 31, 2015 valuation. In April 2017, the SERS Board adopted new actuarial assumptions that will be used in the December 31, 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 KFHG using a 6.5% assumption determined for the risk transfer analysis indicated additional savings, which 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 SERS Board is outside the scope of our assignment.

For SERS, there would be no additional contribution rate during a 10-year period from July 1, 2022 to June 30, 2032. 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. KFHG 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 copies of the May 23, 2017 estimate and the June 2, 2017 supplemental letter by Conduent for PSERS and the May 22, 2017 estimate and its May 31, 2017 addendum by KFHG for SERS with the projected impact of this Amendment. In addition, Conduent and KFHG have provided us with additional details regarding their projections. We appreciate their cooperation in providing this information on a timely basis to meet the 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, 2016 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 7.25% for PSERS and 7.5% for SERS 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 6.25% for PSERS and 6.5% for SERS and actual investment return on the market value of assets also equals 6.25% for PSERS and 6.5% for SERS 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 total employee contribution rate of 8.25% whereas the alternative options require a lower contribution rate equal to 7.5%.

Under the reduced hybrid tier (Option 2), the total member contributions are 0.75% less, with 1% less to the DB plan and 0.25% more to the DC plan and the employer contribution to the DC plan is 0.25% less. The difference is that the member contributes 1% of pay less to the DB plan and receives a DB accrual rate of 1% versus 1.25%. Therefore, Option 1 members would contribute an additional 1% of pay for a 0.25% percentage increase in the accrual rate (a 25% increase), along with a potentially slightly lower superannuation age. Under Act 120, PSERS and SERS members can elect to make an additional contribution and receive a percentage increase in the accrual rate of 0.50% (from 2% to 2.5% {a 25% increase} 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% percentage increase in the accrual rate whereas, for SERS, the additional contribution rate is 3.05% of pay or 1.525% per 0.25% percentage 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 the Option 2 hybrid tier and 0.25% less than the Option 1 hybrid tier. Therefore, we would expect very few members to elect the DC plan only option under PSERS since there is no additional employer provided benefit versus Options 1 and 2. For SERS members, the employer contribution under the DC plan only option would increase from 2.25% under Option 1 and 2% under Option 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 the System actuaries, as shown in the following table:

New Tier Election Percentages Assumed by System Actuaries		
	PSERS	SERS
Option 1 (DB+DC)	65%	50%
Option 2 (DB+DC)	30%	25%
DC Only Option	5%	25%

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 to opt out to the other options. This is consistent with the assumptions used by Conduent for PSERS and KFHG for SERS. 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.

We do note that Conduent indicated the impact of three alternative assumptions for the new tier election percentages. Two of the scenarios assumed a higher percentage of members electing Option 2 and/or the DC only option. Since Option 1 has the highest cost, these two alternative assumptions produced higher estimated savings. The third alternative scenario assumed a higher percentage of members electing Option 1 and as Option 1 has the highest cost, this third alternative assumption produced lower estimated savings.

Current member elections for new benefit tier

In their cost estimates, neither Conduent nor KFHG assumed that any current active members would elect one of the three new benefit tiers. We believe the likelihood of such elections would be small and it would have a de minimis impact on the Amendment's cost estimates if reflected.

Impact of Amendment A01558

In the original cost estimates provided by the Systems' actuaries and in AmendmentA01354 prior to Amendment A01558, commencement of benefits prior to age 62 was not permitted for Classes T-G, T-H, A-5, and A-6, unless eligible for subsidized early retirement at age 57 with 25 years of service for Classes T-G and A-5. Along with some technical corrections, Amendment A01558 provided for the following:

1. Removal of the age 62 benefit commencement restriction for vested members in the new classes of service
2. Expansion of the early retirement eligibility for the 3% per year reduction for Class T-H from age 62 to age 55 for members who terminate service at age 55 or later with 25 or more years of service
3. Unless eligible for the 3% per year reduction factor for early retirement, a larger "cost neutral" reduction for early retirement for all Class T-G and Class T-H members with less than 25 years of service if retiring prior to age 62 and for all Class A-5 and Class A-6 members retiring prior to age 62.
4. Class T-G and Class T-H members with 25 or more years of service who retire prior to age 62 but are not eligible for the 3% per year reduction factor for early

> retirement, would have the early retirement reduction factor based on the current actuarial equivalence factors of 4% annual interest and the unisex mortality table adopted by the board.

We understand that the larger reduction for early retirement for impacted members is to be determined on a cost-neutral basis. In other words, the estimated costs/(savings) due to the amended Amendment would essentially be the same as that determined for the original Amendment and outlined in the System actuaries' original estimates referenced earlier.

For PSERS, Amendment A01558 states that the larger early retirement reduction factors are to be determined "on the basis of interest at the rate as calculated by the board's actuary and the mortality tables adopted by the board." As we understand, the directive for determining this interest rate is to provide for essentially the same savings as originally estimated in Conduent's May 23, 2017 cost estimate. This determination is complicated because items 2 and 4 included in Amendment A01558 noted above add costs when compared to the provisions included in Conduent's analysis. As a result, all else being equal, our expectation is that a higher, potentially unreasonable, interest rate may result to ensure the same savings as before. Such an interest rate may require a fresh look at the assumptions applied for immediate commencement of benefits prior to eligibility for subsidized early retirement.

In Conduent's June 2, 2017 supplemental information letter on Amendment A01558, they state "By eliminating the age-62 restriction for benefit commencement…., the savings outlined in our cost note of May 23rd would be reduced, possibly eliminated entirely or changed to an overall cost to the System. However,…, new early retirement reduction factors would be calculated so that when they were applied to the benefits of Class T-G and T-H members, the additional costs are completely offset by the savings generated by the new early retirement factors." Conduent further states that "the changes in the benefit provisions outlined above could lead to changes in both the percentage of members who elect to commence benefits immediately upon termination of employment as well as in the percentage of members who elect Class T-G membership versus Class T-H membership." At this point, Conduent does not anticipate changing these assumptions. If such a change was made, the resulting estimated savings would change which in turn would impact the interest rate determination.

If this Amendment is enacted, we recommend that this actuarial equivalence interest rate determination be carefully reviewed with the Amendment's sponsors along with the PSERS Board prior to adoption for reasonableness.

For SERS, KFHG's May 31, 2017 addendum indicated that the basis for the larger early retirement reduction factors (a 7.375% annual interest and unisex mortality adopted by the board) provides for "pre-age 62 cost neutrality", based on the assumptions used in the December 31, 2015 valuation. KFHG also indicated any changes resulting from this amendment to the cost/(savings under variation 1 in their "May 22, 2017 actuarial cost note, we expect, would be de minimis."

Additional commentary

The following represents Milliman's additional commentary on Conduent's analysis for the Amendment's impact on PSERS:

- Conduent 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 (we note that the disability rates peak at age 60 for males and at age 57 for females and then decline). This would increase the Amendment's cost, reducing the savings.

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

- KFHG completed this analysis, including the additional accrued liability contributions to be made in future years due to savings generated by the other changes contained in this Amendment and the determination of the "cost-neutral" interest rate of 7.375% used in §5702(f), based on the actuarial assumptions used in the December 31, 2015 valuation and did not reflect the revision to the economic assumptions adopted by the SERS Board in April 2017. In particular the investment return assumption was lowered from 7.5% to 7.25% and inflation assumption was reduced from 2.75% to 2.6%. Any other changes are not yet publicly available. Absent other assumption changes made, 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.
- In KFHG'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, the total DB+DC/DB contribution dollars included in KFHG'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 KFHG'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 7.25% for PSERS and 7.5% for SERS 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 table shows the expected accumulated nominal dollar cash flow costs/(savings) on the employer contributions for the fiscal years 2018-2019 through 2049-2050 as provided by the System actuaries. It is important to note that KFHG displayed contributions through the 2051-2052 fiscal year for SERS and thus, the numbers shown below will differ from the aggregate numbers reported by KFHG in order to provide costs that are consistent with the period reported by Conduent for PSERS.

The table also shows the present value of the expected cash flow costs/(savings) as of June 30, 2018, assuming end of year payment, at 3.6% (a proxy for budget growth provided by the IFO) and at the current investment return for the Systems (7.25% for PSERS and 7.5% for SERS).

Impact on Employer Contributions if AmendmentA01354 to Senate Bill 1, PN 853 is enacted for Fiscal Years 2018-2019 through 2049-2050
(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 3.6% as of June 30, 2018	Present Value of Cash Flow Costs / (Savings) at 7.25% for PSERS and 7.50% for SERS as of June 30, 2018
PSERS			
FY 2018-2019 to FY 2021-2022	$61.7	$55.2	$49.5
FY 2022-2023 to FY 2033-2034	95.8	73.9	57.6
FY 2034-2035 to FY 2049-2050	(374.3)	(145.5)	(58.9)
Total	(216.8)	(16.4)	48.2
SERS			
FY 2018-2019 to FY 2021-2022	(6.1)	(5.1)	(4.3)
FY 2022-2023 to FY 2033-2034	399.8	314.4	244.5
FY 2034-2035 to FY 2049-2050	(1,573.2)	(612.1)	(231.3)
Total	(1,179.5)	(302.8)	8.9
Both PSERS and SERS			
FY 2018-2019 to FY 2021-2022	55.6	50.1	45.2
FY 2022-2023 to FY 2033-2034	495.6	388.3	302.1
FY 2034-2035 to FY 2049-2050	(1,947.5)	(757.6)	(290.2)

	Cash Flow Costs / (Savings) as determined by System Actuary	Present Value of Cash Flow Costs / (Savings) at 3.6% as of June 30, 2018	Present Value of Cash Flow Costs / (Savings) at 7.25% for PSERS and 7.50% for SERS as of June 30, 2018
Total	(1,396.3)	(319.2)	57.1

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.

Graphs

Attached to this letter are eight graphs – the first four for PSERS and the second four for SERS – showing the estimated employer contribution rates, the estimated employer contribution amounts, the estimated funded ratio as of the beginning of the fiscal year for PSERS and as of the middle of the fiscal year for SERS, and the estimated unfunded accrued liability as of the beginning of the fiscal year for PSERS and as of the middle of the fiscal year for SERS (the valuation dates for each respective System) under current law and if the Amendment is enacted. These graphs are based on the respective System's actuary projections.

As shown on the PSERS' graphs (pages 44 to 47), there is not a significant difference in the estimated employer contribution rates, the estimated employer contribution amounts, the estimated funded ratio, and the estimated unfunded accrued liability if the Amendment is enacted based on the deterministic parameters used in these projections.

As shown on the first SERS graph (page 48), the estimated employer contribution rate under the Amendment is initially higher than under current law for fiscal year 2022-2023 due to the change to the traditional entry age normal approach. This continues until fiscal year 2031-2032 when the Amendment is projected to have a lower estimated employer contribution rate than current baseline projections.

As shown on the second SERS graph (page 49), the estimated employer contribution amounts, which has the same pattern as the employer contribution rate.

As shown on the third SERS graph (page 50), there is small decrease in the funded ratio (ratio of the actuarial value of assets to the actuarial accrued liability) if the Amendment is enacted due to the current entry age normal method. This is reversed starting with the December 31, 2021 valuation when the change to the traditional entry age normal method is first reflected. Due to the switch to the traditional entry age normal method and the additional accrued liability contributions, the funded ratio is projected to reach and exceed 100% under the Amendment rather than just approach 100% as is the case under the current normal cost methodology.

The fourth SERS graph (page 51) shows the estimated UAL. If the Amendment is enacted, there would be an initial increase in the estimated UAL due to the lower normal cost for future hires under the Amendment using the current entry age normal method. When the switch occurs to the traditional entry age method in the December 31, 2021 valuation, the estimated UAL is lower under the Amendment. Due to the change in the normal cost methodology and the additional accrued liability contributions, the unfunded liability is now projected to reach $0 (actually a surplus is projected).

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 based upon the actuarial assumptions used in this analysis, most notably investment return assumptions of 7.25% for PSERS and 7.50% for SERS. These assumptions are risk-based assumptions meaning that there is a risk that actual returns could be lower than the assumption resulting in higher DB plan costs in the future with the Commonwealth and other employers bearing that risk.

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 [2]	SERS [3]
Act 120 [1]	2.90%	5.75%
Option 1 (DB+DC)	2.83%	4.26%
Option 2 (DB+DC)	2.45%	3.67%
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 PSERS normal cost rates are from the projected 2020 valuation.

[3] The SERS normal cost rates provided by KFHG 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 and timing adjustments. These factors have been applied to the Act 120 normal cost rate for Class A-3 general employees 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 SERS Board in April 2017, 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.

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. Currently there are no specific actuarial standards regarding “risk transfer analysis”, but 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 each and every year. 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 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 7.25% to 6.25% for PSERS or 7.5% to 6.5% for SERS). 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.

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 (7.25% for PSERS and 7.5% for SERS). *(Current law)*

B. Also start with the schedule of employer contributions for the proposed benefit package at the current assumed investment rate of return (7.25% for PSERS and 7.5% for SERS). *(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 6.25% or 6.5% investment rate of return for PSERS and SERS, respectively (1 percentage point lower than the current 7.25% or 7.5% assumption). *(Current law with alternate investment assumptions)*

D. Determine the schedule of employer contributions for the proposed benefit package assuming a 6.25% or 6.5% investment rate of return for PSERS and SERS, respectively (1 percentage point lower than the current 7.25% or 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. As requested, the SERS analysis reflects the impact of the benefit reforms, but not the proposed financing reforms. 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 2018-2019 through 2049-2050.

Sensitivity Analysis for AmendmentA01354 to Senate Bill 1, PN 853
based on Estimated Employer Contributions
for Fiscal Years 2018-2019 through 2049-2050
(Amounts in millions and based on System actuary's projections)

	PSERS	SERS
Current assumed investment rate of return assumption	7.25%	7.5%
Alternative assumed investment rate of return assumption	6.25%	6.5%
A. Current law at current assumed investment rate of return assumption	$143,433.8	$64,412.8
B. Proposed law[1] at current assumed investment rate of return assumption	143,217.0	63,454.6
C. Current law at alternative assumed investment rate of return assumption	176,511.0	80,783.1

	PSERS	SERS
D. Proposed law[1] at alternative assumed investment rate of return assumption	172,591.5	79,618.0
E. Cost/(Savings) at current assumed investment rate of return assumption (B – A)	(216.8)	(958.2)
F. Cost/(Savings) at alternative assumed investment rate of return assumption (D – C)	(3,919.5)	(1,165.1)
Percentage increase in cost/(savings) due to lower investment return ({F ÷ E} – 1)	1,708%	22%

[1] For SERS, only benefit reforms reflected.

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 the percentage increase for SERS is much lower than PSERS is the assumed percentage of new hires electing the DC only option. The SERS estimate assumes that 25% of newly eligible Class A-5 members opt out and elect instead 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 A-3 (or Class A-4) tiers. It is estimated that approximately 20% of new members would be identified as Class A-5 exempt members.

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 AmendmentA01354 to Senate Bill 1, PN 853 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	$200,379	$177,896	$56,598
Proposed law (DB only)	169,467	157,301	46,405
Percentage reduction	15.4%	11.6%	18.0%

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 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-A of the PSERS cost estimate would have a current law benefit of $61,038 per year. Under the Amendment, this sample employee C, if a member of Class T-G, would have a DB benefit of $36,973 per year and an estimated DC benefit of $13,971 per year for a total annual benefit of $50,944. If the Amendment was enacted, this sample employee would:

- Have a reduction in the total benefit by 17% from $61,038 to $50,944.
- Be subject to inflation risk, investment risk, and longevity risk on the DC portion of the benefit (which is about 27% 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 and incorporate the difference in any change to personal savings due to any change in required contributions.

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. Although a formal request has not been requested, we offer the following comments.

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 require 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. Conduent recommended that PSERS' investment consultant perform an analysis in their cost note. KFHG indicated in their cost estimate that it was not "necessary to factor in any future reduction(s) to the underlying 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, 2016, expected benefit payments for the upcoming year represent approximately 13.7% of market value. If the Amendment is enacted, the expected benefit payments for the upcoming year represent approximately 7.2% of market value as of June 30, 2048. 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 11.6% of market value as of December 31, 2048. 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.

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.

Note that the liquidity ratio was determined based on the cost projections for the original projections, which reflected a delayed benefit commencement to age 62. We do not anticipate a reversal of the downward trend in the liquidity ratio if updated projections were used.

Basis for Analysis

Due to time constraints dictated by the IFO for providing this actuarial note by June 2, 2017, we are providing this letter on an accelerated basis. In particular, we were provided with the PSERS actuarial cost estimate on May 23, the PSERS supplemental letter on June 2, the SERS actuarial cost estimate on May 22, the SERS's addendum on May 31, AmendmentA01354 to Senate Bill 1, Printer's Number 853, on May 22, Amendment A01558 on June 1, and some supplementary information provided by the Systems' actuaries as late as May 31. 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, Conduent, and Korn Ferry 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 Conduent and Korn Ferry 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 IFO may provide a copy of Milliman's work, in its entirety, any applicable regulatory or governmental agency, as required by law.

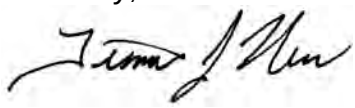
No third party recipient of Milliman's work product should rely upon Milliman's work product. Such recipients should engage qualified professionals for advice appropriate to their own specific needs.

The consultants who worked on this assignment are 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,



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Enclosures

This analysis was prepared solely for the Pennsylvania Independent Fiscal Office and may not be appropriate for other purposes. Milliman does not intend to benefit and assumes no duty or liability to other parties who receive this work.

Amendment A01354 to Senate Bill 1, Printer's Number 853 – Primary Provisions that would impact Actuarial Valuations of PSERS and SERS

Amendment A01354 to Senate Bill 1, Printer's Number 853, as amended by Amendment A01558, 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.
    - 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, 2019 for SERS members.

- State Police and most other hazardous duty members hired on or after January 1, 2019 (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 pensionable compensation.

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**Amendment A01354 to Senate Bill 1, Printer's Number 853 –
Primary Provisions that would impact Actuarial Valuations of PSERS and SERS**

- 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.

- Current active members in PSERS could elect within 90 days to become Class T-G, Class T-H, or Class DC members effective for all service on or after January 1, 2020. The member's total contribution rate would remain the same with the allocation between the defined benefit plan and defined contribution plan as follows. Only former Class T-E and T-F members would be subject to the shared-risk contribution, with the same adjustments as Class T-G and T-H members. Members who elect Class DC prospectively would have their DB benefit frozen based on service and salary as of January 1, 2020.

