Segal Consulting

Public Employees' Retirement Association of Colorado

Actuarial Valuation and Review as of December 31, 2018

State Division Trust Fund
School Division Trust Fund
Local Government Division Trust Fund
Judicial Division Trust Fund
Denver Public Schools Division Trust Fund

This report has been prepared at the request of the Board of Trustees to assist in administering the Funds. The measurements shown in this actuarial valuation may not be applicable for other purposes.

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June 18, 2019

The Board of Trustees
Public Employees' Retirement Association of Colorado
1301 Pennsylvania Street
Denver, CO 80203-2386

Dear Trustees:

We certify that the information contained in this report is accurate and fairly presents the actuarial position of the Division Trust Funds of the Public Employees' Retirement Association of Colorado (PERA) as of December 31, 2018.

All calculations have been made in conformity with generally accepted actuarial principles and practices, and with the Actuarial Standards of Practice issued by the Actuarial Standards Board. In our opinion the results presented also comply with Colorado Statutes, and, where applicable, the Internal Revenue Code, and ERISA. The undersigned are independent actuaries. All are Fellows of the Society of Actuaries, Enrolled Actuaries, and Members of the American Academy of Actuaries, and are experienced in performing valuations for large public retirement systems. All meet the Qualification Standards of the American Academy of Actuaries.

PENSION FUNDING ACTUARIAL VALUATION – DIVISION TRUST FUNDS

The primary purposes of the valuation report are to determine the adequacy of the current employer contribution rates, to describe the current financial condition of PERA, and to analyze changes in PERA's financial condition. Information required by PERA in connection with the Governmental Accounting Standards Board Statements No. 67 and 68 (GASB 67 and GASB 68) are included in a separate report. Valuations are prepared annually, as of December 31 of each year, the last day of PERA's plan and fiscal year.

PENSION FINANCING OBJECTIVES

PERA maintains five pre-funded, hybrid defined benefit pension plans [i.e., State Division Trust Fund, School Division Trust Fund, Local Government Division Trust Fund, Judicial Division Trust Fund, and Denver Public Schools (DPS) Division Trust Fund]. Each defined benefit pension plan is funded through PERA-affiliated employer contributions, member contributions, a $225 million direct distribution from the State of Colorado, and the investment earnings resulting from those contributions. The fixed contribution rate at which each division's employers and members contribute is determined by the Colorado General Assembly and defined within the statutes governing PERA.

PERA's defined benefit pension plan funding policy (pension finding policy), as developed and maintained by the PERA Board of Trustees (Board), is used to gauge the adequacy of the statutory contributions. The purposes of this pension funding policy are to state the overall funding goals and annual actuarial metrics and to guide the Board when considering whether to pursue or support proposed contribution and benefit legislation related to the Division Trust Funds. The policy also includes a brief list of governance responsibilities regarding the commissioning, collection, and review of actuarial information, as described in the Board's Governance Manual.

PERA also maintains two pre-funded defined benefit retiree health care subsidy plans (i.e., Health Care Trust Fund and DPS Health Care Trust Fund), classified as other postemployment benefit (OPEB) plans. On January 19, 2018, the Board approved a separate defined benefit OPEB plan funding policy (OPEB funding policy) with regard to these plans recognizing the adoption and implementation of the Governmental Accounting Standards Board (GASB) Statement No. 74, applicable to OPEB. The results of the OPEB funding actuarial valuation are inclued in a separate report.

PERA's pension funding policy is provided in *Section 4, Exhibit III*.

PROGRESS TOWARD REALIZATION OF PENSION FINANCING OBJECTIVES

The results indicate that for all Division Trust Funds, other than the Denver Public Schools Division, the combined employer and member contribution rates, including the direct distribution from the State, are sufficient to fund the normal cost for all members, and each division's unfunded accrued liability, with consideration of the amounts allocated to finance the Annual Increase Reserve (AIR) Funds, and provide additional contributions to help finance both Health Care Trust Funds. The resulting amortization periods for each division as of December 31, 2018, recognizing future increases to member contributions and the Amortization Equalization Disbursement (AED) and the Supplemental Amortization Equalization Disbursement (SAED), are shown in the following table:

Trust Fund	Amortization Period
State Division	35 years
School Division	37 years
Local Government Division	37 years
Judicial Division	23 years
Denver Public Schools (DPS) Division	Infinite

Members who begin membership after December 31, 2019, will be covered by a different benefit structure with a lower normal cost rate, so, as members who began membership prior to January 1, 2020, leave covered employment and are replaced by members in the lower cost benefit structure, the total normal cost rate is expected to decline. As a result, the portion of the total statutory contribution rate available to pay off the UAAL is expected to increase each year in the future until all active members in the valuation are covered by the provisions in the most recent benefit tier. While this is expected to improve the Plan's financial health in future years, it is impossible to anticipate the long-term funding progress without performing an open group projection of future valuation results. Such projections are performed to assist the Board in evaluating the long-term funding of each division, but the projections are completed after the actuarial valuation results are known.

The December 31, 2018 valuation results for the DPS Division are based upon the current, statutory levels of funding. Colorado statutes call for a "true-up" in 2020, and every five years following, with the expressed purpose of adjusting the total DPS contribution rate to ensure equalization of the ratio of unfunded actuarial accrued liability over payroll between the DPS and School Divisions at the end of the 30-year period beginning January 1, 2010. As such, future levels of funding for the DPS Division may differ from those assumed.

REPORTING CONSEQUENCES

PERA is required to disclose certain actuarial information in its Comprehensive Annual Financial Report (CAFR), including the Net Pension Liability (NPL), the sensitivity of the NPL to changes in the discount rate, a schedule of changes in NPL, and a comparison of actual contributions to the ADC. PERA’s affiliated employers are required to comply with GASB 68, which also requires disclosure of certain actuarial information in their financial statements. This information will be provided in a separate report.

BENEFIT PROVISIONS

Plan benefits are specified in Title 24, Article 51 of the Colorado Revised Statutes (C.R.S.), administrative rules set forth at 8 C.C.R. 1502-1, and applicable provisions of the federal Internal Revenue Code. Colorado State law provisions may be amended from time to time by the Colorado General Assembly. A summary of the plan provisions is provided in *Section 4, Exhibit II*.

ASSUMPTIONS AND METHODS

The information and analysis used in selecting each assumption that has a significant effect on this actuarial valuation resulted from the 2016 Actuarial Experience Study covering plan experience over the four-year period January 1, 2012 through December 31, 2015 and Board discussion at the November 18, 2016 Board meeting. In addition, effective November 16, 2018, the pension funding policy was revised to better align the 30-year period to achieve 100% funding as targeted through the enactment of SB 18-200. Therefore, the Unfunded Actuarial Accrued Liability (UAAL) as of December 31, 2017 is the initial legacy liability and is amortized over 30 years from December 31, 2017 (i.e., 29 years remaining as of December 31, 2018). Pursuant to the Board’s funding policy, any growth (or reduction) in unfunded liabilities resulting from the initial legacy UAAL, is amortized over the same closed period. Thus, the 2018 contribution deficiency is amortized over a 29 year period, but the 2018 actuarial experience gain or loss, recognized as a new layer of UAAL, is amortized over 30 years. Based on professional judgment, no assumption changes are warranted at this time. A summary of the assumptions and methods applied in this valuation is provided in *Section 4, Exhibit I*.

DATA

Member data for retired, active, and inactive participants was supplied as of December 31, 2018, by PERA. We have not subjected this data to any auditing procedures, but have examined the data for reasonableness and consistency with the prior year's data. Asset information was also supplied by PERA. That assistance is gratefully acknowledged.

Sincerely,

Segal Consulting, a Member of The Segal Group, Inc.

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Section 1: Actuarial Valuation Summary

Purpose and Basis

This report was prepared by Segal Consulting to present a funding valuation of the Division Trust Funds of the Public Employees' Retirement Association of Colorado (PERA) as of December 31, 2018. The funding valuation was performed to determine whether the assets and contribution rates are sufficient to provide the prescribed benefits. The measurements shown in this actuarial valuation may not be applicable for other purposes. In particular, the measures herein are not necessarily appropriate for assessing the sufficiency of PERA's Division Trust Fund assets to cover the estimated cost of settling the coordinated benefit obligations of those trusts. Future actuarial measurements may differ significantly from the current measurements presented in this report due to such factors as the following: plan experience differing from that anticipated by the economic or demographic assumptions; changes in economic or demographic assumptions; increases or decreases expected as part of the natural operation of the methodology used for these measurements; and changes in plan provisions or applicable law.

Certain disclosure information required by GASB 67 and GASB 68 as of December 31, 2018 for PERA is provided in a separate report.

The contribution requirements presented in this report are based on:

- The benefit provisions set forth in the Colorado Revised Statutes, as administered by the PERA Board of Trustees;
- The characteristics of covered active members, inactive members, and retirees and survivors as of December 31, 2018, provided by PERA;
- The assets of PERA's Division Trust Funds as of December 31, 2018, provided by PERA;
- Economic assumptions regarding future salary increases and investment earnings;
- Other actuarial assumptions, regarding member terminations, retirement, death, etc.; and
- The pension funding policy adopted by the PERA Board of Trustees, most recently updated effective November 16, 2018.

In addition, contribution requirements resulting from the December 31, 2018, funding actuarial valuation and applicable to the plan year ending December 31, 2020, will be used in the contribution adequacy test under the Automatic Adjustment Provisions enacted under Senate Bill 2018-200 (SB 18-200). See item I in Section 2 of this report for additional detail.

Valuation Highlights – State Division Trust Fund

1. Segal strongly recommends an actuarial funding method that targets 100% funding of the actuarial accrued liability. Generally, this implies payments that are ultimately at least enough to cover normal cost, interest on the unfunded actuarial accrued liability and a portion of the principal balance. The pension funding policy adopted by PERA for evaluating the State Division Trust Fund meets this standard.
2. The employers' contributions to the State Division on account of benefits consist of four amounts set by statute. The basic amount is 9.13% of salary for non-state troopers and 11.83% of salary for state troopers (after reduction for the Health Care Trust Fund Contribution of 1.02% of salary). These rates will be increasing by 0.25% effective July 1, 2019 as a result of the passage of SB 18-200. For members of the PERA Benefit Structure hired on or after January 1, 2007, an allocation of the statutory rates of 1.00% of salary is made each year to pre-fund the Annual Increase Reserve (AIR), which provides post-retirement increases for these members in retirement. In addition, an annual direct distribution from the State treasury will be made to the State Division until the Fund is 100% funded. The allocation for each year is estimated at $76.9 million. This additional amount is considered in the number of years to amortize the Unfunded Actuarial Accrued Liability (UAAL). Lastly, employers make an Amortization Equalization Disbursement (AED) contribution of 5.00% and Supplemental Amortization Equalization Disbursement (SAED) contribution of 5.00%.
3. The employer statutory contribution rate for the plan year beginning January 1, 2020 is equal to 18.89% of salary for employers. Based upon the results of the December 31, 2018 actuarial valuation, after recognizing the net employer normal cost rate of 2.93% of salary, the remaining basic contribution is 15.96% of salary. Contributions at this level will amortize the unfunded actuarial accrued liability of $11.2 billion over 35 years, assuming the aggregate payroll of the State Division increases by 3.50% per year.
4. The Automatic Adjustment Provision (AAP) assessment of SB 18-200, performed as of December 31, 2018, indicates the need to increase employer and member contributions each by 0.50% of salary and reduce the maximum Annual Increase (AI) rate, referred to as the “AI cap” by 0.25%, beginning July 1, 2020.
5. Effective with the 2018 valuation, the amortization period was reset to 30 years. Therefore the UAAL as of December 31, 2017 is the initial legacy liability and is amortized over 30 years from December 31, 2017 (i.e., 29 years remaining as of December 31, 2018). Pursuant to the Board’s funding policy, any growth (or reduction) in unfunded liabilities resulting from the initial legacy UAAL, is amortized over the same closed period. Thus, the 2018 contribution deficiency also is amortized over a 29 year period, but the 2018 actuarial experience gain or loss, recognized as a new layer of UAAL, is amortized over 30 years.
6. Actual employer contributions and State direct distribution made during the plan year ending December 31, 2018 were $645.7 million, which is 85% of the actuarially determined contribution. In the prior plan year, actual contributions were $549.6 million, which is 87% of the prior year actuarially determined contribution.
7. The funded ratio based on the actuarial value of assets over the actuarial accrued liability as of December 31, 2018 is 56.1%, compared to 57.5% as of December 31, 2017. This ratio is a measure of funding status and its history is a measure of funded progress. Based on the market value of assets, the funded ratio as of December 31, 2018 is 54.2%, compared to 61.0% as of December 31, 2017. These

measurements are not necessarily appropriate for assessing the sufficiency of the Plan's assets to cover the estimated cost of settling the Plan's benefit obligation or the need for or the amount of future contributions.

8. For the year ended December 31, 2018, PERA's total fund annualized rate of return on a market value basis was reported to be (3.5%). For the same period, Segal has determined specifically for the State Division Trust Fund, the asset return on a market value basis was (3.34%). After gradual recognition of investment gains and losses under the actuarial smoothing method, the actuarial rate of return was 5.93%. This represents an experience loss when compared to the assumed rate of 7.25%. As of December 31, 2018, the actuarial value of assets of $14.3 billion represented 103.4% of the market value of $13.8 billion.
9. The portion of deferred investment gains and losses recognized during the calculation of the December 31, 2018 actuarial value of assets contributed a loss of $182.5 million. The demographic and liability experience, including administrative expenses, resulted in a net loss of $361.0 million.

Valuation Highlights – School Division Trust Fund

1. Segal strongly recommends an actuarial funding method that targets 100% funding of the actuarial accrued liability. Generally, this implies payments that are ultimately at least enough to cover normal cost, interest on the unfunded actuarial accrued liability and a portion of the principal balance. The pension funding policy adopted by PERA for evaluating the School Division Trust Fund meets this standard.
2. The employers' contributions to the School Division on account of benefits consist of four amounts set by statute. The basic amount is 9.13% (after reduction for the Health Care Trust Fund Contribution of 1.02% of salary). This rate will be increasing by 0.25% effective July 1, 2019 as a result of the passage of SB 18-200. For members of the PERA Benefit Structure hired on or after January 1, 2007, an allocation of the statutory rates of 1.00% of salary is made each year to pre-fund the AIR, which provides post-retirement increases for these members in retirement. In addition, an annual direct distribution from the State treasury will be made to the School Division until the Fund is 100% funded. The allocation for each year is estimated at $127.5 million. This additional amount is considered in the number of years to amortize the Unfunded Actuarial Accrued Liability. Lastly, employers make an AED contribution of 4.50% and a SAED contribution of 5.50%.
3. The employer statutory contribution rate for the plan year beginning January 1, 2020 is equal to 18.88% of salary for employers. Based upon the results of the December 31, 2018 actuarial valuation, after recognizing the net employer normal cost rate of 3.82% of salary, the remaining basic contribution is 15.06% of salary. Contributions at this level will amortize the unfunded actuarial accrued liability of $17.5 billion over 37 years, assuming the aggregate payroll of the School Division increases by 3.50% per year.
4. The AAP assessment of SB 18-200, performed as of December 31, 2018, indicates the need to increase employer and member contributions each by 0.50% of salary and reduce the maximum AI rate, referred to as the “AI cap” by 0.25%, beginning July 1, 2020.
5. Effective with the 2018 valuation, the amortization period was reset to 30 years. Therefore the UAAL as of December 31, 2017 is the initial legacy liability and is amortized over 30 years from December 31, 2017 (i.e., 29 years remaining as of December 31, 2018). Pursuant to the Board’s funding policy, any growth (or reduction) in unfunded liabilities resulting from the initial legacy UAAL, is amortized over the same closed period. Thus, the 2018 contribution deficiency also is amortized over a 29 year period, but the 2018 actuarial experience gain or loss, recognized as a new layer of UAAL, is amortized over 30 years.
6. Actual employer contributions and State direct distribution made during the plan year ending December 31, 2018 were $1.0 billion, which is 80% of the actuarially determined contribution. In the prior plan year, actual contributions were $837.8 million, which is 83% of the prior year actuarially determined contribution.
7. The funded ratio based on the actuarial value of assets over the actuarial accrued liability as of December 31, 2018 is 57.9%, compared to 59.4% as of December 31, 2017. This ratio is a measure of funding status and its history is a measure of funded progress. Based on the market value of assets, the funded ratio as of December 31, 2018 is 56.0%, compared to 62.9% as of December 31, 2017. These measurements are not necessarily appropriate for assessing the sufficiency of the Plan’s assets to cover the estimated cost of settling the Plan’s benefit obligation or the need for or the amount of future contributions.

8. For the year ended December 31, 2018, PERA's total fund annualized rate of return on a market value basis was reported to be (3.5%). For the same period, Segal has determined specifically for the School Division Trust Fund, the asset return on a market value basis was (3.37%). After gradual recognition of investment gains and losses under the actuarial smoothing method, the actuarial rate of return was 5.95%. This represents an experience loss when compared to the assumed rate of 7.25%. As of December 31, 2018, the actuarial value of assets of $24.1 billion represented 103.4% of the market value of $23.3 billion.
9. The portion of deferred investment gains and losses recognized during the calculation of the December 31, 2018 actuarial value of assets contributed a loss of $302.1 million. The demographic and liability experience, including administrative expenses, resulted in a net loss of $675.5 million.

Valuation Highlights – Local Government Division Trust Fund

1. Segal strongly recommends an actuarial funding method that targets 100% funding of the actuarial accrued liability. Generally, this implies payments that are ultimately at least enough to cover normal cost, interest on the unfunded actuarial accrued liability and a portion of the principal balance. The pension funding policy adopted by PERA for evaluating the Local Government Division Trust Fund meets this standard.
2. The employers' contributions to the Local Government Division on account of benefits consist of three amounts set by statute. The basic amount is 8.98% of salary and, effective for certain public safety personnel hired on or after January 1, 2020, the basic amount is 11.83% of salary (after reduction for the Health Care Trust Fund Contribution of 1.02% of salary). For members of the PERA Benefit Structure hired on or after January 1, 2007, an allocation of the statutory rates of 1.00% of salary is made each year to pre-fund the AIR, which provides post-retirement increases for these members in retirement. In addition, employers make an AED contribution of 2.20% and a SAED contribution of 1.50%.
3. The employer statutory contribution rate for the plan year beginning January 1, 2020 is equal to 12.08% of salary for employers. Based upon the results of the December 31, 2018 actuarial valuation, after recognizing the net employer normal cost rate of 3.53% of salary, the remaining basic contribution is 8.55% of salary. Contributions at this level will amortize the unfunded actuarial accrued liability of $1.2 billion over 37 years, assuming the aggregate payroll of the Local Government Division increases by 3.50% per year.
4. The AAP assessment of SB 18-200, performed as of December 31, 2018, indicates the need to increase employer and member contributions each by 0.50% of salary and reduce the maximum AI rate, referred to as the “AI cap” by 0.25%, beginning July 1, 2020.
5. Effective with the 2018 valuation, the amortization period was reset to 30 years. Therefore the UAAL as of December 31, 2017 is the initial legacy liability and is amortized over 30 years from December 31, 2017 (i.e., 29 years remaining as of December 31, 2018). Pursuant to the Board’s funding policy, any growth (or reduction) in unfunded liabilities resulting from the initial legacy UAAL, is amortized over the same closed period. Thus, the 2018 contribution deficiency also is amortized over a 29 year period, but the 2018 actuarial experience gain or loss, recognized as a new layer of UAAL, is amortized over 30 years.
6. Actual employer contributions made during the plan year ending December 31, 2018 were $77.6 million, which is 82% of the actuarially determined contribution. In the prior plan year, actual contributions were $76.0 million, which is 101% of the prior year actuarially determined contribution.
7. The funded ratio based on the actuarial value of assets over the actuarial accrued liability as of December 31, 2018 is 77.7%, compared to 79.5% as of December 31, 2017. This ratio is a measure of funding status and its history is a measure of funded progress. Based on the market value of assets, the funded ratio as of December 31, 2018 is 75.1%, compared to 84.2% as of December 31, 2017. These measurements are not necessarily appropriate for assessing the sufficiency of the Plan’s assets to cover the estimated cost of settling the Plan’s benefit obligation or the need for or the amount of future contributions.

8. For the year ended December 31, 2018, PERA's total fund annualized rate of return on a market value basis was reported to be (3.5%). For the same period, Segal has determined specifically for the Local Government Division Trust Fund, the asset return on a market value basis was (3.38%). After gradual recognition of investment gains and losses under the actuarial smoothing method, the actuarial rate of return was 5.97%. This represents an experience loss when compared to the assumed rate of 7.25%. As of December 31, 2018, the actuarial value of assets of $4.1 billion represented 103.4% of the market value of $3.9 billion.
9. The portion of deferred investment gains and losses recognized during the calculation of the December 31, 2018 actuarial value of assets contributed a loss of $50.1 million. The demographic and liability experience, including administrative expenses, resulted in a net loss of $85.2 million.

Valuation Highlights – Judicial Division Trust Fund

1. Segal strongly recommends an actuarial funding method that targets 100% funding of the actuarial accrued liability. Generally, this implies payments that are ultimately at least enough to cover normal cost, interest on the unfunded actuarial accrued liability and a portion of the principal balance. The pension funding policy adopted by PERA for evaluating the Judicial Division Trust Fund meets this standard.
2. The employers' contributions to the Judicial Division on account of benefits consist of four amounts set by statute. The basic amount is 12.64% of salary (after reduction for the Health Care Trust Fund Contribution of 1.02% of salary). These rates will be increasing by 0.25% effective July 1, 2019 as a result of the passage of SB 18-200. For members of the PERA Benefit Structure hired on or after January 1, 2007, an allocation of the statutory rates of 1.00% of salary is made each year to pre-fund the AIR, which provides post-retirement increases for these members in retirement. In addition, an annual direct distribution from the State treasury will be made to the Judicial Division until the Fund is 100% funded. The allocation for each year is estimated at $1.3 million. This additional amount is considered in the number of years to amortize the Unfunded Actuarial Accrued Liability. Lastly, employers make AED and SAED contributions at the following rates:

Year	AED	SAED
2018	2.20%	1.50%
2019	3.40%	3.40%
2020	3.80%	3.80%
2021	4.20%	4.20%
2022	4.60%	4.60%
2023 and later	5.00%	5.00%

3. The employer statutory contribution rate for the plan year beginning January 1, 2020 is equal to 20.08% of salary for employers. Based upon the results of the December 31, 2018 actuarial valuation, after recognizing the net employer normal cost rate of 7.96% of salary, the remaining basic contribution amounts to 12.12% of salary. Contributions at this level will amortize the unfunded actuarial accrued liability of $131.8 million over 23 years, assuming the aggregate payroll of the Judicial Division increases by 3.50% per year.
4. The AAP assessment of SB 18-200, performed as of December 31, 2018, indicates the need to increase employer and member contributions each by 0.50% of salary and reduce the maximum AI rate, referred to as the “AI cap” by 0.25%, beginning July 1, 2020.

5. Effective with the 2018 valuation, the amortization period was reset to 30 years. Therefore the UAAL as of December 31, 2017 is the initial legacy liability and is amortized over 30 years from December 31, 2017 (i.e., 29 years remaining as of December 31, 2018). Pursuant to the Board's funding policy, any growth (or reduction) in unfunded liabilities resulting from the initial legacy UAAL, is amortized over the same closed period. Thus, the 2018 contribution deficiency also is amortized over a 29 year period, but the 2018 actuarial experience gain or loss, recognized as a new layer of UAAL, is amortized over 30 years.
6. Actual employer contributions and State direct distribution made during the plan year ending December 31, 2018 were $9.5 million, which is 69% of the actuarially determined contribution. In the prior plan year, actual contributions were $7.9 million, which is 72% of the prior year actuarially determined contribution.
7. The funded ratio based on the actuarial value of assets over the actuarial accrued liability as of December 31, 2018 is 70.6%, compared to 72.4% as of December 31, 2017. This ratio is a measure of funding status and its history is a measure of funded progress. Based on the market value of assets, the funded ratio as of December 31, 2018 is 68.2%, compared to 76.7% as of December 31, 2017. These measurements are not necessarily appropriate for assessing the sufficiency of the Plan's assets to cover the estimated cost of settling the Plan's benefit obligation or the need for or the amount of future contributions.
8. For the year ended December 31, 2018, PERA's total fund annualized rate of return on a market value basis was reported to be (3.5%). For the same period, Segal has determined specifically for the Judicial Division Trust Fund, the asset return on a market value basis was (3.39%). After gradual recognition of investment gains and losses under the actuarial smoothing method, the actuarial rate of return was 5.96%. This represents an experience loss when compared to the assumed rate of 7.25%. As of December 31, 2018, the actuarial value of assets of $316.0 million represented 103.5% of the market value of $305.3 million.
9. The portion of deferred investment gains and losses recognized during the calculation of the December 31, 2018 actuarial value of assets contributed a loss of $3.9 million. The demographic and liability, including administrative expenses, experience resulted in a net loss of $7.2 million.

Valuation Highlights – Denver Public Schools Division Trust Fund

1. Segal strongly recommends an actuarial funding method that targets 100% funding of the actuarial accrued liability. Generally, this implies payments that are ultimately at least enough to cover normal cost, interest on the unfunded actuarial accrued liability and a portion of the principal balance. The pension funding policy adopted by PERA for evaluating the Denver Public Schools Division Trust Fund meets this standard.
2. The employers' contributions to the Denver Public Schools Division (DPS) on account of benefits consist of four amounts set by statute. The basic amount is 9.13% of salary (after reduction for the Health Care Trust Fund Contribution of 1.02% of salary). These rates will be increasing by 0.25% effective July 1, 2019 as a result of the passage of SB 18-200. For members of the PERA Benefit Structure hired on or after January 1, 2010, an allocation of the statutory rates of 1.00% of salary is made each year to pre-fund the AIR, which provides post-retirement increases for these members in retirement. In addition, an annual direct distribution from the State treasury will be made to the DPS Division until the Fund is 100% funded. The allocation for each year is estimated at $19.3 million. This additional amount is considered in the number of years to amortize the Unfunded Actuarial Accrued Liability. Lastly, employers make an AED contribution of 4.50% and a SAED contribution of 5.50%.
3. The employer statutory contribution rate for the plan year beginning January 1, 2020 is equal to a net of 5.89% of salary for employers as shown below.

	Contribution
Employer Statutory (weighted and equal to the statutory base rate less the adjustment for the 0.66% AIR contributions for post-2006 members)	9.74%
AED and SAED	10.00%
DPS HCTF	(1.02%)
PCOP Credit	(12.83%)
Net	5.89%

4. Based upon the results of the December 31, 2018 actuarial valuation, after recognizing the net employer normal cost rate of 3.14% of salary, the remaining basic contribution amounts to 2.75% of salary. Contributions at this level will not amortize the unfunded actuarial accrued liability of $987.3 million, assuming the aggregate payroll of the DPS Division increases by 3.50% per year.
5. The infinite amortization period of the DPS Division reflects the expected level of the DPS Division's 2020 employer contribution offsets resulting from the cost of certain Pension Certificates of Participation (PCOP). As the PCOP offsets are expected to reduce over time, the

realized amortization period is expected to be lower if the DPS Division's statutory employer contribution amounts are maintained at their current level. Additionally, Colorado statutes call for a "true-up" in 2020, and every five years following, with the expressed purpose of adjusting the total DPS Division contribution rate to ensure equalization of the ratio of unfunded actuarial accrued liability over payroll between the DPS Division and the School Division as of December 31, 2039. The initial and most recent true-up resulted in an employer contribution rate for the DPS Division of 10.15%, an amount in excess of that indicated by the statutory equalization ratio.

6. The AAP assessment of SB 18-200, performed as of December 31, 2018, indicates the need to increase employer and member contributions each by 0.50% of salary and reduce the maximum AI rate, referred to as the "AI cap" by 0.25%, beginning July 1, 2020.
7. Effective with the 2018 valuation, the amortization period was reset to 30 years. Therefore the UAAL as of December 31, 2017 is the initial legacy liability and is amortized over 30 years from December 31, 2017 (i.e., 29 years remaining as of December 31, 2018). Pursuant to the Board's funding policy, any growth (or reduction) in unfunded liabilities resulting from the initial legacy UAAL, is amortized over the same closed period. Thus, the 2018 contribution deficiency also is amortized over a 29 year period, but the 2018 actuarial experience gain or loss, recognized as a new layer of UAAL, is amortized over 30 years.
8. Actual employer contributions and State direct distribution made during the plan year ending December 31, 2018 were $50.0 million, which is 51% of the actuarially determined contribution. In the prior plan year, actual contributions were $23.5 million, which is 35% of the prior year actuarially determined contribution.
9. The funded ratio based on the actuarial value of assets over the actuarial accrued liability as of December 31, 2018 is 76.8%, compared to 79.7% as of December 31, 2017. This ratio is a measure of funding status and its history is a measure of funded progress. Based on the market value of assets, the funded ratio as of December 31, 2018 is 74.3%, compared to 84.5% as of December 31, 2017. These measurements are not necessarily appropriate for assessing the sufficiency of the Plan's assets to cover the estimated cost of settling the Plan's benefit obligation or the need for or the amount of future contributions.
10. For the year ended December 31, 2018, PERA's total fund annualized rate of return on a market value basis was reported to be (3.5%). For the same period, Segal has determined specifically for the DPS Division Trust Fund, the asset return on a market value basis was (3.36%). After gradual recognition of investment gains and losses under the actuarial smoothing method, the actuarial rate of return was 5.93%. This represents an experience loss when compared to the assumed rate of 7.25%. As of December 31, 2018, the actuarial value of assets of $3.261 billion represented 103.3% of the market value of $3.156 billion.
11. The portion of deferred investment gains and losses recognized during the calculation of the December 31, 2018 actuarial value of assets contributed a loss of $41.8 million. The demographic and liability experience, including administrative expenses, resulted in a net loss of $79.1 million.

Summary of Key Valuation Results for State Division

		2018	2017
Demographic data for plan year ending December 31:	• Number of retirees and survivors	40,446	39,364
	• Number of terminated vested members	7,074	6,788
	• Number of inactive members	78,576	75,350
	• Number of active members		
	o General	54,623	54,814
	o Troopers	888	872
	o Total	55,511	55,686
	• Total payroll supplied by PERA		
	o General	$2,816,393,917	$2,696,005,967
	o Troopers	82,433,354	78,201,236
	o Total	$2,898,827,271	$2,774,207,203
	• Average payroll supplied by PERA		
	o General	$51,561	$49,185
	o Troopers	92,830	89,680
	o Total	$52,221	$49,819
Actuarial accrued liability as of December 31:	• Retirees and survivors	$17,396,462,266	$16,740,449,864
	• Terminated vested members	548,788,334	467,462,412
	• Inactive members	150,700,746	187,510,661
	• Active members	7,413,900,634	7,386,662,201
	• Total	$25,509,851,980	$24,782,085,138
Assets as of December 31:	• Market value of assets (MVA)	$13,837,862,906	$15,105,378,385
	• Actuarial value of assets (AVA)	14,303,725,826	14,256,409,942
	• Actuarial value of assets as a percentage of market value of assets	103.4%	94.4%
Funded status for plan year ending December 31:	• Unfunded/(overfunded) actuarial accrued liability on market value of assets	$11,671,989,074	$9,676,706,753
	• Funded percentage on MVA basis	54.2%	61.0%
	• Unfunded/(overfunded) actuarial accrued liability on actuarial value of assets	$11,206,126,154	$10,525,675,196
	• Funded percentage on AVA basis	56.1%	57.5%
	• Effective amortization period	35 years	33 years
Gains/(losses):	• Asset experience	($182,483,903)	$50,664,218
	• Liability and other experience	(360,959,608)	(225,581,245)
	• Plan changes	0	1,592,698,649
	• Assumption/method changes	0	0
	• Total gain/(loss)	($543,443,511)	$1,417,781,622

Contributions for plan year ending:		12/31/2020	12/31/2019
	• Total normal cost rate	12.11%	10.72%
	• Less member contribution rate	(9.18%)	(8.43%)
	• Employer normal cost rate	2.93%	2.29%
	• Unfunded actuarial accrued liability rate	20.76%	20.99%
	• Actuarially determined contribution rate	23.69%	23.28%
	• Equivalent single amortization period[1]	27 years	26 years

[1] State Division reflects an adjustment for the impact of AED and SAED contributions received from employers on the estimated pensionable payroll of employees electing to participate in the defined contribution plan.