	Member Contribution Rate					
Current Class	Current	If elect Class T-G		If elect Class T-H		If elect Class DC
		DB	DC	DB	DC	DC
T-C	6.25%	5.50%	0.75%	4.50%	1.75%	6.25%
T-D hired before July 22, 1983	6.50	5.50	1.00	4.50	2.00	6.50
T-D hired on or after July 22, 1983	7.50	5.50	2.00	4.50	3.00	7.50
T-E	7.50	5.50	2.00	4.50	3.00	7.50
T-F	10.30	5.50	4.80	4.50	5.80	10.30

- Other than State Police officers and most other hazardous duty members, a current active member in SERS could elect between January 1, 2019 and March 31, 2019 to become a Class A-5 member, a Class A-6 member, or a participant (DC Only) effective for all service on or after July 1, 2019. The member's total contribution rate would remain the same with the allocation between the defined

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benefit plan and defined contribution plan as follows. Only former Class A-3 and A-4 members would be subject to the shared-risk contribution, with the same adjustments as Class A-3 and A-4 members who did not elect Class A-5, Class A-6, or to become a participant. Members who elect to become a participant prospectively would have their DB benefit frozen based on service and salary as of July 1, 2019.

	Member Contribution Rate					
Current Class	Current	If elect Class A-5		If elect Class A-6		If elect to be a participant (DC Only)
		DB	DC	DB	DC	DC
AA	6.25%	5.00%	1.25%	4.00%	2.25%	6.25%
A	5.00	5.00	0.00	4.00	1.00	5.00
D-4	7.50	5.00	2.50	4.00	3.50	7.50
E-1 [1]	7.50	5.00	2.50	4.00	3.50	7.50
E-2	7.50	5.00	2.50	4.00	3.50	7.50
A-3	6.25	5.00	1.25	4.00	2.25	6.25
A-4	9.30	5.00	4.30	4.00	5.30	9.30

[1] The member contribution rate shown for E-1 members applies after 10 years of judicial service. The member contribution rate for E-1 members is 2.5% higher for the first 10 years of judicial service.

Future members

Employees who join PSERS on or after July 1, 2019 and most employees who join SERS on or after January 1, 2019 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 as elected. 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.

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**Amendment A01354 to Senate Bill 1, Printer's Number 853 –
Primary Provisions that would impact Actuarial Valuations of PSERS and SERS**

In addition, new members could irrevocably elect two alternative benefit designs at first eligibility – (a) a lower defined benefit formula with 1% lower member contributions with a defined contribution plan with 0.25% higher member contributions and lower employer contributions – Class T-H in PSERS and Class A-6 in SERS - or (b) only a defined contribution plan with lower total member contributions, a PSERS lower employer contribution, and a higher SERS employer contribution – 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.

Defined Benefit Plan for future members

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 a 3-year period).
- 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 similar shared risk/gain adjustments as for Class T-E and A-3 members. The shared risk/gain adjustments would be 0.75% instead of 0.5% and the member contribution rate could increase or decrease by up to 3%.
- Superannuation age would increase to age 67 with 3 years of service, or any combination of age and service that totals 97 with at least 35 years of service for Class T-G, Class A-5, and Class A-6 and to age 67 with 3 years of service for Class T-H.
- Early retirement would continue to be available immediately to vested members who terminate service; however, the reduction factors for early retirement would be different from the current actuarially equivalent factors (based on a 4% annual interest and the unisex mortality adopted by board for this purpose) in the following situations:
    - For Class T-G members who terminate service at age 57 or later with 25 or more years of service, the reduction factor would be 3% for each year

retirement occurs prior to superannuation age.
  - For Class T-H members who terminate service at age 55 or later with 25 or more years of service, the reduction factor would be 3% for each year retirement occurs prior to superannuation age.
  - For Class T-G and Class T-H members retiring prior to age 62 with less than 25 years of service, the reduction factor would be (1) the current actuarially equivalent reduction factor (e.g. using 4%) from age 62 to superannuation age plus (2) an actuarially equivalent factor based on a interest rate determined by the board's actuary and the unisex mortality table adopted by the board from age at retirement to age 62.
  - For Class A-5 members who retire at age 57 or later with 25 or more years of service, the reduction factor would be 3% for each year retirement occurs prior to superannuation age.
  - For Class A-6 members who retire at age 62 or later with 25 or more years of service, the reduction factor would be 3% for each year retirement occurs prior to superannuation age.
  - For other Class A-5 and Class A-6 members retiring prior to age 62, the reduction factor would be (1) the current actuarially equivalent reduction factor (e.g. using 4%) from age 62 to superannuation age plus (2) an actuarially equivalent factor based on a 7.375% annual interest and the unisex mortality table adopted by the board from age at retirement to age 62.
- 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 2.75% of compensation for Class T-G members, 3.0% of compensation for Class T-H members, 3.25% of compensation for Class A-5 members, 3.5% of compensation for 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.

- Employer contributions of 2.25% of compensation for Class T-G and Class A-5 members, 2% of compensation for Class T-H, Class DC, and Class A-6 members and 3.5% of compensation for DC-only participants in SERS.
- 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 four 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 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.

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

SERS

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 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, 2018 and December 31, 2021 due to this Amendment would be amortized beginning July 1, 2019 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, 2018 through the fiscal year beginning July 1, 2041 until such 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.

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 factor 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 accrued liability contribution for SERS. The rate would apply to the compensation of active members and active participants.

Fiscal year beginning July 1	Additional accrued liability contribution rate for SERS
2018	0.00%
2019	0.71
2020	0.66
2021	0.62
2022	0.00
2023	0.00
2024	0.00
2025	0.00
2026	0.00
2027	0.00
2028	0.00
2029	0.00
2030	0.00
2031	0.00
2032	0.10
2033	0.22
2034	0.33
2035	0.43
2036	0.53
2037	0.62
2038	0.71

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Amendment A01354 to Senate Bill 1, Printer's Number 853 – Primary Provisions that would impact Actuarial Valuations of PSERS and SERS

Fiscal year beginning July 1	Additional accrued liability contribution rate for SERS
2039	0.79
2040	0.86
2041	0.93

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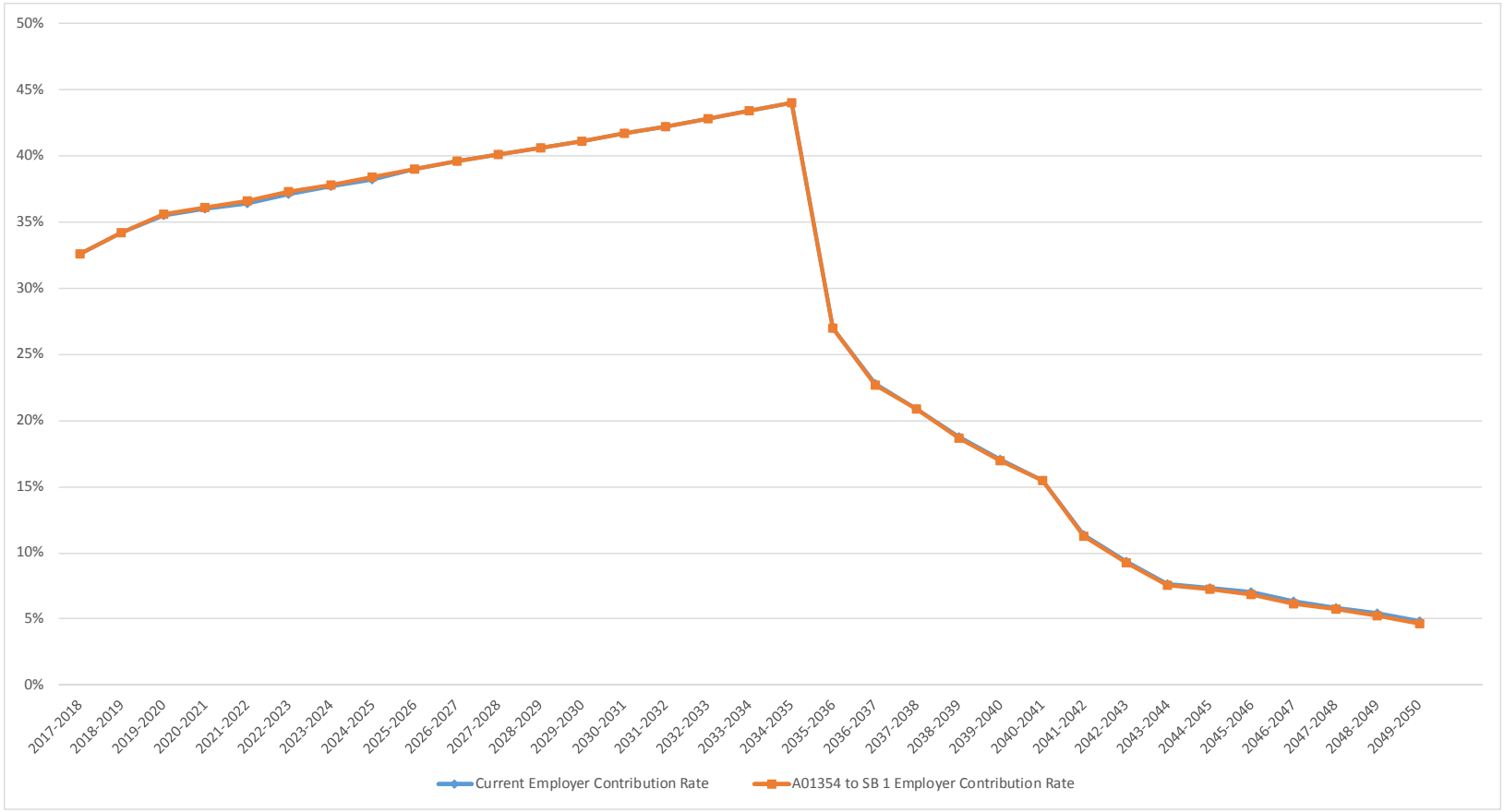
Graphs

PENNSYLVANIA PUBLIC SCHOOL EMPLOYEES RETIREMENT SYSTEM

Estimated Employer Contribution Rates
Under current law and if AmendmentA01354 to Senate Bill 1, Printer's Number 853 is enacted



Based on projections prepared by Conduent as provided by the IFO and PSERS.

This graph is an attachment to a June 2, 2017 letter to Mr. Matthew Knittel. Please refer to that letter for more information, including explanatory notes and statements of reliance.

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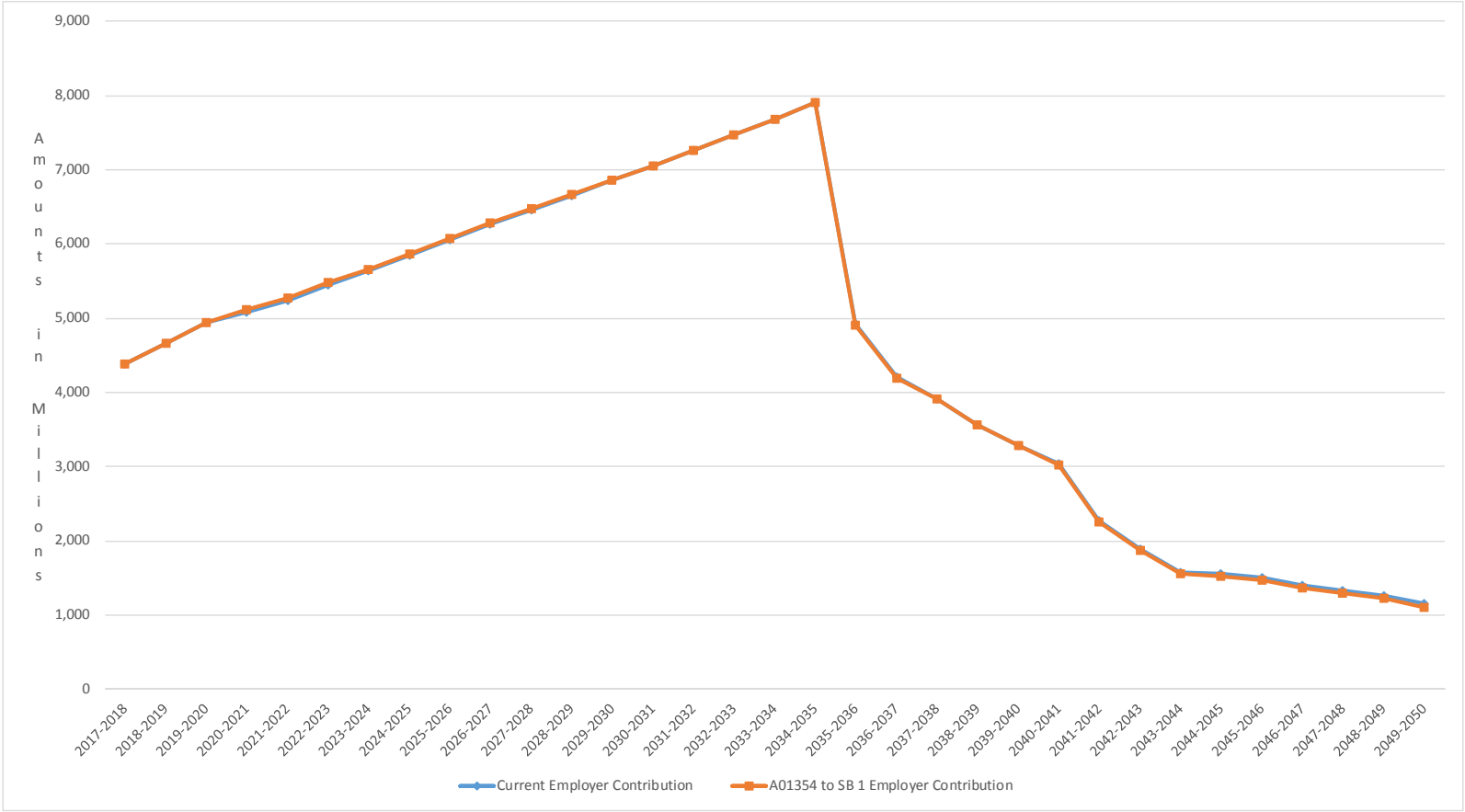
Graphs

PENNSYLVANIA PUBLIC SCHOOL EMPLOYEES RETIREMENT SYSTEM

Estimated Employer Contribution Amounts
Under current law and if AmendmentA01354 to Senate Bill 1, Printer's Number 853 is enacted



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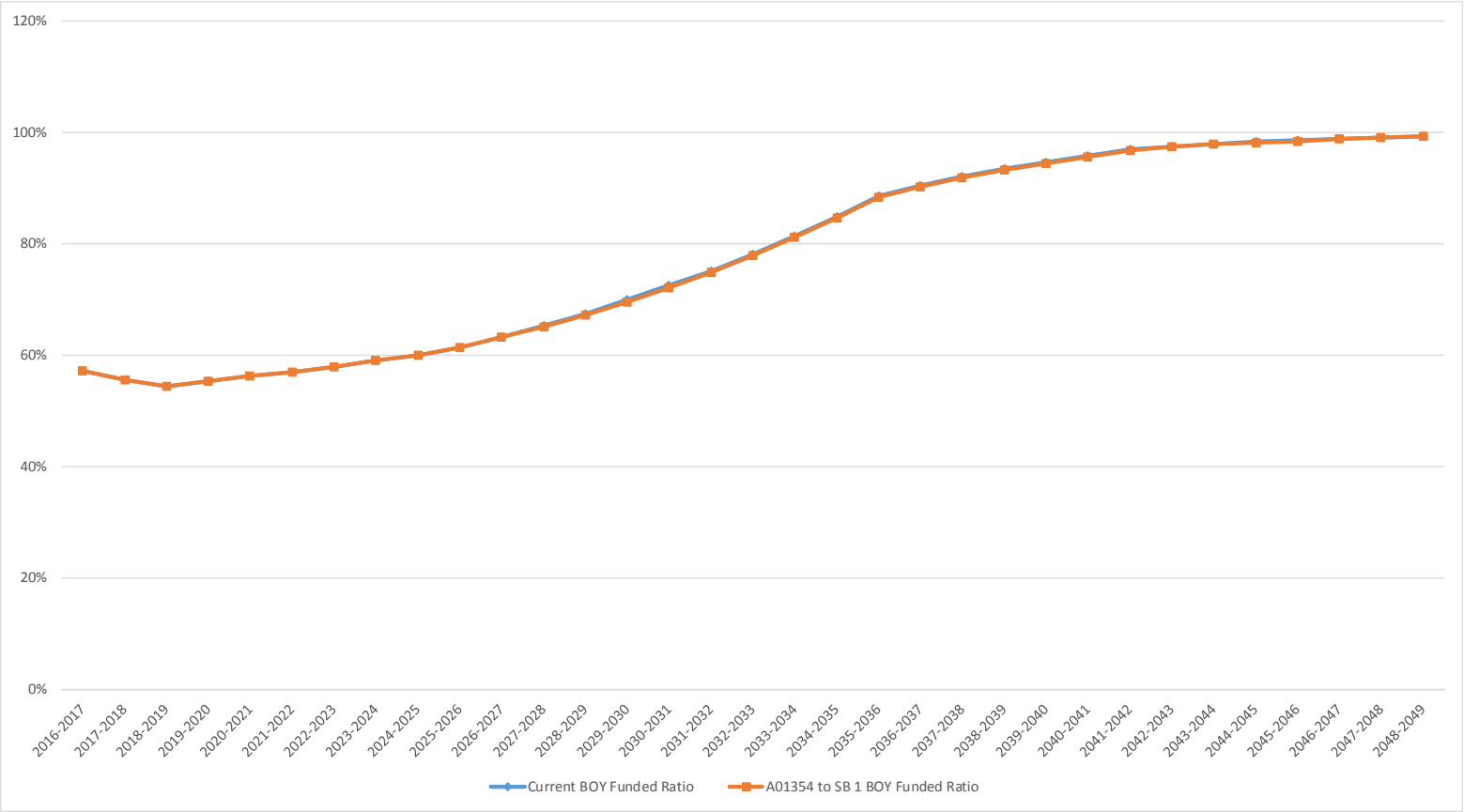
Graphs

PENNSYLVANIA PUBLIC SCHOOL EMPLOYEES RETIREMENT SYSTEM

Estimated Funded Ratios as of the beginning of the fiscal year
Under current law and if AmendmentA01354 to Senate Bill 1, Printer's Number 853 is enacted