Summary of Key Valuation Results for School Division

		2018	2017
Demographic data for plan year ending December 31:	• Number of retirees and survivors	66,543	64,327
	• Number of terminated vested members	17,001	16,439
	• Number of inactive members	125,944	120,037
	• Number of active members	126,333	122,990
	• Total payroll supplied by PERA	$4,789,503,451	$4,471,356,847
	• Average payroll supplied by PERA	37,912	36,355
Actuarial accrued liability as of December 31:	• Retirees and survivors	$26,795,274,761	$25,861,986,057
	• Terminated vested members	901,102,818	792,486,283
	• Inactive members	226,036,763	283,066,953
	• Active members	13,675,985,078	13,108,675,209
	• Total	$41,598,399,420	$40,046,214,502
Assets as of December 31:	• Market value of assets (MVA)	$23,304,910,906	$25,204,919,910
	• Actuarial value of assets (AVA)	24,094,441,728	23,780,045,308
	• Actuarial value of assets as a percentage of market value of assets	103.4%	94.3%
Funded status for plan year ending December 31:	• Unfunded/(overfunded) actuarial accrued liability on market value of assets	$18,293,488,514	$14,841,294,592
	• Funded percentage on MVA basis	56.0%	62.9%
	• Unfunded/(overfunded) actuarial accrued liability on actuarial value of assets	$17,503,957,692	$16,266,169,194
	• Funded percentage on AVA basis	57.9%	59.4%
	• Effective amortization period	37 years	38 years
Gains/(losses):	• Asset experience	($302,112,856)	$94,633,723
	• Liability and other experience	(675,460,463)	(314,095,814)
	• Plan changes	0	2,632,264,634
	• Assumption/method changes	0	0
	• Total gain/(loss)	($977,573,319)	$2,412,802,543
Contributions for plan year ending:		**12/31/2020**	**12/31/2019**
	• Total normal cost rate	12.95%	12.00%
	• Less member contribution rate	(9.13%)	(8.38%)
	• Employer normal cost rate	3.82%	3.62%
	• Unfunded actuarial accrued liability rate	19.55%	19.97%
	• Actuarially determined contribution rate	23.37%	23.59%
	• Equivalent single amortization period	28 years	28 years

Summary of Key Valuation Results for Local Government Division

		2018	2017
Demographic data for plan year ending December 31:	• Number of retirees and survivors	7,662	7,369
	• Number of terminated vested members	2,696	2,741
	• Number of inactive members	25,034	23,937
	• Active members	13,260	12,770
	• Total payroll supplied by PERA	$660,998,127	$632,768,337
	• Average payroll supplied by PERA	49,849	49,551
Actuarial accrued liability as of December 31:	• Retirees and survivors	$3,372,679,291	$3,177,551,189
	• Terminated vested members	259,622,706	244,569,616
	• Inactive members	47,612,643	60,405,230
	• Active members	1,560,970,573	1,563,405,980
	• Total	$5,240,885,213	$5,045,932,015
Assets as of December 31:	• Market value of assets (MVA)	$3,935,921,050	$4,249,852,277
	• Actuarial value of assets (AVA)	4,070,679,098	4,009,412,912
	• Actuarial value of assets as a percentage of market value of assets	103.4%	94.3%
Funded status for plan year ending December 31:	• Unfunded/(overfunded) actuarial accrued liability on market value of assets	$1,304,964,163	$796,079,738
	• Funded percentage on MVA basis	75.1%	84.2%
	• Unfunded/(overfunded) actuarial accrued liability on actuarial value of assets	$1,170,206,115	$1,036,519,103
	• Funded percentage on AVA basis	77.7%	79.5%
	• Effective amortization period	37 years	22 years
Gains/(losses):	• Asset experience	($50,114,830)	$17,613,698
	• Liability and other experience	(85,214,150)	(21,387,798)
	• Plan changes	5,566,395	325,881,932
	• Assumption/method changes	0	0
	• Total gain/(loss)	($129,762,585)	$322,107,832
Contributions for plan year ending:		**12/31/2020**	**12/31/2019[1]**
	• Total normal cost rate	11.53%	10.22%
	• Less member contribution rate	(8.00%)	(8.00%)
	• Employer normal cost rate	3.53%	2.22%
	• Unfunded actuarial accrued liability rate	9.48%	8.91%
	• Actuarially determined contribution rate	13.01%	11.13%
	• Equivalent single amortization period	29 years	28 years

[1] Adjusted to recognize the 8.00% member contribution rate pursuant to HB 19-1217

Summary of Key Valuation Results for Judicial Division

		2018	2017
Demographic data for plan year ending December 31:	• Number of retirees and survivors	382	376
	• Number of terminated vested members	12	9
	• Number of inactive members	4	5
	• Number of active members	332	332
	• Total payroll supplied by PERA	$50,505,856	$48,947,607
	• Average payroll supplied by PERA	152,126	147,433
Actuarial accrued liability as of December 31:	• Retirees and survivors	$282,448,796	$274,800,174
	• Terminated vested members	3,521,524	2,586,139
	• Inactive members	74,213	155,319
	• Active members	161,712,400	150,566,567
	• Total	$447,756,933	$428,108,199
Assets as of December 31:	• Market value of assets (MVA)	$305,303,696	$328,458,690
	• Actuarial value of assets (AVA)	315,970,361	310,084,726
	• Actuarial value of assets as a percentage of market value of assets	103.5%	94.4%
Funded status for plan year ending December 31:	• Unfunded/(overfunded) actuarial accrued liability on market value of assets	$142,453,237	$99,649,509
	• Funded percentage on MVA basis	68.2%	76.7%
	• Unfunded/(overfunded) actuarial accrued liability on actuarial value of assets	$131,786,572	$118,023,473
	• Funded percentage on AVA basis	70.6%	72.4%
	• Effective amortization period	23 years	24 years
Gains/(losses):	• Asset experience	($3,933,778)	$1,380,803
	• Liability and other experience	(7,213,963)	15,707
	• Plan changes	0	34,446,758
	• Assumption/method changes	0	0
	• Total gain/(loss)	($11,147,741)	$35,843,268
Contributions for plan year ending:		**12/31/2020**	**12/31/2019**
	• Total normal cost rate	17.08%	17.03%
	• Less member contribution rate	(9.13%)	(8.38%)
	• Employer normal cost rate	7.96%	8.65%
	• Unfunded actuarial accrued liability rate	14.09%	13.25%
	• Actuarially determined contribution rate	22.05%	21.90%
	• Equivalent single amortization period	29 years	28 years

Summary of Key Valuation Results for Denver Public Schools Division

		2018	2017
Demographic data for plan year ending December 31:	• Number of retirees and survivors	7,156	7,044
	• Number of terminated vested members	1,780	1,596
	• Number of inactive members	12,286	10,919
	• Number of active members		
	o DPS benefit structure	2,898	3,246
	o PERA benefit structure	13,250	12,745
	o Total	16,148	15,991
	• Total payroll supplied by PERA		
	o DPS benefit structure	$197,032,537	$202,547,206
	o PERA benefit structure	525,007,536	455,651,100
	o Total	$722,040,073	$658,198,306
	• Average payroll supplied by PERA		
	o DPS benefit structure	$67,989	$62,399
	o PERA benefit structure	39,623	35,751
	o Total	$44,714	$41,161
Actuarial accrued liability as of December 31:	• Retirees and survivors	$2,818,344,279	$2,753,468,131
	• Terminated vested members	86,621,828	75,974,789
	• Inactive members	37,021,422	37,810,624
	• Active members	1,306,614,685	1,221,272,910
	• Total	$4,248,602,214	$4,088,526,454
Assets as of December 31:	• Market value of assets (MVA)	$3,155,738,171	$3,452,666,927
	• Actuarial value of assets (AVA)	3,261,337,748	3,257,769,807
	• Actuarial value of assets as a percentage of market value of assets	103.3%	94.4%
Funded status for plan year ending December 31:	• Unfunded/(overfunded) actuarial accrued liability on market value of assets	$1,092,864,043	$635,859,527
	• Funded percentage on MVA basis	74.3%	84.4%
	• Unfunded/(overfunded) actuarial accrued liability on actuarial value of assets	987,264,466	830,756,647
	• Funded percentage on AVA basis	76.8%	79.7%
	• Effective amortization period	Infinite	Infinite
Gains/(losses):	• Asset experience	($41,787,264)	$11,201,333
	• Liability and other experience	(79,099,562)	11,399,266
	• Plan changes	0	246,987,335
	• Assumption/method changes	0	0
	• Total gain/(loss)	($120,886,826)	$269,587,934

Contributions for plan year ending:		12/31/2020	12/31/2019
	• Total normal cost rate	12.27%	12.69%
	• Less member contribution rate	(9.13%)	(8.38%)
	• Employer normal cost rate	3.14%	4.31%
	• Unfunded actuarial accrued liability rate	7.27%	6.83%
	• Actuarially determined contribution rate	10.42%	11.14%
	• Equivalent single amortization period	29 years	28 years

Important Information About Actuarial Valuations

An actuarial valuation is a budgeting tool with respect to the financing of future projected obligations of a pension plan. It is an estimated forecast – the actual long-term cost of the plan will be determined by the actual benefits and expenses paid and the actual investment experience of the plan.

In order to prepare a valuation, Segal Consulting ("Segal") relies on a number of input items. These include:

Plan of benefits	Plan provisions define the rules that will be used to determine benefit payments, and those rules, or the interpretation of them, may change over time. Even where they appear precise, outside factors may change how they operate. It is important to keep Segal informed with respect to plan provisions and administrative procedures, and to review the plan summary included in our report to confirm that Segal has correctly interpreted the plan of benefits.
Participant data	An actuarial valuation for a plan is based on data provided to the actuary by PERA. Segal does not audit such data for completeness or accuracy, other than reviewing it for obvious inconsistencies compared to prior data and other information that appears unreasonable. It is important for Segal to receive the best possible data and to be informed about any known incomplete or inaccurate data.
Assets	The valuation is based on the market value of assets as of the valuation date, as provided by PERA. PERA uses an "actuarial value of assets" that differs from market value to gradually reflect year-to-year changes in the market value of assets in determining the contribution requirements.
Actuarial assumptions	In preparing an actuarial valuation, Segal projects the benefits to be paid to existing plan participants for the rest of their lives and the lives of their beneficiaries. This projection requires actuarial assumptions as to the probability of death, disability, withdrawal, and retirement of each participant for each year. In addition, the benefits projected to be paid for each of those events in each future year reflect actuarial assumptions as to salary increases and cost-of-living adjustments. The projected benefits are then discounted to a present value, based on the assumed rate of return that is expected to be achieved on the plan's assets. There is a reasonable range for each assumption used in the projection and the results may vary materially based on which assumptions are selected. It is important for any user of an actuarial valuation to understand this concept. Actuarial assumptions are periodically reviewed to ensure that future valuations reflect emerging plan experience. While future changes in actuarial assumptions may have a significant impact on the reported results, which does not mean that the previous assumptions were unreasonable.

The user of Segal's actuarial valuation (or other actuarial calculations) should keep the following in mind:

- The actuarial valuation is prepared at the request of the PERA. Segal is not responsible for the use or misuse of its report, particularly by any other party.
- An actuarial valuation is a measurement of the Plans' assets and liabilities at a specific date. Accordingly, except where otherwise noted, Segal did not perform an analysis of the potential range of future financial measures. The actual long-term cost of the plan will be determined by the actual benefits and expenses paid and the actual investment experience of the Plans.
- Actuarial results in this report are not rounded, but that does not imply precision. In addition, in some cases the underlying calculations involve more precision than what is presented in this report and the rounded numbers shown herein may appear not to add as a result.
- If PERA is aware of any event or trend that was not considered in this valuation that may materially change the results of the valuation, Segal should be advised, so that we can evaluate it.
- Segal does not provide investment, legal, accounting, or tax advice. Segal's valuation is based on our understanding of applicable guidance in these areas and of the plan's provisions, but they may be subject to alternative interpretations. PERA should look to their other advisors for expertise in these areas.
- This is Segal's first valuation for PERA. Numbers shown it the valuation for the prior year are from the actuarial valuation report (dated June 18, 2018) prepared by Cavanaugh Macdonald Consulting.

As Segal Consulting has no discretionary authority with respect to the management or assets of PERA, it is not a fiduciary in its capacity as actuaries and consultants with respect to PERA.

Section 2: Actuarial Valuation Results

A. Member Data

The Actuarial Valuation and Review considers the number and demographic characteristics of covered members, including active members, inactive members, retirees and beneficiaries.

This section presents a summary of significant statistical data on these member groups.

More detailed information for this valuation year and the preceding valuation can be found in *Section 3, Exhibits A, B, C, D and E*.

STATE DIVISION
MEMBER POPULATION: 2009 – 2018

As of December 31	Active General Members	Active State Troopers Members	Active Total	Terminated Vested Members	Inactive Members	Retirees and Survivors	Total Membership	Ratio of Retirees and Survivors to Actives
2009	53,534	799	54,333	4,623	53,820	31,463	144,239	0.58
2010	54,179	798	54,977	4,587	55,911	32,500	147,975	0.59
2011	54,145	811	54,956	4,756	58,597	33,212	151,521	0.60
2012	53,993	811	54,804	5,029	61,293	34,125	155,251	0.62
2013	54,538	816	55,354	5,340	63,759	34,981	159,434	0.63
2014	54,471	829	55,300	5,678	66,330	35,937	163,245	0.65
2015	54,450	841	55,291	6,075	69,385	36,992	167,743	0.67
2016	54,889	836	55,725	6,426	72,398	38,140	172,689	0.68
2017	54,814	872	55,686	6,788	75,350	39,364	177,188	0.71
2018	54,623	888	55,511	7,074	78,576	40,446	181,607	0.73

SCHOOL DIVISION
MEMBER POPULATION: 2009 – 2018

As of December 31	Active Members	Terminated Vested Members	Inactive Members	Retirees and Survivors	Total Membership	Ratio of Retirees and Survivors to Actives
2009	119,390	9,968	81,448	47,641	258,447	0.40
2010	116,486	10,523	85,528	49,933	262,470	0.43
2011	114,820	11,250	89,225	51,898	267,193	0.45
2012	115,294	11,942	93,097	53,952	274,285	0.47
2013	117,727	12,854	96,832	55,986	283,399	0.48
2014	119,618	13,807	101,603	58,145	293,173	0.49
2015	120,239	14,904	108,184	60,109	303,436	0.50
2016	121,945	15,727	113,942	62,102	313,716	0.51
2017	122,990	16,439	120,037	64,327	323,793	0.52
2018	126,333	17,001	125,944	66,543	335,821	0.53

LOCAL GOVERNMENT DIVISION
MEMBER POPULATION: 2009 – 2018

As of December 31	Active Members	Terminated Vested Members	Inactive Members	Retirees and Survivors	Total Membership	Ratio of Retirees and Survivors to Actives
2009	16,166	1,274	16,251	4,692	38,383	0.29
2010	16,144	1,348	16,865	5,075	39,432	0.31
2011	16,065	1,436	17,725	5,320	40,546	0.33
2012	12,097	3,075	20,104	5,901	41,177	0.49
2013	11,954	2,868	20,286	6,167	41,275	0.52
2014	12,084	2,788	20,956	6,466	42,294	0.54
2015	12,176	2,791	21,915	6,777	43,659	0.56
2016	12,736	2,748	22,896	7,065	45,445	0.55
2017	12,770	2,741	23,937	7,369	46,817	0.58
2018	13,260	2,696	25,034	7,662	48,652	0.58

JUDICIAL DIVISION
MEMBER POPULATION: 2009 – 2018

As of December 31	Active Members	Terminated Vested Members	Inactive Members	Retirees and Survivors	Total Membership	Ratio of Retirees and Survivors to Actives
2009	317	8	6	292	623	0.92
2010	317	7	5	294	623	0.93
2011	329	8	5	312	654	0.95
2012	329	7	5	321	662	0.98
2013	332	6	5	323	666	0.97
2014	334	5	9	331	679	0.99
2015	334	7	8	345	694	1.03
2016	335	8	5	361	709	1.08
2017	332	9	5	376	722	1.13
2018	332	12	4	382	730	1.15

DENVER PUBLIC SCHOOLS DIVISION[1]
MEMBER POPULATION: 2010 – 2018

As of December 31	Active Members	Terminated Vested Members	Inactive Members	Retirees and Survivors	Total Membership	Ratio of Retirees and Survivors to Actives
2010	13,171	542	1,853	6,215	21,781	0.47
2011	13,571	553	3,118	6,311	23,553	0.47
2012	13,911	645	4,414	6,415	25,385	0.46
2013	14,816	759	5,501	6,564	27,640	0.44
2014	15,414	850	6,787	6,698	29,749	0.43
2015	15,929	1,109	8,118	6,812	31,968	0.43
2016	15,950	1,374	9,545	6,941	33,810	0.44
2017	15,991	1,596	10,919	7,044	35,550	0.44
2018	16,148	1,780	12,286	7,156	37,370	0.44

[1] DPS Division began January 1, 2010

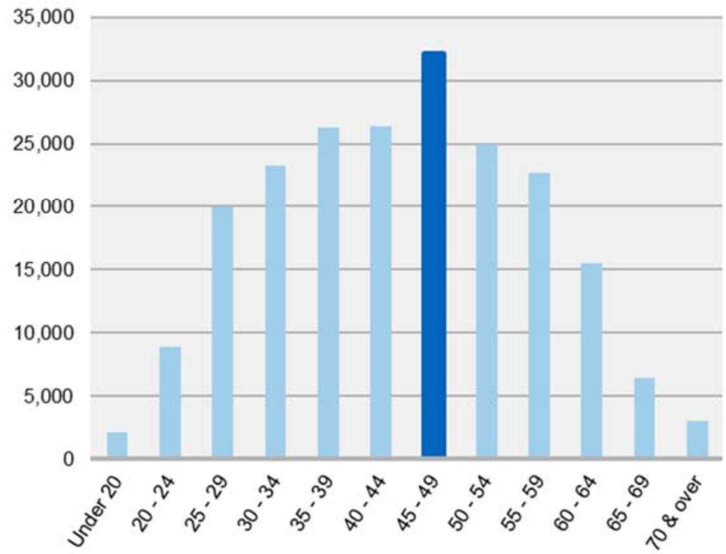
Active Members

Plan costs are affected by the age, years of service and compensation of active members. The following table shows the number of active members, average age, average years of service, and average payroll for the Division Trust Funds for the current and prior year valuations.

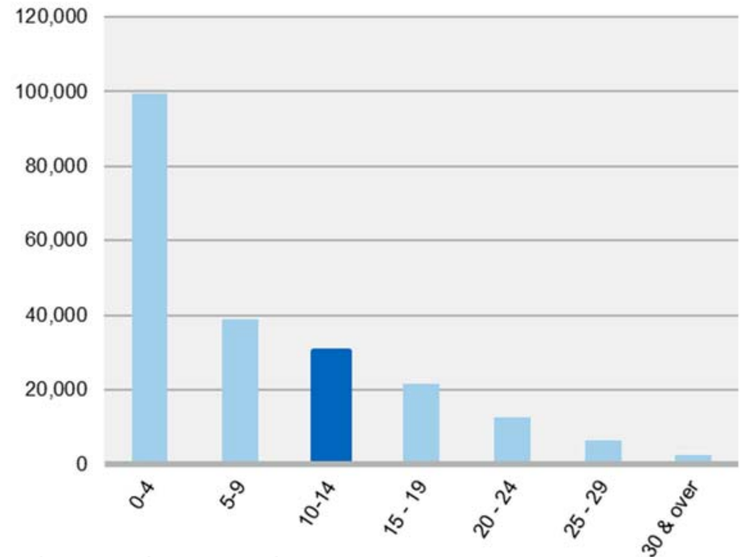
Item	State Division General	State Division Troopers	School Division	Local Government Division	Judicial Division	Denver Public Schools Division
December 31, 2018:						
Number	54,623	888	126,333	13,260	332	16,148
Average age	45.4	41.6	44.6	44.1	56.1	40.4
Average service	8.7	12.1	8.4	7.3	13.7	6.2
Average payroll	$51,561	$92,830	$37,912	$49,849	$152,126	$44,714
December 31, 2017:						
Number	54,814	872	122,990	12,770	332	15,991
Average age	45.6	41.7	44.6	44.0	55.4	40.5
Average service	8.7	12.4	8.4	7.6	13.2	6.1
Average payroll	$49,185	$89,680	$36,355	$49,551	$147,433	$41,161

ALL DIVISION TRUST FUNDS
ACTIVE MEMBER DATA

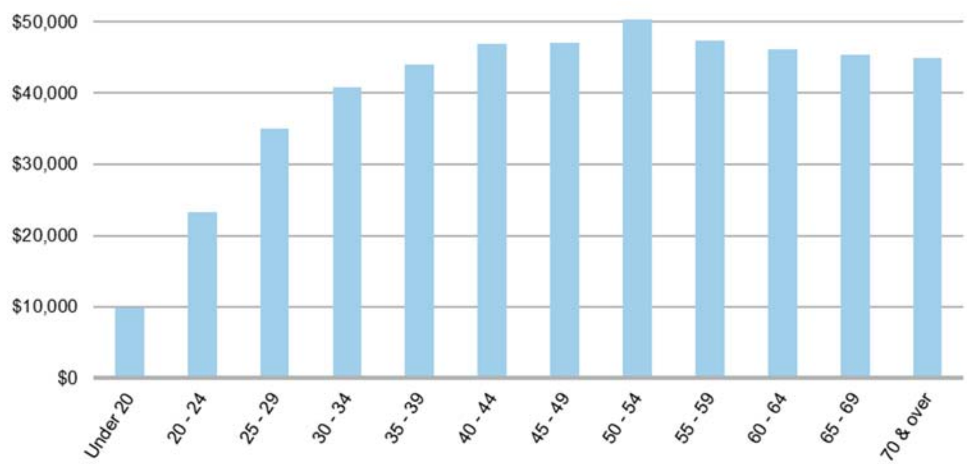
ACTIVES BY AGE



ACTIVES BY YEARS OF SERVICE



AVERAGE PAYROLL OF ACTIVES BY AGE



Note: The dark blue shaded bar represents the average age and average service for active members.

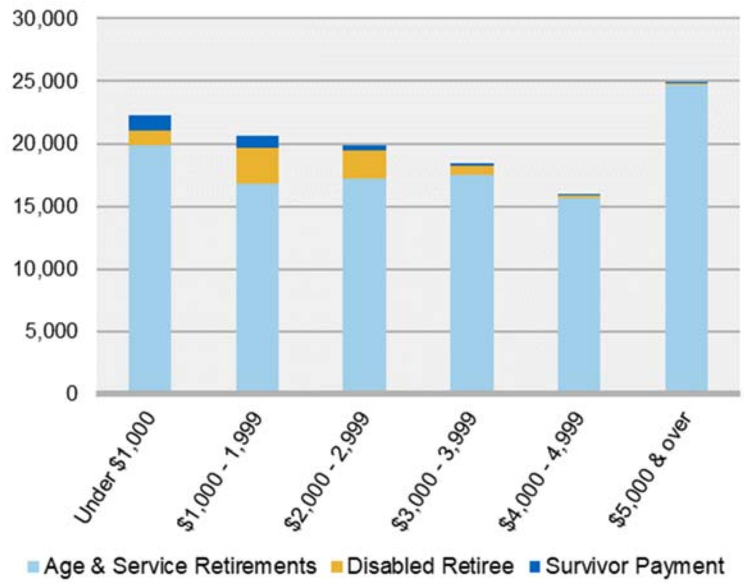
Retirees and Survivors

The following table shows the number of retirees and survivors, average age, and average annual benefit for the current and prior valuations.

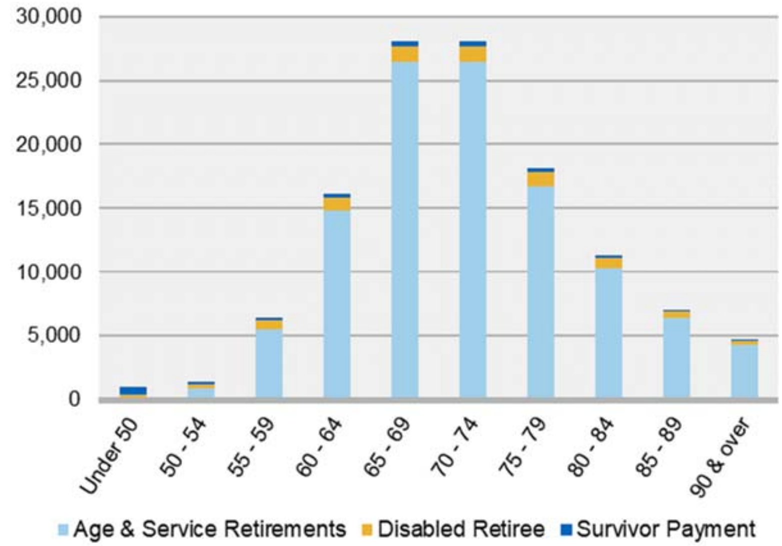
Item	State Division	School Division	Local Government Division	Judicial Division	Denver Public Schools Division
December 31, 2018:					
Number of retirees and survivors	40,446	66,543	7,662	382	7,156
Average age	71.5	71.3	69.4	74.8	74.2
Average annual benefit	$40,034	$36,595	$37,834	$69,627	$38,926
December 31, 2017:					
Number of retirees and survivors	39,364	64,327	7,369	376	7,044
Average age	71.3	71.1	69.1	74.3	74.1
Average annual benefit	$40,036	$36,771	$37,627	$68,723	$38,865

ALL DIVISION TRUST FUNDS RETIREE AND SURVIVOR DATA

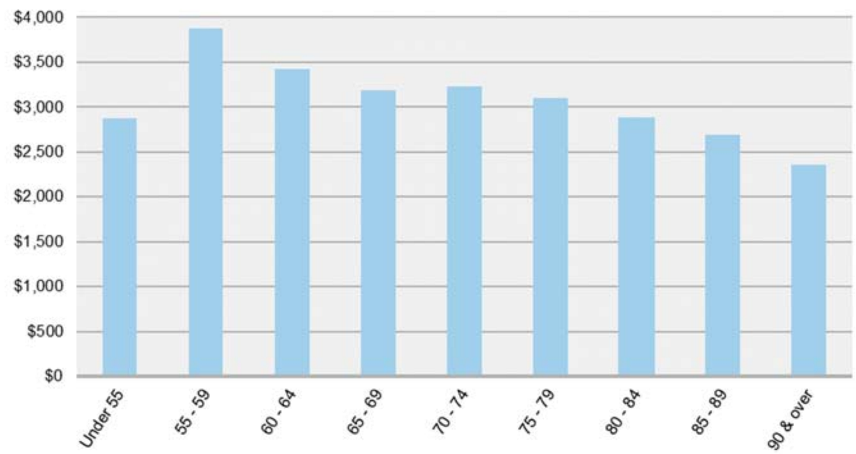
RETIREES AND SURVIVORS BY TYPE AND AMOUNT



RETIREES AND SURVIVORS BY TYPE AND AGE



AVERAGE BENEFIT AMOUNTS OF RETIREES AND SURVIVORS BY AGE



Historical Plan Population

The charts below demonstrates the progression of the active population over the last 10 years.

STATE DIVISION
ACTIVE MEMBER DATA STATISTICS: 2009 – 2018

As of December 31	Active Members		Total Payroll Supplied by PERA, Annualized		Average Payroll		Average Age	Average Service
	Number	Percent Change	Amount in $ Thousands	Percent Change	$ Amount	Percent Change		
2009	54,333	-	$2,384,137	-	$43,880	-	45.82	8.97
2010	54,977	1.19%	2,392,080	0.33%	43,511	(0.84%)	45.84	8.90
2011	54,956	(0.04%)	2,393,791	0.07%	43,558	0.11%	45.98	8.96
2012	54,804	(0.28%)	2,384,934	(0.37%)	43,518	(0.09%)	46.19	9.04
2013	55,354	1.00%	2,474,965	3.77%	44,712	2.74%	46.10	9.00
2014	55,300	(0.10%)	2,564,670	3.62%	46,377	3.72%	46.01	9.02
2015	55,291	(0.02%)	2,641,867	3.01%	47,781	3.03%	45.87	8.97
2016	55,725	0.78%	2,710,651	2.60%	48,643	1.80%	45.66	8.84
2017	55,686	(0.07%)	2,774,207	2.34%	49,819	2.42%	45.50	8.78
2018	55,511	(0.31%)	2,898,827	4.49%	52,221	4.82%	45.36	8.75

SCHOOL DIVISION
ACTIVE MEMBER DATA STATISTICS: 2009 – 2018

As of December 31	Active Members: Number	Active Members: Percent Change	Total Payroll Supplied by PERA, Annualized: Amount in $ Thousands	Total Payroll Supplied by PERA, Annualized: Percent Change	Average Payroll: $ Amount	Average Payroll: Percent Change	Average Age	Average Service
2009	119,390	-	$3,922,175	-	$32,852	-	44.21	7.98
2010	116,486	(2.43%)	3,900,662	(0.55%)	33,486	1.93%	44.46	8.29
2011	114,820	(1.43%)	3,821,603	(2.03%)	33,283	(0.61%)	44.60	8.46
2012	115,294	0.41%	3,819,066	(0.07%)	33,125	(0.47%)	44.62	8.46
2013	117,727	2.11%	3,938,650	3.13%	33,456	1.00%	44.57	8.38
2014	119,618	1.61%	4,063,236	3.16%	33,968	1.53%	44.49	8.29
2015	120,239	0.52%	4,235,290	4.23%	35,224	3.70%	44.55	8.36
2016	121,945	1.42%	4,349,320	2.69%	35,666	1.25%	44.53	8.38
2017	122,990	0.86%	4,471,357	2.81%	36,355	1.93%	44.60	8.42
2018	126,333	2.72%	4,789,503	7.12%	37,912	4.28%	44.56	8.38

LOCAL GOVERNMENT DIVISION
ACTIVE MEMBER DATA STATISTICS: 2009 – 2018

As of December 31	Active Members		Total Payroll Supplied by PERA, Annualized		Average Payroll		Average Age	Average Service
	Number	Percent Change	Amount in $ Thousands	Percent Change	$ Amount	Percent Change		
2009	16,166	-	$705,097	-	$43,616	-	43.76	7.71
2010	16,144	(0.14%)	705,265	0.02%	43,686	0.16%	43.99	7.60
2011	16,065	(0.49%)	718,169	1.83%	44,704	2.33%	44.15	7.67
2012	12,097	(24.70%)	523,668	(27.08%)	43,289	(3.17%)	44.75	7.89
2013	11,954	(1.18%)	529,003	1.02%	44,253	2.23%	44.71	8.02
2014	12,084	1.09%	540,468	2.17%	44,726	1.07%	44.67	7.89
2015	12,176	0.76%	561,518	3.89%	46,117	3.11%	44.45	7.80
2016	12,736	4.60%	608,223	8.32%	47,756	3.55%	44.53	7.60
2017	12,770	0.27%	632,768	4.04%	49,551	3.76%	43.97	7.58
2018	13,260	3.84%	660,998	4.46%	49,849	0.60%	44.08	7.31

JUDICIAL DIVISION
ACTIVE MEMBER DATA STATISTICS: 2009 – 2018

As of December 31	Active Members		Total Payroll Supplied by PERA, Annualized		Average Payroll		Average Age	Average Service
	Number	Percent Change	Amount in $ Thousands	Percent Change	$ Amount	Percent Change		
2009	317	-	$37,583	-	$118,557	-	55.41	13.79
2010	317	0.00%	37,412	(0.45%)	118,019	(0.45%)	56.01	14.08
2011	329	3.79%	39,033	4.33%	118,642	0.53%	56.14	13.63
2012	329	0.00%	39,045	0.03%	118,678	0.03%	56.25	14.00
2013	332	0.91%	39,942	2.30%	120,306	1.37%	56.40	14.23
2014	334	0.60%	42,977	7.60%	128,674	6.96%	56.54	14.36
2015	334	0.00%	46,870	9.06%	140,329	9.06%	56.65	14.32
2016	335	0.30%	48,700	3.90%	145,372	3.59%	55.93	13.79
2017	332	(0.90%)	48,948	0.51%	147,433	1.42%	55.39	13.22
2018	332	0.00%	50,506	3.18%	152,126	3.18%	56.06	13.71

DENVER PUBLIC SCHOOLS DIVISION[1]
ACTIVE MEMBER DATA STATISTICS: 2010 – 2018

As of December 31	Active Members		Total Payroll Supplied by PERA, Annualized		Average Payroll		Average Age	Average Service
	Number	Percent Change	Amount in $ Thousands	Percent Change	$ Amount	Percent Change		
2010	13,171	-	$470,774	-	$35,743	-	43.52	5.65
2011	13,571	3.04%	491,646	4.43%	36,228	1.36%	42.35	5.90
2012	13,911	2.51%	510,872	3.91%	36,724	1.37%	42.14	5.90
2013	14,816	6.51%	547,660	7.20%	36,964	0.65%	41.49	5.79
2014	15,414	4.04%	584,319	6.69%	37,908	2.55%	41.00	5.80
2015	15,929	3.34%	621,115	6.30%	38,993	2.86%	41.78	7.15
2016	15,950	0.13%	642,177	3.39%	40,262	3.25%	40.42	5.88
2017	15,991	0.26%	658,198	2.49%	41,161	2.23%	40.48	6.06
2018	16,148	0.98%	722,040	9.70%	44,714	8.63%	40.44	6.21

[1] DPS Division began January 1, 2010

The charts below show the growth among the service retiree population over the last 10 years. Disability retirees and survivors are not included in the charts.