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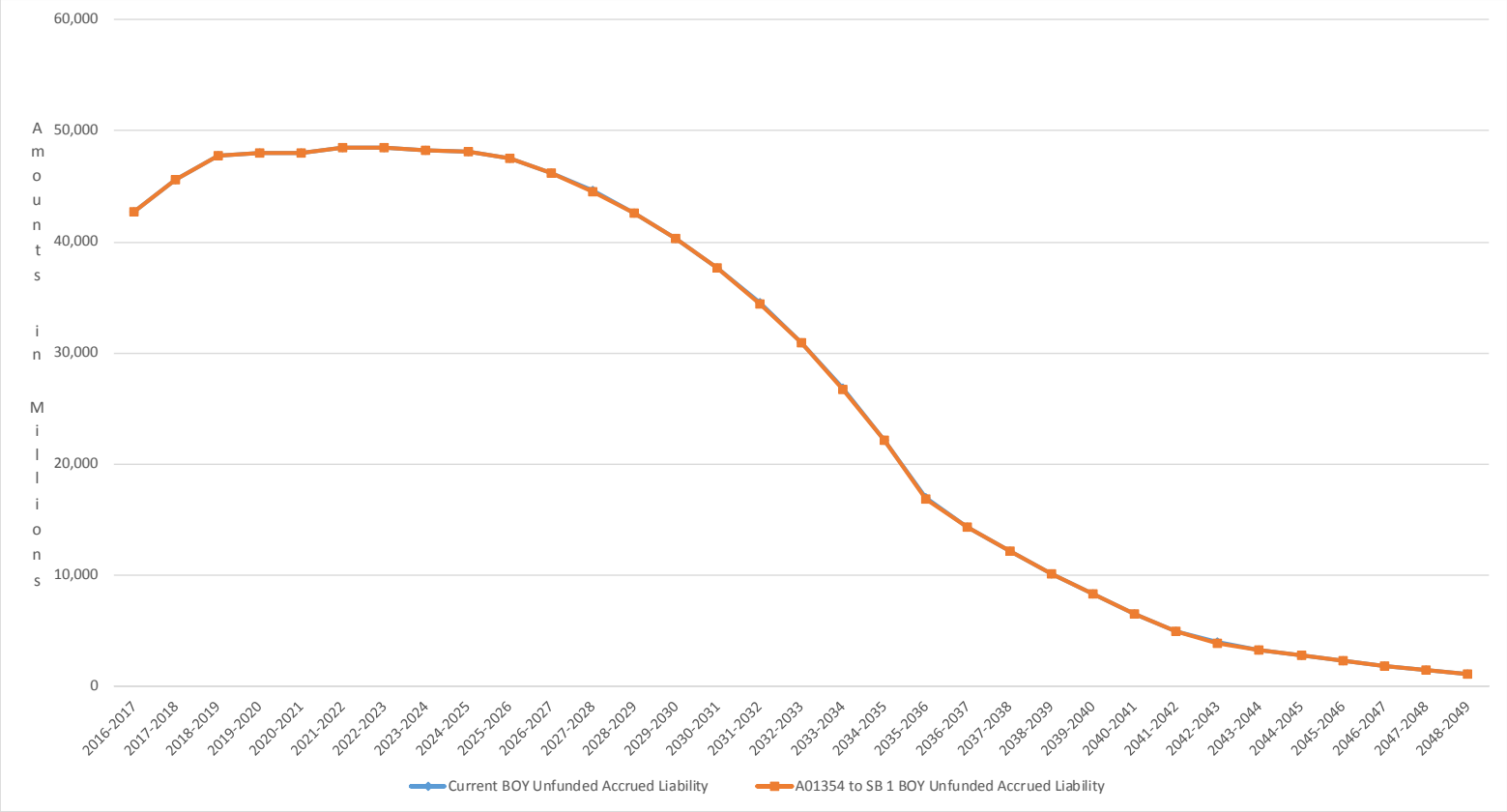
Graphs

PENNSYLVANIA PUBLIC SCHOOL EMPLOYEES RETIREMENT SYSTEM

Estimated Unfunded Accrued Liability as of the beginning of the fiscal year
Under current law and if AmendmentA01354 to Senate Bill 1, Printer's Number 853 is enacted



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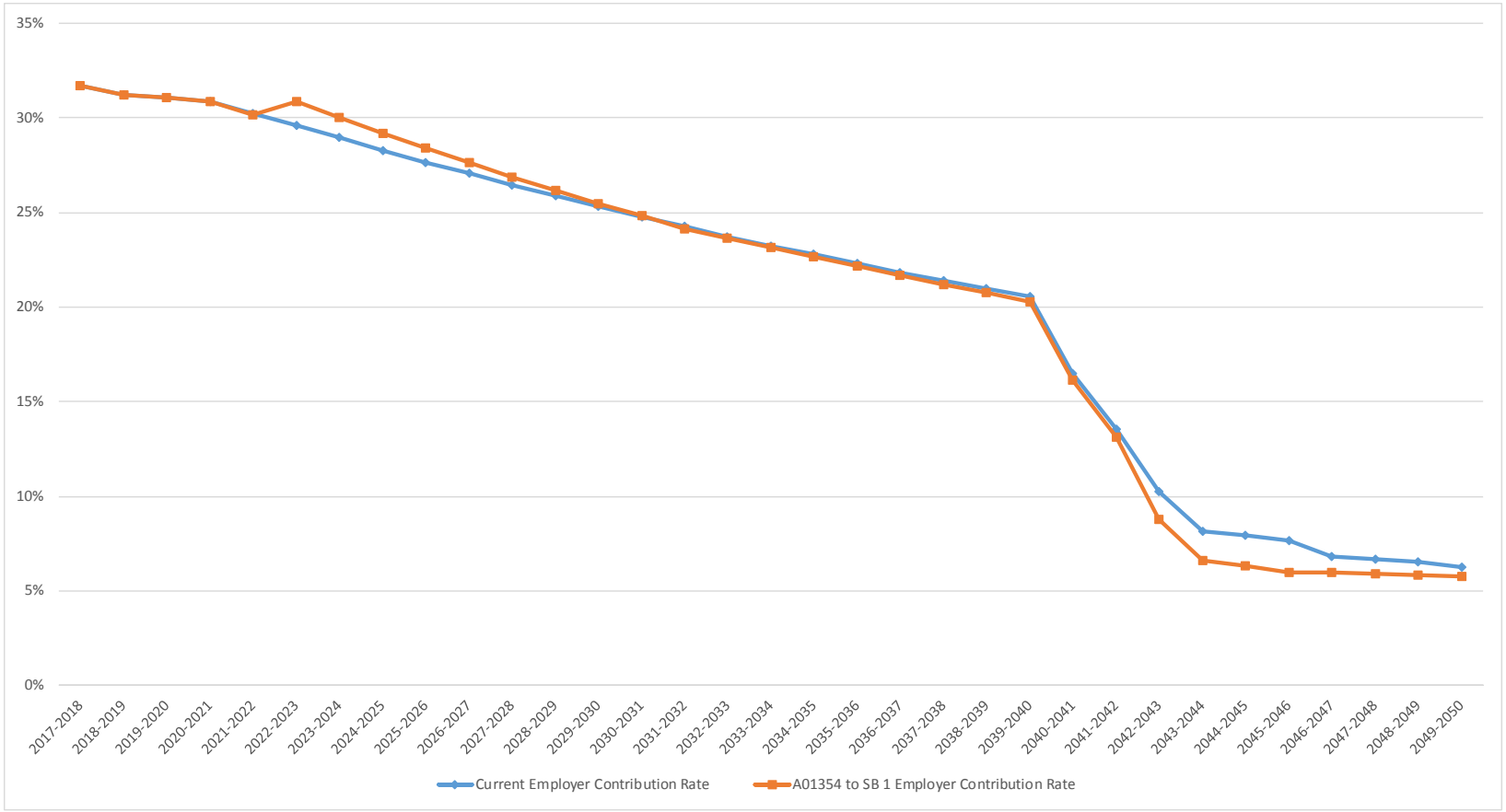
Graphs

PENNSYLVANIA STATE EMPLOYEES RETIREMENT SYSTEM

Estimated Employer Contribution Rates
Under current law and if AmendmentA01354 to Senate Bill 1, Printer's Number 853 is enacted



Based on projections prepared by Korn Ferry Hay Group as provided by the IFO and SERS.

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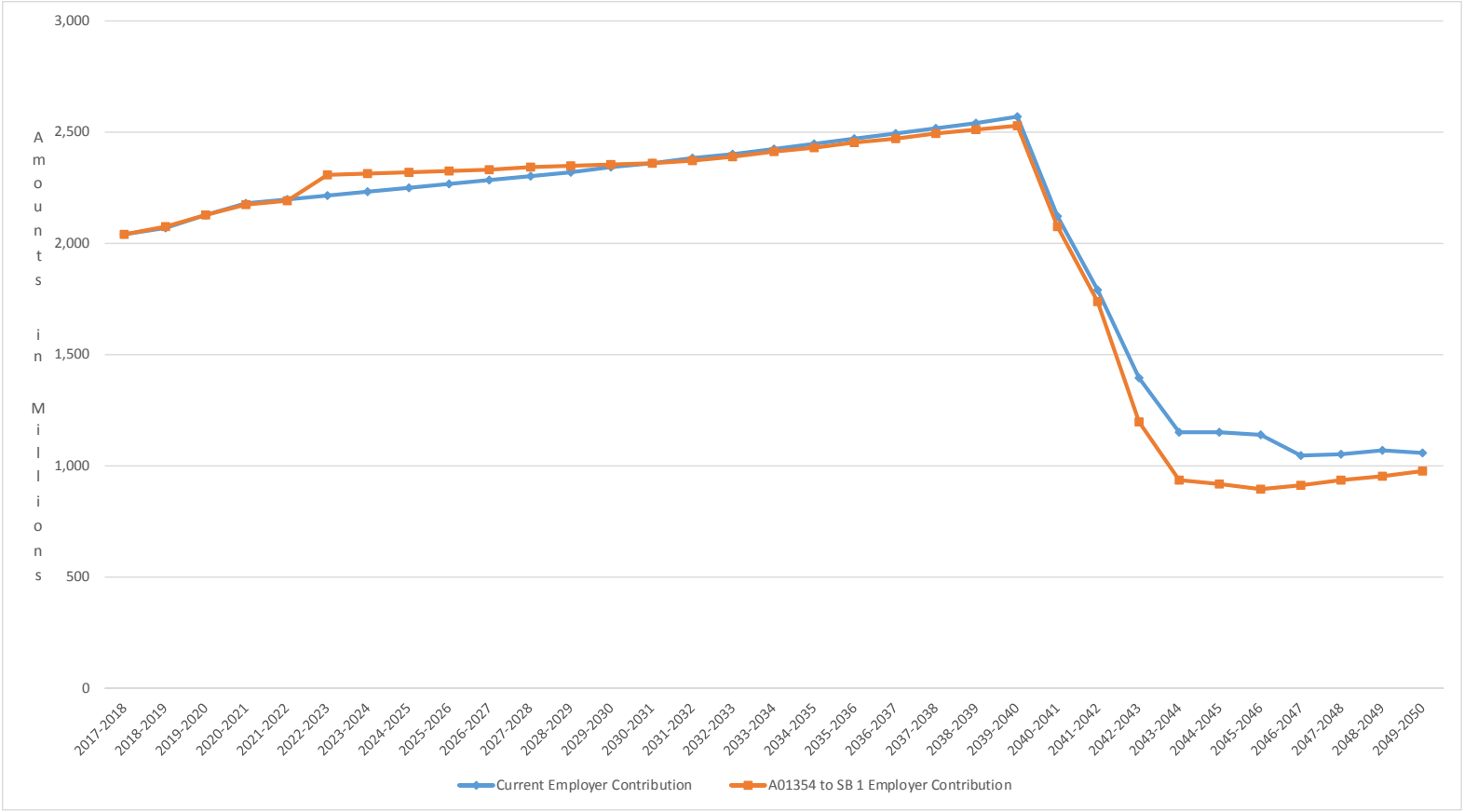
Graphs

PENNSYLVANIA STATE EMPLOYEES RETIREMENT SYSTEM

Estimated Employer Contribution Amounts
Under current law and if AmendmentA01354 to Senate Bill 1, Printer's Number 853 is enacted



Based on projections prepared by Korn Ferry Hay Group as provided by the IFO and SERS.

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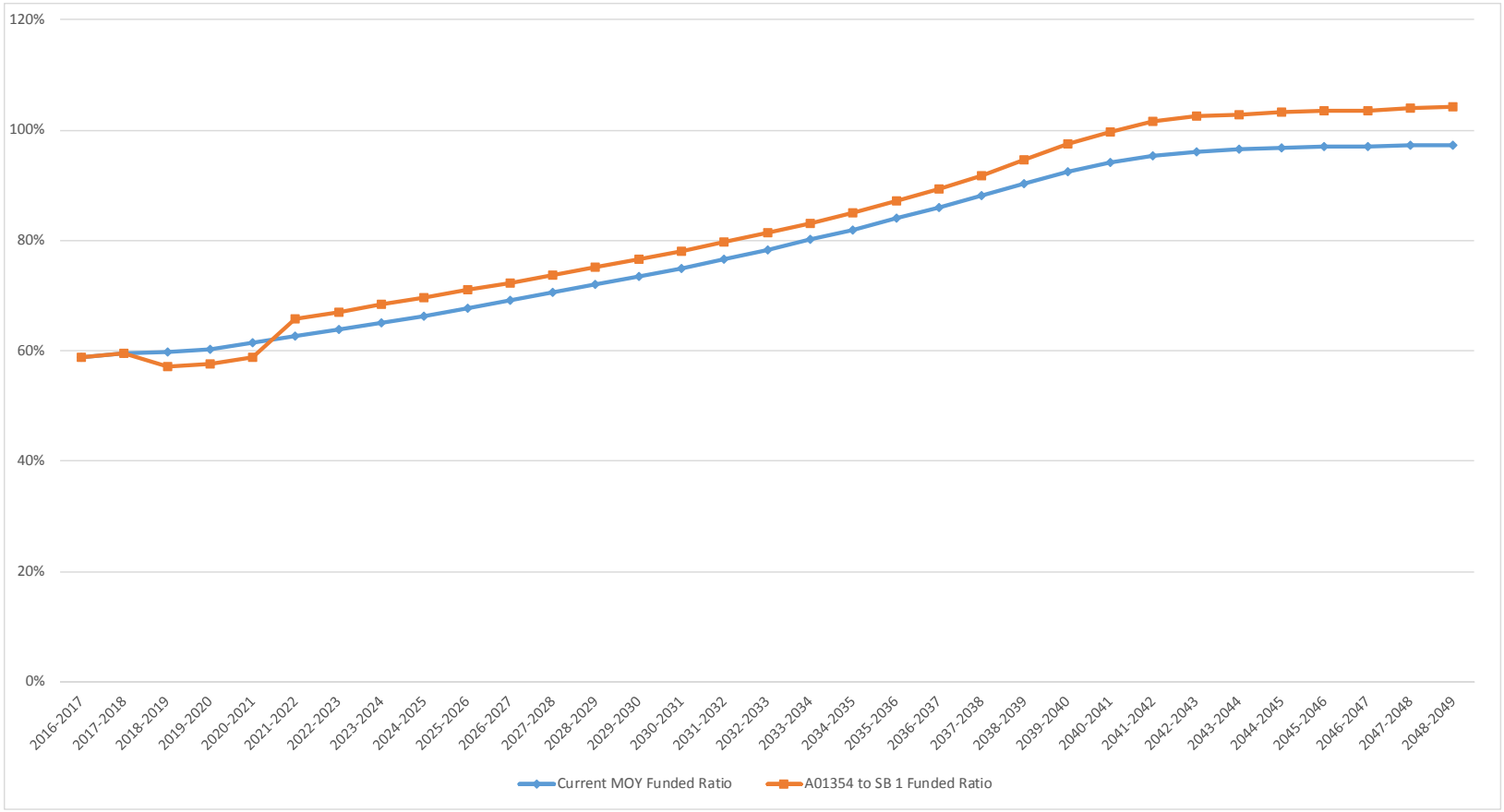
Graphs

PENNSYLVANIA STATE EMPLOYEES RETIREMENT SYSTEM

Estimated Funded Ratios as of the middle of the fiscal year
Under current law and if AmendmentA01354 to Senate Bill 1, Printer's Number 853 is enacted



Based on projections prepared by Korn Ferry Hay Group as provided by the IFO and SERS.

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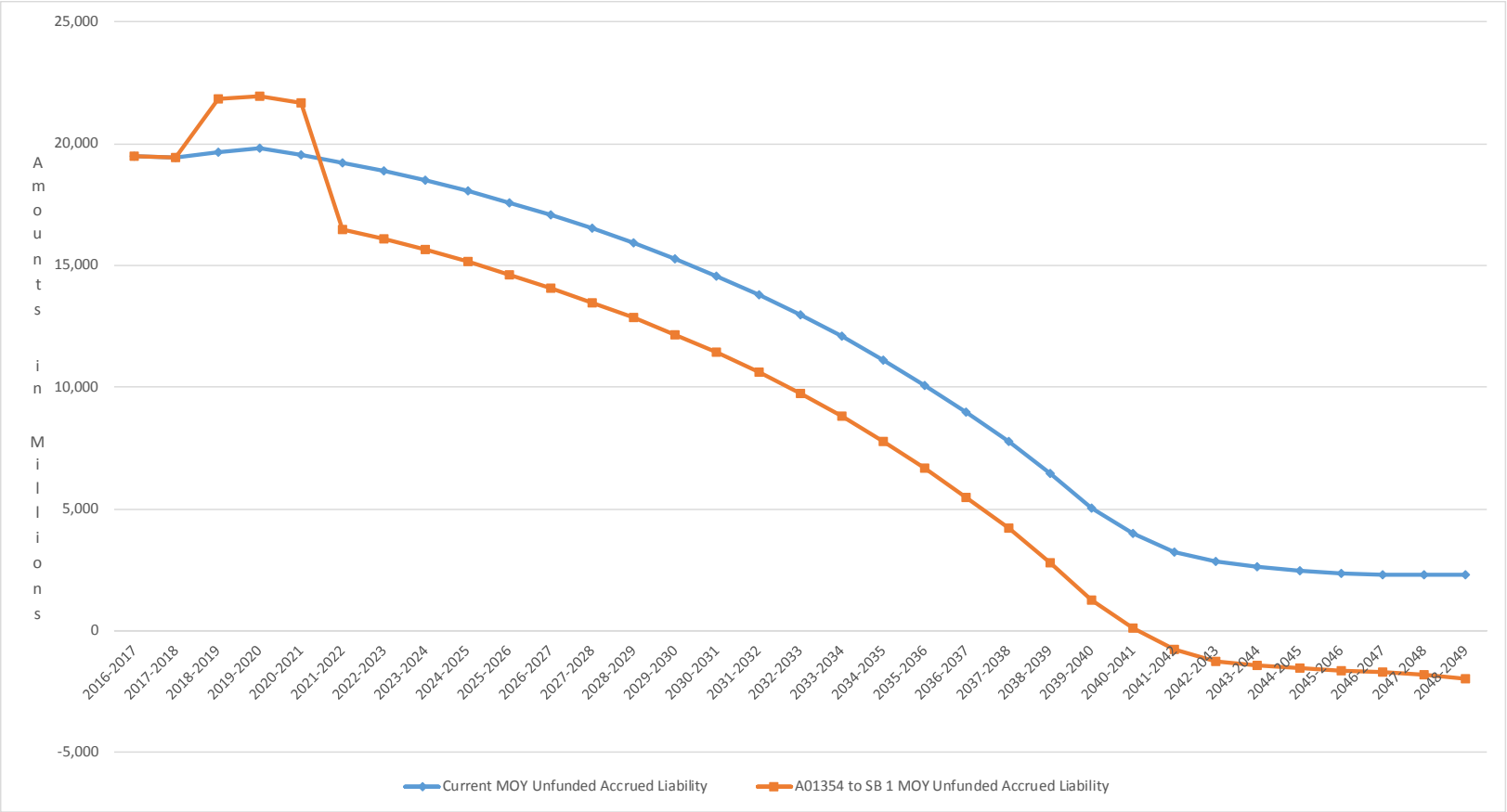
Graphs

PENNSYLVANIA STATE EMPLOYEES RETIREMENT SYSTEM

Estimated Unfunded Accrued Liability as of the middle of the fiscal year
Under current law and if AmendmentA01354 to Senate Bill 1, Printer's Number 853 is enacted



Based on projections prepared by Korn Ferry Hay Group as provided by the IFO and SERS.