STATE DIVISION
SERVICE RETIREE DATA STATISTICS: 2009 – 2018

As of December 31	Service Retirees		Average Annual Amount		Average Age
	Number	Percent Change	$ Amount	Percent Change	
2009	26,884	-	$37,167	-	70.3
2010	27,943	3.94%	37,469	0.81%	70.4
2011	28,709	2.74%	38,375	2.42%	70.6
2012	29,659	3.31%	39,182	2.10%	70.7
2013	30,515	2.89%	39,888	1.80%	71.0
2014	31,511	3.26%	40,271	0.96%	71.2
2015	32,594	3.44%	40,886	1.53%	71.4
2016	33,756	3.57%	41,857	2.37%	71.6
2017	34,974	3.61%	42,021	0.39%	71.8
2018	36,063	3.11%	41,958	(0.15%)	72.0

SCHOOL DIVISION
SERVICE RETIREE DATA STATISTICS: 2009 – 2018

As of December 31	Service Retirees		Average Annual Amount		Average Age
	Number	Percent Change	$ Amount	Percent Change	
2009	43,440	-	$35,056	-	69.1
2010	45,672	5.14%	35,058	0.01%	69.3
2011	47,663	4.36%	35,638	1.65%	69.5
2012	49,695	4.26%	36,149	1.43%	69.7
2013	51,665	3.96%	36,630	1.33%	70.1
2014	53,778	4.09%	36,858	0.62%	70.4
2015	55,747	3.66%	37,255	1.08%	70.8
2016	57,748	3.59%	38,003	2.01%	71.1
2017	59,968	3.84%	37,938	(0.17%)	71.4
2018	62,154	3.65%	37,724	(0.56%)	71.7

LOCAL GOVERNMENT DIVISION
SERVICE RETIREE DATA STATISTICS: 2009 – 2018

As of December 31	Service Retirees		Average Annual Amount		Average Age
	Number	Percent Change	$ Amount	Percent Change	
2009	3,832	-	$35,855	-	68.1
2010	4,210	9.86%	36,595	2.06%	67.9
2011	4,449	5.68%	37,438	2.30%	68.1
2012	5,027	12.99%	37,975	1.43%	67.7
2013	5,287	5.17%	38,354	1.00%	68.1
2014	5,595	5.83%	38,244	(0.29%)	68.5
2015	5,908	5.59%	38,709	1.22%	68.8
2016	6,197	4.89%	39,371	1.71%	69.1
2017	6,510	5.05%	39,403	0.08%	69.5
2018	6,813	4.65%	39,509	0.27%	69.8

JUDICIAL DIVISION
SERVICE RETIREE DATA STATISTICS: 2009 – 2018

As of December 31	Service Retirees		Average Annual Amount		Average Age
	Number	Percent Change	$ Amount	Percent Change	
2009	257	-	$54,354	-	74.0
2010	261	1.56%	56,230	3.45%	74.0
2011	278	6.51%	57,565	2.37%	74.1
2012	286	2.88%	59,399	3.19%	74.1
2013	290	1.40%	61,786	4.02%	74.5
2014	299	3.10%	62,341	0.90%	74.7
2015	311	4.01%	65,048	4.34%	74.6
2016	327	5.14%	68,813	5.79%	74.3
2017	344	5.20%	71,084	3.30%	74.4
2018	349	1.45%	71,996	1.28%	75.1

DENVER PUBLIC SCHOOLS DIVISION[1]
SERVICE RETIREE DATA STATISTICS: 2010 – 2018

As of December 31	Service Retirees: Number	Service Retirees: Percent Change	Average Annual Amount: $ Amount	Average Annual Amount: Percent Change	Average Age[2]
2010	5,707	-	$36,338	-	73.2
2011	5,804	1.70%	37,075	2.03%	73.4
2012	5,915	1.91%	37,693	1.67%	73.6
2013	6,060	2.45%	38,374	1.81%	73.8
2014	6,203	2.36%	38,683	0.81%	74.0
2015	6,317	1.84%	39,124	1.14%	74.2
2016	6,456	2.20%	40,008	2.26%	74.3
2017	6,551	1.47%	40,111	0.26%	74.5
2018	6,659	1.65%	40,167	0.14%	74.6

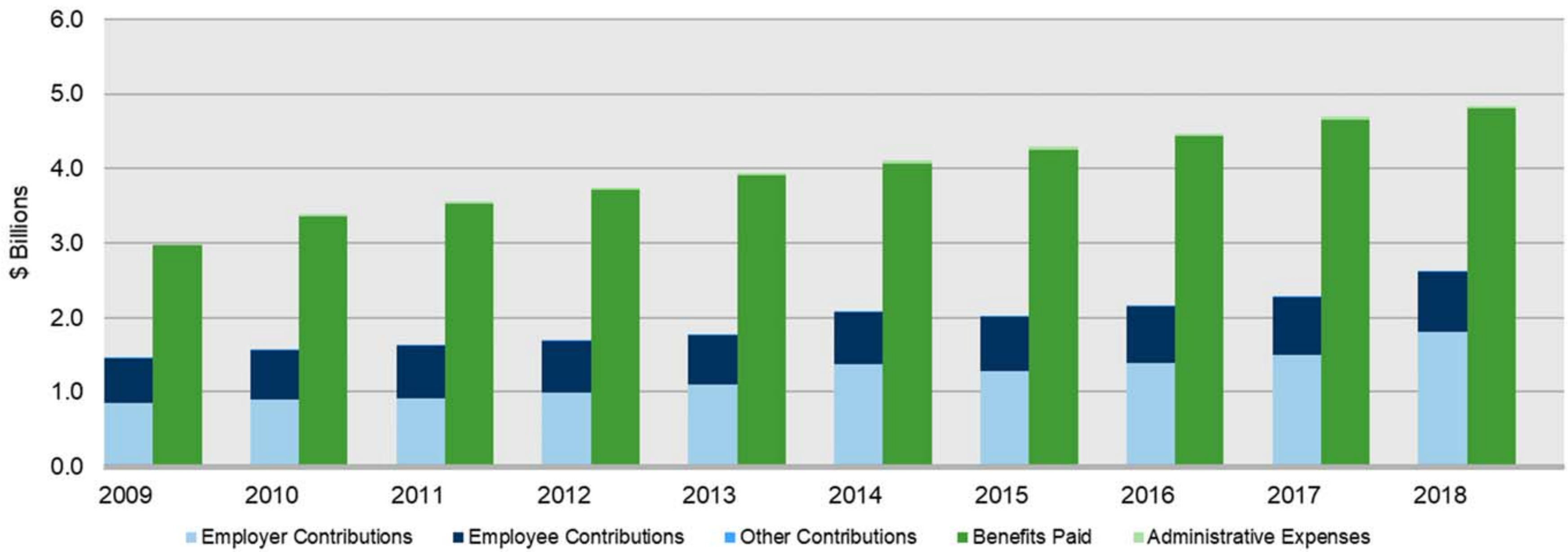
[1] DPS Division began January 1, 2010
[2] Average age shown for years prior to 2014 represents only retirees with a DPS benefit structure

B. Financial Information

Retirement plan funding anticipates that, over the long term, both contributions (less administrative expenses) and investment earnings (less investment fees) will be needed to cover benefit payments. Retirement plan assets change as a result of the net impact of these income and expense components.

Additional financial information, including a summary of these transactions for the valuation year, is presented in *Section 3, Exhibits E, F* and *G*.

COMPARISON OF CONTRIBUTIONS WITH BENEFITS PAID FOR YEARS ENDED DECEMBER 31, 2009 – 2018[1] ALL DIVISION TRUST FUNDS



[1] Results as of December 31, 2009, do not include the Denver Public Schools Division

It is desirable to have level and predictable plan costs from one year to the next. For this reason, the Board has approved an asset valuation method that gradually adjusts to market value. Under this valuation method, the full value of market fluctuations is not recognized in a single year and, as a result, the asset value and the plan costs are more stable. The amount of the adjustment to recognize market value is treated as income, which may be positive or negative. Realized and unrealized gains and losses are treated equally and, therefore, the sale of assets has no immediate effect on the actuarial value.

STATE DIVISION
DETERMINATION OF ACTUARIAL VALUE OF ASSETS
FOR YEAR ENDED DECEMBER 31, 2018, AND DECEMBER 31, 2017

				2018		2017
1.	Market value of assets available for benefits			**$13,837,862,906**		**$15,105,378,385**
2.	Calculation of unrecognized return[1]	Original Amount[2]	% Not Recognized		% Not Recognized	
	a. Year ended December 31, 2018	($1,558,865,478)	75%	($1,169,149,109)		
	b. Year ended December 31, 2017	1,422,540,317	50%	711,270,159	75%	$1,066,905,238
	c. Year ended December 31, 2016	(31,935,879)	25%	(7,983,970)	50%	(15,967,940)
	d. Year ended December 31, 2015	(807,875,479)		0	25%	(201,968,855)
	e. Total unrecognized return			($465,862,920)		$848,968,443
3.	Actuarial value of assets: 1 – 2e			**$14,303,725,826**		**$14,256,409,942**
4.	Actuarial value as a percent of market value: 3 ÷ 1			103.4%		94.4%

[1] Recognition at 25% per year over four years

[2] Total return minus expected return on a market value basis

SCHOOL DIVISION
DETERMINATION OF ACTUARIAL VALUE OF ASSETS
FOR YEAR ENDED DECEMBER 31, 2018, AND DECEMBER 31, 2017

				2018		2017
1.	Market value of assets available for benefits			**$23,304,910,906**		**$25,204,919,910**
2.	Calculation of unrecognized return[1]	**Original Amount[2]**	**% Not Recognized**		**% Not Recognized**	
	a. Year ended December 31, 2018	($2,619,821,688)	75%	($1,964,866,266)		
	b. Year ended December 31, 2017	2,375,316,244	50%	1,187,658,122	75%	$1,781,487,183
	c. Year ended December 31, 2016	(49,290,713)	25%	(12,322,678)	50%	(24,645,357)
	d. Year ended December 31, 2015	(1,327,868,901)		0	25%	(331,967,224)
	e. Total unrecognized return			($789,530,822)		$1,424,874,602
3.	Actuarial value of assets: 1 – 2e			**$24,094,441,728**		**$23,780,045,308**
4.	Actuarial value as a percent of market value: 3 ÷ 1			103.4%		94.3%

[1] Recognition at 25% per year over four years

[2] Total return minus expected return on a market value basis

LOCAL GOVERNMENT DIVISION
DETERMINATION OF ACTUARIAL VALUE OF ASSETS
FOR YEAR ENDED DECEMBER 31, 2018, AND DECEMBER 31, 2017

				2018		2017
1.	Market value of assets available for benefits			**$3,935,921,050**		**$4,249,852,277**
2.	Calculation of unrecognized return[1]	**Original Amount[2]**	**% Not Recognized**		**% Not Recognized**	
	a. Year ended December 31, 2018	($442,744,097)	75%	($332,058,073)		
	b. Year ended December 31, 2017	398,404,373	50%	199,202,187	75%	$298,803,280
	c. Year ended December 31, 2016	(7,608,648)	25%	(1,902,162)	50%	(3,804,324)
	d. Year ended December 31, 2015	(218,238,373)		0	25%	(54,559,591)
	e. Total unrecognized return			($134,758,048)		$240,439,365
3.	Actuarial value of assets: 1 – 2e			**$4,070,679,098**		**$4,009,412,912**
4.	Actuarial value as a percent of market value: 3 ÷ 1			103.4%		94.3%

[1] Recognition at 25% per year over four years

[2] Total return minus expected return on a market value basis

JUDICIAL DIVISION
DETERMINATION OF ACTUARIAL VALUE OF ASSETS
FOR YEAR ENDED DECEMBER 31, 2018, AND DECEMBER 31, 2017

			2018			2017
1. Market value of assets available for benefits			**$305,303,696**			**$328,458,690**
2. Calculation of unrecognized return[1]	**Original Amount[2]**	**% Not Recognized**		**% Not Recognized**		
a. Year ended December 31, 2018	($34,306,520)	75%	($25,729,890)			
b. Year ended December 31, 2017	30,479,769	50%	15,239,885	75%		$22,859,827
c. Year ended December 31, 2016	(706,638)	25%	(176,660)	50%		(353,319)
d. Year ended December 31, 2015	(16,530,163)		0	25%		(4,132,544)
e. Total unrecognized return			($10,666,665)			$18,373,964
3. Actuarial value of assets: 1 – 2e			**$315,970,361**			**$310,084,726**
4. Actuarial value as a percent of market value: 3 ÷ 1			103.5%			94.4%

[1] Recognition at 25% per year over four years

[2] Total return minus expected return on a market value basis

DENVER PUBLIC SCHOOLS DIVISION
DETERMINATION OF ACTUARIAL VALUE OF ASSETS
FOR YEAR ENDED DECEMBER 31, 2018, AND DECEMBER 31, 2017

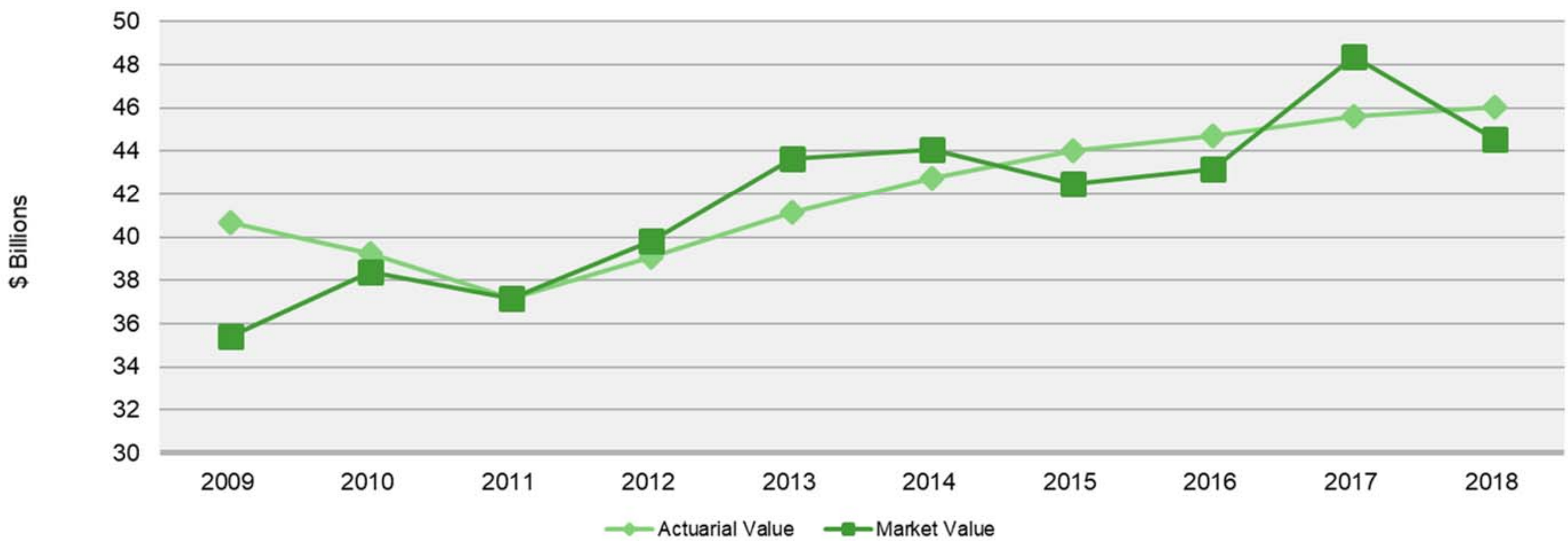
				2018		2017
1.	Market value of assets available for benefits			**$3,155,738,171**		**$3,452,666,927**
2.	Calculation of unrecognized return[1]	**Original Amount[2]**	**% Not Recognized**		**% Not Recognized**	
	a. Year ended December 31, 2018	($356,414,000)	75%	($267,310,500)		
	b. Year ended December 31, 2017	326,971,460	50%	163,485,730	75%	$245,228,595
	c. Year ended December 31, 2016	(7,099,228)	25%	(1,774,807)	50%	(3,549,614)
	d. Year ended December 31, 2015	(187,127,443)		0	25%	(46,781,861)
	e. Total unrecognized return			($105,599,577)		$194,897,120
3.	Actuarial value of assets: 1 – 2e			**$3,261,337,748**		**$3,257,769,807**
4.	Actuarial value as a percent of market value: 3 ÷ 1			103.3%		94.4%

[1] Recognition at 25% per year over four years

[2] Total return minus expected return on a market value basis

Both the actuarial value and market value of assets, when compared to actuarial accrued liabilities, are representations of PERA's financial status. As investment gains and losses are gradually taken into account, the actuarial value of assets tracks the market value of assets. The actuarial asset value is significant because the Plan's liabilities are compared to these assets to determine what portion, if any, remains unfunded. Amortization of the unfunded actuarial accrued liability is an important element in determining the actuarially determined contributions.

ACTUARIAL VALUE OF ASSETS VS. MARKET VALUE OF ASSETS AS OF DECEMBER 31, 2009 – 2018[1] ALL DIVISION TRUST FUNDS



[1] Results as of December 31, 2019, do not include the Denver Public Schools Division

C. Actuarial Experience

To calculate any actuarially determined contribution (ADC), assumptions are made about future events that affect the amount and timing of benefits to be paid and assets to be accumulated. Each year actual experience is measured against the assumptions. If overall experience is more favorable than anticipated (an actuarial gain), the ADC will decrease relative to the previous year. On the other hand, the ADC will increase if overall actuarial experience is less favorable than expected (an actuarial loss).

Taking account of experience gains or losses in one year without making a change in assumptions reflects the belief that the single years' experience was a short-term development and that, over the long term, experience will return to the original assumptions. For contribution requirements to remain stable, assumptions should approximate experience.

If assumptions are changed, the contribution requirement is adjusted to take into account a change in experience anticipated for all future years.

The total loss is $1.8 billion, which includes $580.4 million from investment losses and $1.2 billion in net losses from all other sources. The net experience variation from individual sources other than investments was 1.54% of the actuarial accrued liability. A discussion of the major components of the actuarial experience is on the following pages.

ACTUARIAL EXPERIENCE FOR YEAR ENDED DECEMBER 31, 2018

	Item	State Division	School Division	Local Government Division	Judicial Division	Denver Public Schools Division	Total
1.	Net gain/(loss) from investments[1]	($182,483,903)	($302,112,856)	($50,114,830)	($3,933,778)	($41,787,262)	($580,432,629)
2.	Net gain/(loss) from administrative expenses	(303,200)	(4,941,101)	31,818	121,481	(145,996)	($5,236,998)
3.	Net gain/(loss) from liability and other experience	(360,656,408)	(670,519,362)	(85,245,968)	(7,335,444)	(78,953,568)	(1,202,710,750)
4.	Net experience gain/(loss): 1 + 2 + 3	($543,443,511)	($977,573,319)	($135,328,980)	($11,147,741)	($120,886,826)	($1,788,380,377)

[1] Details on next page

Investment Experience

A major component of projected asset growth is the assumed rate of return. The assumed return should represent the expected long-term rate of return, based on PERA's investment policy. The rate of return on the market value of assets was (3.36%) for the year ended December 31, 2018.

For valuation purposes, the assumed rate of return on the actuarial value of assets is 7.25%. The actual rate of return on an actuarial basis for the 2018 plan year was 5.95%. Since the actual return for the year was less than the assumed return, PERA experienced an actuarial loss during the year ended December 31, 2018 with regard to its investments.

INVESTMENT EXPERIENCE – ALL DIVISION TRUST FUNDS

		Year Ended December 31, 2018		Year Ended December 31, 2017	
		Market Value	Actuarial Value	Market Value	Actuarial Value
1.	Value assets at the beginning of year	$48,341,276,189	$45,613,722,695	$43,148,650,931	$44,687,696,483
2.	Contributions during the plan year	2,628,023,623	2,628,023,623	2,290,523,650	2,290,523,650
3.	Contributions receivable	0	0	1,063,119	1,063,119
4.	Benefits and expense during the plan year	4,841,900,777	4,841,900,777	4,693,830,975	4,693,830,975
5.	Value of assets at the end of year	44,539,736,729	46,046,154,761	48,341,276,189	45,613,722,695
6.	Net investment income: 5 – 1 – 2 – 3 + 4	($1,587,662,306)	$2,646,309,220	$7,594,869,464	$3,328,270,418
7.	Average value of assets: 1 + [2 – 4] x ½	$47,234,337,612	$44,506,784,118	$41,946,997,269	$43,486,042,821
8.	Rate of return: 6 ÷ 7	(3.36%)	5.95%	18.11%	7.65%
9.	Assumed rate of return	7.25%	7.25%	7.25%	7.25%
10.	Expected investment income: 7 x 9	$3,424,489,477	$3,226,741,849	$3,041,157,302	$3,152,738,105
11.	Actuarial gain/(loss): 6 – 10	($5,012,151,783)	($580,432,629)	$4,553,712,162	$175,532,313

Because actuarial planning is long term, it is useful to see how the assumed investment rate of return has followed actual experience over time. The chart below shows the rate of return on an actuarial basis compared to the actual market value investment return for the last 30 years, including averages over select periods.

INVESTMENT RETURN – ALL DIVISION TRUST FUNDS MARKET VALUE VS. ACTUARIAL VALUE: 1989 – 2018

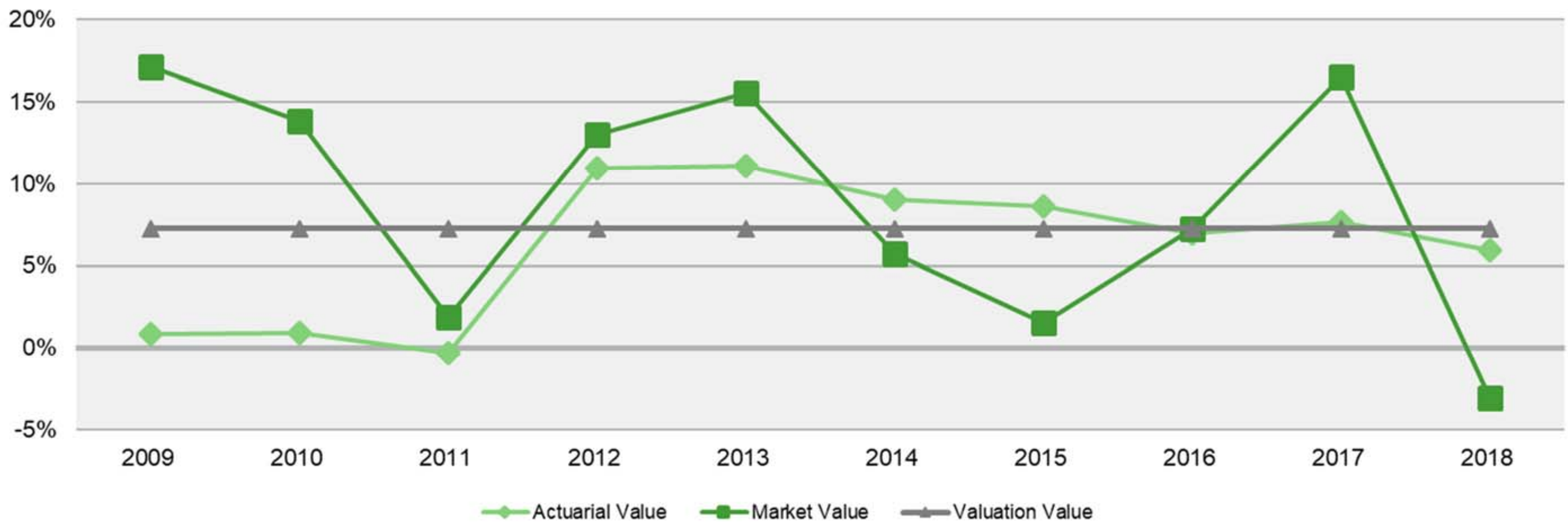
Year Ended December 31	Market Value	Actuarial Value	Year Ended December 31	Market Value	Actuarial Value	Year Ended December 31	Market Value	Actuarial Value
1989	17.2%	10.3%	1999	19.0%	16.6%	2009	17.4%	0.9%
1990	1.5%	3.7%	2000	0.2%	12.5%	2010	14.0%	0.9%
1991	20.1%	9.2%	2001	(7.7%)	6.1%	2011	1.9%	(0.3%)
1992	6.4%	7.4%	2002	(11.8%)	(0.1%)	2012	12.9%	10.9%
1993	14.9%	10.1%	2003	24.1%	0.3%	2013	15.6%	11.1%
1994	1.1%	8.0%	2004	14.1%	3.0%	2014	5.7%	9.0%
1995	24.6%	11.9%	2005	9.8%	8.8%	2015	1.5%	8.6%
1996	13.6%	13.2%	2006	15.7%	10.6%	2016	7.3%	6.9%
1997	20.1%	14.8%	2007	10.0%	11.3%	2017	18.1%	7.7%
1998	15.7%	17.5%	2008	(26.0%)	2.1%	2018	(3.4%)	5.9%

	Market Value	Actuarial Value
Most recent five-year average return	5.6%	7.6%
Most recent ten-year average return	8.8%	6.1%
Most recent 15-year average return	7.0%	6.3%
Most recent 20-year average return	6.2%	6.5%
Most recent 30-year average return	8.5%	N/A

Note: For 1989-2018, investment returns on a market value basis were provided by PERA.

Subsection B described the actuarial asset valuation method that gradually recognizes fluctuations in the market value rate of return. The goal of this is to stabilize the actuarial rate of return and to produce more level pension plan costs.

MARKET AND ACTUARIAL RATES OF RETURN FOR YEARS ENDED DECEMBER 31, 2009 – 2018[1] ALL DIVISION TRUST FUNDS



[1] Results as of December 31, 2009, do not include the Denver Public Schools Division.

Administrative Expenses

Administrative expenses for the year ended December 31, 2018 totaled $41,088,490 compared to the assumption of $34,792,438. This resulted in a loss of $5,236,998 the year, when adjusted for timing.

Other Experience

There are other differences between the expected and the actual experience that appear when the new valuation is compared with the projections from the previous valuation. These include:

- retirement experience (earlier or later than projected),
- the number of disability retirements (more or fewer than projected),
- mortality (more or fewer deaths than projected),
- the extent of turnover among participants,
- new members, and
- pay increases (greater or smaller than projected).

The net loss from this other experience for the year ended December 31, 2018 amounted to $1.2 billion, which is 1.54% of the actuarial accrued liability.

EXPERIENCE DUE TO CHANGES IN DEMOGRAPHICS FOR YEAR ENDED DECEMBER 31, 2018

Item	State Division	School Division	Local Government Division	Judicial Division	Denver Public Schools Division	Total
Age and service retirements	($62,620,141)	($96,657,429)	($9,748,628)	$515,905	($9,017,620)	($177,527,913)
Disability retirements	(5,555,944)	(5,195,931)	(1,790,910)	115,484	(859,256)	(13,286,557)
Deaths	(38,108,117)	(71,258,525)	(5,198,773)	(2,597,774)	(762,979)	(117,926,168)
Withdrawals	23,983,902	(60,469,643)	(715,777)	376,863	42,007,302	5,182,647
New members	(65,688,630)	(107,607,534)	(15,079,617)	(1,812,996)	(41,151,227)	(231,340,004)
Pay increases	(36,888,688)	(85,419,219)	4,042,124	665,301	(44,349,103)	(161,949,585)
Other[1]	(175,778,790)	(243,911,081)	(56,754,387)	(4,598,227)	(24,820,685)	(505,863,170)
Total gain/(loss)	**($360,656,408)**	**($670,519,362)**	**($85,245,968)**	**($7,335,444)**	**($78,953,568)**	**($1,202,710,750)**

[1] Primarily due to change in actuary/software

An additional source of gain or loss that is sepearely identified and amortized over a period equal to the reminaing years of the legacy UAAL amortization is the gain or loss due to contribution excess or deficiency.

CONTRIBUTION DEFICIENCY OR EXCESS FOR YEAR ENDED DECEMBER 31, 2018

	Item	State Division	School Division	Local Government Division	Judicial Division	Denver Public Schools Division
1.	**Actuarially determined employer contribution rate for 2018:**					
	a. Total normal cost rate	10.87%	12.22%	10.36%	18.50%	12.89%
	b. Less member contribution rate	(8.05%)	(8.00%)	(8.00%)	(8.00%)	(8.00%)
	c. Employer normal cost rate 1a + 1b	2.82%	4.22%	2.36%	10.50%	4.89%
	d. UAAL contribution rate	23.48%	22.58%	11.91%	16.76%	8.61%
	e. Actuarially Determined Contribution rate: 1c + 1d	26.30%	26.80%	14.27%	27.26%	13.50%
2.	Covered payroll for 2018	$2,898,827,271	$4,789,503,451	$660,998,127	$50,505,856	$722,040,073
3.	**Expected contribution for 2018:**					
	a. Employer (based on the ADC)	$762,391,572	$1,283,586,925	$94,324,433	$13,767,896	$97,475,410
	b. Member	233,355,595	383,160,276	52,879,850	4,040,468	57,763,206
	c. Total: 3a + 3b	**$995,747,167**	**$1,666,747,201**	**$147,204,283**	**$17,808,364**	**$155,238,616**
4.	**Actual contribution for 2018:**					
	a. Employer	$567,244,181	$901,413,388	$77,578,359	$8,092,192	$31,370,077
	b. Member	261,499,998	414,308,437	58,034,331	4,697,606	61,091,797
	c. Direct distribution	78,488,543	126,504,713	0	1,384,837	18,621,907
	d. Purchased service/disaffiliation payments	25,193,858	27,500,932	5,615,317	633,975	2,919,955
	e. Total: 4a + 4b + 4c – 4d	**$882,038,864**	**$1,414,725,606**	**$129,997,373**	**$13,540,660**	**$108,163,826**
5.	**Contribution deficiency/(excess), adjusted for interest: (3c – 4e) * 1.03625**	**$117,830,229**	**$261,157,378**	**$17,830,660**	**$4,422,408**	**$48,781,251**

D. Changes in the Actuarial Accrued Liability

The actuarial accrued liability for all Division Trust Funds combined as of December 31, 2018 is $77,045,495,760, an increase of $2,654,629,452, or 3.57%, from the actuarial accrued liability as of the prior valuation date. The change in liability is due to interest, accumulation and payment of benefits, and actuarial experience (as discussed in the previous subsection).

Actuarial Assumptions

- There are no assumption or method changes reflected in this report, with the exception of the resetting of the 30-year amortization period as described in sub-section *H, Actuarially Determined Contribution*. There is no effect on the Actuarial Accrued Liability or Normal Cost due to this change.
- Details on actuarial assumptions and methods are in *Section 4, Exhibit I*.

Plan Provisions

- There were no changes in plan provisions since the prior valuation, with the exception of the enactment of HB 19-1217, allowing the members of the Local Government to continue to contribute 8.0%, without any scheduled increases as initially adopted under SB 18-200. It also should be noted that changes to plan provisions required by SB 18-200 were first recognized in the December 31, 2017, actuarial valuation for funding purposes. SB 18-200 reforms will be recognized, as appropriate, in the current and future actuarial valuations commensurate with or following the coordinating effective dates of each reform.
- A summary of plan provisions is in *Section 4, Exhibit II*.

E. Cash Flow

Cash flow is the difference between contributions and benefit payments, refunds, and expenses. Negative cash flow indicates that the payments made from the Plan exceed contributions made to the Plan.

STATE DIVISION
HISTORY OF CASH FLOW: 2009 – 2018

Year Ended December 31	Contributions and Other Additions[1]	Disbursements or Expenditures: Benefit Payments and Other Deductions	Disbursements or Expenditures: Administrative Expenses	Disbursements or Expenditures: Total Disbursements	Net Cash Flow for the Year[2]	Market Value of Assets	Net Cash Flow as Percent of Market Value
2009	$500,997,353	($1,135,386,385)	($8,728,559)	($1,144,114,944)	($643,117,591)	$11,603,616,627	(5.5%)
2010	524,035,255	(1,197,871,756)	(8,941,776)	(1,206,813,532)	(682,778,277)	12,472,407,278	(5.5%)
2011	555,140,010	(1,249,998,860)	(8,685,322)	(1,258,684,182)	(703,544,172)	12,001,769,795	(5.9%)
2012	571,470,636	(1,306,616,975)	(8,567,960)	(1,315,184,935)	(743,714,299)	12,766,458,781	(5.8%)
2013	623,076,397	(1,370,336,426)	(9,779,692)	(1,380,116,118)	(757,039,721)	13,935,753,759	(5.4%)
2014	671,762,176	(1,418,924,953)	(10,066,516)	(1,428,991,469)	(757,229,293)	13,956,630,097	(5.4%)
2015	722,662,803	(1,486,924,073)	(10,778,521)	(1,497,702,594)	(775,039,791)	13,391,398,092	(5.8%)
2016	765,158,202	(1,549,111,043)	(11,270,928)	(1,560,381,971)	(795,223,769)	13,538,772,410	(5.9%)
2017	822,220,289	(1,618,673,714)	(11,744,733)	(1,630,418,447)	(808,198,158)	15,105,378,385	(5.4%)
2018	915,127,973	(1,678,897,880)	(11,901,923)	(1,690,799,803)	(775,671,830)	13,837,862,906	(5.6%)

[1] Includes member and employer contributions, the direct distribution allocation, as well as any purchased service credits during the year

[2] Equal to Contributions + Total Disbursements

SCHOOL DIVISION
HISTORY OF CASH FLOW: 2009 – 2018

Year Ended December 31	Contributions and Other Additions[1]	Disbursements or Expenditures			Net Cash Flow for the Year[2]	Market Value of Assets	Net Cash Flow as Percent of Market Value
		Benefit Payments and Other Deductions	Administrative Expenses	Total Disbursements			
2009	$799,595,882	($1,646,522,863)	($13,225,957)	($1,659,748,820)	($860,152,938)	$18,292,602,473	(4.7%)
2010	841,932,341	(1,733,560,776)	(17,103,502)	(1,750,664,278)	(908,731,937)	19,851,424,717	(4.6%)
2011	864,653,805	(1,822,348,954)	(16,321,845)	(1,838,670,799)	(974,016,994)	19,247,853,318	(5.1%)
2012	895,773,249	(1,921,463,511)	(16,087,408)	(1,937,550,919)	(1,041,777,670)	20,636,677,134	(5.0%)
2013	955,240,310	(2,020,523,076)	(18,522,707)	(2,039,045,783)	(1,083,805,473)	22,682,339,114	(4.8%)
2014	1,029,538,024	(2,117,766,894)	(19,289,856)	(2,137,056,750)	(1,107,518,726)	22,846,249,402	(4.8%)
2015	1,111,049,048	(2,217,629,742)	(20,865,372)	(2,238,495,114)	(1,127,446,066)	22,062,123,913	(5.1%)
2016	1,181,421,769	(2,318,086,171)	(21,990,705)	(2,340,076,876)	(1,158,655,107)	22,465,387,820	(5.2%)
2017	1,237,200,737	(2,434,471,331)	(23,018,690)	(2,457,490,021)	(1,220,289,284)	25,204,919,910	(4.8%)
2018	1,450,188,672	(2,495,428,206)	(23,560,475)	(2,518,988,681)	(1,068,800,009)	23,304,910,906	(4.6%)

[1] Includes member and employer contributions, the direct distribution allocation, as well as any purchased service credits during the year

[2] Equal to Contributions + Total Disbursements

LOCAL GOVERNMENT DIVISION
HISTORY OF CASH FLOW: 2009 – 2018

Year Ended December 31	Contributions and Other Additions[1]	Disbursements or Expenditures			Net Cash Flow for the Year[2]	Market Value of Assets	Net Cash Flow as Percent of Market Value
		Benefit Payments and Other Deductions	Administrative Expenses	Total Disbursements			
2009	$145,044,551	($173,010,855)	($2,160,285)	($175,171,140)	($30,126,589)	$2,571,160,415	(1.2%)
2010	148,129,421	(194,442,454)	(2,214,507)	(196,656,961)	(48,527,540)	2,878,016,330	(1.7%)
2011	152,028,478	(205,313,953)	(2,156,333)	(207,470,286)	(55,441,808)	2,875,755,598	(1.9%)
2012	155,096,241	(241,367,090)	(2,034,615)	(243,401,705)	(88,305,464)	3,154,896,908	(2.8%)
2013	115,319,671	(255,297,491)	(2,020,798)	(257,318,289)	(141,998,618)	3,493,354,525	(4.1%)
2014	301,832,863	(259,117,301)	(2,090,929)	(261,208,230)	40,624,633	3,733,495,817	1.1%
2015	119,961,560	(267,449,300)	(2,252,600)	(269,701,900)	(149,740,340)	3,639,914,028	(4.1%)
2016	124,622,164	(273,485,113)	(2,394,530)	(275,879,643)	(151,257,479)	3,748,369,298	(4.0%)
2017	132,855,191	(293,053,988)	(2,541,497)	(295,595,485)	(162,740,294)	4,249,852,277	(3.8%)
2018	136,453,253	(306,861,804)	(2,620,564)	(309,482,368)	(173,029,115)	3,935,921,050	(4.4%)

[1] Includes member and employer contributions as well as any purchased service credits during the year

[2] Equal to Contributions + Total Disbursements

JUDICIAL DIVISION
HISTORY OF CASH FLOW: 2009 – 2018

Year Ended December 31	Contributions and Other Additions[1]	Disbursements or Expenditures			Net Cash Flow for the Year[2]	Market Value of Assets	Net Cash Flow as Percent of Market Value
		Benefit Payments and Other Deductions	Administrative Expenses	Total Disbursements			
2009	$10,661,579	($15,209,375)	($21,080)	($15,230,455)	($4,568,876)	$200,269,609	(2.3%)
2010	11,757,740	(15,612,160)	(61,442)	(15,673,602)	(3,915,862)	223,737,885	(1.8%)
2011	10,649,363	(17,472,918)	(61,185)	(17,534,103)	(6,884,740)	220,962,997	(3.1%)
2012	12,203,758	(18,258,046)	(60,842)	(18,318,888)	(6,115,130)	242,877,176	(2.5%)
2013	11,407,028	(19,094,113)	(69,291)	(19,163,404)	(7,756,376)	272,159,709	(2.8%)
2014	11,504,588	(20,003,229)	(71,858)	(20,075,087)	(8,570,499)	278,860,041	(3.1%)
2015	15,003,372	(21,365,942)	(77,178)	(21,443,120)	(6,439,748)	276,563,143	(2.3%)
2016	14,694,746	(23,009,443)	(80,752)	(23,090,195)	(8,395,449)	287,888,462	(2.9%)
2017	15,132,874	(25,451,584)	(85,589)	(25,537,173)	(10,404,299)	328,458,690	(3.2%)
2018	14,399,835	(26,532,248)	(86,385)	(26,618,633)	(12,218,798)	305,303,696	(4.0%)

[1] Includes member and employer contributions, the direct distribution allocation, as well as any purchased service credits during the year

[2] Equal to Contributions + Total Disbursements

DENVER PUBLIC SCHOOLS DIVISION[1]
HISTORY OF CASH FLOW: 2010 – 2018

Year Ended December 31	Contributions and Other Additions[1]	Disbursements or Expenditures: Benefit Payments and Other Deductions	Disbursements or Expenditures: Administrative Expenses	Disbursements or Expenditures: Total Disbursements	Net Cash Flow for the Year[2]	Market Value of Assets	Net Cash Flow as Percent of Market Value
2010	$44,655,698	($219,261,622)	($2,944,370)	($222,205,992)	($177,550,294)	$2,940,091,076	(6.0%)
2011	52,935,400	(228,172,519)	(1,914,095)	(230,086,614)	(177,151,214)	2,818,096,176	(6.3%)
2012	56,330,139	(234,836,300)	(1,919,047)	(236,755,347)	(180,425,208)	2,992,217,469	(6.0%)
2013	68,757,802	(245,141,932)	(2,239,708)	(247,381,640)	(178,623,838)	3,265,768,053	(5.5%)
2014	65,254,237	(256,978,880)	(2,377,366)	(259,356,246)	(194,102,009)	3,254,063,981	(6.0%)
2015	58,876,010	(265,098,162)	(2,599,429)	(267,697,591)	(208,821,581)	3,094,338,946	(6.7%)
2016	71,501,564	(272,199,954)	(2,754,331)	(274,954,285)	(203,452,721)	3,108,232,941	(6.5%)
2017	84,177,678	(281,932,605)	(2,857,244)	(284,789,849)	(200,612,171)	3,452,666,927	(5.8%)
2018	111,853,890	(293,092,149)	(2,919,143)	(296,011,292)	(184,157,402)	3,155,738,171	(5.8%)

[1] Includes member and employer contributions, the direct distribution allocation, as well as any purchased service credits during the year

[2] Equal to Contributions + Total Disbursements

F. Development of Unfunded/(Overfunded) Actuarial Accrued Liability

DEVELOPMENT OF UNFUNDED/(OVERFUNDED) ACTUARIAL ACCRUED LIABILITY

		State Division	School Division	Local Government Division	Judicial Division	Denver Public Schools Division	Total
1.	Unfunded/(overfunded) actuarial accrued liability at January 1, 2018	$10,525,675,196	$16,266,169,194	$1,036,519,103	$118,023,473	$830,756,647	$28,777,143,613
2.	Normal cost at beginning of year	300,417,116	544,219,976	65,432,611	8,373,413	85,127,952	1,003,571,068
3.	Total contributions	(915,127,973)	(1,450,188,672)	(136,453,253)	(14,399,835)	(111,853,890)	(2,628,023,623)
4.	Interest on:						
	a. Unfunded actuarial accrued liability and normal cost	784,891,693	1,218,753,215	79,891,499	9,163,774	66,401,633	2,159,101,814
	b. Total contributions	(33,173,389)	(52,569,340)	(4,946,430)	(521,994)	(4,054,702)	(95,265,855)
	c. Total interest: 4a + 4b	751,718,304	1,166,183,875	74,945,069	8,641,780	62,346,931	2,063,835,959
5.	Expected unfunded/(overfunded) actuarial accrued liability: 1 + 2 + 3 + 4c	10,662,682,643	16,526,384,373	1,040,443,530	120,638,831	866,377,640	29,216,527,017
6.	Changes due to:						
	a. (Gain)/loss	543,443,511	977,573,319	135,328,980	11,147,741	120,886,826	1,788,380,377
	b. Assumptions	0	0	0	0	0	0
	c. Funding method	0	0	0	0	0	0
	d. Plan provisions	0	0	(5,566,395)	0	0	(5,566,395)
	e. Total changes: 6a + 6b + 6c + 6d	543,443,511	977,573,319	129,762,585	11,147,741	120,886,826	1,782,813,982
7.	Unfunded/(overfunded) actuarial accrued liability at end of year: 5 + 6e	$11,206,126,154	$17,503,957,692	$1,170,206,115	$131,786,572	$987,264,466	$30,999,340,999

G. Statutory Employer Contributions

The statutory employer contribution rates for each division are shown in the following table:

	Employer Contribution Rate	
Division Trust Fund	In Effect on December 31, 2018	Effective July 1, 2019
State (Non-Troopers)	10.15%	10.40%
State (Troopers)	12.85%	13.10%
School	10.15%	10.40%
Local Government	10.00%	10.00%
Judicial	13.66%	13.91%
Denver Public Schools	10.15%	10.40%

SB 18-200 increased employer contribution rates by 0.25% effective July 1, 2019 for State, School, Judicial and DPS Division Trust Funds only.

For each division, 1.02% of the statutory rates shown above is allocated to the Health Care Trust Funds for each active member. In addition, 1.00% of the statutory rates shown above is allocated to the Annual Increase Reserve on behalf of the active members who began membership on or after January 1, 2007. In addition to the statutory rates shown above, AED contributions and SAED contributions are to be made by all employers. Those amounts are continued in each division until the Division's actuarial funded ratio exceeds 103%. At that time, the amount of the AED and SAED will each be reduced by 0.5% of payroll. The 2019 AED and SAED contribution rates by division are shown in the following tables:

Division Trust Fund	2019 AED Rate	2019 SAED Rate
State	5.00%	5.00%
School	4.50%	5.50%
Local Government	2.20%	1.50%
Judicial	3.40%	3.40%
Denver Public Schools	4.50%	5.50%

The AED and SAED contributions will increase for the Judicial Division according to the following schedule:

Judicial Division		
Year	AED	SAED
2019	3.40%	3.40%
2020	3.80%	3.80%
2021	4.20%	4.20%
2022	4.60%	4.60%
2023 and later	5.00%	5.00%

For the DPS Division Trust Fund, the statutory rates (including AED and SAED contributions) are being offset annually by an amount equivalent to that which Denver Public Schools pays to finance principal and interest payments on Pension Certificates of Participation (PCOPs) issued in 1997 and 2008 and refinanced during 2011, 2012, and 2013.

SB 18-200 initiated an annual Direct Distribution from the State treasury of $225 million, effective July 1, 2018, for the State, School, Judicial and DPS Division Trust Funds until each division receiving such distribution is 100% funded. Amounts to each division are allocated based on the reported payroll as of December 31, of the prior year. In addition to the employer and member statutory contribution rates, these amounts are considered in the number of years to amortize the UAAL.

SB 18-200 also initiated an Automatic Adjustment Provision, which is intended to keep PERA on track to achieve full funding in 30 years (i.e., by December 31, 2047). If PERA is ahead or behind the 30-year schedule to reach full funding, the following four components can adjust automatically:

- Member contribution rates
- Employer contribution rates
- Maximum AI rate, referred to as the “AI cap” and used to determine amounts paid to benefit recipients
- Direct distribution from the State

The following chart describes how the AAP operates, dependent on the resulting ratio of actual contribution dollars received versus expected dollars based on the actuarially determined contribution:

Automatic Adjustment Provision		
Component	**AAP Ratio < 98%**	**AAP Ratio > 120%**
AI cap	Decrease by up to 0.25% in one year, not to fall below 0.5%	Increase by up to 0.25% in one year, not to exceed 2%
Employer contributions	Increase by up to 0.5% in one year, not to exceed an additional 2%	Decrease by up to 0.5% in one year, not to fall below 2018 levels[1]
Member contributions	Increase by up to 0.5% in one year, not to exceed an additional 2%	Decrease by up to 0.5% in one year, not to fall below 2018 levels[1]
Direct distribution from the State	Increase by up to $20 million in one year, not to exceed $225 million	Decrease by up to $20 million in one year

[1] Cannot fall below the contribution rates in effect immediately prior to the passage of SB 18-200.

The AAP Ratio, which is outlined in *Section 2, I,* is the ratio of the Blended Total Contribution Rate to the Blended Total Required Contribution.

H. Actuarially Determined Contribution

For each Plan, the amount of the actuarially determined contribution is comprised of an employer normal cost payment and a payment on the unfunded/(overfunded) actuarial accrued liability. This total amount is divided by the projected payroll for active members to determine the actuarially determined contribution.

PERA's pension funding policy is included in *Section 4, Exhibit III*. The methodology used to calculate the actuarially determined contributions for the pension plans is based on closed (layered) amortization periods of 30 years. The length of the amortization periods are as follows:

- The December 31, 2014 legacy UAAL was being amortized over a closed 30-year period. Effective November 16, 2018, the pension funding policy was revised to better align the 30-year period to achieve 100% funding as targeted through the enactment of SB 18-200. Therefore, the legacy UAAL as of December 31, 2017, is being amortized over a closed 30-year period (29 years remaining as of December 31, 2018).
- Contribution deficiencies/surpluses are amortized over the remaining period of the legacy UAAL.
- Experience gains and losses are amortized over 30 years from the date of the valuation.
- Assumption changes are amortized over 30 years from the date of the valuation.
- Other changes in the UAAL are amortized over 30 years from the date of the valuation.
- Benefit changes are amortized over a period determined by the Board to represent the anticipated duration of the payment of the change, not to exceed 25 years.

The contribution requirements as of December 31, 2018 are based on the data previously described, the actuarial assumptions and Plan provisions described in *Section 4*, including all changes affecting future costs adopted at the time of the actuarial valuation, actuarial gains and losses, and changes in the actuarial assumptions.

Contribution rates for the year ending December 31, 2020, are derived from the results of the December 31, 2018, annual actuarial valuation.

SCHEDULE OF COMPUTED EMPLOYER CONTRIBUTION RATES FOR THE 2020 PLAN YEAR BASED UPON THE RESULTS OF THE DECEMBER 31, 2018 ACTUARIAL FUNDING VALUATION

Item	State Division	School Division	Local Government Division	Judicial Division	Denver Public Schools Division
Normal cost rates					
Service retirement benefits	6.96%	8.04%	6.53%	14.39%	8.20%
Disability retirement benefits	0.36%	0.23%	0.27%	0.60%	0.30%
Survivor benefits	0.17%	0.15%	0.17%	0.49%	0.15%
Termination withdrawals	2.93%	3.10%	2.87%	1.11%	2.78%
Refunds	1.29%	1.03%	1.29%	0.09%	0.44%
Administrative expense load	0.40%	0.40%	0.40%	0.40%	0.40%
Total normal cost	12.11%	12.95%	11.53%	17.08%	12.27%
Member contributions	(9.18%)	(9.13%)	(8.00%)	(9.13%)	(9.13%)
Employer normal cost	**2.93%**	**3.82%**	**3.53%**	**7.96%**	**3.14%**
Percentage available to amortize unfunded actuarial accrued liabilities	15.96%	15.06%	8.55%	12.12%	2.75%
Effective amortization period	35 years	37 years	37 years	23 years	Infinite
Total employer contribution rate for actuarially funded benefits	10.48%	10.40%	10.00%	13.91%	10.40%
Amortization Equalization Disbursement	5.00%	4.50%	2.20%	3.80%	4.50%
Supplemental Amortization Equalization Disbursement	5.00%	5.50%	1.50%	3.80%	5.50%
Less Health Care Trust Fund	(1.02%)	(1.02%)	(1.02%)	(1.02%)	(1.02%)
Less Annual Increase Reserve	(0.57%)	(0.50%)	(0.60%)	(0.41%)	(0.66%)
Less PCOP credit	N/A	N/A	N/A	N/A	(12.83%)
Employer contribution rate for defined benefit plan	**18.89%**	**18.88%**	**12.08%**	**20.08%**	**5.89%**

The underlying calculations involve more precision than what is presented and the rounded numbers shown may not add as a result.

STATE DIVISION
ACTUARIALLY DETERMINED CONTRIBUTION

		12/31/2018 Valuation Date Contribution for the 2020 Plan Year		12/31/2017 Valuation Date Contribution for the 2019 Plan Year	
		Amount	% of Payroll[1]	Amount	% of Payroll[1]
1.	Total normal cost	$355,232,425	11.71%	$299,507,549	10.32%
2.	Administrative expenses	12,134,937	0.40%	11,609,150	0.40%
3.	Expected member contributions	(278,561,059)	(9.18%)	(244,662,841)	(8.43%)
4.	Employer normal cost: 1 + 2 + 3	$88,806,303	2.93%	$66,453,858	2.29%
5.	Actuarial accrued liability	$25,509,851,980		$24,782,085,138	
6.	Actuarial value of assets	14,303,725,826		14,256,409,942	
7.	Unfunded/(overfunded) actuarial accrued liability: 5 - 6	$11,206,126,154		$10,525,675,196	
8.	Payment on unfunded actuarial accrued liability	629,900,871	20.76%	609,144,159	20.99%
9.	Actuarially determined contribution: 4 + 8	$718,707,014	23.69%	$675,598,017	23.28%
10.	Projected payroll	$3,033,734,207		$2,902,287,558	

[1] The underlying calculations involve more precision than what is presented and the rounded numbers shown may not add as a result.

STATE DIVISION
UNFUNDED ACTUARIAL ACCRUED LIABILITY AMORTIZATION SCHEDULE

Description	Original Balance	Outstanding Balance as of 12/31/2017	1/1/2018 Amortization Payment	Outstanding Balance as of 12/31/2018	1/1/2019 Amortization Payment	Amortization Period as of 12/31/2018[1]
December 31, 2014 legacy UAAL	$9,884,833,576	$10,413,311,168	$610,665,847			N/A
December 31, 2015 contribution deficiency	116,762,177	120,373,100	7,059,017			N/A
December 31, 2015 UAAL base	7,581	7,893	449			N/A
December 31, 2016 contribution deficiency	94,394,299	95,626,729	5,607,820			N/A
December 31, 2016 UAAL base	1,151,254,867	1,168,930,983	65,750,744			N/A
December 31, 2017 contribution deficiency	77,802,090	77,802,090	4,562,533			N/A
December 31, 2017 plan change	(1,592,698,649)	(1,592,698,649)	(97,873,630)			N/A
December 31, 2017 UAAL base	242,321,942	242,321,942	13,371,545			N/A
December 31, 2017 legacy UAAL (revised funding policy effective December 31, 2018)	10,525,675,196	N/A	N/A	$10,687,284,102	$580,470,974	29 years
December 31, 2018 contribution deficiency		N/A	N/A	117,830,228	6,399,851	29 years
December 31, 2018 UAAL base		N/A	N/A	401,011,824	21,367,188	30 years
Total		**$10,525,675,196**	**$609,144,325**	**$11,206,126,154**	**$608,238,013**	
Total with interest to middle of the year			N/A		**$629,900,871**	
Projected payroll			**$2,902,287,558**		**$3,033,734,207**	
Total as a percentage of projected payroll			**20.99%**		**20.76%**	
Equivalent single amortization period						27 years

[1] State Division reflects an adjustment for the impact of AED and SAED contributions received from employers on the estimated pensionable payroll of employees electing to participate in the defined contribution plan

SCHOOL DIVISION
ACTUARIALLY DETERMINED CONTRIBUTION

		12/31/2018 Valuation Date Contribution for the 2020 Plan Year		12/31/2017 Valuation Date Contribution for the 2019 Plan Year	
		Amount	% of Payroll[1]	Amount	% of Payroll[1]
1.	Total normal cost	$631,512,377	12.55%	$544,813,489	11.60%
2.	Administrative expenses	20,131,278	0.40%	18,789,303	0.40%
3.	Expected member contributions	(459,244,786)	(9.13%)	(393,401,025)	(8.38%)
4.	Employer normal cost: 1 + 2 - 3	$192,398,869	3.82%	$170,201,767	3.62%
5.	Actuarial accrued liability	$41,598,399,420		$40,046,214,502	
6.	Actuarial value of assets	24,094,441,728		23,780,045,308	
7.	Unfunded/(overfunded) actuarial accrued liability: 5 - 6	$17,503,957,692		$16,266,169,194	
8.	Payment on unfunded actuarial accrued liability	983,797,213	19.55%	938,045,912	19.97%
9.	Actuarially determined contribution: 4 + 8	$1,176,196,082	23.37%	$1,108,247,679	23.59%
10.	Projected payroll	$5,032,819,574		$4,697,325,673	

[1] The underlying calculations involve more precision than what is presented and the rounded numbers shown may not add as a result.

SCHOOL DIVISION
UNFUNDED ACTUARIAL ACCRUED LIABILITY AMORTIZATION SCHEDULE

Description	Original Balance	Outstanding Balance as of 12/31/2017	1/1/2018 Amortization Payment	Outstanding Balance as of 12/31/2018	1/1/2019 Amortization Payment	Amortization Period as of 12/31/2018
December 31, 2014 legacy UAAL	$14,243,175,754	14,959,067,068	$877,241,755			N/A
December 31, 2015 contribution deficiency	187,761,223	193,567,822	11,351,361			N/A
December 31, 2015 UAAL base	107,402,233	110,975,704	6,369,948			N/A
December 31, 2016 contribution deficiency	172,767,248	175,022,930	10,263,837			N/A
December 31, 2016 UAAL base	2,850,091,683	2,893,851,369	162,775,121			N/A
December 31, 2017 contribution deficiency	164,974,093	164,974,093	9,674,545			N/A
December 31, 2017 plan change	(2,632,264,634)	(2,632,264,634)	(161,756,460)			N/A
December 31, 2017 UAAL base	400,974,842	400,974,842	22,126,156			N/A
December 31, 2017 legacy UAAL (revised funding policy effective December 31, 2018)	16,266,169,194	N/A	N/A	$16,515,916,407	$897,048,304	29 years
December 31, 2018 contribution deficiency		N/A	N/A	261,157,378	14,184,546	29 years
December 31, 2018 UAAL base		N/A	N/A	726,883,907	38,730,691	30 years
Total		**$16,266,169,194**	**$938,046,263**	**$17,503,957,692**	**$949,963,541**	
Total with interest to middle of the year			N/A		**$983,797,213**	
Projected payroll			**$4,697,325,673**		**$5,032,819,574**	
Total as a percentage of projected payroll			**19.97%**		**19.55%**	
Equivalent single amortization period						28 years

LOCAL GOVERNMENT DIVISION
ACTUARIALLY DETERMINED CONTRIBUTION

		12/31/2018 Valuation Date Contribution for the 2020 Plan Year		12/31/2017 Valuation Date Contribution for the 2019 Plan Year	
		Amount	% of Payroll[1]	Amount	% of Payroll[1]
1.	Total normal cost	$77,148,166	11.13%	$65,111,755	9.82%
2.	Administrative expenses	2,771,626	0.40%	2,651,288	0.40%
3.	Expected member contributions	(55,432,527)	(8.00%)[2]	(53,025,756)	(8.00%)[2]
4.	Employer normal cost: 1 + 2 - 3	$24,487,265	3.53%	$14,737,287	2.22%
5.	Actuarial accrued liability	$5,240,885,213		$5,045,932,015	
6.	Actuarial value of assets	4,070,679,098		4,009,412,912	
7.	Unfunded/(overfunded) actuarial accrued liability: 5 - 6	$1,170,206,115		$1,036,519,103	
8.	Payment on unfunded actuarial accrued liability	65,680,857	9.48%	59,075,069	8.91%
9.	Actuarially determined contribution: 4 + 8	$90,168,122	13.01%	$73,812,356	11.13%
10.	Projected payroll	$692,906,583		$662,821,946	

[1] The underlying calculations involve more precision than what is presented and the rounded numbers shown may not add as a result.
[2] Reflects HB 19-1217

LOCAL GOVERNMENT DIVISION
UNFUNDED ACTUARIAL ACCRUED LIABILITY AMORTIZATION SCHEDULE

Description	Original Balance	Outstanding Balance as of 12/31/2017	1/1/2018 Amortization Payment	Outstanding Balance as of 12/31/2018	1/1/2019 Amortization Payment	Amortization Period as of 12/31/2018
December 31, 2014 legacy UAAL	$981,567,288	$1,030,902,878	$60,455,043			N/A
December 31, 2015 contribution deficiency	8,412,023	8,672,168	508,561			N/A
December 31, 2015 UAAL base	(4,853,027)	(5,014,496)	(287,829)			N/A
December 31, 2016 contribution deficiency	924,188	936,254	54,905			N/A
December 31, 2016 UAAL base	311,697,681	316,483,419	17,801,753			N/A
December 31, 2017 contribution deficiency	795,293	795,293	46,638			N/A
December 31, 2017 plan change	(325,771,932)	(325,771,932)	(20,019,155)			N/A
December 31, 2017 disaffiliation change	(110,000)	(110,000)	(13,301)			N/A
December 31, 2017 UAAL base	9,625,519	9,625,519	531,145			N/A
December 31, 2017 legacy UAAL (revised funding policy effective December 31, 2018)	1,036,519,103	N/A	N/A	$1,052,433,591	$57,162,058	29 years
December 31, 2018 contribution deficiency		N/A	N/A	17,830,660	968,458	29 years
December 31, 2018 plan change		N/A	N/A	(5,566,395)	(330,299)	25 years
December 31, 2018 UAAL base		N/A	N/A	105,508,259	5,621,816	30 years
Total		**$1,036,519,103**	**$59,077,760**	**$1,170,206,115**	**$63,422,033**	
Total with interest to middle of the year			N/A		**$65,680,857**	
Projected payroll			**$662,821,946**		**$692,906,583**	
Total as a percentage of projected payroll			**8.91%**		**9.48%**	
Equivalent single amortization period						29 years

JUDICIAL DIVISION
ACTUARIALLY DETERMINED CONTRIBUTION

		12/31/2018 Valuation Date Contribution for the 2020 Plan Year		12/31/2017 Valuation Date Contribution for the 2019 Plan Year	
		Amount	% of Payroll[1]	Amount	% of Payroll[1]
1.	Total normal cost	$8,765,697	16.68%	$8,467,950	16.63%
2.	Administrative expenses	210,161	0.40%	203,688	0.40%
3.	Expected member contributions	(4,794,289)	(9.13%)	(4,264,727)	(8.38%)
4.	Employer normal cost: 1 + 2 - 3	$4,181,569	7.96%	$4,406,911	8.65%
5.	Actuarial accrued liability	$447,756,933		$428,108,199	
6.	Actuarial value of assets	315,970,361		310,084,726	
7.	Unfunded/(overfunded) actuarial accrued liability: 5 - 6	$131,786,572		$118,023,473	
8.	Payment on unfunded actuarial accrued liability	7,404,773	14.09%	6,747,396	13.25%
9.	Actuarially determined contribution: 4 + 8	$11,586,342	22.05%	$11,154,307	21.90%
10.	Projected payroll	$52,540,155		$50,922,117	

[1] The underlying calculations involve more precision than what is presented and the rounded numbers shown may not add as a result.

JUDICIAL DIVISION
UNFUNDED ACTUARIAL ACCRUED LIABILITY AMORTIZATION SCHEDULE

Description	Original Balance	Outstanding Balance as of 12/31/2017	1/1/2018 Amortization Payment	Outstanding Balance as of 12/31/2018	1/1/2019 Amortization Payment	Amortization Period as of 12/31/2018
December 31, 2014 legacy UAAL	$100,387,095	$105,432,756	$6,182,874			N/A
December 31, 2015 contribution deficiency	2,562,162	2,641,398	154,899			N/A
December 31, 2015 UAAL base	10,242,579	10,583,368	607,480			N/A
December 31, 2016 contribution deficiency	2,963,099	3,001,786	176,033			N/A
December 31, 2016 UAAL base	29,149,854	29,597,415	1,664,813			N/A
December 31, 2017 contribution deficiency	3,219,310	3,219,310	188,789			N/A
December 31, 2017 plan change	(34,446,758)	(34,446,758)	(2,116,803)			N/A
December 31, 2017 UAAL base	(2,005,802)	(2,005,802)	(110,682)			N/A
December 31, 2017 legacy UAAL (revised funding policy effective December 31, 2018)	118,023,473	N/A	N/A	$119,835,579	$6,508,770	29 years
December 31, 2018 contribution deficiency		N/A	N/A	4,422,408	240,199	29 years
December 31, 2018 UAAL base		N/A	N/A	7,528,585	401,147	30 years
Total		**$118,023,473**	**$6,747,403**	**$131,786,572**	**$7,150,116**	
Total with interest to middle of the year			N/A		**$7,404,773**	
Projected payroll			**$50,922,117**		**$52,540,155**	
Total as a percentage of projected payroll			**13.25%**		**14.10%**	
Equivalent single amortization period						29 years

DENVER PUBLIC SCHOOLS DIVISION
ACTUARIALLY DETERMINED CONTRIBUTION

		12/31/2018 Valuation Date Contribution for the 2020 Plan Year		12/31/2017 Valuation Date Contribution for the 2019 Plan Year	
		Amount	% of Payroll[1]	Amount	% of Payroll[1]
1.	Total normal cost	$90,449,692	11.87%	$85,381,681	12.29%
2.	Administrative expenses	3,048,145	0.40%	2,778,168	0.40%
3.	Expected member contributions	(69,535,800)	(9.13%)	(58,167,896)	(8.38%)
4.	Employer normal cost: 1 + 2 - 3	$23,962,037	3.14%	$29,991,953	4.31%
5.	Actuarial accrued liability	$4,248,602,214		$4,088,526,454	
6.	Actuarial value of assets	3,261,337,748		3,257,769,807	
7.	Unfunded/(overfunded) actuarial accrued liability: 5 - 6	$987,264,466		$830,756,647	
8.	Payment on unfunded actuarial accrued liability	55,430,854	7.27%	47,466,988	6.83%
9.	Actuarially determined contribution: 4 + 8	$79,392,891	10.42%	$77,458,941	11.14%
10.	Projected payroll	$762,036,167		$694,542,047	

[1] The underlying calculations involve more precision than what is presented and the rounded numbers shown may not add as a result.

DENVER PUBLIC SCHOOLS DIVISION
UNFUNDED ACTUARIAL ACCRUED LIABILITY AMORTIZATION SCHEDULE

Description	Original Balance	Outstanding Balance as of 12/31/2017	1/1/2018 Amortization Payment	Outstanding Balance as of 12/31/2018	1/1/2019 Amortization Payment	Amortization Period as of 12/31/2018
December 31, 2014 legacy UAAL	$664,636,814	$698,042,827	$40,935,194			N/A
December 31, 2015 contribution deficiency	65,469,649	67,494,328	3,958,057			N/A
December 31, 2015 UAAL base	(44,659,260)	(46,145,157)	(2,648,708)			N/A
December 31, 2016 contribution deficiency	54,386,179	55,096,256	3,230,999			N/A
December 31, 2016 UAAL base	260,935,158	264,941,500	14,902,591			N/A
December 31, 2017 contribution deficiency	44,040,228	44,040,228	2,582,643			N/A
December 31, 2017 plan change	(246,987,335)	(246,987,335)	(15,177,728)			N/A
December 31, 2017 UAAL base	(5,726,000)	(5,726,000)	(315,966)			N/A
December 31, 2017 legacy UAAL (revised funding policy effective December 31, 2018)	830,756,647	N/A	N/A	$843,511,903	$45,814,650	29 years
December 31, 2018 contribution deficiency		N/A	N/A	48,781,251	2,649,513	29 years
December 31, 2018 UAAL base		N/A	N/A	94,971,312	5,060,374	30 years
Total		**$830,756,647**	**$47,467,082**	**$987,264,466**	**$53,524,537**	
Total with interest to middle of the year			N/A		**$55,430,854**	
Projected payroll			**$694,542,047**		**$762,036,167**	
Total as a percentage of projected payroll			**6.83%**		**7.27%**	
Equivalent single amortization period						29 years

Reconciliation of Actuarially Determined Contribution

The charts below details the changes in the actuarially determined contributions from the prior valuation to the current year's valuation.

RECONCILIATION OF ACTUARIALLY DETERMINED CONTRIBUTION

Item	State Division[1]	School Division[1]	Local Government Division[1]	Judicial Division[1]	Denver Public Schools Division[1]
1. Prior valuation	23.28%	23.59%	10.75%	21.90%	11.14%
2. Increases/(decreases) due to:					
• Effect of change in amortization period	(0.93%)	(0.80%)	(0.27%)	(0.45%)	(0.21%)
• Effect of change in payroll and normal cost	1.13%	0.22%	1.33%	0.07%	(0.84%)
• Effect of contributions (more)/less than actuarially determined contribution	0.21%	0.29%	0.14%	0.11%	0.35%
• Effect of gains and losses on accrued liability and administrative expenses	0.42%	0.49%	0.46%	0.76%	0.43%
• Effect of investment (gain)/loss	0.33%	0.33%	0.40%	0.41%	0.30%
• Effect of plan changes	(0.75%)[2]	(0.75%)[2]	0.20%[3]	(0.75%)[2]	(0.75%)[2]
• Effect of change in actuarial assumptions and methods	0.00%	0.00%	0.00%	0.00%	0.00%
• Net effect of other changes	0.00%	0.00%	0.00%	0.00%	0.00%
Total change	0.41%	(0.22%)	2.26%	0.15%	(0.72%)
3. Current valuation: 1 + 2	23.69%	23.37%	13.01%	22.05%	10.42%
4. Statutory employer contribution rate	18.89%	18.88%	12.08%	20.08%	5.89%
5. Margin available [contribution sufficiency/(deficiency)]: 4 - 3	(4.80%)	(4.49%)	(0.93%)	(1.97%)	(4.53%)

[1] The underlying calculations involve more precision than what is presented and the rounded numbers shown may not add as a result.

[2] Reflects change in member contribution rates pursuant to SB18-200.

[3] Reflects change in member contribution rates pursuant to HB19-1217.

I. Automatic Adjustment Provisions (AAP)

The automatic adjustment provision initiates automatic changes to member and employer contribution rates, the annual increase cap, and the direct distribution from the State under certain circumstances. Automatic changes are triggered when the ratio of the Blended Total Contribution Rate[1] to the Blended Total Required Contribution is less than 98% or greater than 120%. The table below calculates the Blended Total Contribution Rate and the Blended Total Required Contribution for the 2020 plan year.

BLENDED TOTAL CONTRIBUTION RATE AND BLENDED TOTAL REQUIRED CONTRIBUTION FOR THE 2020 PLAN YEAR

	Item	State Division	School Division	Local Government Division	Judicial Division	Denver Public Schools Division	Total Weighted Average
1.	Unfunded actuarial accrued liability as of December 31, 2018	$11,206,126,154	$17,503,957,692	$1,170,206,115	$131,786,572	$987,264,466	$30,999,340,999
2.	Member contribution rate	9.18%	9.13%	8.00%	9.13%	9.13%	9.10%
3.	Employer contribution rate[2]	18.89%	18.88%	12.08%	20.08%	5.89%	18.22%
4.	Actuarially determined employer contribution rate	23.69%	23.37%	13.01%	22.05%	10.42%	22.68%
5.	Direct distribution rate						2.27%
6.	Blended total contribution rate: 2 + 3 + 5						29.59%
7.	Blended total required contribution: 2 + 4						31.78%
8.	Ratio of blended total contribution rate to blended total required contribution: 6 ÷ 7						93.11%

[1] "Blended Total Contribution Rate" is used synonymously with the term "Blended Total Contribution Amount", which is defined in C.R.S. 24-51-413(1)(a).

[2] Statutory base contribution rates plus AED and SAED contributions less 1.02% HCTF contributions, PCOP credit for DPS Division, and 1% AIR contributions for post-2006 members.

AUTOMATIC ADJUSTMENT PROVISIONS EFFECTIVE JULY 1, 2020
- BEFORE AUTOMATIC ADJUSTMENT PROVISION

	Item	State Division – Non-Trooper	State Division – Trooper	School Division	Local Government Division	Judicial Division	Denver Public Schools Division
1.	Member contribution rate	9.50%	11.50%	9.50%	8.00%	9.50%	9.50%
2.	Employer contribution rate[1]	10.40%	13.10%	10.40%	10.00%	13.91%	10.40%
3.	Annual increase cap	1.50%	1.50%	1.50%	1.50%	1.50%	1.50%
4.	Direct distribution amount	$225,000,000 spread across all divisions except for Local Government Division					

AUTOMATIC ADJUSTMENT PROVISIONS EFFECTIVE JULY 1, 2020
- AFTER AUTOMATIC ADJUSTMENT PROVISION[2]

	Item	State Division – Non-Trooper	State Division – Trooper	School Division	Local Government Division	Judicial Division	Denver Public Schools Division
1.	Member contribution rate	10.00%	12.00%	10.00%	8.50%	10.00%	10.00%
2.	Employer contribution rate[1]	10.90%	13.60%	10.90%	10.50%	14.41%	10.90%
3.	Annual increase cap	1.25%	1.25%	1.25%	1.25%	1.25%	1.25%
4.	Direct distribution amount	$225,000,000 spread across all divisions except for Local Government Division					

[1] Statutory base contribution rates

[2] After reflecting the automatic adjustment provisions, the estimated ratio of blended total contribution rate to blended total required contribution is 97.8%

J. History of Employer Contributions

Critical information to assess the funding progress is the historical comparison of the actuarially determined contribution (annual required contribution prior to 2014) to the actual contributions. A history of the most recent years of contributions is shown below.