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CONDUENT
500 Plaza Drive
Secaucus, New Jersey 07096

May 23, 2017

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

Dear Glen:

Re: Cost Note for Proposed Hybrid plan for New Members effective July 1, 2019

As requested, we have examined a proposed hybrid plan for new members of the Public Schools Employees' Retirement System effective July 1, 2019 (as provided by PSERS staff and hereafter simply referred to as Hybrid Plan). The proposal would create new Class T-G and T-H memberships under the Pennsylvania Public School Employees' Retirement System (PSERS) for members joining the System on or after July 1, 2019. Any employee who becomes a member of the Retirement System effective July 1, 2019 would have the option of electing Class T-G membership, Class T-H membership or Class DC participation within 90 days of becoming a member. Current active members and former PSERS members returning to active service would also be eligible to elect Class T-G or Class T-H membership or Class DC participation. In addition, the proposal would establish a defined contribution plan for future new members effective July 1, 2019 and would provide for a cost-neutral Option 4 for T-E and T-F members effective July 1, 2019, under which they would be able to elect full or partial distribution of their member contribution balances upon retirement.

The Hybrid Plan benefit provisions are summarized as follows:

<u>Employees who become a member of the System on or after July 1, 2019</u>

a. Class T-G Membership - Hybrid Plan – Default 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 years of service.

- Eligibility for superannuation (receipt of unreduced retirement benefits) would be reached at the earlier of (1) attainment of age 67 with three years of service or (2) satisfaction of the Rule of 97 (i.e., the sum of the participant's age and service is greater than or equal to 97) and completion of at least 35 years of service.

- Members would vest after ten 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 eligibility would be reduced by the PSERS' actuarial equivalence factors.

- Members who terminate on or after attaining age 57 with at least 25 years of service would be able to commence benefits immediately. Benefits commencing prior to eligibility for superannuation would be reduced by 3% for each year by which commencement occurs prior to superannuation eligibility.

- Members with five years of service would be eligible for disability benefits, which would be calculated using a 2.0% accrual rate.

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

- Members would be subject to a shared risk/gain provision, under which the member contribution rate would be no more than 3% below or 3% above the member's basic contribution rate, with rate increases or decreases made in increments of 0.75%.

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

2. Defined Contribution (DC) Plan Provisions

- DC plan mandatory participant contributions would be 2.75% of pay. Mandatory participant contributions are intended to be pre-tax "pickup" contributions.

- The DC plan employer contribution would be 2.25% of pay.

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

- Each DC participant will have an individual investment account where all participant and employer contributions are accumulated and investment experience, fees and cost are credited or charged.

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 (receipt of unreduced retirement benefits) would be reached at attainment of age 67 with three years of service.
- Members would vest after ten 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 eligibility for 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 based on a 2.0% accrual rate.
- Members would be eligible to elect a cost-neutral Option 4 partial or full lump-sum distribution of accumulated deductions at benefit commencement.
- Members would be subject to a shared risk/gain provision, under which the member contribution rate would be no more than 3% below or 3% above the member's basic contribution rate, with increases or decreases in the rate in increments of 0.75%.
- Members would be eligible for the Health Care Premium assistance program.

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.

- Each DC participant will have an individual investment account where all participant and employer contributions are accumulated and investment experience, fees and cost are credited or charged.

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.
- Each DC participant will have an individual investment account where all participant and employer contributions are accumulated and investment experience, fees and cost are credited or charged.
- Members would be eligible for the Health Care Premium assistance program.

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

- Effective July 1, 2019, members would be eligible to elect a cost-neutral Option 4 partial or full lump-sum distribution of accumulated deductions at benefit commencement for all service.
- Members would be subject to a shared risk/gain provision, under which the member contribution rate would be no more than 2% below or 2% above the member’s basic contribution rate.

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., in each subsequent valuation, the remaining amortization period would 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., in each subsequent valuation, the remaining amortization period would 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., in each subsequent valuation, the remaining amortization period would decrease by one year) 10-year amortization period.

- DC Only Plan 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.

Where presented, the “funded ratio” and “unfunded accrued liability” are measured on an actuarial value of assets basis. It should be noted that making the same measurements using the market value of the System’s assets would result in different funded ratios and unfunded accrued liabilities. Moreover, the funded ratio presented is appropriate for evaluating the need and level of future contributions but makes no assessment regarding the funded status of the plan if the plan were to settle (i.e., purchase annuities to cover) a portion or all of its liabilities.

The results reported in this cost note are based on the assumption that the Hybrid Plan will cover only employees hired on or after July 1, 2019, and do not take into consideration elections by current PSERS members or former PSERS members returning to active service of membership in the Hybrid Plan. In addition, 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 Hybrid Plan, 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 Hybrid Plan 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 Hybrid Plan are presented in the attached tables. In determining the base costs/(savings), it has been assumed that, among new school employees hired on or after July 1, 2019, 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) for the base scenario and on three sets of alternative election percentages:

1. 65% Class T-G membership, 30% Class T-H membership and 5% Class DC Participation (base scenario) - Savings of $216,792,000.

2. 55% Class T-G membership, 40% Class T-H membership and 5% Class DC Participation - Savings of $339,564,000.

3. 45% T-G membership, 40% Class T-H membership and 15% Class DC participation - Savings of $583,510,000.

4. 70% Class T-G membership, 25% Class T-H membership and 5% Class DC participation - Savings of $155,062,000

The 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.

The attached Table 1 illustrates the estimated potential savings through the 2050 fiscal year for the proposed plans based on the base election percentages outlined above.

The proposal indicates 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 1 shows an initial increase in the employer rates and contributions for the fiscal years 2020 to 2032 and then, generally, 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 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 total employer DC rate plus the employer normal cost rates for Class T-H 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 2050.

Table 2 allocates the total projected cost/(savings) between the proposed benefit and funding reforms of the Hybrid Plan. Table 2 also provides the following summary of the costs/(savings) impact on employer contributions for fiscal years 2018 -2019 to 2049 – 2050 from Table 1.

Impact of on Employer Contributions for Fiscal Years 2018-2019 to 2049-2050*		
	Amounts in Millions	
Fiscal Year Ending	Cash Flow Basis	Present Value as of June 30 ,2017
2019 – 2029	$ 151	$ 97
2030 - 2040	(54)	(11)
2041 - 2050	(314)	(41)
Total	$ (217)	$ 45

* See items (a) and (b) from the previous paragraph for an explanation of the varying cost/(savings),

In addition, Table 2 provides the estimated effect of investment risk sharing on the plan under a 6.25% 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-G membership, Class T-H 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 (T-H member deferring commencement of the DB benefit to age 62), one hypothetical T-H member retiring at age 67 with 35 years of service with an unreduced benefit and one hypothetical T-G member and DC participant retiring at age 65 with 34 years of service . The eighth benefit example has been provided for T-H members age 67 with 35 years of service with no comparison to a T-E member's benefit. In all of the benefit comparisons presented, benefits under the Hybrid Plan 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 Hybrid Plan.

Members of proposed Classes T-G and T-H, 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 Hybrid Plan "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 6.25%, which is 1% less than the System's current 7.25% 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 8.25%, which is 1% more than the System's current 7.25% 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 Hybrid Plan assuming an annual return on assets of 6.25% when compared to current law. The net reduction in projected cumulative Employer contributions under the Hybrid Plan design reflects the increase in the expected Class T-G and Class T-H risk share contributions of $2,396,856,000 due to the expansion of the risk share provisions. The increase in member risk share contributions reduces employer required contributions. Conversely, Exhibit V B shows an increase in total employer contributions should the funds earn an annual 8.25% 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, 2016 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, 2013 through June 30, 2016.
- Actuarial Equivalence is based on the current statutory interest rate of 4.0% and the unisex mortality table required by the Retirement Code. The analysis does not reflect any change in the assumptions used to determine Actuarial Equivalence.

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.

Additionally, it has been assumed that all distributions of defined-contribution balances to participants at retirement will be made in the form of lump-sum distributions. The addition of any options to receive such balances in accounts bearing a minimum interest rate guarantee will add risk to the System and would generate additional long-term costs that would have to be estimated by stochastic forecasts.

A noteworthy difficulty in the estimation of liabilities arising under the Hybrid Plan 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.

This cost note is based on an assumed 7.25% annual discount rate. However, under the Hybrid plan, it is possible that liquidity issues may arise due to the shift in liability towards retirees and that the PSERS Board may change the System's 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 Hybrid plan 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 Hybrid Plan 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.

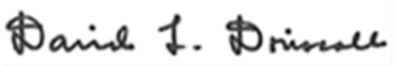
This cost note only provides information with regard to future funding contributions of the System. It does not provide any information with regard to the impact any changes may have on financial disclosures under applicable GASB standards.

This cost note 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, 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, 2016
PSERS (Current) vs. Proposed Hybrid plan for New Members effective July 1, 2019

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		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)		Actuarial Value of Assets ($Millions)	
		Hybrid Plan																			Cost/(Savings)							
	Current	DB Plan	Members Enrolled in DC		Current	Hybrid Plan DB	Current	Hybrid Plan DB	Current	Hybrid Plan DB	Hybrid Plan DC	Current	Hybrid Plan DB	Current	Hybrid Plan DB		Current	Hybrid Plan DB + DC	Current	Hybrid Plan DB + DC	Cash Flow Basis	Present Value as of June 30, 2017	Current	Hybrid Plan DB	Current	Hybrid Plan DB	Current	Hybrid DB
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 %	25.97 %	25.97 %	0.90 %	21.40 %	21.40 %					60.6 %	60.6 %	$ 37,335.8	$ 37,335.8	$ 57,361.6	$ 57,361.6
2016	13,375,000	13,375,000		1.29	4.00	4.00	7.49	7.49	8.38	8.38		19.44	19.44	27.82	27.82	0.84	25.84	25.84					**57.3**	**57.3**	**42,723.9**	**42,723.9**	**57,390.1**	**57,390.1**
2017	13,549,000	13,549,000		7.25	8.31	8.31	7.52	7.52	8.31	8.31		20.89	20.89	29.20	29.20	0.83	30.03	30.03	$ 4,068,765	$ 4,068,765	$ 0	$ 0	55.6	55.6	45,628.6	45,628.1	57,092.9	57,092.0
2018	**13,449,000**	**13,449,000**		7.25	7.70	7.70	**7.54**	**7.54**	**7.70**	**7.70**		**24.04**	**24.04**	**31.74**	**31.74**	**0.83**	**32.57**	**32.57**	**4,380,339**	**4,380,339**	**0**	**0**	54.6	54.6	47,796.2	47,795.7	57,421.0	57,418.9
2019	13,657,662	13,657,662		7.25	7.52	7.52	7.55	7.55	7.52	7.52		25.80	25.80	33.32	33.32	0.86	34.18	34.18	4,668,189	4,668,189	0	0	55.5	55.5	47,966.7	47,966.2	59,765.1	59,761.0
2020	13,886,043	13,886,043	$ 606,843	7.25	7.36	7.36	7.55	7.55	7.36	7.36	0.09 %	27.32	27.32	34.68	34.68	0.85	35.53	35.62	4,933,711	4,946,834	13,123	10,638	56.4	56.4	48,049.6	48,049.1	62,219.9	62,212.9
2021	14,136,176	14,136,176	1,174,728	7.25	7.21	7.21	7.55	7.55	7.21	7.21	0.18	27.89	27.89	35.10	35.10	0.85	35.95	36.13	5,081,955	5,107,359	25,403	19,200	57.0	57.0	48,473.4	48,473.0	64,371.2	64,361.6
2022	14,408,372	14,408,372	1,739,501	7.25	7.06	6.96	7.55	7.44	7.06	6.96	0.26	28.51	28.51	35.57	35.47	0.83	36.40	36.56	5,244,647	5,267,856	23,208	16,355	58.0	58.0	48,456.7	48,455.0	66,985.9	66,942.7
2023	14,695,797	14,695,797	2,304,141	7.25	6.92	6.72	7.55	7.34	6.92	6.72	0.34	29.36	29.36	36.28	36.08	0.83	37.11	37.25	5,453,610	5,474,046	20,435	13,428	59.2	59.1	48,234.4	48,230.0	69,842.7	69,733.3
2024	14,983,986	14,983,986	2,853,230	7.25	6.79	6.50	7.55	7.24	6.79	6.50	0.41	30.07	30.07	36.86	36.57	0.81	37.67	37.79	5,644,468	5,662,715	18,248	11,180	60.2	60.1	48,104.5	48,096.0	72,651.7	72,442.2
2025	15,271,925	15,271,925	3,387,508	7.25	6.64	6.27	7.55	7.15	6.64	6.27	0.48	30.80	30.80	37.44	37.07	0.80	38.24	38.35	5,839,984	5,856,733	16,749	9,568	61.5	61.4	47,483.1	47,469.2	75,973.7	75,630.7
2026	15,562,653	15,563,135	3,906,674	7.25	6.50	6.04	7.55	7.07	6.50	6.04	0.54	31.68	31.67	38.18	37.71	0.79	38.97	39.04	6,064,766	6,076,289	11,523	6,137	63.4	63.2	46,215.4	46,194.8	79,945.9	79,433.8
2027	15,850,665	15,851,183	4,442,998	7.25	6.35	5.81	7.55	6.99	6.35	5.81	0.61	32.45	32.45	38.80	38.26	0.78	39.58	39.65	6,273,693	6,284,382	10,688	5,308	65.4	65.2	44,590.5	44,561.9	84,271.3	83,555.9
2028	16,129,651	16,130,224	4,990,086	7.25	6.20	5.59	7.55	6.91	6.20	5.59	0.67	33.10	33.09	39.30	38.68	0.77	40.07	40.12	6,463,151	6,471,284	8,133	3,766	67.6	67.4	42,648.2	42,619.0	88,906.7	87,941.6
2029	16,401,876	16,402,506	5,552,788	7.25	6.05	5.35	7.55	6.84	6.05	5.35	0.73	33.76	33.75	39.81	39.10	0.77	40.58	40.60	6,655,881	6,659,758	3,877	1,674	69.9	69.7	40,343.0	40,313.7	93,897.5	92,639.1
2030	16,668,260	16,668,936	6,133,491	7.25	5.88	5.13	7.56	6.76	5.88	5.13	0.80	34.46	34.44	40.34	39.57	0.77	41.11	41.14	6,852,322	6,856,886	4,564	1,837	72.5	72.2	37,640.8	37,611.5	99,269.3	97,668.8
2031	16,930,453	16,930,620	6,732,528	7.25	5.73	4.90	7.56	6.68	5.73	4.90	0.86	35.17	35.16	40.90	40.06	0.77	41.67	41.69	7,054,920	7,058,363	3,443	1,292	75.3	74.9	34,507.8	34,478.5	105,055.0	103,058.9
2032	17,188,407	17,187,434	7,352,161	7.25	5.56	4.66	7.56	6.60	5.56	4.66	0.93	35.90	35.89	41.46	40.55	0.77	42.23	42.25	7,258,664	7,260,838	2,174	761	78.3	77.9	30,911.2	30,881.9	111,271.8	108,823.0
2033	17,445,637	17,443,549	7,996,801	7.25	5.40	4.42	7.56	6.52	5.40	4.42	0.99	36.65	36.64	42.05	41.06	0.77	42.82	42.82	7,470,222	7,469,567	(654)	(214)	81.5	81.1	26,813.7	26,784.6	117,950.6	114,986.6
2034	17,701,963	17,698,752	8,664,557	7.25	5.23	4.17	7.56	6.44	5.23	4.17	1.06	37.41	37.40	42.64	41.57	0.77	43.41	43.40	7,684,422	7,681,023	(3,400)	(1,034)	84.9	84.6	22,175.4	22,146.6	125,142.4	121,599.2
2035	17,956,989	17,952,671	9,357,476	7.25	5.05	3.91	7.56	6.36	5.05	3.91	1.13	38.19	38.19	43.24	42.10	0.77	44.01	44.00	7,902,871	7,898,665	(4,205)	(1,193)	88.7	88.4	16,955.4	16,927.0	132,868.4	128,679.4
2036	18,215,992	18,210,331	10,074,613	7.25	4.88	3.66	7.56	6.27	4.88	3.66	1.20	21.34	21.33	26.22	24.99	0.77	26.99	26.96	4,916,496	4,908,845	(7,651)	(2,024)	90.6	90.3	14,321.4	14,293.5	137,876.0	132,959.1
2037	18,478,243	18,470,917	10,820,923	7.25	4.70	3.40	7.56	6.19	4.70	3.40	1.27	17.29	17.28	21.99	20.68	0.77	22.76	22.72	4,205,648	4,196,014	(9,634)	(2,376)	92.1	91.8	12,183.4	12,156.1	142,313.7	136,577.8
2038	18,749,501	18,740,484	11,594,084	7.25	4.52	3.14	7.56	6.10	4.52	3.14	1.34	15.61	15.60	20.13	18.74	0.77	20.90	20.85	3,918,646	3,906,990	(11,655)	(2,680)	93.5	93.3	10,154.2	10,127.7	146,585.7	139,931.8
2039	19,027,284	19,016,518	12,394,827	7.25	4.34	2.88	7.56	6.01	4.34	2.88	1.41	13.64	13.64	17.98	16.52	0.77	18.75	18.70	3,567,616	3,555,994	(11,622)	(2,492)	94.8	94.5	8,305.9	8,280.2	150,615.5	142,942.4
2040	19,316,239	19,303,846	13,223,664	7.25	4.16	2.62	7.56	5.92	4.16	2.62	1.48	12.11	12.10	16.27	14.72	0.77	17.04	16.97	3,291,487	3,276,127	(15,360)	(3,071)	95.9	95.7	6,577.5	6,552.9	154,459.3	145,655.9
2041	19,616,246	19,601,973	14,080,290	7.25	3.98	2.36	7.56	5.83	3.98	2.36	1.55	10.76	10.75	14.74	13.11	0.77	15.51	15.43	3,042,480	3,025,240	(17,240)	(3,214)	97.0	96.8	4,950.4	4,927.0	158,175.6	148,110.7
2042	19,929,712	19,913,229	14,958,902	7.25	3.81	2.10	7.56	5.74	3.81	2.10	1.62	6.80	6.79	10.61	8.89	0.77	11.38	11.28	2,268,001	2,247,104	(20,897)	(3,632)	97.6	97.4	3,958.7	3,936.8	161,248.3	149,802.8
2043	20,264,056	20,245,289	15,853,784	7.25	3.65	1.86	7.55	5.65	3.65	1.86	1.69	4.92	4.91	8.57	6.77	0.77	9.34	9.23	1,892,663	1,869,333	(23,330)	(3,781)	98.1	97.9	3,252.8	3,232.5	164,089.5	151,138.1
2044	20,631,884	20,610,704	16,763,844	7.25	3.50	1.63	7.55	5.57	3.50	1.63	1.76	3.38	3.37	6.88	5.00	0.77	7.65	7.53	1,578,339	1,551,756	(26,583)	(4,017)	98.4	98.2	2,794.0	2,775.6	166,809.8	152,211.6
2045	21,043,487	21,019,853	17,687,405	7.25	3.36	1.42	7.55	5.49	3.36	1.42	1.82	3.26	3.25	6.62	4.67	0.77	7.39	7.26	1,555,114	1,525,970	(29,144)	(4,106)	98.7	98.5	2,313.2	2,297.0	169,770.6	153,371.1
2046	21,503,463	21,477,286	18,630,542	7.25	3.26	1.25	7.54	5.41	3.26	1.25	1.88	3.01	2.99	6.27	4.24	0.77	7.04	6.89	1,513,844	1,478,897	(34,946)	(4,591)	98.9	98.8	1,836.5	1,822.8	172,983.2	154,586.7
2047	22,019,999	21,991,133	19,597,883	7.25	3.16	1.10	7.54	5.34	3.16	1.10	1.93	2.40	2.38	5.56	3.48	0.77	6.33	6.18	1,393,866	1,358,427	(35,439)	(4,341)	99.2	99.1	1,443.3	1,432.2	176,453.0	155,852.9
2048	22,584,226	22,552,457	20,587,305	7.25	3.10	0.97	7.53	5.28	3.10	0.97	1.97	2.01	2.00	5.11	2.97	0.77	5.88	5.71	1,327,952	1,288,662	(39,290)	(4,487)	99.4	99.3	1,094.9	1,086.7	180,221.8	157,225.0
2049	23,197,178	23,162,270	21,582,373	7.25	3.04	0.87	7.53	5.22	3.04	0.87	2.01	1.63	1.62	4.67	2.49	0.77	5.44	5.27	1,261,926	1,221,809	(40,118)	(4,272)	99.6	99.5	797.5	792.1	184,295.3	158,765.5
2050	23,855,576	23,817,382	22,573,904	7.25	3.01	0.78	7.52	5.17	3.01	0.78	2.05	1.05	1.04	4.06	1.82	0.77	4.83	4.64	1,152,224	1,105,031	(47,193)	(4,686)	99.7	99.6	605.5	602.6	188,629.8	160,455.8
																	Total:		$ 151,882,883	$ 151,666,091	$ (216,792)	$ 44,934						