STATE DIVISION
HISTORY OF EMPLOYER CONTRIBUTIONS: 2009 – 2018

Plan Year Ended December 31	Actuarially Determined Employer Contribution (ADC)		Actual Employer Contribution		Percent Contributed
	Amount	Percentage of Payroll	Amount[1]	Percentage of Payroll	
2009	$426,998,909	17.91%	$293,234,081	12.30%	68.7%
2010	452,820,768	18.93%[2]	282,640,229	11.82%	62.4%
2011	326,273,768	13.63%[2]	277,122,403	11.58%	84.9%
2012	393,991,090	16.52%[2]	328,055,004	13.76%	83.3%
2013	495,240,593	20.01%	393,217,865	15.89%	79.4%
2014	524,474,957	20.45%	434,388,378	16.94%	82.8%
2015	590,457,196	22.35%	472,605,238	17.89%	80.0%
2016	604,746,141	22.31%	508,966,375	18.78%	84.2%
2017	630,022,456	22.71%	549,621,778	19.81%	87.2%
2018	762,391,572	26.30%	645,732,724	22.28%	84.7%

[1] Beginning in 2018, the actual employer contribution amount includes a direct distribution from the State treasury

[2] The State Division 2010, 2011, and 2012 Actuarially Determined Contributions have been adjusted to reflect the contribution rate swap of 2.5% of payroll for the period July 1, 2010 through June 30, 2012, decreasing the employer contribution rate

SCHOOL DIVISION
HISTORY OF EMPLOYER CONTRIBUTIONS: 2009 – 2018

Plan Year Ended December 31	Actuarially Determined Employer Contribution (ADC)		Actual Employer Contribution		Percent Contributed
	Amount	Percentage of Payroll	Amount[1]	Percentage of Payroll	
2009	$649,512,218	16.56%	$474,872,411	12.11%	73.1%
2010	731,374,046	18.75%	512,390,515	13.14%	70.1%
2011	601,138,216	15.73%	534,230,314	13.98%	88.9%
2012	672,155,545	17.60%	564,444,062	14.78%	84.0%
2013	779,458,799	19.79%	613,738,447	15.58%	78.7%
2014	798,425,826	19.65%	673,043,013	16.56%	84.3%
2015	929,222,688	21.94%	738,533,745	17.44%	79.5%
2016	972,507,903	22.36%	794,872,295	18.28%	81.7%
2017	1,007,843,833	22.54%	837,837,286	18.74%	83.1%
2018	1,283,586,925	26.80%	1,027,918,101	21.46%	80.1%

[1] Beginning in 2018, the actual employer contribution amount includes a direct distribution from the State treasury

LOCAL GOVERNMENT DIVISION
HISTORY OF EMPLOYER CONTRIBUTIONS: 2009 – 2018

Plan Year Ended December 31	Actuarially Determined Employer Contribution (ADC)		Actual Employer Contribution		Percent Contributed
	Amount	Percentage of Payroll	Amount	Percentage of Payroll	
2009	$78,547,810	11.14%	$82,986,434	11.77%	105.7%
2010	86,818,162	12.31%	87,731,399	12.44%	101.1%
2011	64,491,578	8.98%	89,536,217	12.47%	138.8%
2012	51,267,141	9.79%	83,815,949	16.01%	163.5%
2013	56,180,165	10.62%	65,329,207	12.35%	116.3%
2014	63,667,135	11.78%	252,545,073	46.73%	396.7%
2015	76,478,780	13.62%	67,893,740	12.09%	88.8%
2016	72,865,069	11.98%	72,162,542	11.86%	99.0%
2017	75,425,986	11.92%	75,963,608	12.00%	100.7%
2018	94,324,433	14.27%	77,578,359	11.74%	82.2%

JUDICIAL DIVISION
HISTORY OF EMPLOYER CONTRIBUTIONS: 2009 – 2018

Plan Year Ended December 31	Actuarially Determined Employer Contribution (ADC)		Actual Employer Contribution		Percent Contributed
	Amount	Percentage of Payroll	Amount[1]	Percentage of Payroll	
2009	$6,419,118	17.08%	$5,749,439	15.30%	89.6%
2010	6,969,881	18.63%[2]	5,604,746	14.98%	80.4%
2011	6,362,439	16.30%[2]	5,356,113	13.72%	84.2%
2012	7,137,427	18.28%[2]	5,839,873	14.96%	81.8%
2013	8,599,454	21.53%	6,493,766	16.26%	75.5%
2014	8,625,480	20.07%	6,954,101	16.18%	80.6%
2015	10,053,557	21.45%	7,561,652	16.13%	75.2%
2016	10,747,986	22.07%	7,859,965	16.14%	73.1%
2017	11,032,791	22.54%	7,888,651	16.12%	71.5%
2018	13,767,896	27.26%	9,477,029	18.76%	68.8%

[1] Beginning in 2018, the actual employer contribution amount includes a direct distribution from the State treasury

[2] The Judicial Division 2010, 2011, and 2012 Actuarially Determined Contributions have been adjusted to reflect the contribution rate swap of 2.5% of payroll for the period July 1, 2010 through June 30, 2012, decreasing the employer contribution rate

DENVER PUBLIC SCHOOLS[1] DIVISION
HISTORY OF EMPLOYER CONTRIBUTIONS: 2010 – 2018

Plan Year Ended December 31[1]	Actuarially Determined Employer Contribution (ADC)		Actual Employer Contribution		Percent Contributed
	Amount	Percentage of Payroll	Amount[2]	Percentage of Payroll	
2010	$68,780,044	14.61%	$5,732,740	1.22%	8.3%
2011	58,260,081	11.85%	11,721,571	2.38%	20.1%
2012	49,043,747	9.60%	13,144,731	2.57%	26.8%
2013	63,145,188	11.53%	23,103,723	4.22%	36.6%
2014	56,503,673	9.67%	15,845,059	2.71%	28.0%
2015	68,695,272	11.06%	5,307,691	0.85%	7.7%
2016	67,171,731	10.46%	13,385,624	2.08%	19.9%
2017	67,662,786	10.28%	23,478,032	3.57%	34.7%
2018	97,475,410	13.50%	49,991,984	6.92%	51.3%

[1] DPS Division began January 1, 2010

[2] Beginning in 2018, the actual employer contribution amount includes a direct distribution from the State treasury

K. Additional Information

The other critical piece of information regarding PERA's financial status is the funded ratio. This ratio compares the actuarial value of assets to the actuarial accrued liabilities of each Division Trust Fund. High ratios indicate a well-funded plan with assets sufficient to cover the plan's actuarial accrued liabilities. Lower ratios may indicate recent changes to benefit structures, funding of the plan below actuarial requirements, poor asset performance, or a variety of other factors. The charts that follow show the funded ratio calculated using the actuarial value of assets.

STATE DIVISION
SCHEDULE OF FUNDING PROGRESS

As of December 31	Actuarial Value of Assets (AVA)	Actuarial Accrued Liability (AAL)	Unfunded Actuarial Accrued Liability (UAAL)	Funded Ratio	Annual Covered Payroll	UAAL as a % of Covered Payroll
2009	$13,382,736,472	$19,977,217,169	$6,594,480,697	67.0%	$2,384,136,844	276.6%
2010	12,791,946,348	20,356,176,064	7,564,229,716	62.8%	2,392,080,128	316.2%
2011	12,010,044,704	20,826,543,471	8,816,498,767	57.7%	2,393,791,402	368.3%
2012	12,538,675,449	21,191,495,125	8,652,819,676	59.2%	2,384,933,961	362.8%
2013	13,129,459,956	22,843,725,166	9,714,265,210	57.5%	2,474,965,482	392.5%
2014	13,523,487,577	23,408,321,153	9,884,833,576	57.8%	2,564,669,718	385.4%
2015	13,882,819,694	24,085,671,123	10,202,851,429	57.6%	2,641,866,650	386.2%
2016	14,026,331,996	25,669,915,820	11,643,583,824	54.6%	2,710,650,565	429.5%
2017	14,256,409,942	24,782,085,138	10,525,675,196	57.5%	2,774,207,203	379.4%
2018	14,303,725,826	25,509,851,980	11,206,126,154	56.1%	2,898,827,271	386.6%

SCHOOL DIVISION
SCHEDULE OF FUNDING PROGRESS

As of December 31	Actuarial Value of Assets (AVA)	Actuarial Accrued Liability (AAL)	Unfunded Actuarial Accrued Liability (UAAL)	Funded Ratio	Annual Covered Payroll	UAAL as a % of Covered Payroll
2009	$21,054,909,740	$30,412,815,401	$9,357,905,661	69.2%	$3,922,175,230	238.6%
2010	20,321,736,466	31,339,754,491	11,018,018,025	64.8%	3,900,661,576	282.5%
2011	19,266,110,172	31,986,199,035	12,720,088,863	60.2%	3,821,603,410	332.8%
2012	20,266,573,925	32,619,033,148	12,352,459,223	62.1%	3,819,065,598	323.4%
2013	21,369,379,750	35,437,311,570	14,067,931,820	60.3%	3,938,649,818	357.2%
2014	22,143,356,419	36,386,532,173	14,243,175,754	60.9%	4,063,235,757	350.5%
2015	22,871,661,446	37,677,153,575	14,805,492,129	60.7%	4,235,290,282	349.6%
2016	23,263,343,921	41,352,968,451	18,089,624,530	56.3%	4,349,319,783	415.9%
2017	23,780,045,308	40,046,214,502	16,266,169,194	59.4%	4,471,356,847	363.8%
2018	24,094,441,728	41,598,399,420	17,503,957,692	57.9%	4,789,503,451	365.5%

LOCAL GOVERNMENT DIVISION
SCHEDULE OF FUNDING PROGRESS

As of December 31	Actuarial Value of Assets (AVA)	Actuarial Accrued Liability (AAL)	Unfunded Actuarial Accrued Liability (UAAL)	Funded Ratio	Annual Covered Payroll	UAAL as a % of Covered Payroll
2009	$2,932,628,241	$3,850,820,636	$918,192,395	76.2%	$705,097,035	130.2%
2010	2,926,045,102	4,005,566,126	1,079,521,024	73.0%	705,265,331	153.1%
2011	2,882,691,014	4,160,014,773	1,277,323,759	69.3%	718,169,015	177.9%
2012	3,098,721,347	4,157,620,538	1,058,899,191	74.5%	523,668,446	202.2%
2013	3,291,297,571	4,502,281,918	1,210,984,347	73.1%	529,003,436	228.9%
2014	3,629,400,231	4,610,967,519	981,567,288	78.7%	540,468,037	181.6%
2015	3,777,160,876	4,780,697,981	1,003,537,105	79.0%	561,518,205	178.7%
2016	3,879,197,057	5,213,051,954	1,333,854,897	74.4%	608,222,609	219.3%
2017	4,009,412,912	5,045,932,015	1,036,519,103	79.5%	632,768,337	163.8%
2018	4,070,679,098	5,240,885,213	1,170,206,115	77.7%	660,998,127	177.0%

JUDICIAL DIVISION
SCHEDULE OF FUNDING PROGRESS

As of December 31	Actuarial Value of Assets (AVA)	Actuarial Accrued Liability (AAL)	Unfunded Actuarial Accrued Liability (UAAL)	Funded Ratio	Annual Covered Payroll	UAAL as a % of Covered Payroll
2009	$228,713,654	$295,695,685	$66,982,031	77.3%	$37,582,661	178.2%
2010	227,813,622	303,839,197	76,025,575	75.0%	37,412,139	203.2%
2011	221,514,844	319,437,250	97,922,406	69.3%	39,033,369	250.9%
2012	238,806,614	326,897,142	88,090,528	73.1%	39,045,008	225.6%
2013	256,800,478	351,598,057	94,797,579	73.0%	39,941,730	237.3%
2014	270,866,145	371,253,240	100,387,095	73.0%	42,976,979	233.6%
2015	286,890,898	401,965,650	115,074,752	71.4%	46,869,730	245.5%
2016	297,888,464	447,117,414	149,228,950	66.6%	48,699,531	306.4%
2017	310,084,726	428,108,199	118,023,473	72.4%	48,947,607	241.1%
2018	315,970,361	447,756,933	131,786,572	70.6%	50,505,856	260.9%

DENVER PUBLIC SCHOOLS[1] DIVISION
SCHEDULE OF FUNDING PROGRESS

As of December 31	Actuarial Value of Assets (AVA)	Actuarial Accrued Liability (AAL)	Unfunded Actuarial Accrued Liability (UAAL)	Funded Ratio	Annual Covered Payroll	UAAL as a % of Covered Payroll
2010	$2,961,719,943	$3,332,814,445	$371,094,502	88.9%	$470,773,746	78.8%
2011	2,804,705,933	3,442,527,012	637,821,079	81.5%	491,646,251	129.7%
2012	2,936,695,129	3,495,549,312	558,854,183	84.0%	510,872,366	109.4%
2013	3,075,894,894	3,785,871,992	709,977,098	81.2%	547,659,912	129.6%
2014	3,151,455,921	3,816,092,735	664,636,814	82.6%	584,319,269	113.7%
2015	3,207,326,956	3,905,240,456	697,913,500	82.1%	621,114,573	112.4%
2016	3,220,935,045	4,246,430,437	1,025,495,392	75.9%	642,177,158	159.7%
2017	3,257,769,807	4,088,526,454	830,756,647	79.7%	658,198,306	126.2%
2018	3,261,337,748	4,248,602,214	987,264,466	76.8%	722,040,073	136.7%

[1] DPS Division began January 1, 2010

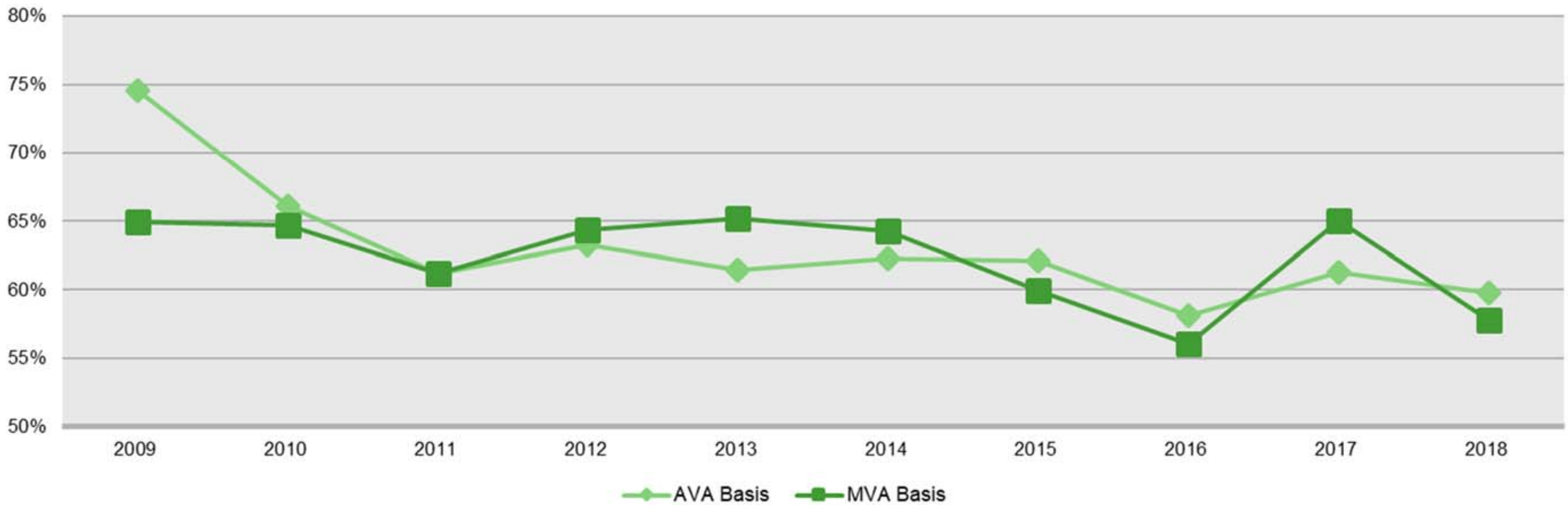
ALL DIVISION TRUST FUNDS[1]
SCHEDULE OF FUNDING PROGRESS

As of December 31	Actuarial Value of Assets (AVA)	Actuarial Accrued Liability (AAL)	Unfunded Actuarial Accrued Liability (UAAL)	Funded Ratio	Annual Covered Payroll	UAAL as a % of Covered Payroll
2009	$37,598,988,107	$54,536,548,891	$16,937,560,784	68.9%	$7,048,991,770	240.3%
2010	39,229,261,481	59,338,150,323	20,108,888,842	66.1%	7,506,192,920	267.9%
2011	37,185,066,667	60,734,721,541	23,549,654,874	61.2%	7,464,243,447	315.5%
2012	39,079,472,464	61,790,595,265	22,711,122,801	63.2%	7,277,585,379	312.1%
2013	41,122,832,649	66,920,788,703	25,797,956,054	61.5%	7,530,220,378	342.6%
2014	42,718,566,293	68,593,166,820	25,874,600,527	62.3%	7,795,669,760	331.9%
2015	44,025,859,870	70,850,728,785	26,824,868,915	62.1%	8,106,659,440	330.9%
2016	44,687,696,483	76,929,484,076	32,241,787,593	58.1%	8,359,069,646	385.7%
2017	45,613,722,695	74,390,866,308	28,777,143,613	61.3%	8,585,478,300	335.2%
2018	46,046,154,761	77,045,495,760	30,999,340,999	59.8%	9,121,874,778	339.8%

[1] Results as of December 31, 2009, do not include the Denver Public Schools Division

The chart below shows the funded ratio for the total of all Division Trust Funds calculated using both the actuarial value of assets and the market value of assets.

ALL DIVISION TRUST FUNDS[1]
FUNDED RATIO, AS OF DECEMBER 31



[1] Results as of December 31, 2009, do not include the Denver Public Schools Division

L. GFOA Solvency Test

The Actuarial Accrued Liability represents the present value of benefits earned, calculated using the Division Trust Funds' actuarial cost method. The Actuarial Value of Assets reflects the financial resources available to liquidate the liability. The portion of the liability covered by assets reflects the extent to which accumulated plan assets are sufficient to pay future benefits, and is shown for liabilities associated with member contributions, pensioner liabilities, and other liabilities. The Government Finance Officers Association (GFOA) recommends that the pension funding policy aim to achieve a funded ratio of 100 percent.

STATE DIVISION
SOLVENCY TEST AS OF DECEMBER 31

	Aggregate Accrued Liabilities				Portion of Accrued Liabilities Covered by Plan Assets		
As of December 31	(1) Active Member Contributions	(2) Retirees, Beneficiaries, and Inactive Members	(3) Employer-Financed Portion of Active Members	Actuarial Value of Plan Assets	(1)	(2)	(3)
2009	$2,568,286,884	$12,660,958,307	$4,747,971,978	$13,382,736,472	100.0%	85.4%	0.0%
2010	2,569,046,085	13,149,658,232	4,637,471,747	12,791,946,348	100.0%	77.7%	0.0%
2011	2,629,639,816	13,710,392,567	4,486,511,088	12,010,044,704	100.0%	68.4%	0.0%
2012	2,668,942,433	14,191,468,725	4,331,083,967	12,538,675,449	100.0%	69.5%	0.0%
2013	2,675,468,549	15,296,367,708	4,871,888,909	13,129,459,956	100.0%	68.3%	0.0%
2014	2,688,513,975	15,846,199,642	4,873,607,536	13,523,487,577	100.0%	68.4%	0.0%
2015	2,685,014,226	16,470,370,315	4,930,286,582	13,882,819,694	100.0%	68.0%	0.0%
2016	2,678,311,640	17,933,226,454	5,058,377,726	14,026,331,996	100.0%	63.3%	0.0%
2017	2,668,406,361	17,395,422,937	4,718,255,840	14,256,409,942	100.0%	66.6%	0.0%
2018	2,682,956,087	18,095,951,346	4,730,944,547	14,303,725,826	100.0%	64.2%	0.0%

SCHOOL DIVISION
SOLVENCY TEST AS OF DECEMBER 31

As of December 31	Aggregate Accrued Liabilities			Actuarial Value of Plan Assets	Portion of Accrued Liabilities Covered by Plan Assets		
	(1) Active Member Contributions	(2) Retirees, Beneficiaries, and Inactive Members	(3) Employer-Financed Portion of Active Members		(1)	(2)	(3)
2009	$3,769,099,659	$18,830,712,228	$7,813,003,514	$21,054,909,740	100.0%	91.8%	0.0%
2010	3,779,759,908	19,658,748,616	7,901,245,967	20,321,736,466	100.0%	84.1%	0.0%
2011	3,783,336,053	20,666,020,619	7,536,842,363	19,266,110,172	100.0%	74.9%	0.0%
2012	3,823,347,689	21,466,077,782	7,329,607,677	20,266,573,925	100.0%	76.6%	0.0%
2013	3,881,145,368	23,301,640,854	8,254,525,348	21,369,379,750	100.0%	75.1%	0.0%
2014	3,915,705,391	24,247,868,140	8,222,958,642	22,143,356,419	100.0%	75.2%	0.0%
2015	4,003,251,233	25,133,167,683	8,540,734,659	22,871,661,446	100.0%	75.1%	0.0%
2016	4,108,960,910	27,922,422,826	9,321,584,715	23,263,343,921	100.0%	68.6%	0.0%
2017	4,212,088,158	26,937,539,293	8,896,587,051	23,780,045,308	100.0%	72.6%	0.0%
2018	4,344,573,744	27,922,414,342	9,331,411,334	24,094,441,728	100.0%	70.7%	0.0%

LOCAL GOVERNMENT DIVISION
SOLVENCY TEST AS OF DECEMBER 31

	Aggregate Accrued Liabilities				Portion of Accrued Liabilities Covered by Plan Assets		
As of December 31	(1) Active Member Contributions	(2) Retirees, Beneficiaries, and Inactive Members	(3) Employer-Financed Portion of Active Members	Actuarial Value of Plan Assets	(1)	(2)	(3)
2009	$678,518,930	$1,963,924,503	$1,208,377,203	$2,932,628,241	100.0%	100.0%	24.0%
2010	657,846,613	2,180,451,070	1,167,268,443	2,926,045,102	100.0%	100.0%	7.5%
2011	666,794,291	2,330,542,885	1,162,677,597	2,882,691,014	100.0%	95.1%	0.0%
2012	528,029,133	2,750,955,523	878,635,882	3,098,721,347	100.0%	93.4%	0.0%
2013	533,003,238	2,991,177,371	978,101,309	3,291,297,571	100.0%	92.2%	0.0%
2014	534,694,536	3,114,435,619	961,837,364	3,629,400,231	100.0%	99.4%	0.0%
2015	533,262,306	3,275,092,726	972,342,949	3,777,160,876	100.0%	99.0%	0.0%
2016	545,507,394	3,573,343,965	1,094,200,595	3,879,197,057	100.0%	93.3%	0.0%
2017	544,524,644	3,482,526,035	1,018,881,336	4,009,412,912	100.0%	99.5%	0.0%
2018	549,498,715	3,679,914,640	1,011,471,858	4,070,679,098	100.0%	95.7%	0.0%

JUDICIAL DIVISION
SOLVENCY TEST AS OF DECEMBER 31

As of December 31	Aggregate Accrued Liabilities			Actuarial Value of Plan Assets	Portion of Accrued Liabilities Covered by Plan Assets		
	(1) Active Member Contributions	(2) Retirees, Beneficiaries, and Inactive Members	(3) Employer-Financed Portion of Active Members		(1)	(2)	(3)
2009	$52,754,332	$165,904,221	$77,037,132	$228,713,654	100.0%	100.0%	13.1%
2010	53,742,058	171,903,999	78,193,140	227,813,622	100.0%	100.0%	2.8%
2011	54,688,241	186,420,121	78,328,888	221,514,844	100.0%	89.5%	0.0%
2012	57,762,144	193,773,713	75,361,285	238,806,614	100.0%	93.4%	0.0%
2013	59,347,907	208,235,801	84,014,349	256,800,478	100.0%	94.8%	0.0%
2014	60,973,005	214,541,387	95,738,848	270,866,145	100.0%	97.8%	0.0%
2015	60,118,183	232,302,854	109,544,613	286,890,898	100.0%	97.6%	0.0%
2016	58,119,195	273,416,269	115,581,950	297,888,464	100.0%	87.7%	0.0%
2017	54,972,648	277,541,632	95,593,919	310,084,726	100.0%	91.9%	0.0%
2018	57,922,275	286,044,533	103,790,125	315,970,361	100.0%	90.2%	0.0%

DENVER PUBLIC SCHOOLS[1] DIVISION
SOLVENCY TEST AS OF DECEMBER 31

As of December 31	Aggregate Accrued Liabilities			Actuarial Value of Plan Assets	Portion of Accrued Liabilities Covered by Plan Assets		
	(1) Active Member Contributions	(2) Retirees, Beneficiaries, and Inactive Members	(3) Employer-Financed Portion of Active Members		(1)	(2)	(3)
2010	$317,442,198	$2,370,216,811	$645,155,436	$2,961,719,943	100.0%	100.0%	42.5%
2011	333,550,047	2,435,504,442	673,472,523	2,804,705,933	100.0%	100.0%	5.3%
2012	348,739,324	2,479,706,314	667,103,674	2,936,695,129	100.0%	100.0%	16.2%
2013	364,126,482	2,672,260,182	749,485,328	3,075,894,894	100.0%	100.0%	5.3%
2014	379,240,340	2,665,352,277	771,500,118	3,151,455,921	100.0%	100.0%	13.9%
2015	394,305,861	2,732,879,071	778,055,524	3,207,326,956	100.0%	100.0%	10.3%
2016	402,849,242	2,999,767,090	843,814,105	3,220,935,045	100.0%	93.9%	0.0%
2017	419,239,199	2,867,253,544	802,033,711	3,257,769,807	100.0%	99.0%	0.0%
2018	438,007,813	2,941,987,529	868,606,872	3,261,337,748	100.0%	96.0%	0.0%

[1] DPS Division began January 1, 2010

ALL DIVISION TRUST FUNDS[1]
SOLVENCY TEST AS OF DECEMBER 31

As of December 31	Aggregate Accrued Liabilities (1) Active Member Contributions	(2) Retirees, Beneficiaries, and Inactive Members	(3) Employer-Financed Portion of Active Members	Actuarial Value of Plan Assets	Portion of Accrued Liabilities Covered by Plan Assets (1)	(2)	(3)
2009	$7,068,659,805	$33,621,499,259	$13,846,389,827	$37,598,988,107	100.0%	90.8%	0.0%
2010	7,377,836,862	37,530,978,728	14,429,334,733	39,229,261,481	100.0%	84.9%	0.0%
2011	7,468,008,448	39,328,880,634	13,937,832,459	37,185,066,667	100.0%	75.6%	0.0%
2012	7,426,820,723	41,081,982,057	13,281,792,485	39,079,472,464	100.0%	77.0%	0.0%
2013	7,513,091,544	44,469,681,916	14,938,015,243	41,122,832,649	100.0%	75.6%	0.0%
2014	7,579,127,247	46,088,397,065	14,925,642,508	42,718,566,293	100.0%	76.2%	0.0%
2015	7,675,951,809	47,843,812,649	15,330,964,327	44,025,859,870	100.0%	76.0%	0.0%
2016	7,793,748,381	52,702,176,604	16,433,559,091	44,687,696,483	100.0%	70.0%	0.0%
2017	7,899,231,010	50,960,283,441	15,531,351,857	45,613,722,695	100.0%	74.0%	0.0%
2018	8,072,958,634	52,926,312,390	16,046,224,736	46,046,154,761	100.0%	71.7%	0.0%

[1] Results as of December 31, 2009, do not include the Denver Public Schools Division

M. Summary of Actuarial Valuation Results

LIABILITIES AS OF DECEMBER 31, 2018

	Determination of Unfunded Actuarial Accrued Liability	State Division	School Division	Local Government Division	Judicial Division	Denver Public Schools Division	Total
1.	Present value of future benefits, active members						
	a. Retirement benefits	$8,383,752,386	$15,724,225,273	$1,744,677,021	$214,276,073	$1,682,439,797	$27,749,370,550
	b. Disability benefits	215,598,264	229,367,909	35,475,989	5,265,615	41,180,458	526,888,235
	c. Death benefits	122,608,179	172,400,845	27,195,132	5,229,015	19,648,020	347,081,191
	d. Withdrawal benefits	1,167,774,679	2,262,123,317	271,342,433	5,261,771	307,687,936	4,014,190,136
	e. Total	$9,889,733,508	$18,388,117,344	$2,078,690,575	$230,032,474	$2,050,956,211	$32,637,530,112
2.	Inactive vested members	548,788,334	901,102,818	259,622,706	3,521,524	86,621,828	1,799,657,210
3.	Inactive non-vested members	150,700,746	226,036,763	47,612,643	74,213	37,021,422	461,445,787
4.	Retirees and beneficiaries	17,396,462,266	26,795,274,761	3,372,679,291	282,448,796	2,818,344,279	50,665,209,393
5.	Actuarial present value of projected benefits: 1e + 2 + 3 + 4	$27,985,684,854	$46,310,531,686	$5,758,605,215	$516,077,007	$4,992,943,740	$85,563,842,502
6.	Actuarial present value of future normal costs, active members						
	a. Retirement benefits	$1,487,051,051	$3,038,917,181	$307,460,905	$58,594,809	$506,705,060	$5,398,729,006
	b. Disability benefits	80,243,001	87,559,725	13,220,222	2,644,739	18,207,382	201,875,069
	c. Death benefits	36,225,224	54,649,401	8,008,086	1,919,614	8,883,749	109,686,074
	d. Withdrawal benefits	872,313,598	1,531,005,959	189,030,789	5,160,912	210,545,335	2,808,056,593
	e. Total	$2,475,832,874	$4,712,132,266	$517,720,002	$68,320,074	$744,341,526	$8,518,346,742
7.	**Actuarial accrued liability:** 5 – 6e	**$25,509,851,980**	**$41,598,399,420**	**$5,240,885,213**	**$447,756,933**	**$4,248,602,214**	**$77,045,495,760**
8.	Actuarial value of assets	14,303,725,826	24,094,441,728	4,070,679,098	315,970,361	3,261,337,748	46,046,154,761
9.	**Unfunded/(overfunded) actuarial accrued liability:** 7 - 8	**$11,206,126,154**	**$17,503,957,692**	**$1,170,206,115**	**$131,786,572**	**$987,264,466**	**$30,999,340,999**

N. Actuarial Balance Sheet

An overview of the Division Trust Funds is given by an Actuarial Balance Sheet. First, the amount and timing of all future payments that will be made by the Division Trust Funds for current participants is determined. Then these payments are discounted at the valuation interest rate to the date of the valuation, thereby determining the present value, referred to as the "liability" of the Division Trust Funds.

Second, this liability is compared to the assets. The "assets" for this purpose include the net amount of assets already accumulated by the Division Trust Funds, the present value of future member contributions, the present value of future employer normal cost contributions, and the present value of future employer amortization payments for the unfunded actuarial accrued liability.

ACTUARIAL BALANCE SHEET

	State Division	School Division	Local Government Division	Judicial Division	Denver Public Schools Division	Total
Liabilities:						
• Present value of benefits for retirees and beneficiaries	$17,396,462,266	$26,795,274,761	$3,372,679,291	$282,448,796	$2,818,344,279	50,665,209,393
• Present value of benefits for inactive members	699,489,080	1,127,139,581	307,235,349	3,595,737	123,643,250	2,261,102,997
• Present value of benefits for active members	9,889,733,508	18,388,117,344	2,078,690,575	230,032,474	2,050,956,211	32,637,530,112
Total liabilities	**$27,985,684,854**	**$46,310,531,686**	**$5,758,605,215**	**$516,077,007**	**$4,992,943,740**	**85,563,842,502**
Assets:						
• Total valuation value of assets	$14,303,725,826	$24,094,441,728	$4,070,679,098	$315,970,361	$3,261,337,748	46,046,154,761
• Present value of future member contributions	2,239,449,447	3,946,887,745	407,449,064	42,522,346	656,562,394	7,292,870,996
• Present value of future employer contributions for:						
Entry age normal costs	236,383,427	765,244,521	110,270,938	25,797,728	87,779,132	1,225,475,746
Unfunded actuarial accrued liability	11,206,126,154	17,503,957,692	1,170,206,115	131,786,572	987,264,466	30,999,340,999
Total of current and future assets	**$27,985,684,854**	**$46,310,531,686**	**$5,758,605,215**	**$516,077,007**	**$4,992,943,740**	**85,563,842,502**

O. Risk

The actuarial valuation results depend on a single set of assumptions; however, there is a risk that emerging results may differ significantly as actual experience proves to be different than projected from the current assumptions.

We have not been engaged to perform a detailed analysis of the potential range of the impact of risks relative to PERA's future financial condition, but have included a brief discussion of some of the risks that may affect the Division Trust Funds. A more detailed assessment of the risks could provide a better understanding of the risks inherent in the Division Trust Funds. This assessment may include scenario testing, sensitivity testing, stress testing, and stochastic modeling. Annually, pursuant to Section 24-51-614, C.R.S. from the Office of the State Auditor and at PERA's request, the actuary prepares a document called the Signal Light report. The purpose of the Signal Light report is to help assess the Division Trust Funds' funding progress and to provide information to assess whether the funding mechanisms promote sustainability. PERA might consider expanding the Signal Light report to include stochastic modeling in order to provide a more detailed risk assessment.

A detailed risk assessment, including stochastic modeling, would provide additional useful information. PERA has undergone significant benefit changes, including the Automatic Adjustment Provision, that is expected to allow PERA to achieve full funding in 30 years. Stochastic modeling is critical in order to monitor the likelihood of achieving PERA's funding goals. A detailed risk assessment could model funded percentages, effective amortization periods and projected actuarially determined contributions based upon PERA's target asset allocation and capital market assumptions. The results would allow PERA to assess the likelihood of positive or negative occurrences.

The following risks could significantly affect the Plans' future condition:

Investment Risk (the risk that returns will be different than expected)

> The assets total approximately $45 billion. If the actual market value return for the Plan Year were 1% different from the assumed (either higher or lower), the projected unfunded actuarial liability would change by about $450 million.
>
> If the prior year's investment performance resulted in a market value of assets that is 10% different from the current value, it would result in a change of $4.5 billion in the asset value. A 10% increase in assets would cause the unfunded liability (market value basis) to decrease from $32.5 million to $28.5 million. Likewise, a 10% decrease in the asset value, would cause the unfunded liability to increase from $32.5 million to $37.0 million.
>
> The market value rate of return over the last ten years has ranged from a low of (3.5%) to a high of 18.1%.

The projected year that the funded ratio reaches 100% for each Division Trust Fund is dependent upon investment returns, as well as future changes in demographics, growth in active membership, benefit structure, and projected contributions. The following table demonstrates the sensitivity of investment returns and these elements on the projected number of years to full funding. The projected number of years until the funded ratio reaches 100% is determined under three scenarios:

- The December 31, 2017 actuarial valuation results
- The December 31, 2018 actuarial valuation, reflecting the lower than expected 2018 investment return and other plan experience
- The December 31, 2018 valuation results including the anticipated adjustments to take effect during 2020, resulting from the automatic adjustment provisions enacted through SB18-200.

At the direction of PERA, these deterministic projections of all Division Trust Funds reflect the lower cost benefit structure for new members and use the following assumptions:

- All actuarial assumptions, including achieving 7.25% investment returns are realized
- Active membership growth for State, School and Denver Public Schools is 1.25% each year
- Active membership growth for Local Government and Judicial is 1% per year
- New entrants have the same demographic mix as new hires over the last five years.
- Projected Payroll for new entrants is assumed to grow at the inflation rate.