This is an attachment to Conduent's May 23, 2017 cost note on the proposed Hybrid Plan. Please refer to that cost note for more information.

Table 2

Pennsylvania Public School Employees' Retirement System

A. Analysis of Table 1 - Total Potential Projected Cost/(Savings)
Due to the Proposed Hybrid plan for New Members effective July 1, 2019

1. Cost/(Savings) Allocation of Table 1 - Total Potential Projected Cost/(Savings)	Amounts in millions* Cash Flow Basis	Present Value As of June 30, 2017
Proposed Hybrid Plan Benefit Reforms		
DB Benefit Reforms	$ (7,029)	$ (1,460)
Hybrid DC Plan and DC Only Plan Election	6,812	1,505
Total Cost/(Savings)**	$ (217)	$ 45

2. Total Proposed Hybrid Plan Cost/(Savings) as a Percent of the Total 34-Year Employer Contributions to be Made Under the Current PSERS Plan and Funding Provisions	(0.14%)

3. Impact on Employer Contributions for Fiscal Years 2018 -2019 to 2049 - 2050	Amounts in millions* Cash Flow Basis	Present Value As of June 30, 2017
Fiscal Year Ending		
2019 - 2029	$ 151	$ 97
2030 - 2040	(54)	(11)
2041 - 2050	(314)	(41)
Total **	$ (217)	$ 45

4. 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, 2016, at a rate of 7.25% (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.

** It is estimated by PSERS staff that it will cost approximately $25 million to $35 million over the next 3 years to implement the three new plans that are part of the Hybrid Plan design. The cost/(savings) shown above do not reflect any of these additional administrative costs expected to be incurred.

*** Please refer to page 9 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 6.25% annual investment return

	$ Millions
a. Reduction in cumulative Employer contributions due to the proposed Hybrid plan assuming a 6.25% return (see Exhibit V A)	$ (2,218)
b. Cumulative Employer cost/(savings) under the proposed Hybrid plan assuming a 7.25% return (see Table 1)	(217)
c. Net reduction in cumulative Employer contributions due to Class T-G/T-H/DC only members' DB/DC plan design = a - b	$ (2,001) *

Net reduction in cumulative Employer contributions due to the proposed Hybrid plan assuming a 6.25% return as a Percent of the total 34-Year Employer Contributions to be Made Under the Current PSERS Plan and Funding Provisions (1.32%)

See Exhibit V B for the impact of an 8.25% annual rate of return for all future years.

*The net reduction in projected cumulative Employer contributions under the proposed Hybrid Plan design reflects the increase in expected Class T-G and Class T-H risk share contributions of $2,397 due to the expansion of the risk share provisions. The increase in member risk share contributions reduces Employer required contributions.

This is an attachment to Conduent's May 23, 2017 cost note on the proposed Hybrid Plan. 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-G Member Under Hybrid DB Design: 1.25% accrual, 5.50% member contribution Plus DC Plan: 2.25% employer contribution, 2.75% member contribution

Employee	A	B	C	D	E	F	G	H
Service at Termination	35	35	35	20	20	20	35	34
Age at Hire	30	30	30	45	45	45	22	31
Age at Termination	65	65	65	65	65	65	57	65
Retirement Age	65	65	65	65	65	65	57	65
T-E Superannuation Age	65	65	65	65	65	65	57	65
T-G Superannuation Age	65	65	65	67	67	67	67	67
Salary at Termination	$ 50,000	$ 70,000	$ 90,000	$ 50,000	$ 70,000	$ 90,000	$ 70,000	$ 70,000
PSERS Benefit	$ 33,910	$ 47,474	$ 61,038	$ 19,377	$ 27,128	$ 34,879	$ 47,459	$ 46,117
Side by Side Hybrid Proposal: DB	$ 20,541	$ 28,757	$ 36,973	$ 10,138	$ 14,193	$ 18,248	$ 20,093	$ 26,259
Side by Side Hybrid Proposal: DC	7,762	10,866	13,971	3,935	5,509	7,083	7,659	10,525
Side by Side Hybrid Proposal: Total	$ 28,303	$ 39,623	$ 50,944	$ 14,073	$ 19,702	$ 25,331	$ 27,752	$ 36,784
Side by Side Hybrid Proposal / PSERS Benefit	83%	83%	83%	73%	73%	73%	58%	80%

Hybrid Design

Defined Benefit Design

Benefit Accrual Rate	**1.25%**
Member DB Contribution	**5.50%**
Final Average Salary	**5 years**
Vesting	**10 years**
Cost Neutral Option 4	**Yes**
Superannuation	**Earlier of Age 67 with 3 years of service or Rule of 97 (age plus service) with at least 35 years of service**
Early Retirement with 3% Early Retirement Factor	**Age 57 with 25 years of Service**
Earliest Retirement Age for a Terminated Vested Member	**62**

Defined Contribution Design

Participant DC Contribution	**2.75%**
Employer DC Contributions	**2.25%**
Vesting for Employer Contribution	**3 Years**
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 Conduent's May 23, 2017 cost note on the proposed Hybrid Plan. 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-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	35	35	35	20	20	20	35		35
Age at Hire	30	30	30	45	45	45	22		32
Age at Termination	65	65	65	65	65	65	57		67
Retirement Age	65	65	65	65	65	65	57		67
T-E Superannuation Age	65	65	65	65	65	65	57		N/A
T-H Superannuation Age	67	67	67	67	67	67	67		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	$ 33,910	$ 47,474	$ 61,038	$ 19,377	$ 27,128	$ 34,879	$ 47,459	$ 47,459	N/A
Side by Side Hybrid Proposal: DB	$ 14,193	$ 19,870	$ 25,548	$ 8,110	$ 11,354	$ 14,599	$ 0	$ 19,518	$ 23,005
Side by Side Hybrid Proposal: DC	7,762	10,866	13,971	3,935	5,509	7,083	7,659	7,659	11,831
Side by Side Hybrid Proposal: Total	$ 21,955	$ 30,736	$ 39,519	$ 12,045	$ 16,863	$ 21,682	$ 7,659	$ 27,177	$ 34,836
Side by Side Hybrid Proposal / PSERS Benefit	65%	65%	65%	62%	62%	62%	16%	57%	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	**10 years**
Cost Neutral Option 4	**Yes**
Superannuation	**Age 67 with 3 years of service**
Earliest commencement age	**62**

Defined Contribution Design

Participant DC Contribution	**3.00%**
Employer DC Contributions	**2.00%**
Vesting for Employer Contribution	**3 Years**
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 Conduent's May 23, 2017 cost note on the proposed Hybrid Plan. 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	35	35	35	20	20	20	35	34
Age at Hire	30	30	30	45	45	45	22	31
Age at Termination	65	65	65	65	65	65	57	65
Retirement Age	65	65	65	65	65	65	57	65
T-E Superannuation Age	65	65	65	65	65	65	57	N/A
Salary at Termination	$ 50,000	$ 70,000	$ 90,000	$ 50,000	$ 70,000	$ 90,000	$ 70,000	$ 70,000
PSERS Benefit	$ 33,910	$ 47,474	$ 61,038	$ 19,377	$ 27,128	$ 34,879	$ 47,459	$ 46,117
DC Plan Proposal	$ 14,747	$ 20,646	$ 26,545	$ 7,476	$ 10,467	$ 13,457	$ 14,552	$ 19,997
DC Plan Proposal / PSERS Benefit	43%	43%	43%	39%	39%	39%	31%	43%

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 commencement age	**N/A**

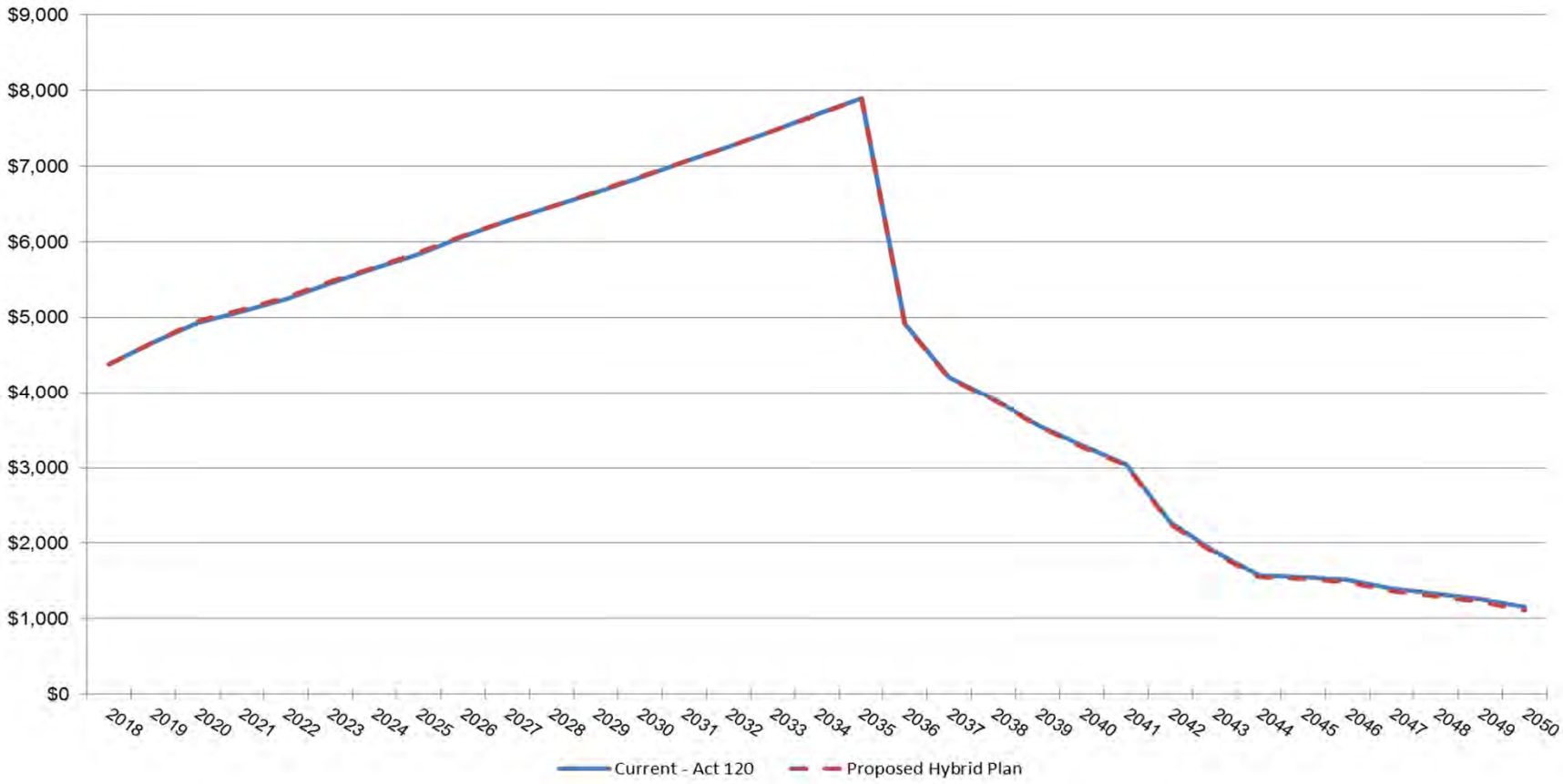
Defined Contribution Design

Participant DC Contribution	**7.50%**
Employer DC Contributions	**2.00%**
Vesting for Employer Contribution	**3 Years**
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 Conduent's May 23, 2017 cost note on the proposed Hybrid Plan. Please refer to that cost note for more information.

EXHIBIT I
Pennsylvania Public School Employees' Retirement System
PSERS (Current) vs. Proposed Hybrid plan for New Members effective July 1, 2019

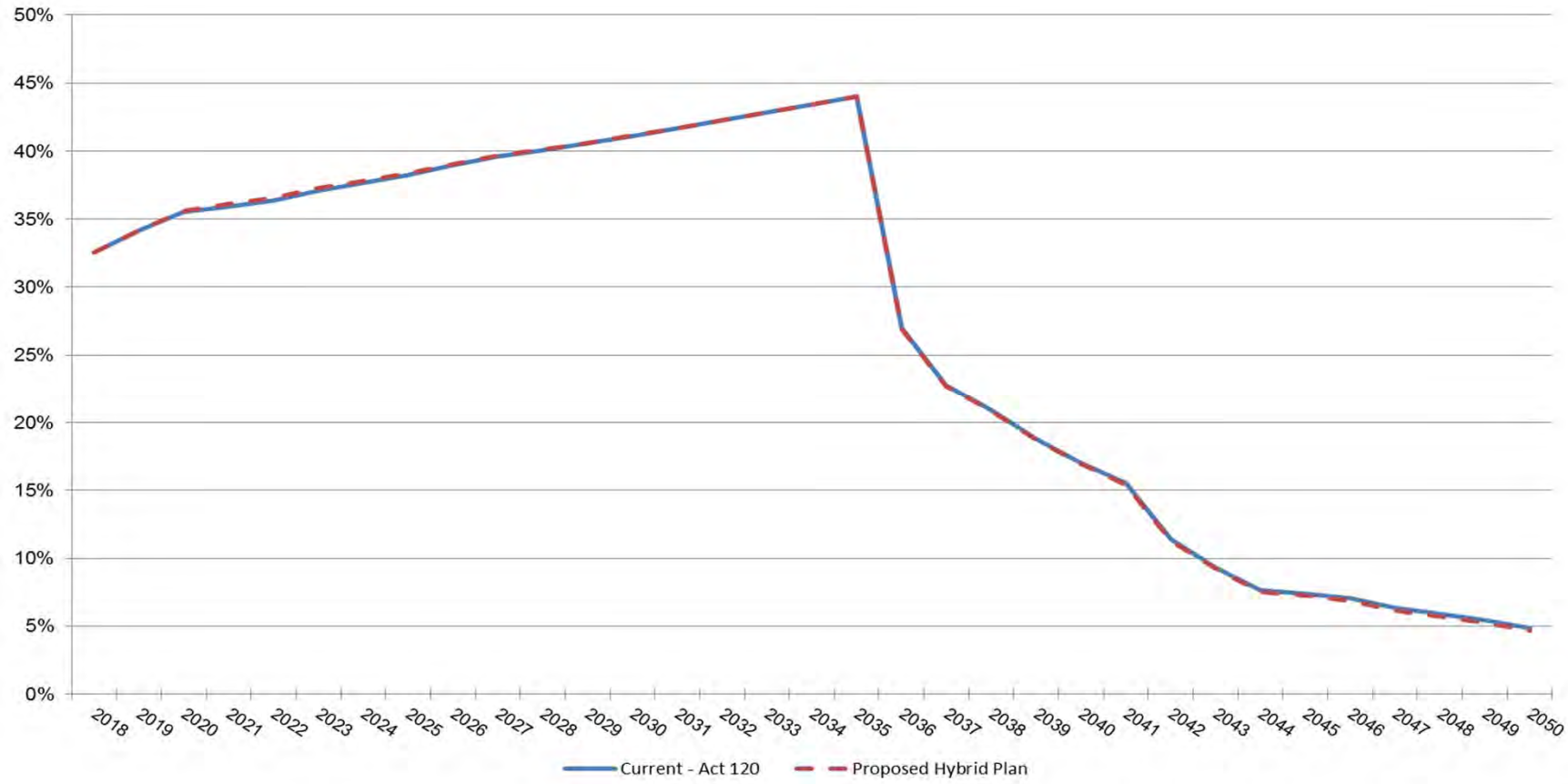
Projection of Employer Contribution Dollars (in Millions)



This is an attachment to Conduent's May 23, 2017 cost note on the proposed Hybrid Plan. Please refer to that cost note for more information.

EXHIBIT II
Pennsylvania Public School Employees' Retirement System
PSERS (Current) vs. Proposed Hybrid plan for New Members effective July 1, 2019

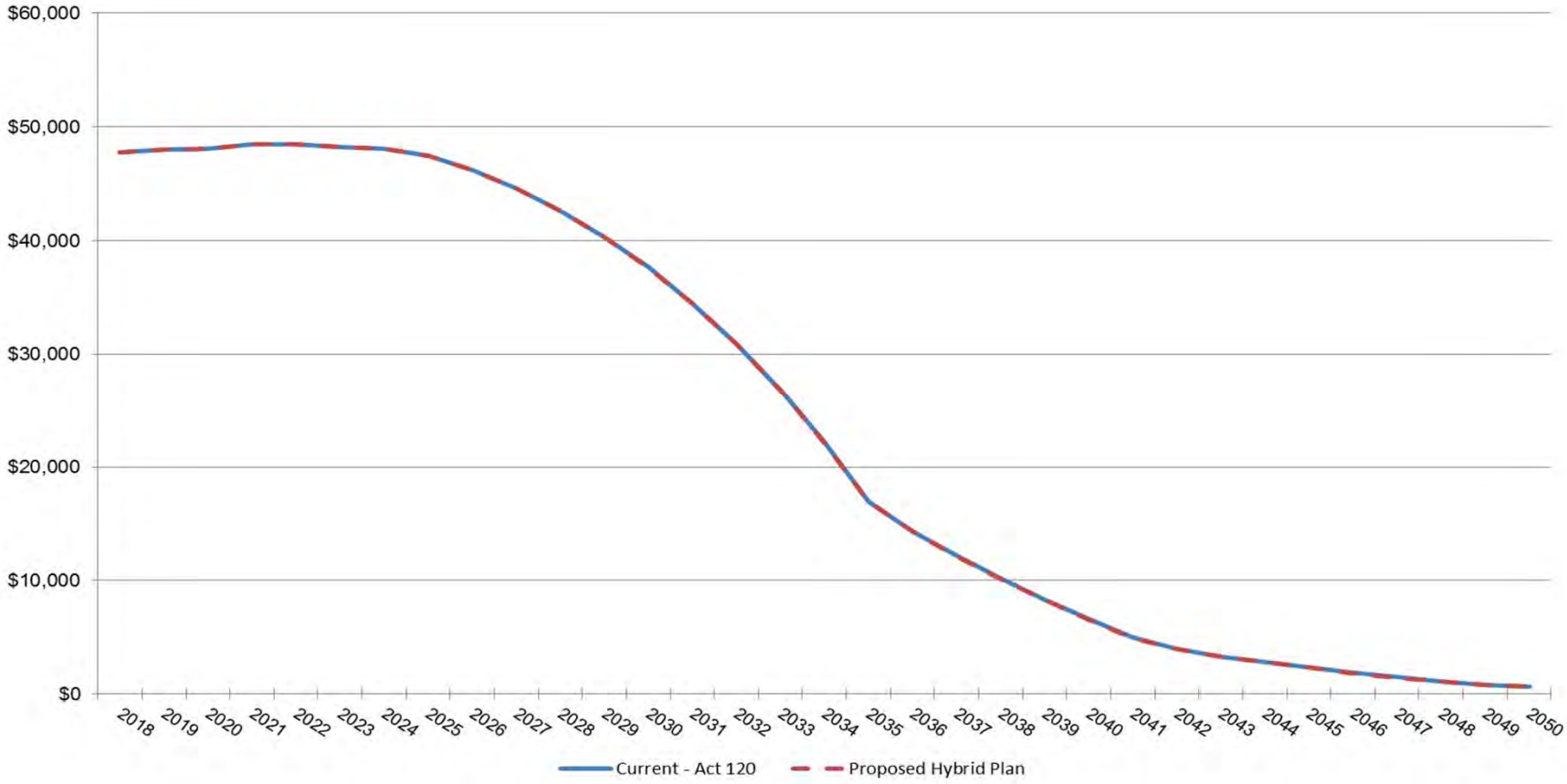
Projection of Total Employer Contribution Rate



This is an attachment to Conduent's May 23, 2017 cost note on the proposed Hybrid Plan. Please refer to that cost note for more information.

EXHIBIT III
Pennsylvania Public School Employees' Retirement System
PSERS (Current) vs. Proposed Hybrid plan for New Members effective July 1, 2019

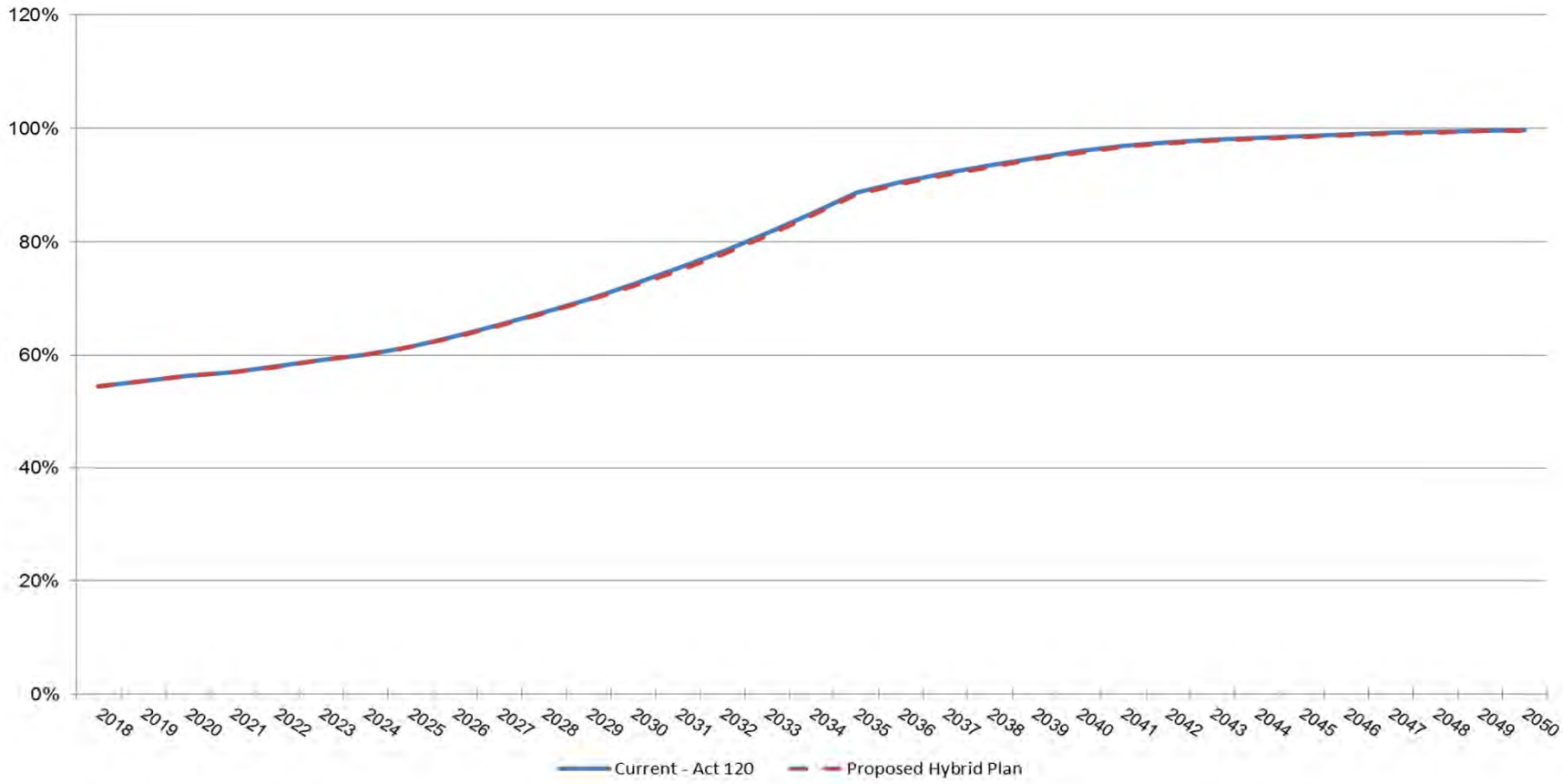
Projection of Unfunded Liability (Actuarial Value of Assets basis and in millions)



This is an attachment to Conduent's May 23, 2017 cost note on the proposed Hybrid Plan. Please refer to that cost note for more information.

EXHIBIT IV
Pennsylvania Public School Employees' Retirement System
PSERS (Current) vs. Proposed Hybrid plan for New Members effective July 1, 2019

Projection of System Funded Ratio (Actuarial Value of Assets basis)



This is an attachment to Conduent's May 23, 2017 cost note on the proposed Hybrid Plan. Please refer to that cost note for more information.

Exhibit V A

Pennsylvania Public School Employees' Retirement System

PSERS (Current) vs. Proposed Hybrid plan for New Members effective July 1, 2019

Additional Member and Employer Contributions Assuming a 6.25% Investment Return (1.00% below the assumed annual discount rate)

Fiscal Year	(x1,000) Current Plan Employer Contributions @6.25% return	(x1,000) Hybrid Employer Contributions @6.25% 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/T-H Proposed Hybrid Plan Member Risk Share Contributions	(x1,000) Total Additional Member Contributions
2017	$ 4,068,765	$ 4,068,765	$ -	$ -	$ -	$ -
2018	4,380,339	4,380,339	-	-	-	-
2019	4,672,286	4,672,286	-	11,135	11,135	-
2020	4,944,820	4,957,943	13,123	13,404	13,404	-
2021	5,104,573	5,129,977	25,404	15,722	15,722	-
2022	5,283,550	5,306,758	23,208	36,188	38,904	2,716
2023	5,513,863	5,534,298	20,435	40,987	46,244	5,257
2024	5,731,375	5,749,622	18,247	45,859	53,644	7,785
2025	5,959,105	5,975,854	16,749	76,252	91,719	15,467
2026	6,223,505	6,235,033	11,528	83,998	103,151	19,153
2027	6,478,167	6,485,692	7,525	92,079	114,804	22,725
2028	6,719,613	6,726,142	6,529	134,002	168,931	34,929
2029	6,970,797	6,971,406	609	145,662	185,372	39,710
2030	7,224,024	7,223,602	(422)	157,633	202,223	44,590
2031	7,490,032	7,483,322	(6,710)	169,948	219,542	49,594
2032	7,760,566	7,748,961	(11,605)	182,762	237,504	54,742
2033	8,044,183	8,026,017	(18,166)	196,066	256,122	60,056
2034	8,337,625	8,311,098	(26,527)	209,873	275,426	65,553
2035	8,639,107	8,606,001	(33,106)	224,175	295,453	71,278
2036	5,743,502	5,700,994	(42,508)	238,926	316,123	77,197
2037	5,129,560	5,077,077	(52,483)	254,150	337,479	83,329
2038	4,946,118	4,883,370	(62,748)	269,795	359,470	89,675
2039	4,705,447	4,632,329	(73,118)	285,806	382,086	96,280
2040	4,547,043	4,459,453	(87,590)	302,119	405,247	103,128
2041	4,421,502	4,322,891	(98,611)	318,713	428,924	110,211
2042	3,780,666	3,664,926	(115,740)	335,570	453,102	117,532
2043	3,538,104	3,403,926	(134,178)	352,648	477,745	125,097
2044	3,356,808	3,202,673	(154,135)	369,926	502,781	132,855
2045	3,463,758	3,287,434	(176,324)	387,276	528,032	140,756
2046	3,548,071	3,347,421	(200,650)	404,495	553,283	148,788
2047	3,549,624	3,328,833	(220,791)	421,463	578,400	156,937
2048	3,604,442	3,352,212	(252,230)	438,179	603,431	165,252
2049	3,651,236	3,373,584	(277,652)	454,450	628,225	173,775
2050	3,649,903	3,334,338	(315,565)	470,454	652,943	182,489
Total	**$ 181,182,079**	**$ 178,964,577**	**$ (2,217,502)**	**$ 7,139,715**	**$ 9,536,571**	**$ 2,396,856**

Note:

	x $1,000
a. Cumulative Employer contributions under the proposed Hybrid plan assuming a 6.25% return	$ 178,964,577
b. Cumulative Employer contributions under the current PSERS plan assuming a 6.25% return	181,182,079
c. Cost/(reduction) in cumulative Employer contributions due to the proposed Hybrid plan assuming a 6.25% return = a - b	$ (2,217,502)
d. Cumulative Employer cost/(savings) under the proposed Hybrid plan assuming a 7.25% return = Table 1	(216,792)
e. Net cost/(reduction) in cumulative Employer contributions due to Class T-E/T-F/T-G/T-H/DC only members' DB/DC plan design = c - d	$ (2,000,710)

The net reduction in cumulative Employer contributions due to the proposed Hybrid Plan design reflects the increase in expected Class T-G and Class T-H risk share contributions of $2,396,856 due to the expansion of the risk share provisions.

This is an attachment to Conduent's May 23, 2017 cost note on the proposed Hybrid Plan. Please refer to that cost note for more information.

Exhibit V B

Pennsylvania Public School Employees' Retirement System

PSERS (Current) vs. Proposed Hybrid plan for New Members effective July 1, 2019

Additional Member and Employer Contributions Assuming an 8.25% Investment Return (1.00% above the assumed annual discount rate)

Fiscal Year	(x1,000) Current Plan Employer Contributions @8.25% return	(x1,000) Hybrid Employer Contributions @8.25% 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/T-H Proposed Hybrid Plan Member Risk Share Contributions	(x1,000) Total Additional Member Contributions
2017	$ 4,068,765	$ 4,068,765	$ -	$ -	$ -	$ -
2018	4,380,339	4,380,339	-	-	-	-
2019	4,665,457	4,665,457	-	-	-	-
2020	4,922,602	4,935,725	13,123	-	-	-
2021	5,059,337	5,084,741	25,404	-	-	-
2022	5,207,186	5,230,394	23,208	-	-	-
2023	5,393,357	5,413,793	20,436	-	-	-
2024	5,557,560	5,575,808	18,248	-	-	-
2025	5,717,809	5,734,557	16,748	-	-	-
2026	5,901,358	5,914,432	13,074	-	-	-
2027	6,059,709	6,070,391	10,682	-	-	-
2028	6,190,560	6,200,296	9,736	-	(42,233)	(42,233)
2029	6,318,003	6,323,507	5,504	-	(46,343)	(46,343)
2030	6,437,282	6,448,497	11,215	-	(50,556)	(50,556)
2031	6,557,164	6,569,068	11,904	-	(109,771)	(109,771)
2032	6,670,821	6,685,059	14,238	-	(118,752)	(118,752)
2033	6,781,119	6,803,224	22,105	-	(128,061)	(128,061)
2034	6,887,834	6,916,437	28,603	-	(206,569)	(206,569)
2035	6,987,064	7,026,166	39,102	-	(221,590)	(221,590)
2036	3,872,720	3,925,487	52,767	-	(237,092)	(237,092)
2037	3,021,193	3,093,300	72,107	-	(337,479)	(337,479)
2038	2,583,681	2,673,867	90,186	-	(359,470)	(359,470)
2039	2,068,266	2,186,805	118,539	-	(382,086)	(382,086)
2040	1,614,838	1,764,636	149,798	-	(405,247)	(405,247)
2041	1,175,013	1,359,072	184,059	-	(428,924)	(428,924)
2042	912,781	894,996	(17,785)	-	(453,102)	(453,102)
2043	895,671	875,289	(20,382)	-	(477,745)	(477,745)
2044	880,981	857,175	(23,806)	-	(502,781)	(502,781)
2045	869,096	842,825	(26,271)	-	(528,032)	(528,032)
2046	866,590	836,727	(29,863)	-	(553,283)	(553,283)
2047	865,386	835,038	(30,348)	-	(578,400)	(578,400)
2048	874,010	837,613	(36,397)	-	(603,431)	(603,431)
2049	883,812	846,580	(37,232)	-	(628,225)	(628,225)
2050	901,741	857,330	(44,411)	-	(652,943)	(652,943)
Total	**$ 132,049,105**	**$ 132,733,396**	**$ 684,291**	**$ -**	**$ (8,052,115)**	**$ (8,052,115)**

Note:

	x $1,000
a. Cumulative Employer contributions under the proposed Hybrid plan assuming an 8.25% return	$ 132,733,396
b. Cumulative Employer contributions under the current PSERS plan assuming an 8.25% return	132,049,105
c. Cost/(reduction) in cumulative Employer contributions due to the proposed Hybrid plan assuming an 8.25% return = a - b	$ 684,291
d. Cumulative Employer cost/(savings) under the proposed Hybrid plan assuming a 7.25% return = Table 1	(216,792)
e. Net cost/(reduction) in cumulative Employer contributions due to Class T-E/T-F/T-G/T-H/DC only members' DB/DC plan design = c - d	$ 901,083

This is an attachment to Conduent's May 23, 2017 cost note on the proposed Hybrid Plan. Please refer to that cost note for more information.