PROJECTED NUMBER OF YEARS UNTIL THE FUNDED RATIO REACHES 100%

	State Division	School Division	Local Government Division	Judicial Division	DPS Division
• December 31, 2017 actuarial valuation results	27	30	15	15	17
• December 31, 2018 actuarial valuation results	33	41	40	24	20
• The December 31, 2018 valuation results including the anticipated adjustments to take effect July 1, 2020, resulting from the automatic adjustment provisions	28	34	29	21	17

To provide an illustration of the potential risk of varied investment return outcomes, below is a table showing the number of years until the funded ratio reaches 100% for the School Division Trust Fund as of December 31, 2018 under the various return scenarios (used for both assumed investment return and to discount liabilities of the plan) that correspond to the confidence levels (probabilities of investment return) as indicated.

SCHOOL DIVISION PROJECTED NUMBER OF YEARS UNTIL THE FUNDED RATIO REACHES 100%[1]

Probability of achieving at least the rate of return displayed (or better), per annum[2]	Long-Term Expected Investment Return and Discount Rate				
	4.23%	5.92%	7.25%	8.33%	10.09%
95th percentile	Infinite				
75th percentile		73			
47th percentile			34		
25th percentile				20	
5th percentile					9

[1] Reflects the results and experience of the December 31, 2018 Actuarial Funding Valuation and the effect of the automatic adjustment provisions.

[2] Results reflecting 50-Year probability outlooks (Monte Carlo simulations), provided by the prior actuary, and based on 30-year capital market assumptions, provided by the Board's investment consultants, at the time the Board last reviewed and changed the long-term expected rate of return/discount rate to 7.25%.

Longevity Risk (the risk that mortality experience will be different than expected)

The actuarial valuation includes an expectation of future improvement in life expectancy. Emerging plan experience that does not match these expectations will result in either an increase or decrease in the actuarially determined contribution.

A 10% reduction in the assumed mortality rates results in an increase in the liabilities of roughly 3% for most plans. For PERA, a 3% liability increase would result in an increase in the unfunded accrued liability from $33.5 million to $34.8 million.

Demographic Risk (the risk that participant experience will be different than assumed)

Examples of this risk include:

- Actual retirements occurring earlier or later than assumed. The value of retirement plan benefits is sensitive to the rate of benefit accruals and any legacy early retirement subsidies that apply.
- More or less active participant turnover than assumed.
- Salary increases more or less than assumed.

Maturity Measures

The risk associated with a pension plan increases as it becomes more mature, meaning that the actives represent a smaller portion of the liabilities of the plan. When this happens, there is a greater risk that fluctuations in the experience of the non-active participants or of the assets of the plan can result in large swings in the contribution requirements.

- Currently the Plan has a total retirees and survivors to active participant ratio of 0.58. For the prior year, benefits paid were $6.573 million more than contributions received. As the Plans mature, more cash will be needed from the investment portfolio to meet benefit payments.
- As of December 31, 2018, the retired life actuarial accrued liability represents 66% of the total actuarial accrued liability. In addition, the actuarial accrued liability for inactive vested participants represents 3% of the total. The higher the non-active actuarial accrued liability is as a percent of the total liability, the greater the danger of volatility in results.

Section 3: Supplemental Information

Exhibit A – Membership Data

Membership data was provided on electronic files sent by PERA staff. While not verifying the correctness of the data at the source, we performed various tests to ensure the internal consistency of the data and its overall reasonableness.

DIVISION TRUST FUNDS
NUMBER OF MEMBERS

Item	State Division	School Division	Local Government Division	Judicial Division	Denver Public Schools Division	Total
1. Retirees and survivors (includes deferred survivors)	40,446	66,543	7,662	382	7,156	122,189
2. Terminated members entitled to future benefits	7,074	17,001	2,696	12	1,780	28,563
3. Inactive members	78,576	125,944	25,034	4	12,286	241,844
4. Active members						
• Vested						
– General members	30,115	67,808	6,058	268	7,309	111,558
– State troopers	651	0	0	0	0	651
• Non-Vested						
– General members	24,508	58,525	7,202	64	8,839	99,138
– State troopers	237	0	0	0	0	237
• Total actives	55,511	126,333	13,260	332	16,148	211,584
5. Grand total: 1 + 2 + 3 + 4	181,607	335,821	48,652	730	37,370	604,180

Exhibit B – Membership Data by Benefit Tier

DIVISION TRUST FUNDS
NUMBER OF MEMBERS

Item	State Division	School Division	Local Government Division	Judicial Division	Denver Public Schools Division
1. Active members					
• PERA benefit structure hired prior to 1/1/2007 and DPS benefit structure	19,233	46,180	3,871	190	3,771
• PERA benefit structure hired after 12/31/2006	36,278	80,153	9,389	142	12,377
2. Terminated vested members					
• PERA benefit structure hired prior to 1/1/2007 and DPS benefit structure	5,366	13,019	2,116	8	1,190
• PERA benefit structure hired after 12/31/2006	1,708	3,982	580	4	590
3. Inactive members					
• PERA benefit structure hired prior to 1/1/2007 and DPS benefit structure	35,266	51,076	9,842	1	1,094
• PERA benefit structure hired after 12/31/2006	43,310	74,868	15,192	3	11,192
4. Retirees and survivors (includes deferred survivors)					
• PERA benefit structure hired prior to 1/1/2007 and DPS benefit structure	39,423	65,305	7,426	371	6,974
• PERA benefit structure hired after 12/31/2006	1,023	1,238	236	11	182
5. Grand total: 1 + 2 + 3 + 4	181,607	335,821	48,652	730	37,370

Exhibit C – Schedule of Active Member Data as of December 31, 2018

STATE DIVISION

Age	Years of Service: Under 5	5-9	10-14	15 - 19	20 - 24	25 - 29	30+	Total	Valuation Payroll
Under 20	257	0	0	0	0	0	0	257	$2,921,849
20 - 24	1,874	8	0	0	0	0	0	1,882	54,771,951
25 - 29	4,351	447	10	0	0	0	0	4,808	190,772,541
30 - 34	4,055	1,716	412	5	0	0	0	6,188	287,521,586
35 - 39	3,299	1,794	1,327	295	17	0	0	6,732	347,744,265
40 - 44	2,429	1,412	1,300	941	270	11	0	6,363	356,930,568
45 - 49	3,493	1,591	1,363	1,030	901	319	20	8,717	488,206,326
50 - 54	1,767	1,127	1,207	922	835	630	186	6,674	404,069,337
55 - 59	1,473	1,010	1,223	988	776	512	294	6,276	360,867,210
60	270	201	230	185	128	85	63	1,162	65,785,661
61	232	175	229	181	108	83	60	1,068	60,292,101
62	204	171	178	137	104	79	51	924	52,469,751
63	172	152	196	138	79	69	57	863	49,217,782
64	138	160	159	139	71	66	43	776	42,449,765
65	135	111	135	111	64	46	37	639	34,048,346
66	121	106	96	68	47	30	26	494	23,988,409
67	95	59	75	56	34	22	26	367	18,662,381
68	90	54	62	42	26	24	23	321	15,596,412
69	60	41	51	44	24	11	14	245	12,628,471
70 & up	230	134	120	99	52	48	72	755	29,882,559
Total	24,745	10,469	8,373	5,381	3,536	2,035	972	55,511	2,898,827,271

Average Age (Non-trooper):	45.42	Average Age (Trooper):	41.59
Average Service (Non-trooper):	8.70	Average Service (Trooper):	12.13
Average Expected Remaining Service Life (Non-trooper):	8.95	Average Expected Remaining Service Life (Trooper):	11.03

SCHOOL DIVISION

Age	Years of Service							Total	Valuation Payroll
	Under 5	5-9	10-14	15 - 19	20 - 24	25 - 29	30+		
Under 20	1,127	0	0	0	0	0	0	1,127	$11,494,116
20 - 24	5,285	71	0	0	0	0	0	5,356	114,521,888
25 - 29	9,858	1,634	49	0	0	0	0	11,541	369,992,791
30 - 34	7,456	4,292	1,122	32	0	0	0	12,902	465,939,999
35 - 39	7,105	3,392	3,875	884	21	0	0	15,277	597,035,627
40 - 44	6,703	3,065	3,077	3,254	561	16	0	16,676	700,573,962
45 - 49	8,463	3,077	3,020	2,687	2,300	555	27	20,129	829,332,353
50 - 54	4,279	2,426	2,814	2,463	1,778	1,471	223	15,454	685,872,207
55 - 59	3,504	1,988	2,457	2,580	1,684	995	522	13,730	557,781,070
60	574	315	418	439	268	165	76	2,255	87,014,969
61	564	274	362	391	233	132	62	2,018	74,734,928
62	499	246	299	312	210	113	70	1,749	64,190,273
63	419	248	242	259	171	120	54	1,513	54,651,253
64	376	184	178	238	151	90	46	1,263	43,067,241
65	328	178	185	146	106	65	40	1,048	34,408,841
66	300	119	115	97	67	45	21	764	21,536,259
67	279	112	89	80	59	35	27	681	18,895,183
68	261	82	64	67	36	21	19	550	14,400,624
69	221	76	70	51	27	23	13	481	11,590,474
70 & up	924	353	257	127	71	40	47	1,819	32,469,393
Total	58,525	22,132	18,693	14,107	7,743	3,886	1,247	126,333	4,789,503,451

Average Age:	44.56
Average Service:	8.38
Average Expected Remaining Service Life:	9.24

LOCAL GOVERNMENT DIVISION

Age	Years of Service							Total	Valuation Payroll
	Under 5	5-9	10-14	15 – 19	20 - 24	25 - 29	30+		
Under 20	598	0	0	0	0	0	0	598	$4,760,793
20 - 24	717	13	0	0	0	0	0	730	15,329,908
25 - 29	1,030	100	9	0	0	0	0	1,139	43,168,027
30 - 34	987	281	87	11	0	0	0	1,366	66,467,669
35 - 39	787	304	231	77	6	0	0	1,405	77,297,505
40 - 44	808	294	281	148	62	2	0	1,595	87,186,367
45 - 49	567	248	365	213	135	54	5	1,587	100,259,550
50 - 54	511	255	281	176	147	83	27	1,480	90,636,603
55 - 59	451	226	298	232	162	86	68	1,523	90,797,225
60	71	31	58	30	28	19	9	246	15,447,744
61	68	31	58	29	24	13	12	235	14,255,357
62	61	41	33	20	19	16	8	198	10,789,888
63	70	21	44	26	21	9	7	198	10,390,983
64	55	22	33	24	6	12	6	158	8,113,846
65	65	24	21	19	7	4	5	145	6,083,340
66	58	23	22	13	9	5	3	133	5,969,402
67	41	17	18	7	3	5	5	96	4,009,988
68	39	10	13	5	1	3	1	72	2,081,721
69	30	10	12	6	2	3	0	63	2,316,163
70 & up	188	42	34	17	6	2	4	293	5,636,048
Total	7,202	1,993	1,898	1,053	638	316	160	13,260	660,998,127

Average Age:	44.08
Average Service:	7.31
Average Expected Remaining Service Life:	8.22

JUDICIAL DIVISION

Age	Years of Service							Total	Valuation Payroll
	Under 5	5-9	10-14	15 – 19	20 - 24	25 - 29	30+		
Under 20	0	0	0	0	0	0	0	0	-
20 - 24	0	0	0	0	0	0	0	0	-
25 - 29	0	0	0	0	0	0	0	0	-
30 - 34	0	1	0	0	0	0	0	1	$64,966
35 - 39	5	4	1	0	0	0	0	10	1,137,414
40 - 44	17	7	2	1	1	0	0	28	3,873,306
45 - 49	12	9	9	6	1	1	0	38	5,959,766
50 - 54	12	16	22	11	5	3	0	69	10,586,152
55 - 59	10	13	12	9	9	11	6	70	11,176,041
60	0	1	4	4	2	2	1	14	2,113,718
61	2	1	2	3	2	3	0	13	2,150,674
62	3	1	2	2	3	0	1	12	1,880,739
63	1	2	2	2	0	0	0	7	957,605
64	0	1	2	2	2	2	2	11	1,728,630
65	0	2	2	5	0	2	0	11	1,703,844
66	0	0	5	3	2	3	2	15	2,284,660
67	0	0	2	1	2	0	0	5	804,099
68	1	2	3	1	0	1	1	9	1,330,727
69	0	1	1	1	0	1	0	4	619,093
70 & up	1	1	2	5	1	3	2	15	2,134,422
Total	64	62	73	56	30	32	15	332	50,505,856

Average Age:	56.06
Average Service:	13.71
Average Expected Remaining Service Life:	10.45

DENVER PUBLIC SCHOOLS DIVISION

Age	Years of Service							Total	Valuation Payroll
	Under 5	5-9	10-14	15 - 19	20 - 24	25 - 29	30+		
Under 20	115	0	0	0	0	0	0	115	$1,465,734
20 - 24	941	7	0	0	0	0	0	948	23,444,546
25 - 29	2,131	314	0	0	0	0	0	2,445	92,834,913
30 - 34	1,717	941	119	2	0	0	0	2,779	126,575,104
35 - 39	1,585	833	382	32	2	0	0	2,834	132,966,033
40 - 44	705	488	314	199	27	0	0	1,733	88,276,906
45 - 49	571	440	249	234	107	21	2	1,624	84,048,493
50 - 54	367	340	192	174	118	68	8	1,267	65,674,716
55 - 59	306	288	152	147	97	54	27	1,071	52,684,305
60	63	66	20	28	18	6	6	207	8,841,651
61	42	61	22	21	10	11	5	172	7,490,196
62	40	61	23	16	15	5	7	167	7,438,831
63	34	43	14	23	13	6	3	136	6,418,593
64	27	49	17	23	9	2	5	132	5,992,316
65	35	23	11	13	10	5	4	101	4,084,627
66	28	20	6	5	6	3	1	69	2,773,213
67	19	22	5	6	5	3	1	61	2,363,872
68	21	18	4	4	1	2	0	50	1,781,345
69	17	17	6	4	3	0	1	48	2,016,545
70 & up	75	78	13	5	3	7	8	189	4,868,134
Total	8,839	4,109	1,549	936	444	193	78	16,148	722,040,073

Average Age (DPS Benefit Structure) :	49.44	Average Age (PERA Benefit Structure):	38.47
Average Service (DPS Benefit Structure):	15.93	Average Service (PERA Benefit Structure):	4.08
Average Expected Remaining Service Life (DPS Benefit Structure):	8.61	Average Expected Remaining Service Life (PERA Benefit Structure):	10.46

Exhibit D – Schedule of Benefit Recipients by Annual Benefit as of December 31, 2018

Annual Benefit Range[1]	Number of Benefit Recipients[2]					
	State Division	School Division	Local Government Division	Judicial Division	Denver Public Schools Division	Total
$0 - $4,999	1,969	5,836	442	6	226	8,479
$5000 - $9,999	2,643	6,032	646	9	477	9,807
$10,000 - $24,999	8,698	13,881	1,904	32	1,495	26,010
$25,000 - $49,999	14,521	19,844	2,487	69	2,634	39,555
$50,000 - $99,999	11,429	20,142	1,920	188	2,265	35,944
$100,000 - $149,999	944	597	210	74	53	1,878
$150,000 - $199,999	79	36	26	2	0	143
$200,000 - $249,999	26	7	6	0	0	39
$250,000 - $299,999	3	1	2	0	0	6
$300,000 +	3	0	1	0	0	4
Total Benefit Recipients:	**40,315**	**66,376**	**7,644**	**380**	**7,150**	**121,865**

[1] Includes amounts paid under replacement benefit arrangements

[2] Does not include 324 deferred survivors

Exhibit E – Schedule of Retirees, Beneficiaries, and Suvivors Added to and Removed from the Benefit Payroll[1]

Division	Added to Payroll		Removed from Payroll		Payroll - End of Year		Average Annual Benefits	Increase in Average Benefits
	Number	Annual Benefit	Number	Annual Benefit	Number	Annual Benefit		
State								
• 12/31/2017	2,029	$96,524,376	810	$23,794,584	39,232	$1,582,025,544	$40,325	1.6%
• 12/31/2018	1,948	$64,439,160	865	$29,030,196	40,315	$1,617,434,508	$40,120	(0.5%)
School								
• 12/31/2017	3,249	$130,564,260	1,026	$26,635,332	64,163	$2,375,100,588	$37,017	1.0%
• 12/31/2018	3,319	$90,191,556	1,106	$32,160,792	66,376	$2,433,131,352	$36,657	(1.0%)
Local Government								
• 12/31/2017	420	$18,329,400	114	$2,916,156	7,351	$278,542,512	$37,892	1.5%
• 12/31/2018	421	$14,336,628	128	$3,227,280	7,644	$289,651,860	$37,893	0.0%
Judicial								
• 12/31/2017	24	$2,554,728	9	$398,184	375	$25,981,932	$69,285	4.7%
• 12/31/2018	8	$696,864	3	$129,084	380	$26,549,712	$69,868	0.8%
Denver Public Schools								
• 12/31/2017	283	$13,847,400	181	$6,388,008	7,037	$275,136,504	$39,099	1.3%
• 12/31/2018	297	$9,717,816	184	$6,345,060	7,150	$278,509,260	$38,952	(0.4%)
Total Division Trust Funds								
• 12/31/2017	6,005	$261,820,164	2,140	$60,132,264	118,158	$4,536,787,080	$38,396	1.2%
• 12/31/2018	5,993	$179,382,024	2,286	$70,892,412	121,865	$4,645,276,692	$38,118	(0.7%)

[1] Does not include 324 deferred survivors

Exhibit F – Summary Statement of Income and Expenses on a Market Value Basis

Year Ended December 31, 2018	State Division	School Division	Local Government Division	Judicial Division	Denver Public Schools Division	Total
Net assets at market value at beginning of year	**$15,105,378,385**	**$25,204,919,910**	**$4,249,852,277**	**$328,458,690**	**$3,452,666,927**	**$48,341,276,189**
• Employer contributions	567,244,181	901,413,388	77,578,359	8,092,192	31,370,077	1,585,698,197
• Nonemployer contributions	78,488,543	126,504,713	0	1,384,837	18,621,907	225,000,000
• Member contributions	236,312,964	386,812,154	52,420,899	4,063,673	58,172,110	737,781,800
• Purchased service	25,227,291	27,524,936	5,642,244	635,823	2,925,252	61,955,546
• Employer disaffiliation	0	0	0	0	0	0
Total contributions	**$907,272,979**	**$1,442,255,191**	**$135,641,502**	**$14,176,525**	**$111,089,346**	**$2,610,435,543**
• Net appreciation (depreciation)	(798,776,479)	(1,343,232,651)	(227,779,230)	(17,555,880)	(182,997,908)	(2,570,342,148)
• Interest	100,121,461	167,635,815	28,354,423	2,177,394	22,911,027	321,200,120
• Dividends	166,311,901	278,460,088	47,099,572	3,616,873	38,057,539	533,545,973
• Other income	84,011,775	140,662,974	23,792,155	1,827,048	19,224,610	269,518,562
• Annual income reserve adjustment	5,684,221	7,667,628	1,545,957	67,149	1,293,483	16,258,438
• Less investment expense	(52,071,390)	(87,184,404)	(14,746,631)	(1,132,424)	(11,915,617)	(167,050,466)
Net income from investing activities	**($494,718,511)**	**($835,990,550)**	**($141,733,754)**	**($10,999,840)**	**($113,426,866)**	**($1,596,869,521)**
• Net securities lending income	2,841,429	4,757,552	804,715	61,796	650,213	9,115,705
• Other additions	7,888,427	7,957,485	838,678	225,157	769,841	17,679,588
Total additions	**$423,284,324**	**$618,979,678**	**($4,448,859)**	**$3,463,638**	**($917,466)**	**$1,040,361,315**
• Retirees/cobeneficiary benefits	1,593,694,451	2,397,930,598	284,251,188	25,907,626	274,537,791	4,576,321,654
• Survivor benefits	14,840,022	15,455,777	2,494,249	327,548	1,685,820	34,803,416
Total benefits	**$1,608,534,473**	**$2,413,386,375**	**$286,745,437**	**$26,235,174**	**$276,223,611**	**$4,611,125,070**
• Refund of contributions	65,253,352	76,034,851	15,716,551	185,534	11,196,657	168,386,945
• Disability and life insurance premiums	2,092,735	3,505,927	442,006	41,404	404,526	6,486,598
• Administrative expenses	11,901,923	23,560,475	2,620,564	86,385	2,919,143	41,088,490
• Other deductions	3,017,320	2,501,054	3,957,810	70,135	5,267,353	14,813,672
Total deductions	**$1,690,799,803**	**$2,518,988,682**	**$309,482,368**	**$26,618,632**	**$296,011,290**	**$4,841,900,775**
Net increase in assets	**($1,267,515,479)**	**($1,900,009,004)**	**($313,931,227)**	**($23,154,994)**	**($296,928,756)**	**($3,801,539,460)**
Net assets at end of year	**$13,837,862,906**	**$23,304,910,906**	**$3,935,921,050**	**$305,303,696**	**$3,155,738,171**	**$44,539,736,729**
Annual increase reserve	128,558,492	172,639,168	35,467,568	1,542,665	28,703,859	366,911,752
Total net assets	**$13,966,421,398**	**$23,477,550,074**	**$3,971,388,618**	**$306,846,361**	**$3,184,442,030**	**$44,906,648,481**

Exhibit G – Development of the Fund Through December 31, 2018

ALL DIVISION TRUST FUNDS[1]

Year Ended December 31	Employer Contributions	Member Contributions	Other Contributions	Net Investment Return	Admin. Expenses	Benefit Payments	Market Value of Assets at Year-End	Actuarial Value of Assets at Year-End	Actuarial Value as a Percent of Market Value
2009	$856,842,365	$592,777,110	$4,765,565	$4,863,111,176	($24,135,881)	($2,968,215,153)	32,667,649,124	37,598,988,107	115.1%
2010	894,099,629	668,130,772	5,701,100	4,418,156,378	(31,265,597)	(3,358,126,935)	38,365,677,286	39,229,261,481	102.3%
2011	917,966,618	708,208,908	8,063,184	662,618,450	(29,138,780)	(3,522,138,858)	37,164,437,884	37,185,066,667	100.1%
2012	995,299,619	690,354,880	136,682	4,321,580,601	(28,669,872)	(3,717,322,398)	39,793,127,468	39,079,472,464	98.2%
2013	1,101,883,008	665,393,643	5,074,751	5,545,015,463	(32,632,196)	(3,908,686,678)	43,649,375,160	41,122,832,649	94.2%
2014	1,382,775,624	693,520,807	3,339,699	2,247,203,413	(33,896,525)	(4,072,535,499)	44,069,299,338	42,718,566,293	96.9%
2015	1,291,902,066	726,938,223	5,189,510	662,526,310	(36,573,100)	(4,254,930,208)	42,464,338,122	44,025,859,870	103.7%
2016	1,397,246,801	745,253,243	14,898,401	3,001,297,334	(38,491,246)	(4,435,891,724)	43,148,650,931	44,687,696,483	103.6%
2017	1,493,726,236	773,899,920	23,129,607	7,594,637,352	(40,247,753)	(4,653,583,222)	48,341,276,189	45,613,722,695	94.4%
2018	1,810,698,197	799,632,169	17,693,257	(1,587,662,303)	(41,088,490)	(4,800,812,287)	44,539,736,729	46,046,154,761	103.4%

[1] Results as of December 31, 2009, do not include the Denver Public Schools Division.

Exhibit H – Definition of Pension Terms

The following list defines certain technical terms for the convenience of the reader:

Actuarial Accrued Liability for Actives:	The value of all projected benefit payments for current members less the portion that will be paid by future normal costs.
Actuarial Accrued Liability for Pensioners:	The single-sum value of lifetime benefits to existing pensioners. This sum takes into account life expectancies appropriate to the ages of the pensioners and the interest that the sum is expected to earn before it is entirely paid out in benefits.
Actuarial Cost Method:	A procedure allocating the Actuarial Present Value of Future Benefits to various time periods; a method used to determine the Normal Cost and the Actuarial Accrued Liability that are used to determine the Actuarially Determined Contribution (ADC).
Actuarial Gain or Loss:	A measure of the difference between actual experience and expected based upon a set of Actuarial Assumptions, during the period between two Actuarial Valuation dates. Through the actuarial assumptions, rates of decrements, rates of salary increases, and rates of fund earnings have been forecasted. To the extent that actual experience differs from that assumed, Actuarial Accrued Liabilities emerge that may be the same as forecasted, or may be larger or smaller than projected. Actuarial gains are due to favorable experience, e.g., assets earn more than projected, salary increases are less than assumed, members retire later than assumed, etc. Favorable experience means actual results produce actuarial liabilities not as large as projected by the actuarial assumptions. On the other hand, actuarial losses are the result of unfavorable experience, i.e., actual results yield actuarial liabilities that are larger than projected. Actuarial gains will shorten the time required for funding the actuarial balance sheet deficiency while actuarial losses will lengthen the funding period.
Actuarially Equivalent:	Of equal actuarial present value, determined as of a given date and based on a given set of Actuarial Assumptions.
Actuarial Present Value (APV):	The value of an amount or series of amounts payable or receivable at various times, determined as of a given date by the application of a particular set of Actuarial Assumptions. Each such amount or series of amounts is: a. Adjusted for the probable financial effect of certain intervening events (such as changes in compensation levels, marital status, etc.) b. Multiplied by the probability of the occurrence of an event (such as survival, death, disability, withdrawal, etc.) on which the payment is conditioned, and c. Discounted according to an assumed rate (or rates) of return to reflect the time value of money.

Actuarial Present Value of Future Plan Benefits:	The Actuarial Present Value of benefit amounts expected to be paid at various future times under a particular set of Actuarial Assumptions, taking into account such items as the effect of advancement in age, anticipated future compensation, and future service credits. The Actuarial Present Value of Future Plan Benefits includes the liabilities for active members, retired members, beneficiaries receiving benefits, and inactive members entitled to either a refund or a future retirement benefit. Expressed another way, it is the value that would have to be invested on the valuation date so that the amount invested plus investment earnings would provide sufficient assets to pay all projected benefits and expenses when due.
Actuarial Valuation:	The determination, as of a valuation date, of the Normal Cost, Actuarial Accrued Liability, Actuarial Value of Assets, and related Actuarial Present Values for a plan.
Actuarial Value of Assets (AVA):	The value of the Fund's assets as of a given date, used by the actuary for valuation purposes. This may be the market or fair value of plan assets, but commonly plans use a smoothed value in order to reduce the year-to-year volatility of calculated results, such as the funded ratio and the ADC.
Actuarially Determined:	Values that have been determined utilizing the principles of actuarial science. An actuarially determined value is derived by application of the appropriate actuarial assumptions to specified values determined by provisions of the law.
Actuarially Determined Contribution (ADC):	The employer's periodic required contributions, expressed as a dollar amount or a percentage of covered plan compensation, determined under PERA's pension funding policy. The ADC consists of the Employer Normal Cost and the Amortization Payment.
Amortization Method:	A method for determining the Amortization Payment. The most common methods used are level dollar and level percentage of payroll. Under the Level Dollar method, the Amortization Payment is one of a stream of payments, all equal, whose Actuarial Present Value is equal to the UAAL. Under the Level Percentage of Pay method, the Amortization Payment is one of a stream of increasing payments, whose Actuarial Present Value is equal to the UAAL. Under the Level Percentage of Pay method, the stream of payments increases at the assumed rate at which total covered payroll of all active members will increase.
Amortization Payment:	The portion of the pension plan contribution, or ADC, that is designed to pay interest on and to amortize the Unfunded Actuarial Accrued Liability.

Assumptions or Actuarial Assumptions:	The estimates upon which the cost of the Fund is calculated, including: a. Investment return - the rate of investment yield that the Fund will earn over the long-term future; b. Mortality rates - the death rates of members and pensioners; life expectancy is based on these rates; c. Retirement rates - the rate or probability of retirement at a given age; d. Withdrawal rates - the rates at which members of various ages are expected to leave employment for reasons other than death, disability, or retirement; e. Salary increase rates - the rates of salary increase due to inflation and productivity growth.
Closed Amortization Period:	A specific number of years that is counted down by one each year and therefore declines to zero with the passage of time. For example, if the amortization period is initially set at 30 years, it is 29 years at the end of one year, 28 years at the end of two years, etc. See Open Amortization Period.
Decrements:	Those causes/events due to which a member's status (active-inactive-retiree-beneficiary) changes, that is: death, retirement, disability, or termination.
Defined Benefit Plan:	A retirement plan in which benefits are defined by a formula applied to the member's compensation and/or years of service.
Defined Contribution Plan:	A retirement plan, such as a 401(k) plan, a 403(b) plan, or a 457 plan, in which the contributions to the plan are assigned to an account for each member, the plan's earnings are allocated to each account, and each member's benefits are a direct function of the account balance.
Employer Normal Cost:	The portion of the Normal Cost to be paid by the employer. This is equal to the Normal Cost less expected member contributions.
Experience Study:	A periodic review and analysis of the actual experience of the Fund that may lead to a revision of one or more Actuarial Assumptions. Actual rates of decrement and salary increases are compared to the actuarially assumed values and modified as deemed appropriate by the Actuary.
Funded Ratio:	The ratio of the Actuarial Value of Assets (AVA) to the Actuarial Accrued Liability (AAL). Plans sometimes calculate a market funded ratio, using the market value of assets (MVA), rather than or in addition to the AVA.

Funding Period or Amortization Period:	The term "Funding Period" is used in two ways. First, it is the period used in calculating the Amortization Payment as a component of the ADC. Second, it is a calculated item: the number of years in the future that will theoretically be required to amortize (i.e., pay off or eliminate) the Unfunded Actuarial Accrued Liability, based on the statutory employer contribution rate, and assuming no future actuarial gains or losses.
Investment Return:	The rate of earnings of the Fund from its investments, including interest, dividends and capital gain and loss adjustments, computed as a percentage of the average value of the fund. For actuarial purposes, the investment return often reflects a smoothing of the capital gains and losses to avoid significant swings in the value of assets from one year to the next.
Margin:	The difference, whether positive or negative, between the statutory employer contribution rate and the Actuarially Determined Contribution (ADC).
Market Value of Assets:	Plan assets at the fair market value of assets.
Normal Cost:	That portion of the Actuarial Present Value of pension plan benefits and expenses allocated to a valuation year by the Actuarial Cost Method. Any payment with respect to an Unfunded Actuarial Accrued Liability is not part of Normal Cost (see Amortization Payment). For pension plan benefits that are provided in part by member contributions, Normal Cost refers to the total of member contributions and employer Normal Cost unless otherwise specifically stated. Under the entry age normal cost method, the Normal Cost is intended to be the level cost (when expressed as a percentage of pay) needed to fund the benefits of a member form hire until ultimate termination, death, disability, or retirement.
Open Amortization Period:	An open amortization period is one that is used to determine the Amortization Payment, but which does not change over time. If the initial period is set as 30 years, the same 30-year period is used in determining the Amortization Period each year. In theory, if an Open Amortization Period with level percentage of payroll is used to amortize the Unfunded Actuarial Accrued Liability, the UAAL will never decrease, but will become smaller each year, in relation to covered payroll, if the Actuarial Assumptions are realized.
Real Rate of Return:	Nominal rate of return on investments, adjusted for inflation.
Unfunded Actuarial Accrued Liability (UAAL):	The excess of the Actuarial Accrued Liability over the Actuarial Value of Assets. This value may be negative, in which case it may be expressed as a negative Unfunded Actuarial Accrued Liability, also called the Funding Surplus.
Valuation Date or Actuarial Valuation Date:	The date as of which the value of assets is determined and as of which the Actuarial Present Value of Future Plan Benefits is determined. The expected benefits to be paid in the future are discounted to this date.

Section 4: Actuarial Valuation Basis

Exhibit I – Actuarial Assumptions and Actuarial Cost Method

Rationale for Assumptions	The information and analysis used in selecting each assumption that has a significant effect on this actuarial valuation resulted from the 2016 Actuarial Experience Study covering plan experience over the four-year period January 1, 2012 through December 31, 2015 and Board discussion at the November 18, 2016 Board meeting. Based on professional judgment, no assumption changes are warranted at this time.
Long-Term Rate of Return	7.25%, net of investment expenses
Price Inflation Assumption	2.40%
Wage Inflation Assumption	3.50%
Interest Credit	3.00% per annum on member contribution account balances
Expected Administrative Expenses	0.40%
Actuarial Cost Method	Entry Age Actuarial Cost Method. Entry Age is the age at date of employment or, if date is unknown, current age minus years of service. Normal Cost and Actuarial Accrued Liability are calculated on an individual basis and are allocated by salary, with Normal Cost determined using the plan of benefits applicable to each member.
Asset Valuation Method	The actuarial value of assets is determined using the “four-year smoothed value” asset valuation method. Under this method, investment gains and losses are recognized in equal portions over a four-year period. Investment gains and losses are determined by comparing the actual return on market value for a given period to the anticipated earnings over the same period if the market value at the beginning of the period, contributions, benefit payments, and administrative expenses during the period earned the expected rate of return for the portion of the period that each was expected to be included in, or excluded from, plan assets. The expected rate of return for this purpose is equal to the investment rate of return assumption at the beginning of the period. The resulting actuarial value of assets is not constrained to fall within a corridor around the market value of assets.
Percent Married	100% of active members (80% for members of the DPS Division Trust Fund) are assumed to be married, with the wife 2 years younger than the husband.
Post-Retirement Benefit Increases [Annual Increases (AI)]	1.5% per year for members of the DPS Benefit Structure or members of the PERA Benefit Structure with membership prior to 1/01/2007. Members of the PERA Benefit Structure with membership after 12/31/2006 financed by the AIR. In the determination of the Actuarially Determined Contribution rate, as a percentage of covered payroll, the AIR is excluded from both assets and liabilities. The current AI cap is subject to the Automatic Adjustment Provision.