CONDUENT

500 Plaza Drive
Secaucus, New Jersey 07096

June 2, 2017

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

Dear Glen:

Re: Supplemental Information for the Independent Fiscal Office (IFO) with regard to amendment A01558 to amendment A01354 to Senate Bill 1

As requested by the IFO, we are writing to provide our comments on amendment A01558 to amendment A01354 to Senate Bill 1 and the provisions that have changed since we issued our cost note on May 23. We have summarized below the changes in provisions from those reflected in our cost note issued May 23:

(1) All vested Class T-G and T-H members who terminate employment will be able to receive an immediate benefit but may defer commencement to a later age.
(2) Class T-G and T-H members who terminate employment with less than 25 years of service and who commence their benefits prior to age 62 will have their benefits reduced from age 67 to age 62 based on the System's current actuarial-equivalent early retirement factors, which are based on the statutory interest rate of 4%. The benefit will be further reduced from age 62 to the member's age at benefit commencement based on new actuarial-equivalent early retirement factors based on an interest rate to be determined by the Board's actuary. The interest rate will be set so that the cost savings as outlined in our May 23rd cost note of $217,000,000 will remain virtually unchanged under this new set of plan provisions.
(3) Class T-G and T-H members who terminate employment prior to age 57 (for Class T-G members) or age 55 (for Class T-H members) with 25 or more years of service and commence their benefit immediately will have their benefits reduced from age 67 to their age at benefit commencement based on the System's current actuarial-equivalent early retirement factors, which are based on the statutory interest rate of 4%.
(4) Class T-H members who terminate employment on or after age 55 with at least 25 years of service will have their benefits reduced from age 67 to their age at benefit commencement based on the System's current early retirement reduction factors of 3% per year.

By eliminating the age-62 restriction for benefit commencement in the four items noted above, the savings outlined in our cost note of May 23rd would be reduced, possibly eliminated entirely or changed to an overall cost to the System. However, as outlined in Item (2) above, new early retirement reduction factors would be calculated so that when they were applied to the benefits of Class T-G and T-H members , the additional costs are completely offset by the savings generated by the new early retirement factors.

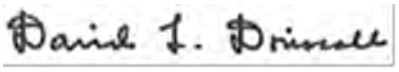
In determining the interest rate to be used for the new early retirement reduction factors, we will run the Class T-G and Class T-H hypothetical member projections at a range of different interest rates, which will vary from each other in 25-basis-point increments, in order to hone in on the rate required to achieve the targeted overall savings of $217,000,000. We will begin with a 6.0% interest rate and then adjust accordingly as the results dictate. We will utilize the current System's assumptions for terminated vested members; 90% are assumed to commence their benefits immediately upon termination of employment and 10% are assumed to defer commencement to superannuation. For Class T-G members who terminate employment on or after age 57 with at least 25 years of service and for Class T-H members who terminate employment on or after age 55 with at least 25 years of service, we will assume that 100% of such participants will commence their benefits immediately.

The changes in the benefit provisions outlined above could lead to changes in both the percentage of members who elect to commence benefits immediately upon termination of employment as well as in the percentage of members who elect Class T-G membership versus Class T-H membership. At this point, we do not propose to change the assumption that 90% of terminated vested members elect immediate commencement of their benefits and 10% defer commencement to superannuation. In addition, we do not propose to change the assumption that 65% of new members on or after July 1, 2019 would elect Class T-G membership and 30% would elect Class T-H membership. Any changes to these assumptions would impact the cost of the proposed reforms, which in turn would affect the interest rate to be used in the development of the new early retirement reduction factors.

As stated previously, the estimated savings outlined in our May 23rd cost note would not change as a result of the changes to the proposed provision of the legislation outlined above, as any cost increase would be offset by the savings resulting from the new actuarial-equivalent early retirement factors to be applied to members' benefits as outlined in (2) above.

Please let me know if you have any questions or need any additional information.

Very truly yours,



David L. Driscoll, FSA, MAAA, EA, FCA
Principal, Consulting Actuary
Enc.
Pc: Brian Carl
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Actuarial Cost Note -
Projected Impact of Bipartisan Consensus
Three-Way Hybrid/DC Pension Proposal

As requested, in connection with the new Bipartisan Consensus Three-Way Hybrid/DC Pension Proposal, whereby most employees who first join SERS on or after January 1, 2019 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 2018 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 "Bipartisan Three-Way Hybrid/DC Proposal"), most employees who join SERS on or after January 1, 2019 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 Bipartisan 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, 2019. However, effective January 1, 2019, 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 Bipartisan Three-Way Hybrid/DC Proposal, most hazardous duty employees would be exempt from the provisions of the proposed new plan design and, hereafter, this group will be referred to as the "Class A-5 exempt employees". For purposes of this actuarial cost note, the "Class A-5 exempt employees" include:

- A State police officer,
- An enforcement officer,
- A wildlife conservation officer,
- A Delaware River Port Authority policeman,
- A park ranger,
- A capitol police officer,
- A campus police officer employed by a State-owned educational institution, community college or The Pennsylvania State University and
- A police officer employed by Fort Indiantown Gap or other designated Commonwealth military installation or facility.
- A corrections officer.

Therefore, all such employees hired after 2018 would be exempt from the Bipartisan Three-Way Hybrid/DC Proposal provision that requires all post-2018 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.
Note: Psychiatric security aides are NOT Class A-5 exempt employees.
References hereafter in this note to "all employees hired after the Bipartisan Three-Way Hybrid/DC plan start date" being subject to the proposed new provisions should be understood, if not specifically excepted, to exclude the Class A-5 exempt employees.

Summary

For those non-exempt employees hired after December 31, 2018, including legislators and judges, the Bipartisan 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 Bipartisan Three-Way Hybrid/DC Proposal follow.

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

Under the Bipartisan Three-Way Hybrid/DC Proposal there would be changes, effective January 1, 2019, 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, 2019 effective date. Note that this particular provision of the Bipartisan 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 Bipartisan 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 the expectation, used throughout our Bipartisan Three-Way Hybrid/DC Proposal cost analyses, that the SERS fund will consistently earn the assumed annual investment return in all years after December 31, 2015 (consistent with our December 31, 2015 actuarial valuation assumptions*), neither the Shared-Gain nor the Shared-Risk provisions have any cost implications of relevance for this Cost Note.

*Our December 31, 2015 actuarial valuation assumptions included a 7.50% assumed annual investment return and a 2.75% assumed annual inflation. Although the SERS Board has adopted revised assumptions (namely, a 7.25% assumed annual investment return and a 2.60% assumed annual inflation) for use in the December 31, 2016 actuarial valuation, implementing those revised assumptions for purposes of this cost analysis was not possible.

Transition to the Bipartisan Three-Way Hybrid/DC Design

The Bipartisan 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 mandatory members of SERS who are first hired after December 31, 2018 would have to elect either one of the two hybrid plans or the stand-alone DC plan. (Optional SERS members would have the same three benefit structure choices.) Because the hybrid plans include both DB and DC components, this means that, under the Bipartisan Three-Way Hybrid/DC Proposal, all non-exempt employees who are mandatory members of SERS or who elect SERS membership first hired after the hybrid/DC start date (January 1, 2019), 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 2019, but not Class A-5 exempt employees) would also have an option to leave their existing classes of service and join one of the three Hybrid/DC plans, as explained more fully in the following paragraphs.

Opt-In for Current Employees

During a three-month election period from January 1, 2019 through March 31, 2019, most active employees who are not Class A-5 exempt employees, will have the opportunity to make an irrevocable election to join one of the new DB tiers or the DC-only plan effective July 1, 2019. The newly elected tier or plan would be prospective only and would generally apply to all future service. Service credit and final average salary would be frozen for employees who elect participation in the DC-only plan. Also, the total employee contribution rate for employees making an opt-in election will be the same before and after any election; any post-election rate adjustment (needed to maintain the same total rate as applied pre-election) will be made in the DC plan contribution rate.

For purposes of the Bipartisan Three-Way Hybrid/DC Proposal cost analyses we discuss in this note, we have not attempted to factor in the impact of current employees opting into the new tiers/plan. Our initial expectation is that such elections (which will not be made by a very significant percentage of eligible employees), in some cases, will result in higher future employer costs (than would be expected under current law) and, in other cases, will result in lower future employer costs; thus we expect this provision to have a de minimis overall cost impact.

DB Plan Is Continuing, Not Closing

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 Bipartisan Three-Way Hybrid/DC Proposal. Therefore, in our cost analyses relating to this proposal, Korn Ferry Hay Group does not consider it necessary to factor in any future reduction(s) to the underlying annual investment return assumption.

Specifics of the Bipartisan 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:

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

   Class A-6 = 1.00% X 5-Year Final Average Salary (including overtime) X Total Credited Service

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

   Under Classes A-5 and A-6, 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 Bipartisan Three-Way Hybrid/DC Proposed Design: See the tables that follow for a summary of the Bipartisan Three-Way Hybrid/DC proposed contribution rates, expressed as a percentage of payroll.

Class A-5 (Default) Bipartisan 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	3.25%
Employer	2.25%

Class A-6 Bipartisan 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%

DC Only 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 is (i) age 67 with three years of service or (ii) "Rule of 97" with 35 years of service, for all members of the proposed Bipartisan Three-Way Hybrid DB System (including both the Class A-5 and Class A-6 tiers).

4. Hybrid DB Early Retirement (ER)—Class A-6 Provisions Set; Two Possibilities Being Considered for Class A-5:
   - For Class A-5 ER Variation 1—Eligibility for early retirement is:

a. Age 62 with 10 years of service, with benefit reductions for early commencement based upon actuarial equivalent factors measured from superannuation age of 67 or
b. Age 57 with 25 years of service, with benefit reductions for early commencement based upon ¼ percent per month for each month under superannuation age of 67.

- For Class A-5 ER Variation 2—Same as Class A-5 ER Variation 1 except that members would be eligible to commence an early retirement annuity after 10 years of service, regardless of age (therefore removing the age 62 requirement). Unless the member met age 57 and 25 years of service, the benefit reduction for early commencement would be based upon actuarial equivalent factors measured from age 67.
- For Class A-6—Eligibility for early retirement is:
  a. Age 62 with 10 years of service, with benefit reductions for early commencement based upon actuarial equivalent factors measured from superannuation age of 67 or
  b. Age 62 with 25 years of service, with benefit reductions for early commencement based upon ¼ percent per month for each month under superannuation age of 67.

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 - 3% of pay. Projections attached to this note are based on an assumption that the target investment returns (as assumed for actuarial valuation purposes) 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 2018)

This Bipartisan Three-Way Hybrid/DC Proposal also includes a change that would become effective January 1, 2019 only to the benefit provisions for new Class A-5 exempt employees, who join SERS on or after the Bipartisan Three-Way Hybrid/DC plan start date, as follows:

Limitation on Voluntary Overtime Pay That May Be Included as DB Compensation for Class A-5 Exempt Employees Post-2018: In any pay period included in the post-2018 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 Bipartisan Three-Way Hybrid/DC Proposal

In accordance with our interpretation of the draft provisions of the Bipartisan 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 (Traditional Entry-Age Actuarial Cost Method). The significant difference between the method currently used for SERS and the method proposed under the Bipartisan 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.
- Under current law, if the legislation resulting from this proposal caused a change in the SERS unfunded accrued liability (UAL) (and it most certainly would), then that change in liability would be funded using a 10-year, level-dollar amortization. However, under the terms of this Bipartisan Three-Way Hybrid/DC Proposal, the change in UAL that would result if it were enacted, would be amortized on a level-dollar basis over a 30-year period, not over a 10-year period.
- 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 Bipartisan Three-Way Hybrid/DC Proposal on SERS DB System

If the Bipartisan Three-Way Hybrid/DC Proposal were to become law, we project that, effective in fiscal 2019/2020, the SERS employer normal cost rate, as a consequence of the less generous provisions of the Bipartisan Three-Way Hybrid DB design (relative to the current SERS DB design for Class A-3 members), would decline to either (i) an estimated 0.97% of payroll based upon Class A-5 ER Variation 1 or (ii) an estimated 1.04% of payroll based upon Class A-5 ER Variation 2. Therefore, in conjunction with our projected December 31, 2018 actuarial valuation, (i) based upon Class A-5 ER Variation 1, approximately $2.2 billion and (ii) based upon Class A-5 ER Variation 2, approximately $2.1 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 (albeit small), 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 Bipartisan Three-Way Hybrid/DC Proposal, the new Traditional Entry-Age Actuarial Cost Method 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 three years of new Class A-5/A-6 members) is (i) 8.42% of payroll based upon Class A-5 ER Variation 1 and (ii) 8.43% of payroll based upon Class A-5 ER Variation 2, both considerably higher rates than the 4.52% of payroll normal cost rate in fiscal 2016/2017. Therefore, in conjunction with our projected December 31, 2021 actuarial valuation, (i) based upon Class A-5 ER Variation 1, approximately $2.7 billion and (ii) based upon Class A-5 ER Variation 2, approximately the same $2.7 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, 2018 valuation would cause the SERS funded status to decrease by about 2.6 percent based upon Class A-5 ER Variation 1 and by about 2.5 percent based upon Class A-5 ER Variation 2 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 3.3 percent based upon Class A-5 ER Variation 1 and by about 3.2 percent based upon Class A-5 ER Variation 2. These changes are reflected (though somewhat masked by the impact of other changes) in our Bipartisan Three-Way Hybrid/DC Proposal funding projections attached to this note.

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

I. For Class A-5 ER Variation 1 (Variation 1)

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, 2018 and incorporating the new Hybrid DB plan designs outlined above for new hires on or after January 1, 2019 and incorporating the new Hybrid DC plan designs outlined above for new entrants to SERS on or after January 1, 2019 and incorporating the new stand-alone DC plan design outlined above for new entrants to SERS on or after January 1, 2019 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 Bipartisan 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, 2019, as follows:

- 50% were assumed to elect Class A-5: Hybrid DB/DC with 1.25% annual DB accrual
- 25% were assumed to elect Class A-6: Hybrid DB/DC with 1.00% annual DB accrual
- 25% were assumed to elect DC Only: Stand-Alone DC Plan Only

Rather than predict, based upon new entrant characteristics, which alternative (A-5, A-6 or DC Only) each would likely elect, we applied the 50%/25%/25% assumption to each individual non-exempt 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, Class A-5 is the default option, which would be assigned automatically if a first-time new hire made no election. Based upon discussions with SERS staff regarding past experience when new entrants are asked to make benefit-related elections at hire, we expect that there will be some degree of default election bias (i.e., tendency for a greater percentage of eligible employees to end up with the default option due to their non-response), and we have factored that into our 50%/25%/25% assumption. For Class A-5 ER Variation 1, the approximate net employer normal cost rates corresponding to each of the Hybrid DB Plans (expressed as a percentage of payroll) under the Traditional Entry-Age Actuarial Cost Method are (i) for Class A-5, 2.01% and (ii) for Class A-6, 1.67%. These are the net employer Hybrid

DB plan normal cost rates only. The Hybrid DC Plan employer contribution rates are in addition to these amounts.

II. For Class A-5 ER Variation 2 (Variation 2)

Under this set of early retirement provisions (described in full on page 6), unlike under Variation 1, members would be eligible to commence an early retirement annuity after 10 years of service regardless of age, therefore removing the age 62 requirement that must be met (unless the member met age 57 and 25 years of service) before commencing an annuity under Variation 1. As a result of this more favorable (and costly) early retirement provision (relative to Variation 1), we have concluded that, if this variation of the proposal were enacted, non-exempt new entrants hired on or after January 1, 2019 would be somewhat more inclined to elect Class A-5 over Class A-6 when they make their plan design elections.

Therefore, in order to perform cost projections for Variation 2, Korn Ferry Hay Group utilized a slightly different assumed set of election percentages than used for costing Variation 1. Specifically, we assumed that, under Class A-5 ER Variation 2 of this proposed legislation, employees first hired on or after January 1, 2019 would make elections as follows:

- 60% would elect Class A-5: Hybrid DB/DC with 1.25% annual DB accrual
- 15% would elect Class A-6: Hybrid DB/DC with 1.00% annual DB accrual
- 25% would elect DC Only: Stand-Alone DC Plan Only

Rather than predict, based upon new entrant characteristics, which alternative (A-5, A-6 or DC Only) each would likely elect, we applied the 60%/15%/25% assumption to each individual non-exempt new entrant. This set of election percentages was utilized for our Class A-5 ER Variation 2 cost projection and underlies each of the Variation 2 cost impact results reported in this note.

For Class A-5 ER Variation 2, the approximate net employer normal cost rates corresponding to each of the Hybrid DB Plans (expressed as a percentage of payroll) under the Traditional Entry-Age Actuarial Cost Method are (i) for Class A-5, 2.07% and (ii) for Class A-6, 1.67%. These are the net employer Hybrid DB plan normal cost rates only. The Hybrid DC Plan employer contribution rates are in addition to these amounts.

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:

- **Bipartisan Three-Way Hybrid/DC Proposal Projection Results Based Upon Class A-5 ER Variation 1:** This one-page cost projection shows our projected annual funding of SERS if the Bipartisan Three-Way Hybrid/DC Proposal, with Class A-5 ER Variation 1, (as 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 projection of future SERS funding through fiscal year 2051/2052, all of which reflects the impact of the Bipartisan Three-Way Hybrid/DC Proposal.

- **Bipartisan Three-Way Hybrid/DC Proposal Projection Results Based Upon Class A-5 ER Variation 2:** This one-page cost projection shows our projected annual funding of SERS if the Bipartisan Three-Way Hybrid/DC Proposal, with Class A-5 ER Variation 2 (as 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 projection of future SERS funding through fiscal year 2051/2052, all of which reflects the impact of the Bipartisan 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 then-current SERS benefit provisions or financing methodologies.

Also attached are two Summary Tables, which provide 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. One of the Summary Tables is based upon Class A-5 ER Variation 1 and the other is based upon Class A-5 ER Variation 2.

The Summary Tables include 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 Bipartisan 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
• Based Upon Class A-5 ER Variation 1:	$(1,291.3) million
• Based Upon Class A-5 ER Variation 2:	$(1,125.2) million

It should be noted that the $166.1 million decrease in projected savings shown above results from Variation 2's more costly (and more favorable to the member) early retirement provisions.

The decrease is derived from (i) approximately $42 million less in savings due to the more costly early retirement provision (assuming the same 50%/25%/25% election percentages as were used for costing Variation 1) and (ii) approximately another $124 million less in savings due to our change in assumed election percentages from 50%/25%/25% for Variation 1 to 60%/15%/25% for Variation 2.

As shown in our attached Summary Tables, it is also important to consider the cash flow cost/ (savings) amounts (stated above) expressed in discounted present value terms:

	3.5% Interest Basis	7.5% Interest Basis
• Based Upon Class A-5 ER Variation 1:	$(345.9) million	$(1.0) million
• Based Upon Class A-5 ER Variation 2:	$(274.6) million	$30.1 million

In addition to the cumulative savings described above, it is important to note the eventual "transfer of risk" that would occur if this Bipartisan 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 Bipartisan 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 Bipartisan 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 Bipartisan Three-Way Hybrid/DC Plan were enacted. Because the employer contribution rate to TIAA-CREF and the other independent retirement programs is 9.29%, those programs will be seriously considered by new educational employees and compared to the Bipartisan Three-Way Hybrid/DC alternatives. To the extent that educational employees hired after 2018 (after the Bipartisan Three-Way Hybrid/DC Plan is in effect) may opt to join SERS at a lesser rate than they have in the past (pre-2019), this could potentially reduce the savings expected to result from the Bipartisan Three-Way Hybrid/DC Plan. However, absent specific evidence of such a change in behavior (and knowing the SERS defined benefit design is appreciated), Korn Ferry Hay Group has performed our cost analyses of this proposal assuming that these educational employees hired after 2018 (after the Bipartisan 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-2019).