Withdrawal Assumption	For all but the Judicial Division, it was assumed that 35% of the vested members who terminate elect to withdraw their contributions and matching employer contributions while the remaining 65% elect to leave their contributions in the plan in order to be eligible for a benefit at their retirement date. For the Judicial Division, it was assumed that 100% of the vested members who terminate elect to leave their contribution in the plan in order to be eligible for a benefit at their retirement date. Current active members assumed to terminate service and leave their contributions in the plan in order to be eligible for a benefit at their retirement date are assumed to retire with a reduced benefit, if applicable, at an age based upon benefit structure, Non-Trooper/Trooper, and/or service as shown in the following table:

Assumed Age of Initial Benefit Receipt	Benefit Structure, Non-Trooper/Trooper, and/or Service
50	PERA Benefit Structure Members (excluding Troopers) with 25 or More Years of Service
50	Troopers with 20 or More Years of Service
55	PERA Benefit Structure Members (excluding Troopers) with 20–25 Years of Service
60	PERA Benefit Structure Members with Less than 20 Years of Service
65	DPS Benefit Structure Members

Inactive Members	It was assumed that 100% of inactive members who terminated employment with less than five years of service elect to withdraw their contributions. Current inactive members in the PERA Benefit Structure who are assumed to leave their contributions in the plan in order to be eligible for a benefit at their retirement date are assumed to retire at age 62 with an unreduced pension benefit. Current inactive members in the DPS Benefit Structure who are assumed to leave their contributions in the plan in order to be eligible for a benefit at their retirement date are assumed to retire at age 65 with an unreduced pension benefit.

Death Before Retirement	Healthy mortality assumptions for active members are based on the RP-2014 White Collar Employee Mortality Table, a table specifically developed for actively working people. To allow for an appropriate margin of improved mortality prospectively, the mortality rates incorporate a 70 percent factor applied to male rates and a 55 percent factor applied to female rates.
Death After Retirement	For State and Local Government Division Trust Funds, the mortality table for post-retirement healthy mortality used in evaluating allowances to be paid is the RP-2014 Healthy Annuitant Mortality Table with adjustments for credibility and gender. For males the adjustments are a 73% factor applied to the rates for ages below 80 and a 108% factor applied to the rates for ages 80 and above, projected to 2018 using the MP-2015 projection scale. For females the adjustments are a 78% factor applied to the rates for ages below 80 and a 109% factor applied to the rates for ages 80 and above, projected to 2020 using the MP-2015 projection scale. For the School, Judicial, and DPS Division Trust Funds, the mortality table for post-retirement healthy mortality used in evaluating allowances to be paid is the RP-2014 White Collar Healthy Annuitant Mortality Table with adjustments for credibility and gender. For males the adjustments are a 93% factor applied to the rates for ages below 80 and a 113% factor applied to the rates for ages 80 and above, projected to 2018 using the MP-2015 projection scale. For females the adjustments are a 68% factor applied to the rates for ages below 80 and a 106% factor applied to the rates for ages 80 and above, projected to 2020 using the MP-2015 projection scale. For all disabled retirees, the RP-2014 Disabled Retiree Mortality Table, incorporating a 90% factor to both male rates and female rates was used for the period after disability retirement. For future benefit recipients, the mortality assumption used to determine the factors for money purchase benefits, reduced service benefits for members who were not eligible to retire as of January 1, 2011, and cobeneficiary payment options is based upon the collective experience of all PERA divisions. For male rates, the RP-2014 Healthy Annuitant Mortality Table with adjustments for credibility and a 79% factor applied to the rates for ages below 80 and a 111% factor applied to the rates for ages 80 and above, projected to 2018 using the MP-2015 projection scale is assumed. For female rates, the RP-2014 White Collar Healthy Annuitant Mortality Table with adjustments for credibility and a 78% factor applied to the rates for ages below 80 and a 102% factor applied to the rates for ages 80 and above, projected to 2019 using the MP-2015 projection scale is assumed. Unisex factors are then developed using a male/female blend based upon factor type, benefit tier, and/or benefit structure.

Salary Increases

Representative values of the assumed annual rates of future salary increases are shown in the following tables:

State Division Trust Fund (Non-Troopers)			
Age	Merit & Seniority	Inflation & Productivity	Total Increase
20	5.67%	3.50%	9.17%
25	3.75	3.50	7.25
30	2.80	3.50	6.30
35	2.05	3.50	5.55
40	1.50	3.50	5.00
45	0.85	3.50	4.35
50	0.50	3.50	4.00
55	0.10	3.50	3.60
60	0.00	3.50	3.50
65	0.00	3.50	3.50
70	0.00	3.50	3.50

State Division Trust Fund (Troopers)			
Age	Merit & Seniority	Inflation & Productivity	Total Increase
20	5.50%	3.50%	9.00%
25	3.75	3.50	7.25
30	2.80	3.50	6.30
35	2.05	3.50	5.55
40	1.50	3.50	5.00
45	1.20	3.50	4.70
50	0.80	3.50	4.30
55	0.40	3.50	3.90
60	0.00	3.50	3.50
65	0.00	3.50	3.50
70	0.00	3.50	3.50

School Division and DPS Division Trust Funds (PERA Benefit Structure)			
Age	Merit & Seniority	Inflation & Productivity	Total Increase
20	6.20%	3.50%	9.70%
25	4.10	3.50	7.60
30	2.95	3.50	6.45
35	2.50	3.50	6.00
40	1.95	3.50	5.45
45	1.35	3.50	4.85
50	0.80	3.50	4.30
55	0.35	3.50	3.85
60	0.00	3.50	3.50
65	0.00	3.50	3.50
70	0.00	3.50	3.50

Local Government Division Trust Fund			
Age	Merit & Seniority	Inflation & Productivity	Total Increase
20	6.95%	3.50%	10.45%
25	4.30	3.50	7.80
30	2.64	3.50	6.14
35	1.72	3.50	5.22
40	1.23	3.50	4.73
45	0.99	3.50	4.49
50	0.79	3.50	4.29
55	0.60	3.50	4.10
60	0.25	3.50	3.75
65	0.00	3.50	3.50
70	0.00	3.50	3.50

Judicial Division Trust Fund			
Age	Merit & Seniority	Inflation & Productivity	Total Increase
30	1.50%	3.50%	5.00%
35	1.50	3.50	5.00
40	0.67	3.50	4.17
45	0.50	3.50	4.00
50	0.50	3.50	4.00
55	0.50	3.50	4.00
60	0.50	3.50	4.00
65	0.50	3.50	4.00
70	0.50	3.50	4.00

All Division Trust Funds (DPS Benefit Structure)			
Age	Merit & Seniority	Inflation & Productivity	Total Increase
20	3.50%	3.50%	7.00%
25	3.50	3.50	7.00
30	3.20	3.50	6.70
35	2.76	3.50	6.26
40	2.12	3.50	5.62
45	1.34	3.50	4.84
50	0.80	3.50	4.30
55	0.42	3.50	3.92
60	0.20	3.50	3.70
65	0.00	3.50	3.50
70	0.00	3.50	3.50

Separations From Active Service

Representative values of the assumed annual rates of termination, death, and disability are shown in the following tables:

State Division Trust Fund (Non-Troopers)						
	Ultimate Termination		Death		Disability	
Age	Males	Females	Males	Females	Males	Females
20	30.00%	20.00%	0.0199%	0.0075%	0.01%	0.01%
25	10.00	14.50	0.0237	0.0080	0.01	0.01
30	7.00	10.00	0.0222	0.0101	0.01	0.01
35	6.00	7.50	0.0257	0.0133	0.03	0.03
40	5.00	6.75	0.0308	0.0184	0.05	0.05
45	4.25	5.50	0.0477	0.0305	0.09	0.09
50	4.25	5.25	0.0827	0.0512	0.20	0.20
55	4.25	5.25	0.1369	0.0777	0.27	0.27
60	4.25	5.25	0.2302	0.1133	0.30	0.30
65	4.25	5.25	0.4064	0.1715	0.30	0.30
70	4.25	5.25	0.7195	0.2988	0.30	0.30

The select termination assumptions for members with less than five years of service are shown in the following table:

State Division Trust Fund (Non-Troopers)		
Service	Males	Females
0	41.50%	41.50%
1	20.50	21.50
2	14.50	16.00
3	11.50	13.00
4	9.50	11.50

State Division Trust Fund (Troopers)						
	Termination[1]		Death		Disability	
Age	Males	Females	Males	Females	Males	Females
20	8.00%	8.00%	0.0199%	0.0075%	0.01%	0.01%
25	6.00	6.00	0.0237	0.0080	0.02	0.02
30	4.00	4.00	0.0222	0.0101	0.04	0.04
35	3.75	3.75	0.0257	0.0133	0.06	0.06
40	3.00	3.00	0.0308	0.0184	0.10	0.10
45	3.00	3.00	0.0477	0.0305	0.25	0.25
50	3.00	3.00	0.0827	0.0512	0.30	0.30
55	3.00	3.00	0.1369	0.0777	0.30	0.30
60	3.00	3.00	0.2302	0.1133	0.30	0.30
65	3.00	3.00	0.4064	0.1715	0.30	0.30
70	3.00	3.00	0.7195	0.2988	0.30	0.30

[1] There are no select termination assumptions for State Troopers.

School Division and DPS Division Trust Funds (PERA Benefit Structure)						
	Ultimate Termination		Death		Disability	
Age	Males	Females	Males	Females	Males	Females
20	20.00%	14.50%	0.0199%	0.0075%	0.01%	0.01%
25	10.00	12.00	0.0237	0.0080	0.01	0.01
30	6.50	8.00	0.0222	0.0101	0.01	0.01
35	5.25	6.50	0.0257	0.0133	0.02	0.02
40	4.25	5.00	0.0308	0.0184	0.04	0.04
45	4.00	5.00	0.0477	0.0305	0.06	0.06
50	4.00	5.00	0.0827	0.0512	0.09	0.09
55	4.00	5.00	0.1369	0.0777	0.15	0.15
60	4.00	5.00	0.2302	0.1133	0.21	0.21
65	4.00	5.00	0.4064	0.1715	0.21	0.21
70	4.00	5.00	0.7195	0.2988	0.21	0.21

The select termination assumptions for members with less than five years of service are shown in the following table:

School Division Trust Fund and DPS Division Trust Funds (PERA Benefit Structure)		
Service	**Males**	**Females**
0	37.00%	34.00%
1	21.00	20.00
2	16.00	15.00
3	12.00	12.00
4	11.00	11.00

Local Government Division Trust Fund						
	Ultimate Termination		Death		Disability	
Age	**Males**	**Females**	**Males**	**Females**	**Males**	**Females**
20	13.00%	16.00%	0.0199%	0.0075%	0.01%	0.01%
25	12.00	16.00	0.0237	0.0080	0.01	0.01
30	8.00	11.00	0.0222	0.0101	0.01	0.01
35	6.00	9.00	0.0257	0.0133	0.03	0.03
40	5.25	6.50	0.0308	0.0184	0.04	0.04
45	4.50	6.50	0.0477	0.0305	0.11	0.11
50	4.50	6.00	0.0827	0.0512	0.15	0.15
55	4.50	6.00	0.1369	0.0777	0.17	0.17
60	4.50	6.00	0.2302	0.1133	0.25	0.25
65	4.50	6.00	0.4064	0.1715	0.25	0.25
70	4.50	6.00	0.7195	0.2988	0.25	0.25

The select termination assumptions for members with less than five years of service are shown in the following table:

Local Government Division Trust Fund		
Service	**Males**	**Females**
0	41.00%	39.00%
1	24.00	23.00
2	17.00	18.00
3	12.00	14.00
4	10.00	11.00

Judicial Division Trust Fund						
	Termination[1]		Death		Disability	
Age	**Males**	**Females**	**Males**	**Females**	**Males**	**Females**
30	1.65%	1.65%	0.0222%	0.0101%	0.01%	0.01%
35	1.65	1.65	0.0257	0.0133	0.02	0.02
40	1.65	1.65	0.0308	0.0184	0.04	0.04
45	1.65	1.65	0.0477	0.0305	0.08	0.08
50	1.65	1.65	0.0827	0.0512	0.10	0.10
55	1.65	1.65	0.1369	0.0777	0.20	0.20
60	1.65	1.65	0.2302	0.1133	0.30	0.30
65	1.65	1.65	0.4064	0.1715	0.30	0.30
70	1.65	1.65	0.7195	0.2988	0.30	0.30

[1] There are no select termination assumptions for members in the Judicial Division Trust Fund.

All Division Trust Funds (DPS Benefit Structure)						
	Termination[1]		Death		Disability	
Age	Males	Females	Males	Females	Males	Females
20	8.00%	10.00%	0.0199%	0.0075%	0.01%	0.01%
25	8.00	10.00	0.0237	0.0080	0.01	0.01
30	7.00	9.00	0.0222	0.0101	0.01	0.01
35	7.00	8.00	0.0257	0.0133	0.02	0.02
40	5.75	6.50	0.0308	0.0184	0.05	0.05
45	5.00	4.50	0.0477	0.0305	0.09	0.09
50	4.50	4.50	0.0827	0.0512	0.20	0.20
55	4.25	4.50	0.1369	0.0777	0.24	0.24
60	4.25	4.50	0.2302	0.1133	0.38	0.38
65	4.25	4.50	0.4064	0.1715	0.40	0.40
70	4.25	4.50	0.7195	0.2988	0.40	0.40

[1] There are no select termination assumptions for members in the DPS Benefit Structure.

Retirement

Representative values of the assumed annual rates of service retirement are shown in the following tables:

State Division Trust Fund (Non-Troopers)				
	Eligible for Reduced Benefits		Eligible for Unreduced Benefits	
Age	Males	Females	Males	Females
50	9.5%	10.0%	60.0%	55.0%
51	9.5	10.0	50.0	40.0
52	9.5	10.0	42.0	36.0
53	9.5	10.0	38.0	34.0
54	9.5	10.0	32.0	26.0
55	9.5	10.0	25.0	25.0
56	9.5	10.0	20.0	24.0
57	9.5	10.0	20.0	20.0
58	9.5	10.0	18.0	18.0
59	9.5	10.0	20.0	18.0
60	9.5	10.0	20.0	21.0
61	9.5	10.0	18.0	18.0
62	9.5	10.0	22.0	19.0
63	9.5	10.0	20.0	19.0
64	9.5	10.0	20.0	19.0
65	0.0	0.0	24.0	22.0
66	0.0	0.0	26.0	26.0
67	0.0	0.0	25.0	24.0
68	0.0	0.0	22.0	25.0
69	0.0	0.0	22.0	24.0
70	0.0	0.0	25.0	25.0
71	0.0	0.0	25.0	25.0
72	0.0	0.0	25.0	25.0
73	0.0	0.0	25.0	25.0
74	0.0	0.0	25.0	25.0
75 & over	0.0	0.0	100.0	100.0

State Division Trust Fund (Troopers)				
	Eligible for Reduced Benefits		Eligible for Unreduced Benefits	
Age	Males	Females	Males	Females
45			40.0%	40.0%
46			40.0	40.0
47			40.0	40.0
48			40.0	40.0
49			40.0	40.0
50	10.0%	10.0%	40.0	40.0
51	10.0	10.0	32.0	32.0
52	10.0	10.0	32.0	32.0
53	10.0	10.0	32.0	32.0
54	10.0	10.0	32.0	32.0
55	5.0	5.0	32.0	32.0
56	5.0	5.0	32.0	32.0
57	5.0	5.0	32.0	32.0
58	5.0	5.0	32.0	32.0
59	5.0	5.0	32.0	32.0
60	10.0	10.0	32.0	32.0
61	10.0	10.0	32.0	32.0
62	10.0	10.0	32.0	32.0
63	10.0	10.0	32.0	32.0
64	10.0	10.0	32.0	32.0
65 & over	0.0	0.0	100.0	100.0

School Division and DPS Division Trust Funds (PERA Benefit Structure)				
	Eligible for Reduced Benefits		Eligible for Unreduced Benefits	
Age	Males	Females	Males	Females
50	8.0%	8.0%	55.0%	60.0%
51	8.0	8.0	48.0	54.0
52	8.0	8.0	46.0	48.0
53	8.0	8.0	42.0	42.0
54	10.0	10.0	40.0	40.0
55	10.0	10.0	28.0	29.0
56	10.0	11.0	25.0	25.0
57	10.0	11.0	25.0	25.0
58	10.0	11.0	22.0	22.0
59	10.0	11.0	22.0	22.0
60	10.0	11.0	25.0	25.0
61	12.0	11.0	25.0	24.0
62	12.0	11.0	24.0	27.0
63	12.0	11.0	24.0	24.0
64	12.0	11.0	24.0	24.0
65	0.0	0.0	27.0	26.0
66	0.0	0.0	28.0	28.0
67	0.0	0.0	25.0	25.0
68	0.0	0.0	24.0	22.0
69	0.0	0.0	24.0	22.0
70	0.0	0.0	22.0	25.0
71	0.0	0.0	22.0	23.0
72	0.0	0.0	22.0	23.0
73	0.0	0.0	22.0	23.0
74	0.0	0.0	22.0	23.0
75 & over	0.0	0.0	100.0	100.0

Local Government Division Trust Fund				
	Eligible for Reduced Benefits		Eligible for Unreduced Benefits	
Age	Males	Females	Males	Females
50	8.0%	9.0%	60.0%	60.0%
51	8.0	9.0	46.0	52.0
52	8.0	9.0	30.0	40.0
53	8.0	9.0	25.0	40.0
54	8.0	9.0	22.0	40.0
55	8.0	12.0	22.0	28.0
56	8.0	12.0	25.0	30.0
57	8.0	12.0	22.0	21.0
58	8.0	12.0	20.0	21.0
59	10.0	11.5	20.0	21.0
60	11.0	11.5	22.0	21.0
61	11.0	11.5	22.0	20.0
62	11.0	11.5	24.0	27.0
63	11.0	11.5	25.0	22.0
64	11.0	11.5	25.0	22.0
65	0.0	0.0	25.0	25.0
66	0.0	0.0	30.0	25.0
67	0.0	0.0	20.0	30.0
68	0.0	0.0	25.0	20.0
69	0.0	0.0	25.0	20.0
70	0.0	0.0	25.0	24.0
71	0.0	0.0	25.0	24.0
72	0.0	0.0	25.0	24.0
73	0.0	0.0	25.0	24.0
74	0.0	0.0	25.0	24.0
75 & over	0.0	0.0	100.0	100.0

Judicial Division Trust Fund				
	Eligible for Reduced Benefits		Eligible for Unreduced Benefits	
Age	Males	Females	Males	Females
50	6.0%	6.0%	6.0%	6.0%
51	6.0	6.0	6.0	6.0
52	6.0	6.0	6.0	6.0
53	6.0	6.0	6.0	6.0
54	6.0	6.0	6.0	6.0
55	6.0	6.0	6.0	6.0
56	6.0	6.0	6.0	6.0
57	6.0	6.0	6.0	6.0
58	6.0	6.0	6.0	6.0
59	6.0	6.0	6.0	6.0
60	8.0	8.0	8.0	8.0
61	8.0	8.0	8.0	8.0
62	8.0	8.0	8.0	8.0
63	8.0	8.0	8.0	8.0
64	8.0	8.0	8.0	8.0
65	0.0	0.0	15.0	15.0
66	0.0	0.0	15.0	15.0
67	0.0	0.0	15.0	15.0
68	0.0	0.0	15.0	15.0
69	0.0	0.0	15.0	15.0
70	0.0	0.0	40.0	40.0
71	0.0	0.0	40.0	40.0
72	0.0	0.0	40.0	40.0
73	0.0	0.0	40.0	40.0
74	0.0	0.0	40.0	40.0
75 & over	0.0	0.0	100.0	100.0

All Division Trust Funds (DPS Benefit Structure)				
	Eligible for Reduced Benefits		Eligible for Unreduced Benefits	
Age	Males	Females	Males	Females
50	8.0%	5.0%	40.0%	40.0%
51	8.0	5.0	40.0	40.0
52	8.0	5.0	35.0	30.0
53	8.0	10.0	35.0	30.0
54	11.0	10.0	30.0	30.0
55	11.0	10.0	30.0	30.0
56	11.0	10.0	20.0	25.0
57	11.0	10.0	24.0	25.0
58	11.0	10.0	22.0	20.0
59	15.0	12.0	25.0	24.0
60	15.0	15.0	22.0	30.0
61	17.0	15.0	20.0	28.0
62	17.0	15.0	25.0	30.0
63	17.0	15.0	40.0	30.0
64	17.0	15.0	20.0	30.0
65	0.0	0.0	30.0	35.0
66	0.0	0.0	30.0	35.0
67	0.0	0.0	30.0	32.0
68	0.0	0.0	30.0	30.0
69	0.0	0.0	30.0	30.0
70	0.0	0.0	30.0	30.0
71	0.0	0.0	30.0	30.0
72	0.0	0.0	30.0	30.0
73	0.0	0.0	30.0	30.0
74	0.0	0.0	30.0	30.0
75 & over	0.0	0.0	100.0	100.0

Single Life Retirement Values and Rates of Post-Retirement Mortality

Healthy Benefit Recipients								
State/Troopers/Local								
Sample Ages	Rates of Post-Retirement Mortality		Present Value of $1.00 Monthly for Life		Present Value of $1.00 Monthly Increasing 1.5% Annually		Future Life Expectancy (Years)	
	Males	Females	Males	Females	Males	Females	Males	Females
40	0.031%	0.018%	$160.33	$162.36	$192.67	$195.98	43.97	46.33
45	0.048	0.031	155.77	158.53	185.38	189.60	39.04	41.38
50	0.297	0.198	149.50	153.23	176.00	181.34	34.15	36.46
55	0.458	0.277	143.13	147.36	166.49	172.33	29.71	31.84
60	0.635	0.393	135.41	139.72	155.38	161.21	25.44	27.30
65	0.831	0.595	125.54	129.88	141.87	147.63	21.27	22.88
70	1.185	0.965	112.83	117.53	125.37	131.43	17.18	18.63
75	1.830	1.627	96.82	102.49	105.67	112.64	13.25	14.62
80	3.824	3.123	77.84	85.09	83.47	91.90	9.63	10.97
85	7.940	6.061	60.12	67.51	63.45	71.72	6.81	7.93

Healthy Benefit Recipients								
School / DPS / Judges								
Sample Ages	Rates of Post-Retirement Mortality		Present Value of $1.00 Monthly for Life		Present Value of $1.00 Monthly Increasing 1.5% Annually		Future Life Expectancy (Years)	
	Males	Females	Males	Females	Males	Females	Males	Females
40	0.031%	0.018%	$160.92	$163.72	$193.61	$198.28	44.55	48.09
45	0.048	0.031	156.60	160.46	186.62	192.62	39.63	43.14
50	0.257	0.130	150.69	155.97	177.64	185.33	34.74	38.22
55	0.397	0.181	144.43	150.57	168.21	176.84	30.23	33.48
60	0.544	0.257	136.67	143.39	157.01	166.15	25.87	28.80
65	0.728	0.422	126.61	133.99	143.23	152.94	21.59	24.22
70	1.117	0.690	113.71	121.96	126.49	136.92	17.43	19.78
75	1.849	1.191	97.88	106.82	106.96	117.81	13.48	15.54
80	3.630	2.537	79.48	88.79	85.31	96.17	9.88	11.63
85	7.332	5.320	61.30	70.46	64.72	75.03	6.95	8.38

Disability Benefit Recipients								
Sample Ages	Rates of Post-Retirement Mortality		Present Value of $1.00 Monthly for Life		Present Value of $1.00 Monthly Increasing 1.5% Annually		Future Life Expectancy (Years)	
	Males	Females	Males	Females	Males	Females	Males	Females
40	0.990%	0.491%	$135.73	$146.58	$158.39	$173.34	30.34	36.11
45	1.534	0.814	129.67	141.02	150.08	165.30	27.01	32.13
50	1.836	1.072	124.52	135.58	142.86	157.43	24.14	28.53
55	2.103	1.303	118.81	129.53	134.98	148.83	21.36	25.09
60	2.394	1.530	111.85	122.21	125.68	138.76	18.59	21.73
65	2.852	1.877	103.18	112.96	114.54	126.61	15.81	18.39
70	3.631	2.538	92.80	101.74	101.68	112.48	13.09	15.16
75	4.886	3.694	81.02	89.16	85.57	97.19	10.53	12.19
80	6.895	5.493	68.25	76.03	72.77	81.74	8.20	9.58
85	10.197	8.138	55.22	63.08	58.11	66.92	6.17	7.37

Exhibit II – Summary of Plan Provisions

This exhibit summarizes the major provisions of the Plan included in the valuation. It is not intended to be, nor should it be interpreted as, a complete statement of all plan provisions.

Effective Date:	Established in 1931, most recently amended during 2015 to "true-up" the employer contribution rate of the DPS Division. The Denver Public Schools Retirement System (DPSRS) was merged into PERA effective January 1, 2010. As of that date, all liabilities and assets of DPSRS were transferred to, and became liabilities and assets of, the DPS Division of PERA, including the maintenance of a separate benefit structure for existing members. Therefore, if a DPS division member terminates employment (without refund) and later is reemployed with an affiliated employer in the State Division, he or she may be building on a DPS Benefit Structure within that division. The benefit provisions of existing members of PERA on the merger date and all new hires, post-merger, are building a benefit under the PERA Benefit Structure.
DEFINITIONS	
Affiliated Employers:	State agencies and institutions of higher education, political subdivisions of the state, all school districts, courts, cities and municipalities and any other public entities that affiliate with PERA.
Annual Increase Reserve (AIR):	Applicable for PERA Benefit Structure members hired on or after January 1, 2007 and prior non-DPSRS members who became PERA members as of January 1, 2010. A portion of the employer contribution, currently equal to 1% of the salaries of affected members, is accumulated in the Annual Increase Reserve to be paid out in annual increases each July 1, to the extent affordable. A separate annual actuarial valuation determines the affordability and the percentage of annual increases to the eligible members within the groups previously defined. The maximum annual increase awarded, if any, by the PERA Board is the least of: a) 1.5% of current benefits, b) The average of the annual CPI-W increase determined each month published for the preceding calendar year, and c) An increase that will exhaust 10% of the year-end market value of the Annual Increase Reserve. Annual increases outlined in this section are subject to change as a result of the Auto Adjust Provision.
Covered Members:	Employees of Affiliated Employers who work in a position subject to membership and for whom contributions are made.
Division:	One of five separate divisions, which include: State, School, Local Government, Judicial and Denver Public Schools (DPS). Only local government entities can voluntarily affiliate with PERA and these entities are assigned to the Local Government Division. The financial activities of each division are accounted for in separate trust funds.

Highest Average Salary (HAS):	For PERA Benefit Structure members not in the Judicial Division who are eligible for retirement as of January 1, 2011, one-twelfth of the average of the highest annual salaries upon which contributions were made during three periods of twelve consecutive months of Service Credit; or for a member with less than three years of Service Credit, one-twelfth of the average of the annual salaries upon which contributions were made. Annual salary increases recognized in the determination of HAS are limited to 15% a year for members who began membership prior to January 1, 2007. For members who began membership on or after January 1, 2007, the annual salary increases recognized in the determination of HAS are limited to 8% a year. For Judicial Division members one-twelfth of the highest annual salary upon which contributions were made during one period of twelve consecutive months of Service Credit. For DPS Benefit Structure members, who are eligible for retirement as of January 1, 2011, the greater of the average of the 36 months of highest annual salaries or the career average salary. For all members who are not eligible for retirement as of January 1, 2011, one-twelfth of the average of the highest annual salaries upon which contributions were made during three periods of twelve consecutive months of Service Credit; or for a member with less than three years of Service Credit, one-twelfth of the average of the annual salaries upon which contributions were made. Annual salary increases recognized in the determination of HAS are limited to 8% a year. Effective January 1, 2020 for members in the State, School, Local Government and DPS Divisions, all members who do not have five years of service credit on December 31, 2019 and new members hired on or after January 1, 2020, the number of years used in the highest average salary calculation will be increased from three years to five years. Effective January 1, 2020 for members in the Judicial Division, all members who do not have five years of service credit on December 31, 2019 and new members hired on or after January 1, 2020, the number of years used in the highest average salary calculation will be increased from one year to three years.
Interest Crediting Rate:	3% per annum on member contribution account balances.
Service Credit:	The total of all earned, purchased, (disability) projected, and military service credit, which is used to determine benefit eligibility and amounts.
Vested Members:	DPS Benefit Structure: Members who accrue five or more years of Service Credit are vested for benefits. PERA Benefit Structure: Members who accrue five or more years of Service Credit or attain age sixty-five are vested for benefits.
Salary:	PERA-includable salary redefined under SB 18-200 for all members to include payouts of unused sick leave. For new members hired on or after July 1, 2019, PERA-includable salary was redefined to include contributions to IRC Section 125 and 132 plans.

Member Contributions:

Member contributions, together with any purchased service credit payments and interest, are credited to individual Member Contribution Accounts.

Effective Date	Percentage of Salary Contributed		
	Non-State Troopers		State Troopers
	State, School, & DPS Divisions	Local Government[1] Division	
Prior to July 1, 2019	8.00%	8.00%	10.00%
July 1, 2019	8.75%	8.00%	10.75%
July 1, 2020	9.50%	8.00%	11.50%
On and after July 1, 2021	10.00%	8.00%	12.00%

[1] Pursuant to HB 19-1217, enacted May 20, 2019.

Effective January 1, 2011, retirees working for a PERA-affiliated employer and not working as state legislators, as judges participating in the Senior Judge Program, or in a position covered by an Optional Retirement Plan are required to make member contributions at the same rate as an active member. The contributions are not credited to the member's account, do not accrue a benefit, and are non-refundable.

Member contributions as outlined in this section are subject to change as a result of the Auto Adjust Provision.

Employer Contributions:	State Division (except State Troopers): 10.15% of salary on and after 7/1/2003 School Division: 10.15% of salary on and after 7/1/2003 State Troopers: 12.85% of salary on and after 7/1/2003 Local Government Division: 10.00% of salary on and after 1/1/2004 Judicial Division : 13.66% of salary on and after 7/1/2004 DPS Division: 10.15% of salary on and after 1/1/2015. Actual employer contributions are reduced by an amount equal to the principal payments plus interest at 8.5% necessary each year to finance the Pension Certificates of Participation (PCOPs) issued in 1997 and 2008 and refinanced thereafter. The amount of the credit for 2018 was 14.70% of salary. The net DPS Division employer contribution rate for 2018 was 3.84% when including the AED and SAED as described below. Effective July 1, 2019, all employer contribution rates will be increased by 0.25%, except for the Local Government Division. The employer contribution rates of the State, School, Local Government, and Judicial Divisions include the contribution of 1.02% allocated to the Health Care Trust Fund. The employer contribution rate of the DPS Division includes the contribution of 1.02% allocated to the DPS Health Care Trust Fund. For PERA Benefit Structure members, hired on or after January 1, 2007, these contribution rates also include the 1.00% of payroll contribution earmarked for the Annual Increase Reserve. Due to legislation in 2004 through 2006, employers are required to pay the statutory contribution, including AED and SAED amounts, on the payroll of working retirees. Effective July 1, 2018 and on July 1st of each year thereafter until all divisions are 100% funded, PERA will receive an annual Direct Distribution from the State in the amount of $225 million. PERA shall allocate the distributions in a manner that is proportionate to the annual payroll of each division, except there shall be no allocation to the Local Government Division. Employer contributions are credited to the employer reserve of each division. Contributions as outlined in this section are subject to change as a result of the Automatic Adjustment Provision

Amortization Equalization Disbursement (AED):

Beginning January 1, 2006 (January 1, 2010 for the DPS Division), each employer shall pay to PERA a disbursement equal to a percentage of total payroll in accordance with the following schedule:

	Percentage of Total Payroll		
Year	State Division	Schools & DPS Divisions	Judicial Division
2006	0.50%	0.50%	0.50%
2007	1.00%	1.00%	1.00%
2008	1.40%	1.40%	1.40%
2009	1.80%	1.80%	1.80%
2010	2.20%	2.20%	2.20%
2011	2.60%	2.60%	2.20%
2012	3.00%	3.00%	2.20%
2013	3.40%	3.40%	2.20%
2014	3.80%	3.80%	2.20%
2015	4.20%	4.20%	2.20%
2016	4.60%	4.50%	2.20%
2017	5.00%	4.50%	2.20%
2018	5.00%	4.50%	2.20%
2019	5.00%	4.50%	3.40%
2020	5.00%	4.50%	3.80%
2021	5.00%	4.50%	4.20%
2022	5.00%	4.50%	4.60%
2023 & after	5.00%	4.50%	5.00%

If, at any time, the actuarial funded ratio for a division is 103% or more, the amount of the disbursement shall be reduced by 0.5% of pay.

For the Local Government Division, the AED contributions are frozen at the 2010 levels. If, at any time, the actuarial funded ratio for a division is 103% or more, then the amount of the disbursement shall be reduced by 0.5% of pay.

Supplemental Amortization Equalization Disbursement (SAED):	Beginning January 1, 2008 (January 1, 2010 for the DPS Division), each employer shall pay to PERA a supplemental disbursement equal to a percentage of total payroll in accordance with the following schedule:

Year	Percentage of Total Payroll		
	State Division	Schools & DPS Divisions	Judicial Division
2008	0.50%	0.50%	0.50%
2009	1.00%	1.00%	1.00%
2010	1.50%	1.50%	1.50%
2011	2.00%	2.00%	1.50%
2012	2.50%	2.50%	1.50%
2013	3.00%	3.00%	1.50%
2014	3.50%	3.50%	1.50%
2015	4.00%	4.00%	1.50%
2016	4.50%	4.50%	1.50%
2017	5.00%	5.00%	1.50%
2018	5.00%	5.50%	1.50%
2019	5.00%	5.50%	3.40%
2020	5.00%	5.50%	3.80%
2021	5.00%	5.50%	4.20%
2022	5.00%	5.50%	4.60%
2023 & after	5.00%	5.50%	5.00%

If, at any time, the actuarial funded ratio for a division is 103% or more, the amount of the disbursement shall be reduced by 0.5% of pay.

For the Local Government Division, the SAED contributions are frozen at the 2010 levels. If, at any time, the actuarial funded ratio for a division is 103% or more, then the amount of the disbursement shall be reduced by 0.5% of pay.

Matching Contributions:	A match applied to individual Member Contribution Accounts when a refund is made or when a money purchase benefit is calculated. The match is applied to the account balance less: 1. Any amount paid for the purchase of service credit, 2. Any payments in lieu of member contributions, and 3. Any interest accrued on 1 and 2. For members who receive a refund and meet the requirements for a service or reduced service retirement at the time the match is applied, or for payments made to survivors or beneficiaries of members who die before retirement, the match is 100% of eligible amounts. For PERA Benefit Structure members who receive a refund prior to meeting the requirements for a service or reduced service retirement, the match is 50% of eligible amounts. Effective January 1, 2011, members must have five years of earned service credit in order to receive the 50% match on a refund. Contributions received prior to January 1, 2011, are matched regardless if the member has five years of service credit on the refund date. For DPS Benefit Structure members who receive a refund prior to meeting the requirements for a service or reduced service retirement, no match is provided.
Blended Total Contribution Amount (or Rate):	The weighted average (based upon the proportion of UAAL attributable to each division as of the most recent valuation date) of the total amounts paid by the employer and the member to PERA for each of the five Division Trust Funds, including the Direct Distribution, but not including the portions of employer contributions remitted to the Health Care Trust Fund and the Annual Increase Reserve.
Blended Total Required Contribution:	The weighted average (based upon the proportion of UAAL attributable to each division as of the most recent valuation date) of the total of the actuarially determined contribution rates and member contribution rates of the five Division Trust Funds.

Automatic Adjustment Provision:	The AAP adjustment is determined using the Blended Total Contribution Amount divided by the Blended Total Required Contribution. If the resulting ratio falls within an acceptable corridor (98% to 119%), no adjustments are made. If the resulting ratio does not achieve a minimum benchmark (is less than 98 percent), adjustments are applied in an equitable manner of impact. An automatic adjustment will occur under the following conditions: • If the resulting ratio is less than 98%, there will be adjustments of equitable impact, increasing the Employer Contribution Rate, increasing the Member Contribution Rate, decreasing the AI cap, and increasing the Direct Distribution (if permitted). • If the resulting ratio is greater than or equal to 120%, there will be adjustments of equitable impact, decreasing the Employer Contribution Rate, decreasing the Member Contribution Rate, increasing the AI cap, and decreasing the Direct Distribution. The AAP defines the limited amounts of total adjustment available in each category, and also the increments of adjustments that can occur in any one year. Multiple steps over multiple years are allowed for a required adjustment as is necessary, but cannot exceed the ultimate limits as set forth in statute, as detailed below: • First adjustment cannot occur prior to July 1, 2020 • Adjustment (increase or decrease) to each of the Employer Contribution Rates and the Member Contribution Rates cannot exceed 0.50% in any one year, and o Cannot exceed 2.00% above the contribution rates reflecting SB 18-200 statutory reforms o Cannot fall below the 2017 contribution rates • Adjustment (increase or decrease) to the AI rate cannot exceed 0.25% in any one year, and o Cannot exceed a 2.00% AI cap maximum o Cannot fall below a 0.50% AI cap minimum • Adjustment to the Direct Distribution cannot exceed $20 million in any one year, and o Cannot exceed the initial $225 million amount o Can be reduced, with no floor • Adjustments that are required because funding is below the 98% threshold will be made to an extent that will bring the revised ratio to 103% following the corrective efforts but in no event can the adjustments in one year be greater than the limit described above. • Adjustments that are required because funding has reached the 120% threshold must not cause the ratio to fall below 103%. The adjustments will be calculated with the annual actuarial valuation and will take effect July 1 of the following calendar year.

PERA BENEFIT STRUCTURE	
Refund of Member Contributions:	In the event a member leaves service for a reason other than death or retirement, member contribution accounts including interest plus matching employer contributions on eligible amounts with interest are refunded upon request.
Service Retirement Eligibility:	The Age and Service Credit requirements to be eligible for a full Service Retirement are listed below:

Members, except State Troopers, hired before July 1, 2005 who have 5 or more years of service credit as of January 1, 2011

Age	Service Credit (Years)
50	30
55	Age + Service = 80 or more
60	20
65	5
65	60 payroll postings

Members, except State Troopers, hired on or after July 1, 2005 but before January 1, 2007, and who have 5 or more years of service credit as of January 1, 2011

Age	Service Credit (Years)
Any	35
55	Age + Service = 80 or more
60	20
65	5
65	60 payroll postings

Members, except State Troopers, hired on or after July 1, 2007 but before January 1, 2011, and who have less than 5 years of service credit as of January 1, 2011

Age	Service Credit (Years)
Any	35
55	30
55	Age + Service = 85 or more
60	25
65	5
65	60 payroll postings

Members, except State Troopers, hired on or after January 1, 2011 but before January 1, 2017 and Members, except State Troopers, hired on or after January 1, 2017 but before January 1, 2020 whose last 10 years of service credit are in either the School or DPS Division

Age	Service Credit (Years)
Any	35
58	Age + Service = 88 or more
65	5
65	60 payroll postings

Members, except State Troopers, hired on or after January 1, 2017 but before January 1, 2020 whose last 10 years of service credit are not in either the School or DPS Divisions

Age	Service Credit (Years)
Any	35
60	Age + Service = 90 or more
65	5
65	60 payroll postings

Members, except State Troopers, hired on or after January 1, 2020

Age	Service Credit (Years)
Any	35
64	30
65	5
65	60 payroll postings

State Troopers hired before January 1, 2020

Age	Service Credit (Years)
Any	30
50	25
55	20
65	5
65	60 payroll postings

State Troopers hired on or after January 1, 2020

Age	Service Credit (Years)
Any	35
55	25
65	5
65	60 payroll postings

<table>
<tr><td>Reduced Service Retirement Eligibility:</td><td>The Age and Service Credit requirements to be eligible for a Reduced Service Retirement are listed below:

Members, except State Troopers, hired before January 1, 2020
<table><tr><th>Age</th><th>Service Credit (Years)</th></tr><tr><td>50</td><td>25</td></tr><tr><td>55</td><td>20</td></tr><tr><td>60</td><td>5</td></tr></table>
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<table><tr><th>Age</th><th>Service Credit (Years)</th></tr><tr><td>55</td><td>25</td></tr><tr><td>60</td><td>5</td></tr></table>
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<table><tr><th>Age</th><th>Service Credit (Years)</th></tr><tr><td>55</td><td>20</td></tr><tr><td>60</td><td>5</td></tr></table></td></tr>
<tr><td>Disability Retirement Eligibility:</td><td>Active members with five or more years of earned service credit and at least 6 months of this disability time earned in the most recent period of membership are eligible to apply for disability retirement. To be eligible, the member must be found to be totally and permanently disabled (mentally or physically) from regular and gainful employment. The service credit requirement is waived for State Troopers injured in the line of duty and for judges found to be disabled by the Colorado Supreme Court.</td></tr>
<tr><td>Survivor Benefits Eligibility:</td><td>The qualified survivors of members who die before retirement with at least one year of service credit are eligible for monthly survivor benefits. The service credit requirement is waived if the death was job-related.</td></tr>
</table>

Service Retirement Benefit:	State (including State Troopers), School, Local Government, and DPS Divisions and Members of the Judicial Division who were on the bench on and after July 1, 1973: The greater of a) or b): a) 2.5% of HAS times years of Service Credit up to 40 b) The money purchase benefit, which is actuarially determined based on the value of the member contribution account and matching employer contributions on the effective date of retirement. Members age 65 with less than 5 years and less than 60 payroll postings are eligible for the money purchase benefit only. In all cases, the benefit is limited to 100% of HAS.
Reduced Service Retirement Benefit:	For all members, except State Troopers, the service retirement benefit calculated above reduced 4% for each year after age 60, 3% for each year from age 55 to age 60, 6% for each year prior to 55, and proportionately for fractions of a year, from the effective date of reduced service retirement to the date the member would have been eligible for a service retirement benefit. For State Troopers, the service retirement benefit calculated above reduced 4% for each year after age 60, 3% for each year from age 50 to age 60, and proportionately for fractions of a year, from the effective date of reduced service retirement to the date the member would have been eligible for a service retirement benefit. Effective January 1, 2011, for all members that are not retirement eligible on January 1, 2011, the service retirement benefit calculated above shall be reduced using actuarial equivalent factors from the effective date of reduced service retirement to the date the member would have been eligible for a service retirement benefit.
Disability Retirement Benefit:	If years of Service Credit at disability are greater than 20, the disability retirement benefit is calculated based on actual Service Credit at disability; otherwise, the disability retirement benefit is calculated based on actual Service Credit at disability plus Service Credit projected to age 65, but not to exceed a total of 20 years of Service Credit. Benefits for disability retirees with an effective disability retirement date on or after July 1, 1988 and before January 1, 1999, who work after retirement will be reduced by one-third of the amount, if any, by which the initial annual PERA benefit plus earned income exceeds the annualized HAS. Disability benefits are payable for as long as the disability retiree is disabled. Benefits cease upon recovery.

Survivor Benefits:	If the deceased was not eligible for Reduced or Service Retirement at the time of death: Benefits are payable in the following order: a) Qualified Children Under Age 23: 40% of HAS for one child, an equal share of 50% of HAS if there are two or more children. b) Spouse: If no qualified children in (a) exist: i. less than 10 years of Service Credit, 25% of HAS, benefits begin at age 60; or ii. 10 or more years of Service Credit, the greater of 25% of HAS or the benefit which would have been payable as a 100% joint and survivor option if the deceased member had been eligible for service retirement and retired on the date of death, benefits begin immediately. c) Qualified Children Age 23 or Over: If no persons in (a) or (b) exist, 40% of HAS for one child, an equal share of 50% of HAS if there are two or more children. d) Dependent Parents: If no persons in (a) to (c) exist, 25% of HAS for one dependent parent or 40% of HAS for two dependent parents (minimum of $100 per month for each dependent parent). Benefits begin immediately and continue until the death of the parent(s). e) Named Beneficiary: If no persons in (a) to (d) exist, single payment equal to the member contribution account plus the appropriate matching contribution, plus interest. f) Estate of Deceased Member: If no persons in (a) to (e) exist, single payment equal to the member contribution account plus the appropriate matching contribution, plus interest. If the deceased was eligible for Reduced or Service Retirement at the time of death: The co-beneficiary is eligible for the amount that would have been payable had the member retired on the date of death and elected the 100% joint and survivor option. The order of payment is: a) Co-beneficiary - If the deceased member designated a co-beneficiary prior to death, that individual takes precedence in payment of benefits. b) Surviving Spouse c) Qualified Children d) Dependent Parents e) Named beneficiary f) Estate
Benefit Options:	Retirement and disability benefits are payable for the life of the retired member. Optional reduced benefits may be elected at the time of retirement to provide for continuation of 50% or 100% of a reduced benefit amount to a designated co-beneficiary. If the member retires any time after the date on which service retirement eligibility is first met, the reduction for 50% or 100% continuation option will be actuarially determined as of the date the member first became eligible for service retirement.

Post-Retirement Benefit Increases:	For members hired prior to January 1, 2007, each year on July 1, benefits which have been paid for at least twelve months preceding July 1, are increased. There is a temporary suspension of annual increases for July 1, 2018 and July 1, 2019 for all members. Beginning July 1, 2019 and each July 1 thereafter, annual increase amounts are adjusted in accordance with the Automatic Adjustment Provision as outlined above. Effective for years prior to 2018, the increase is 2.0% compounded annually for each year of retirement. If the investment return for the prior year is negative, then the increase will be an amount equal to the average of the annual CPI-W increases determined monthly for the prior year with a cap of 2%. Effective for years after 2019, the increase is 1.5% compounded annually for each year of retirement. If the investment return for the prior year is negative, then the increase will be an amount equal to the average of the annual CPI-W increases determined monthly for the prior year with a cap of 1.5%. In addition, the increase will be first paid on the July 1 that is at least 12 months after retirement for those members who retire on or after January 1, 2011. For member hired prior to January 1, 2007 and those that retired on or after July 1, 2018, the waiting period is extended from 12 months to 36 months. Members not eligible to retire as of January, 1 2011 who retire with a reduced service retirement allowance must reach age 60 or the age and service requirements for unreduced service retirement to be eligible for the Post-Retirement Benefit Increases. For PERA Benefit Structure service and disability retirees who were hired on or after January 1, 2007, and for PERA Benefit Structure survivor benefit recipients of deceased members who were hired on or after January 1, 2007: • The increase is the lower of 2.0% (1.5% after 2018) or the average of the CPI-W for each of the months during the prior calendar year. Increases to all benefit recipients in this group are limited to 10% of the total funds available in the Annual Increase Reserve in the division from which they retired or were a member before death. • Members must receive benefits for a full calendar year (three years after 2018) to be eligible for the increase. • The increase for service retirees who retire with a reduced service retirement does not begin until the retiree has been receiving benefits for a full calendar year and has on January 1 of the year the increase is paid, either reached age 60, or years of service plus age equal 85, 88, or 90, whichever is applicable. • No minimum age or service credit requirement shall apply for disability retirees or survivor benefit recipients.

DPS BENEFIT STRUCTURE	
Refund of Member Contributions:	In the event a member leaves service for a reason other than death or retirement, member contribution accounts including interest plus matching employer contributions on eligible amounts with interest are refunded upon request.
Service Retirement Eligibility:	The Age and Service Credit requirements to be eligible for a full Service Retirement are listed below: Members hired before January 1, 2010 who have 5 or more years of service credit as of January 1, 2011

Age	Service Credit (Years)
50	30
55	25 (must include 15 years of earned service)
65	5

Members hired before January 1, 2010 who have 5 years of service credit as of January 1, 2011

Age	Service Credit (Years)
Any	35
55	30 (must include 20 years of earned service)
55	Age + Service = 85 or more
60	25
65	5
65	60 payroll postings

Reduced Service Retirement Eligibility:	The Age and Service Credit requirements to be eligible for a Reduced Service Retirement are listed below: Members who have 5 or more years of service credit as of January 1, 2011

Age	Service Credit (Years)
55	15
Any	25

Members who have less than 5 years of service credit as of January 1, 2011

Age	Service Credit (Years)
50	25
55	20
60	5

Disability Retirement Eligibility:	Active members with five or more years of earned service credit and at least 6 months of this time earned in the most recent period of membership are eligible to apply for disability retirement. To be eligible, the member must be found to be totally and permanently disabled (mentally or physically) from regular and gainful employment.

Survivor Benefits Eligibility:	The qualified survivors of members who die before retirement with at least five years of service credit and are active at time of death are eligible for monthly survivor benefits.
Service Retirement Benefit:	The greater of a) or b): a) 2.5% of HAS times years of Service Credit b) $15 times first 10 years of service credit plus $20 times service credit over 10 years plus an amount equal to annuitized member balance.* * May include matching dollars if eligible.
Reduced Service Retirement Benefit:	See below

For those hired before July 1, 2005 the reduction factors are listed below:

Age	Service Credit	Reduction Amount
Under 50	30 years	4% for each year prior to age 50
Under 50	25 – 30 years	Greater of: • 4% for each year of service below 30 years • 4% for each year below age 50
50 – 55	25 – 30 years	Lesser of: • 4% for each year of service below 30 years • 4% for each year below age 50
Over 55	15 years	Lesser of: • 4% for each year of service below 25 years • 4% for each year below age 65

For those hired on or after July 1, 2005 but before January 1, 2010, the reductions factors are listed below:

Age	Service Credit	Reduction Amount
Under 50	30 years	6% for each year prior to age 50
Under 50	25 – 30 years	Greater of: • 6% for each year of service below 30 years • 6% for each year below age 50
50 – 55	25 – 30 years	Lesser of: • 6% for each year of service below 30 years • 6% for each year below age 50
Over 55	15 years	Lesser of: • 6% for each year of service below 25 years • 6% for each year below age 65

Effective January 1, 2011, for all members that are not retirement eligible on January 1, 2011, the service retirement benefit calculated above shall be reduced using actuarial equivalent factors, from the effective date of reduced service retirement to the date the member would have been eligible for a service retirement benefit.

Disability Retirement Benefit:	If years of Service Credit at disability are greater than 20, the disability retirement benefit is calculated based on actual Service Credit at disability; otherwise, the disability retirement benefit is calculated based on actual Service Credit at disability plus Service Credit projected to age 65, but not to exceed a total of 20 years of Service Credit. Disability benefits are payable for as long as the disability retiree is disabled. Benefits cease upon recovery.
Survivor Benefits:	a) Child: The greater of 10% of HAS for each child up to a limit of 30%, and $160 (pro-rated) for each child up to a limit of $480 b) Spouse with eligible children: The greater of the difference between the child benefit above and 30% (40% if 15 years of service plus 2% for each year of service beyond 25 years) of HAS, and $480 c) Dependent Parents: The greater of 10% of HAS for each parent, and $240 per parent d) Spouse (less than 15 years of service): The lesser of 30% of HAS, and $480; payable at later of age 60 or when the last eligible child loses eligibility e) Spouse (15 years of service or more): The greater of 30% of HAS, plus an additional 1% for each year of service over 15 years, and $480; payable at later of age 50 or when last eligible child loses eligibility
Benefit Options:	Option A: Single life annuity (SLA) with residual refund of member contributions Option B: SLA with guarantee period determined based on accumulated member contribution balance at retirement Option C: 100% joint and survivor annuity (J&S) with 10 years certain (not available to members retiring after January 1, 2010) Option D: Cash refund on annuity portion and SLA on pension portion (not available to members retiring after January 1, 2010) Option E: 50% J&S with 10 years certain (not available to members retiring post January 1, 2010) Option P2: 50% J&S with pop-up and residual refund of member contributions Option P3: 100% J&S with pop-up and residual refund of member contributions
Post-Retirement Benefit Increases:	Each year on July 1, benefits which have been paid for at least twelve months preceding July 1 are increased. The increase is 1.5% compounded annually for each year of retirement. If the investment return for the prior year is negative, then the increase will be an amount equal to the average of the annual CPI-W increases determined monthly for the prior year with a cap of 1.5%. In addition, the increase will be first paid on the July 1 that is at least 36 months after retirement for those members who retire on or after January 1, 2011. Members not eligible to retire as of January 1, 2011 who retire with a reduced service retirement allowance must reach age 60 or the age and service requirements for unreduced service retirement to be eligible for the Post-Retirement Benefit Increases.

Exhibit III – Colorado PERA Defined Benefit Pension Plan Funding Policy

I. Introduction

The Colorado Public Employees' Retirement Association (PERA) maintains five pre-funded, hybrid defined benefit pension plans [i.e., State Division Trust Fund, School Division Trust Fund, Local Government Division Trust Fund, Judicial Division Trust Fund, and Denver Public Schools (DPS) Division Trust Fund]. Each defined benefit pension plan is funded through PERA-affiliated employer contributions, member contributions, and the investment earnings resulting from those contributions. The fixed contribution rate at which each division's employers and members contribute is determined by the Colorado General Assembly and defined within the statutes governing PERA.

The purposes of this funding policy are to state the overall funding goals and annual actuarial metrics and to guide the PERA Board of Trustees (Board) when considering whether to pursue or support proposed contribution and benefit legislation. The policy also includes a brief list of governance responsibilities regarding the commissioning, collection, and review of actuarial information, as described in the Board's Governance Manual.

PERA also maintains two pre-funded defined benefit retiree health care subsidy plans (i.e., Health Care Trust Fund and DPS Health Care Trust Fund}, classified as other postemployment benefit (OPEB) plans. On January 19, 2018, the Board approved a separate OPEB funding policy with regard to these plans recognizing the adoption and implementation of the Governmental Accounting Standards Board (GASB) Statement No. 74, applicable to OPEB.

It is the intention of the Board that this funding policy be considered a working document, reviewed periodically and, as necessary, altered in the future through formal action of the Board. The final page of this document contains the review and revision/adoption history pertaining to the funding policy of the PERA defined benefit pension plans.

II. Background

In response to the unfavorable investment market of 2008, and in addition to the funding policy adopted in November 2007, the Board set the following guiding principles in 2009 in the development of a comprehensive package to maintain long-term sustainability of the pension plans:

- Shared responsibility among members, retirees, and employers;
- Intergenerational equity;
- Preservation of the defined benefit plan;
- Preservation of portability through the maintenance of existing benefit structures for the different divisions; and
- Development of recommendations that would have little-to-no short-term impact on member behavior.

In 2009 and 2010, these guiding principles benefited the Board and all the stakeholders associated with the pension plan as solutions to the immediate funding situation were explored. The Board constructed a series of plan provision changes, enlisting the philosophy of the guiding principles – under the umbrella of shared responsibility – and communicated their recommendations to the General Assembly. Senate Bill 10-001 was the culmination of all the provisional and contribution changes that were to set PERA's course toward sustainability. Senate Bill 10-001 also contained the following funding and annual increase requirements, which now are embedded in Colorado Statute and will be implemented regardless of the Board's pension funding policy:

- Per C.R.S. § 24-51-411(8), and § 24-51-411(9), the AED and the SAED are adjusted based on the year-end actuarial funded ratio within a particular division;
  - If a division trust fund's actuarial funded ratio:
    - Reaches 103%, a decrease in the AED and SAED is mandated, and,

        - Subsequently falls below 90%, an increase is mandated.
    - For the Local Government and Judicial Divisions, if the actuarial funded ratio reaches 90% and subsequently falls below 90%, an increase in the AED and SAED is mandated.
    - Increases in AED and SAED cannot exceed the statutory maximum allowable limitation.
- Per C.R.S. § 24-51-1009.5, if the combined pension divisions' trust fund actuarial funded ratio:
    - Reaches 103%, the upper limit of the annual increase shall be increased by one-quarter of one percent; and,
    - Subsequently falls below 90%, the upper limit of the annual increase shall be decreased by one-quarter of one percent.

These statutory elements, in addition to the current schedule of employer contribution rates, assist in the ongoing balance of shared responsibility. It is not the intention of this Board, through the development of this funding policy, to undermine or circumvent the work accomplished by Senate Bill 10-001, but rather to ensure continued fiduciary commitment through sound governance practices and recognition of these statutory funding policies.

The combined funding policy regarding PERA's pension and OPEB plans, adopted by the Board in November 2007, was in force with regard to the pension plans through December 30, 2014. On March 20, 2015, the Board approved a separate pension funding policy with regard to these plans, which reflects the guiding principles listed above. This pension funding policy is effective with the December 31, 2014 actuarial valuation, recognizes the adoption and implementation of the GASB Statement No. 67, applicable to pensions, and has been adopted and updated as indicated on the last page of the document.

This document is revised as of November 16, 2018, to reflect the Board's funding plan coming out of the September 2017 planning meeting with the intent to 1) propose pension reforms that would fully fund each of the five division trust funds within a 30-year period from first recognition, and 2) reset the 30-year closed amortization period for purposes of determining the Actuarially Determined Contribution (ADC) to mirror the funding period of the proposed changes, contingent on the passage of pension reform legislation. Given the June 4, 2018, enactment of Senate Bill 18-200, the Board was unable to affect the reinitialization of the 30-year period prior to finalization of the December 31, 2017, funding actuarial valuation results. Thus, as of the December 31, 2018, funding actuarial valuation, the 30-year closed amortization period is effective for amortizing the total unfunded actuarial accrued liability (UAAL) for each division trust fund as of December 31, 2017, in alignment with the initial recognition of the Senate Bill 18-200 pension forms. This action allows for a more accurate analysis of the "statutory contribution rate versus ADC rate" necessary to determine if the auto-adjust mechanism, also enacted through Senate Bill 18-200, is triggered for the following period.

III. Funding Goals

- Preservation of the **defined benefit plan structure** of providing lifetime retirement benefits to the employees of PERA-affiliated employers, reflecting the fact that PERA members are not covered under Social Security.
- Demonstration of **transparency and accountability** through the continued maintenance of a defined benefit pension plan funding policy for the stakeholders of PERA.
- **Achievement of a combined divisions' trust fund actuarial funded ratio greater than or equal to 110%.** Once the 110% combined funded ratio is achieved, following (1) the complete discontinuance of AED and SAED contributions, and (2) the restoration of the annual increase to pre-2010 levels pursuant to C.R.S. § 24-51-1009.5, the Board will consider and/or support the following actions, as ordered, as long as the funded ratio, either combined or individual by division, does not fall below 100% after consideration of the proposed change:
    - Examination and possible action of de-risking the total trust fund, including all divisions
    - Reduction in the base contribution rate(s)
    - Adoption of a benefit enhancement, beyond restoration of the annual increase as described above.

If the 110% combined funded ratio benchmark is attained through the assistance of certain funding arrangements where assets, outside of statutory contributions, are added to the plans, and results in additional tax-payer obligation, the payment method and duration of this debt should be considered prior to any supportive action taken regarding benefit enhancements.

- Dedication to the balance between:
  - **Contribution rate stability** – keeping contributions relatively stable over time, and
  - **Intergenerational equity** – allocating costs over the members' period of active service.
- Dedication to the systematic **reduction of the UAAL**, subject to the required action by the state legislature as described in C.R.S. § 24-51-411(8), § 24- 51-411(9), and § 24-51-1009.5, and as briefly summarized above in Section II.
- Recognition that within a multiple-employer cost-sharing defined benefit plan there are **beneficial elements of pooled risk**, both in the accrual of plan liabilities, recognizing actuarial gains and loss by division, rather than by employer; and in the accumulation of plan assets through the engagement of an appropriate level of asset risk management.

IV. Annual Actuarial Metrics

Below is a list of actuarial metrics to be assessed on an **annual basis as of the actuarial valuation date**. The Board recognizes that a single year's results may not be indicative of long-term trends and projected results.

- Funded ratios – Calculate and review by division:
  - The actuarial funded ratio based on the actuarial value of plan assets divided by the defined benefit pension plan's actuarial accrued liability (AAL), and
  - The market value funded ratio based on the market value of plan assets divided by the defined benefit pension plan's AAL.
- Funding period – To be determined for each division with respect to the applicable contribution rates. A funding period is the amortization period required to pay off that division's UAAL considering the resources available. Funding periods for each division will be determined in the annual actuarial valuation in relationship to both
  - Statutory contribution rates, and
  - ADC rates.
- Contribution rate comparison
  - Calculate and review by division.
- Actuarial Projections
  - Perform and review, by division.
    - Actuarial projections considering appropriate benefit provisions, salary and demographic data, actuarial assumptions, membership growth, and statutory contribution rates in order to determine the sustainability of each division under their benefit provisions and statutory contribution rate structure.
    - Projection modeling that allows for the testing of projection results under various economic and demographic stress conditions.

V. Funding Valuation Elements

Annually, the Board's actuary will perform an actuarial valuation for funding purposes, and calculate ADC rates against which to compare contribution rates mandated under State statute. The ADC will be the sum of a payment based on normal cost and a payment on the UAAL. The normal cost and the amount of payment on the UAAL are determined by the following three major components of a funding valuation:

- **Actuarial Cost Method**: This component determines the attribution method upon which the cost/liability of the retirement benefits are allocated to a given period, defining the normal cost or annual accrual rate associated with the projected benefits.

- The Entry Age Cost Method (EA), as is used for PERA's annual actuarial valuation purposes, is to be used for the determination of the normal cost rate and the actuarial accrued liability for purposes of calculating the ADC.
  - Under this method, normal cost is calculated using benefits based on projected service and salary at retirement and is allocated over an individual's career as a level percent of payroll. Because EA normal cost rates are level for each participant, the normal cost pattern for the entire plan under EA is more stable in the face of demographic shifts in the workforce. It is this normal cost stability that makes the EA method the preferred funding method for the majority of public defined benefit pension plans.
- **Asset Valuation Method**: This component dictates the method by which the asset value used in the determination of the UAAL is determined, which could be a market value or a smoothed actuarial value of trust assets.
  - Because investment markets are volatile and defined benefit pension plans typically have long investment horizons, application of an asset-smoothing technique can be an effective tool to manage contribution volatility and provide a more consistent measure of funding over time. Asset-smoothing methods reduce the effect of short-term market volatility on contributions, while still tracking the overall movement of the market value of plan assets by recognizing the effects of investment gains and losses over a period of years.
  - The asset valuation method to be used shall be a four-year smoothed market value of assets. The difference between actual market value investment returns and the expected actuarial investment returns is recognized equally over a four-year period.
- **Amortization Method**: This component prescribes, in terms of duration and pattern, the systematic manner in which the difference between the actuarial accrued liability and the actuarial value of assets is reduced.
  - Once established for any component of the UAAL, the amortization period for that component will be closed and will decrease by one year annually.
  - The amortization payment will be determined on a level percentage of pay basis.
  - The length of the amortization periods will be as follows:
    - Existing UAAL on December 31, 2017 – 30 years.
    - Any increase (or decrease) in the UAAL existing as of December 31, 2017 – remaining period of the initial 30-year period from the date of the valuation.
    - Annual future actuarial experience gains and losses – 30 years from the date of the valuation.
    - Future assumption changes – 30 years from the date of the valuation.
    - Future benefit enhancements/reductions – the number of years, as determined by the Board, to represent the anticipated duration of payment of the enhancement or, if a reduction, duration of the benefit to the plan. This determination will be based on the nature of the benefit change and the demographics of the membership group affected by the change, not to exceed 25 years from the date of the valuation.
  - If any future annual actuarial valuation indicates a division has a negative UAAL, the ADC shall be set equal to the Normal Cost until such time as the funded ratio equals or exceed 120%. At that time, the ADC shall be equal to the Normal Cost less an amount equal to 15 year amortization of the portion of the negative UAAL above the 120% funded ratio.
  - The target amortization period noted above regarding new UAAL will be applied for funding benchmark and RSI reporting purposes. Alternative ADCs will be determined by division, by applying the layered amortization methodology as described above, using a 25-year closed period, a 20-year closed period, and a 15-year closed period, in lieu of the 30-year period, for amortization of new UAAL. These comparatives are to appear in the Comprehensive Annual Financial Report (CAFR) as a demonstration of the transparency and accountability funding goal delineated in Section III of this document.

In conjunction with the three major components discussed above, a number of actuarial assumptions are used to develop the annual actuarial metrics, as well as the ADC rates, and are described in detail in the annual actuarial valuation report. The actuarial assumptions are derived and proposed by the Board's actuary and adopted by the PERA Board of Trustees in conformity with the Actuarial Standards of Practice issued by the Actuarial Standards Board. The assumptions represent the Board's best estimate of anticipated experience under the benefit provisions of PERA and are intended to be long-term in nature. In the development of actuarial assumptions, the Board considers not only past experience but also trends, external economic forces, and future demographic and economic expectations.

- Actuarial Assumptions – Actuarial assumptions are generally grouped into two major categories:
  - Demographic assumptions, which include rates of termination, retirement, disability, mortality, etc., and
  - Economic assumptions, which include investment return, salary increase, payroll growth, and inflation, etc.

Actuarial assumptions do not impact the total cost of the plan (benefit payments and expenses), but rather the timing of prescribed contributions. To the extent that actuarial experience deviates from the assumptions, and actual contributions deviate from projected, experience gains and losses will occur. These gains (or losses) then serve to reduce (or increase) the projected future contributions necessary to achieve or sustain a certain actuarial standard. It is in this vein that the ADC rates may help indicate if the statutory contribution rates are adequate to meet the future cost requirements of the plan, although the ADC calculated in valuation results has limitations due to changing costs over time. Considering various benefit tiers currently in effect within the Colorado PERA defined benefit pension plan, the results of the actuarial projections will be the best indication of the adequacy of the statutorily prescribed pension contribution schedule.

VI. Governance Policy/Processes

As delineated in the PERA Governance Manual, below is a list of specific actuarial and/or funding related studies, the frequency at which they should be commissioned/requested by the Board, and additional responsibilities relating to the studies:

- **Actuarial Valuation** (perform annually) – The Board is responsible for reviewing PERA's annual actuarial valuation report; and submitting a summary report to the Legislative Audit Committee and the Joint Budget Committee of the General Assembly, together with any recommendations concerning such liabilities that have accrued. In addition, the Board, in consultation with their retained actuary, will provide recommendations to the Colorado General Assembly regarding any necessary adjustments to the statutory employer and member contribution rates.
- **Experience Analysis** (perform periodically, historically performed approximately every four years) – The Board is responsible for ensuring that an experience analysis is performed as prescribed, for reviewing the results of that study, and for approving the actuarial assumptions and methodologies to be used for all actuarial purposes relating to the defined benefit pension and OPEB plans.
- **Actuarial Audit** (perform every five years, or the appointment of a new actuarial firm will satisfy requirement) – The Board is responsible for ensuring that an actuarial audit is performed as prescribed and for reviewing the results of that audit.
- **Asset Liability Study** (perform at least every three to five years, or more frequently if necessary) – The Board is responsible for ensuring that a study of the relationship between the defined benefit trust assets and liabilities is performed as prescribed and for reviewing the results of that study.
- Review of the **Defined Benefit Pension Plan Funding Policy** and the **Defined Benefit OPEB Plan Funding Policy** (perform periodically) – The Board is responsible for the periodic review of the funding policies applicable to the defined benefit pension and OPEB plans, as is deemed necessary.

VII. Glossary of Funding Policy Terms

- **Actuarial Accrued Liability (AAL)**: The AAL is the value at a particular point in time of all past normal costs. This is the amount of assets the plan would have today if the current plan provisions, actuarial assumptions, and participant data had always been in effect, contributions equal to the normal cost had been made, and all actuarial assumptions had been met. For each of the PERA defined benefit plans, the AAL includes the balance in the affiliated annual increase reserve.
- **Actuarial Cost Method**: The actuarial cost method allocates a portion of the total cost (present value of benefits) to each year of service, both past service and future service.

- **Annual Increase Reserve (AIR)**: As of January 1, 2007, an AIR was created for each division trust fund for the purpose of funding annual increases for PERA benefit structure members hired on or after January 1, 2007. A portion of the employer contribution, equal to one percent of the salaries of affected members, is accumulated in the AIR to be paid out in annual increases each July 1, to the extent affordable. Although invested with the affiliated division assets, the reserve balances are accounted for separately.
- **Asset Values**: For each of the PERA defined benefit plans, the actuarial and market asset values include the balance in the affiliated AIR.
  - Actuarial Value of Assets (AVA): The AVA is the market value of assets less the deferred investment gains or losses not yet recognized by the asset smoothing method.
  - Market Value of Assets (MVA): The MVA is the fair value of assets of the plan as reported in the plan's audited financial statements.
- **Entry Age Normal Actuarial Cost Method (EAN)**: The EAN actuarial cost method is a funding method that calculates the normal cost as a level percentage of pay or level dollar amount over the working lifetime of the plan's members.
- **Funded Ratio**: The funded ratio is the ratio of the plan assets to the plan's actuarial accrued liabilities.
  - Actuarial Value Funded Ratio: is the ratio of the AVA to the AAL.
  - Market Value Funded Ratio: is the ratio of the MVA to the AAL.
- **Normal Cost**: The normal cost is the cost allocated under the actuarial cost method to each year of active member service.
- **Present Value of Benefits (PVB) or total cost**: The PVB is the value at a particular point in time of all projected future benefit payments for current plan members, plus the balance in the affiliated AIR. The future benefit payments and the value of those payments are determined using actuarial assumptions regarding future events. Examples of these assumptions are estimates of retirement and termination patterns, salary increases, investment returns, etc.
- **Surplus**: A surplus refers to the positive difference, if any, between the AVA and the AAL.
- **Unfunded Actuarial Accrued Liability (UAAL)**: The UAAL is the portion of the AAL that is not currently covered by the AVA It is the positive difference between the AAL and the AVA.
- **Valuation Date**: The valuation date is the annual date upon which an actuarial valuation is performed; meaning that the trust assets and liabilities of the plan are valued as of that date. PERA's annual valuation date is December 31st.

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Amended: November 16, 2018

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