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 Bipartisan Three-Way Hybrid/DC Proposal versus under the current law (Baseline).

8. To the extent certain groups other than the Class A-5 exempt employees, such as judges, are excluded from the Bipartisan Three-Way Hybrid/DC design through further amendments or litigation, there could be a material impact on the actuarial results presented herein.

9. The cost estimates included herein were based upon our December 31, 2015 actuarial valuation results, including the underlying census data, assets and actuarial assumptions (which included a 7.50% assumed annual investment return and a 2.75% assumed annual inflation). Although revised assumptions have been adopted by the SERS Board for use in the December 31, 2016 actuarial valuation (namely, a 7.25% assumed annual investment

return and a 2.60% assumed annual inflation), implementing those revised assumptions for purposes of this cost analysis was not possible.

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 Actuarial 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.
Member American Academy of Actuaries
Enrolled Actuary No. 17-3885

By: _____
Craig R. Graby
Member American Academy of Actuaries
Enrolled Actuary No. 17-7319

May 22, 2017

Summary Table

Pennsylvania State Employees' Retirement System
Allocation of Potential Projected (Savings)/Cost Through FY 2052
Due to Bipartisan Three-Way Hybrid/DC Proposal - Class A-5 ER Variation 1
(Amounts in millions)

	Cash Flow	PV 1	PV 2
Benefit Reforms	No Interest	7.5% Interest	3.5% Interest
Amendment - 1.25% DB Accrual or 1% DB Accrual for most hires after December 31, 2018	$ (6,390.3)	$ (1,438.1)	$ (2,964.7)
Amendment - DC Plan (Er 2.25% or 2.0% or 3.5%) for most hires after December 31, 2018	$ 5,035.5	$ 1,037.1	$ 2,268.6
Sub-total Benefit Reforms	$ (1,354.9)	$ (401.0)	$ (696.1)
Total Hybrid Plan: (Savings)/Cost through FY 2052 without Financing Reforms	$ (1,354.9)	$ (401.0)	$ (696.1)
Financing Reforms			
New Entry Age Normal Cost Approach	$ (90.9)	$ 306.2	$ 227.6
Future savings due to reforms are contributed to the plan ("plow-back")	$ 154.4	$ 93.8	$ 122.5
Sub-total Financing Reforms	$ 63.5	$ 400.0	$ 350.1
Total Hybrid Plan: (Savings)/Cost through FY 2052 with Financing (Normal Cost Method & Plow Back) Reforms	$ (1,291.3)	$ (1.0)	$ (345.9)

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, 2018

- 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 Rule of 97 with 35 years credited service
- Hybrid DB early retirement: Age 62 with 10 years credited service - actuarially reduced
- Hybrid 1.25% DB alternative early retirement: Age 57 w/ 25 yrs credited service - 3%/yr early retirement reduction
- Hybrid 1.00% DB alternative early retirement: Age 62 w/ 25 yrs credited service - 3%/yr early retirement reduction
- 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, 2018

- DC employer contribution rate: 2.25% for 1.25% accrual hybrid DC and 2% for 1% accrual hybrid DC
- DC employer contribution rate: 3.5% for DC-only option
- DC employee contribution rate: 3.25% for 1.25% accrual hybrid DC and 3.5% for 1% accrual hybrid DC
- DC employee contribution rate: 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 50% of new entrants elect 1.25% DB Hybrid, 25% elect 1.00% DB Hybrid, and 25% elect DC-only

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 & an additional amount equal to those savings is contributed in the future (based on a fixed % of payroll each year)

Based on data, assumptions, and methods from the December 31, 2015 valuation

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.

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

5/22/2017

Bipartisan Three-Way Hybrid/DC Proposal, Including New 1% or 1.25% Accrual DB Tier, Plus New DC Plan (DC/DB) with Employer Contribution at 2.25/2.0% OR DC-Only Plan with Employer Contribution at 3.5%; Most Hazardous Duty Employees Remain in Current DB Plan; No Fresh Start; Traditional Entry Age Normal Cost Beginning in 2021; Superannuation: Age 67 or Rule of 97 & 35 YOS; Special 3% per Year Early Reduction for 25 YOS; Class A-5 ER Variation 1; 10% OT Limit on Exempt Groups; Savings Plowed Back into Trust

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	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 Baseline Percent	Baseline Baseline $ ($ in millions)
2016	7.50%	2017/2018	4.52%	31.70	6,446.0	2,043.3	-	-	2,043.3	31.70	-	-	-	58.8	19.46	56.7	31.70	2,043.3
2017	7.50%	2018/2019	4.52%	31.21	6,498.3	2,066.7	144.3	8.5	2,075.2	31.24	-	2.0	2.0	59.6	19.42	57.7	31.21	2,073.2
2018	7.50%	2019/2020	0.97%	30.26	6,411.1	2,066.8	434.1	14.0	2,080.8	30.40	0.71	0.1	2.1	57.2	21.84	56.3	31.11	2,129.3
2019	7.50%	2020/2021	0.97%	29.97	6,333.0	2,107.2	721.0	23.3	2,130.5	30.20	0.66	(2.2)	(0.1)	57.6	21.96	57.4	30.89	2,179.2
2020	7.50%	2021/2022	0.97%	29.22	6,258.2	2,114.6	1,010.9	32.6	2,147.2	29.54	0.62	(6.0)	(6.1)	58.7	21.66	58.6	30.24	2,198.3
2021	7.50%	2022/2023	8.42%	30.47	6,185.6	2,172.7	1,305.2	137.6	2,310.3	30.84	-	93.4	87.4	65.9	16.48	65.8	29.59	2,216.9
2022	7.50%	2023/2024	8.16%	29.56	6,112.5	2,150.8	1,606.8	165.3	2,316.1	30.00	-	81.3	168.6	67.1	16.07	67.1	28.95	2,234.8
2023	7.50%	2024/2025	7.90%	28.68	6,037.7	2,130.3	1,917.0	192.3	2,322.6	29.20	-	70.6	239.2	68.4	15.63	68.4	28.31	2,252.0
2024	7.50%	2025/2026	7.66%	27.83	5,964.6	2,110.3	2,232.7	218.5	2,328.8	28.41	-	59.6	298.9	69.7	15.15	69.7	27.68	2,269.2
2025	7.50%	2026/2027	7.43%	27.00	5,893.5	2,091.3	2,553.8	244.0	2,335.3	27.65	-	48.6	347.5	71.0	14.64	71.0	27.07	2,286.7
2026	7.50%	2027/2028	7.20%	26.20	5,825.5	2,073.4	2,879.5	268.7	2,342.1	26.91	-	37.4	384.9	72.3	14.08	72.3	26.48	2,304.7
2027	7.50%	2028/2029	6.99%	25.43	5,761.6	2,056.6	3,208.9	292.7	2,349.3	26.19	-	26.1	411.0	73.7	13.49	73.7	25.90	2,323.2
2028	7.50%	2029/2030	6.79%	24.68	5,697.3	2,040.5	3,546.8	316.2	2,356.7	25.49	-	14.4	425.4	75.1	12.84	75.1	25.34	2,342.3
2029	7.50%	2030/2031	6.59%	23.95	5,630.5	2,024.8	3,895.5	339.6	2,364.4	24.82	-	2.5	428.0	76.6	12.15	76.6	24.79	2,361.9
2030	7.50%	2031/2032	6.40%	23.24	5,561.5	2,009.6	4,255.1	362.8	2,372.4	24.17	-	(9.8)	418.2	78.1	11.41	78.1	24.27	2,382.2
2031	7.50%	2032/2033	6.21%	22.56	5,490.4	1,994.9	4,625.6	385.8	2,380.7	23.53	0.10	(12.2)	405.9	79.6	10.61	79.6	23.76	2,403.1
2032	7.50%	2033/2034	6.04%	21.90	5,416.9	1,980.5	5,007.6	409.0	2,389.5	22.92	0.22	(12.2)	393.8	81.3	9.75	81.3	23.26	2,424.6
2033	7.50%	2034/2035	5.87%	21.25	5,346.2	1,966.0	5,396.3	431.9	2,397.9	22.32	0.33	(13.6)	380.2	83.1	8.81	83.1	22.78	2,446.9
2034	7.50%	2035/2036	5.72%	20.62	5,283.2	1,951.7	5,786.9	454.2	2,405.9	21.73	0.43	(16.3)	363.9	85.0	7.79	85.0	22.31	2,469.8
2035	7.50%	2036/2037	5.57%	20.00	5,226.7	1,937.3	6,181.1	476.1	2,413.4	21.16	0.53	(19.6)	344.3	87.1	6.68	87.1	21.86	2,493.5
2036	7.50%	2037/2038	5.44%	19.40	5,174.6	1,922.7	6,581.1	497.8	2,420.5	20.59	0.62	(24.5)	319.8	89.4	5.49	89.4	21.42	2,517.9
2037	7.50%	2038/2039	5.30%	18.81	5,125.3	1,907.6	6,988.9	519.5	2,427.1	20.03	0.71	(29.9)	289.9	91.9	4.19	91.9	20.99	2,543.0
2038	7.50%	2039/2040	5.18%	18.23	5,079.7	1,892.3	7,404.0	541.3	2,433.6	19.49	0.79	(36.7)	253.1	94.5	2.79	94.5	20.58	2,569.0
2039	7.50%	2040/2041	5.07%	13.99	5,037.9	1,402.4	7,826.6	563.5	1,965.9	15.28	0.86	(44.8)	208.3	97.5	1.28	97.5	16.49	2,121.4
2040	7.50%	2041/2042	4.97%	10.87	4,999.5	1,031.1	8,257.3	586.0	1,617.1	12.20	0.93	(53.3)	155.0	99.8	0.12	99.8	13.53	1,793.7
2041	7.50%	2042/2043	4.87%	7.42	4,965.0	589.8	8,696.2	608.8	1,198.6	8.77	-	(198.7)	(43.7)	101.5	(0.77)	101.5	10.23	1,397.3
2042	7.50%	2043/2044	4.78%	5.26	4,935.2	303.7	9,142.6	631.2	934.9	6.64	-	(217.0)	(260.7)	102.5	(1.24)	102.5	8.18	1,151.9
2043	7.50%	2044/2045	4.68%	4.95	4,911.3	268.6	9,595.9	653.2	921.8	6.35	-	(231.3)	(492.0)	102.8	(1.40)	102.8	7.95	1,153.1
2044	7.50%	2045/2046	4.59%	4.59	4,894.6	224.5	10,055.1	675.2	899.7	6.02	-	(243.8)	(735.8)	103.2	(1.54)	103.2	7.65	1,143.5
2045	7.50%	2046/2047	4.50%	4.50	4,887.0	220.0	10,518.7	697.4	917.4	5.95	-	(129.4)	(865.2)	103.5	(1.66)	103.5	6.79	1,046.8
2046	7.50%	2047/2048	4.42%	4.42	4,889.3	216.2	10,986.2	719.8	936.0	5.90	-	(120.2)	(985.4)	103.6	(1.72)	103.6	6.65	1,056.2
2047	7.50%	2048/2049	4.35%	4.35	4,903.5	213.4	11,456.2	742.5	955.9	5.84	-	(113.5)	(1,098.9)	103.9	(1.83)	103.9	6.54	1,069.4
2048	7.50%	2049/2050	4.29%	4.29	4,931.8	211.6	11,926.9	765.6	977.2	5.80	-	(80.6)	(1,179.5)	104.3	(1.96)	104.3	6.27	1,057.8
2049	7.50%	2050/2051	4.24%	4.24	4,973.8	210.7	12,399.1	789.2	999.9	5.76	-	(53.9)	(1,233.4)	104.4	(1.98)	104.4	6.07	1,053.8
2050	7.50%	2051/2052	4.19%	4.19	5,028.5	210.7	12,874.3	813.4	1,024.1	5.72	-	(58.0)	(1,291.3)	104.8	(2.10)	104.8	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. Bipartisan Three-Way Hybrid/DC Proposal Assuming New A-5 Member Joins Default 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
A-5 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
A-5 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. Bipartisan Three-Way Hybrid/DC Proposal
Assuming New A-5 Member Joins Default 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 or Rule of 97 with 35 years of service;
- Hybrid DB Plan Early Retirement
  - Class A-5 ER Variation 1: Annuities commencing prior to age 67 will be:
    - actuarially reduced if age is at least 62 and service is 10 to 25 years OR
    - reduced 3% per year if age is at least 57 and service is 25 years or more
  - Class A-5 ER Variation 2: Annuities commencing after 10 years of service will be:
    - actuarially reduced if age 57 & service of 25 years has not been attained OR
    - reduced 3% per year if age is at least 57 and service is 25 years or more
- Contribution assumptions included:
  - Hybrid DB Plan: 5.00% employee contributions
  - Hybrid Defined Contribution (DC) Plan: 3.25% employee contributions and 2.25% 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; however, effective January 1, 2019 for newly hired exempt employees, pay for voluntary overtime included in retirement covered compensation may not exceed 10% of base pay each pay period.
- 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. Bipartisan Three-Way Hybrid/DC Proposal Assuming New A-6 Member Elects Alternative 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
A-6 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
A-6 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. Bipartisan Three-Way Hybrid/DC Proposal
Assuming New A-6 Member Elects Alternative 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 or Rule of 97 with 35 years of service; DB annuities commencing prior to age 67 will be:
  - actuarially reduced if age is at least 62 and service is 10 to 25 years OR
  - reduced 3% per year if age is at least 62 and 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; however, effective January 1, 2019 for newly hired exempt employees, pay for voluntary overtime included in retirement covered compensation may not exceed 10% of base pay each pay period.
- 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. Bipartisan Three-Way Hybrid/DC Proposal Assuming New Member Elects 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**
Current Plan Payable at Age 65	$9,455	$19,060	$28,884
Three-Way Hybrid/DC Proposal: DC-Only Plan Annuity Payable at Age 67 Superannuation:			
• **Unreduced DB Annuity**	N/A	N/A	N/A
• **DC Annuity**	$4,322	$9,149	$15,315
• **Total Payable at Age 67**	$4,322	$9,149	$15,315
Payable at Age 65 Early Retirement:			
• **Reduced DB Benefit**	N/A	N/A	N/A
• **DC Annuity**	$4,100	$8,679	$14,527
• **Total Payable at Age 65**	$4,100	$8,679	$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**
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: DC-Only Plan Annuity Payable at Age 70:			
• **DB Annuity**	N/A	N/A	N/A
• **DC Annuity**	$14,165	$29,982	$50,188
• **Total Payable at Age 70**	$14,165	$29,982	$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**
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. Bipartisan Three-Way Hybrid/DC Proposal
Assuming New Member Elects 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; however, effective January 1, 2019 for newly hired exempt employees, pay for voluntary overtime included in retirement covered compensation may not exceed 10% of base pay each pay period.

- 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.

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May 31, 2017

Mr. Jay Pagni
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State Employees' Retirement System
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Addendum to May 22, 2017 Actuarial Cost Note – Bipartisan Three-Way Hybrid/DC Proposal

Dear Jay:

The purpose of this letter is (i) to document the proposed draft Amendment A01354 to the Bipartisan Three-Way Hybrid/DC Proposal that we have received, (ii) to communicate the results of our actuarial analysis to determine the actuarial interest rate assumption to be used by SERS in order to achieve pre-age 62 early retirement reduction factors that are cost neutral and (iii) to comment on the impact that this amendment would have on the "ER Variation 1" projected future SERS costs, as presented in our May 22, 2017 actuarial cost note.

Amendment A01354 to Allow Class A-5 and A-6 Members to Retire After 10 Years of Service

Under this amendment to the Bipartisan Three-Way Hybrid/DC Proposal, both Class A-5 and Class A-6 members who retire after 10 years of service (or 10 eligibility points), regardless of age, would be eligible to commence an early retirement annuity subject to reduction as follows:

- If commencing on or after age 62, subject to the same actuarial equivalent reduction factors as currently applicable to SERS early retirees or
- If commencing prior to age 62, subject to somewhat lower reduction factors based upon the current SERS actuarial equivalence basis for determining the reduction between ages 67 and 62 and a less favorable cost neutral basis for determining the reduction prior to age 62.

Cost Neutral Basis for Pre-Age 62 Portion of Early Retirement Reductions

Based upon our actuarial analysis to determine an underlying interest rate assumption that, in combination with the current SERS actuarial equivalence mortality assumption, would result in cost neutral pre-age 62 early retirement reduction factors, Korn Ferry Hay Group has determined that a 7.375% interest rate (0.125% lower than the 7.50% interest assumption used in the cost estimates included in our May 22, 2017 actuarial cost note) would accomplish the desired outcome. That is, pre-age 62 cost neutrality is achieved by using pre-age 62 early retirement reduction factors that are based upon 7.375% interest and SERS' current mortality assumptions

for actuarial equivalence for purposes of determining the pre-age 62 portion of the overall early retirement reduction for those electing to commence early retirement annuities prior to age 62.

Cost Impact of Above-Described Amendment

First, it is Korn Ferry Hay Group's expectation that this amendment (as described above) to the early retirement provisions of the Bipartisan Three-Way Hybrid/DC Proposal would not result in any significant change in the election behavior of non-exempt employees first hired on or after January 1, 2019 (as they choose from among the three pension design options available under this proposal), which we predicted and used for purposes of costing ER Variation 1 in our May 22, 2017 actuarial cost note. Therefore, we assume that the same set of election percentages, 50%/25%/25% for A-5, A-6 and DC Only, respectively, will apply under the amended proposal.

Second, consistent with the cost neutrality objective underlying the new pre-age 62 early retirement reduction basis, we expect there to be negligible cost impact resulting from this amendment, relative to the ER Variation 1 costs/(savings) communicated in our May 22, 2017 actuarial cost note. Therefore, any changes resulting from this amendment to the costs/(savings) under ER Variation 1 presented on pages 11 and 12 of our May 22, 2017 actuarial cost note, we expect, would be de minimis.

Actuarial Certification

To the best of our knowledge, this letter is complete and accurate and all related cost and liability determinations have been made in accordance with the applicable actuarial standards of practice 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 these results are members of the Society of Actuaries or other professional actuarial organizations, and meet the 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: _____ By: _____

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