AUDIT REPORT

Denver Employees Retirement Plan
Actuarial Valuation

Denver Employees Retirement Plan
November 2019

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November 21, 2019

AUDITOR’S LETTER

The objective of our audit of the Denver Employees Retirement Plan actuarial valuation was to review the Jan. 1, 2019 Actuarial Valuation Report, including the assumptions and processes to calculate the net pension liability for the Denver Employees Retirement Plan as reported in the city’s Comprehensive Annual Financial Report. Bolton Partners Inc. conducted this audit on behalf of the Auditor’s Office. I am pleased to present the results of this audit.

I am very pleased with the review findings that the Jan. 1, 2019 Denver Employees Retirement Plan Actuarial Valuation Report was compliant with the relevant actuarial standards and appropriately valued the provisions in the Denver Revised Municipal Code. The audit, however, revealed that the Denver Employees Retirement Plan could improve some of its processes surrounding the assumptions in the plan’s valuation.

This audit is authorized pursuant to the City and County of Denver Charter, Article V, Part 2, Section 1, “General Powers and Duties of Auditor,” and was conducted by Bolton Partners Inc. to assess the Denver Employees Retirement Plan’s compliance with applicable Actuarial Standards of Practice. Those standards provide guidance for retirement plan valuations’ assumptions and processes used to calculate and disclose a plan’s assets and liabilities.

We extend our appreciation to personnel at the Denver Employees Retirement Plan who assisted and cooperated with us during the audit. For any questions, please feel free to contact me at 720-913-5000.

Denver Auditor’s Office

Timothy M. O’Brien, CPA
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City and County of Denver, Colorado

Audit of Denver Employees Retirement Plan Actuarial Valuation

November 21, 2019

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To management of Denver Employees Retirement Plan and the City and County of Denver's Auditor's Office (Denver, Colorado):

This report addresses our audit of the Denver Employees Retirement Plan annual Actuarial Valuation Report as of January 1, 2019. We concluded that:

- The January 1, 2019 Actuarial Valuation Report is generally in compliance with the Actuarial Standards of Practice (ASOPs) 4, 27, 35, 41, and 44. The ASOPs provide guidance to actuaries in actuarial communications, determining appropriate economic and demographic assumptions, and funding, asset, and amortization methods. The disclosures that address ASOP 51, which covers the assessment and disclosure of risk, are very thorough and well communicated.

- The assumptions and methods used in the January 1, 2019 Actuarial Valuation Report are appropriate in determining the liabilities of the plan. However, we have noted assumptions that should be reviewed. An example is the unused sick and vacation increases to the Highest Average Salary (HAS). This assumption was not reviewed during the 2018 experience study. Additionally, we recommend that future reports contain all assumptions used in determining the liabilities. We noticed the January 1, 2019 Actuarial Valuation Report did not contain additional assumptions used for the valuation of retiree medical benefits, such as election percentages.

- The change of funding method from Projected Unit Credit (PUC) to Entry Age Normal (EAN) is appropriate for the plan. This method is appropriate for plans that use pay-based formulas and contributions determined as a percentage of pay.

- We recommend that the actuarial valuation report fully disclose the components of the actuarially determined contribution (ADC) rate that is the basis for the upcoming year’s budgeted contribution. We understand that the plan has updated its procedures and is using the projected 2020 contribution rate from page 14 of the January 1, 2019 valuation as the basis for the requested 2020 total contribution rate. We agree with this approach. The 2019 valuation report should be updated or supplemented to provide the full development of the 2020 ADC rate. Future valuation reports should be revised to reflect the new procedures (e.g., the January 1, 2020 valuation report should fully disclose the development of the 2021 ADC).

- The values of the results of our replication are within acceptable ranges, and we have concluded that the January 1, 2019 Actuarial Valuation Report appropriately values the provisions in the Denver Revised Municipal Code given the assumptions and methods being used. We closely replicated the Present Value of Future Benefits (PVFB), the Accrued Liability (AL), and the Normal Cost (NC) calculations.
The undersigned actuaries are available to answer any questions on the material in this report or to provide explanations or further details as appropriate. We meet the Qualification Standards of the American Academy of Actuaries to render the actuarial opinions contained in this report. We are not aware of any direct or material indirect financial interest or relationship, including investments or other services, that could create a conflict of interest that would impair the objectivity of our work.

Sincerely,

BOLTON

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EXECUTIVE SUMMARY

The Auditor requested a review of the January 1, 2019 Actuarial Valuation Report for the Denver Employees Retirement Plan (DERP). Bolton was hired to collect and validate all source information, produce independent models to verify computational and procedural accuracy, and provide feedback on the valuation models’ strengths and weaknesses and recommendations for improvements. We did not audit the census or asset data.

We validated the accuracy of the 2019 key valuation results by replicating the actuarial valuation calculations using the data, methods, and assumptions provided by DERP and the plan’s actuary, Cheiron. Below is a summary of those results (all numbers are in $1,000s):

Combined Pension and Retiree Medical Results:

<table>
<thead>
<tr>
<th></th>
<th>Present Value of Future Benefits (PVFB)</th>
<th>Accrued Liability (AL)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(in $1,000s) 2019 Valuation Bolton Replication Difference (%)</td>
<td>(in $1,000s) 2019 Valuation Bolton Replication Difference (%)</td>
</tr>
<tr>
<td>Actives</td>
<td>1,577,400 1,579,606 0.1%</td>
<td>1,192,694 1,173,628 -1.6%</td>
</tr>
<tr>
<td>Inactives</td>
<td>2,599,814 2,600,013 0.0%</td>
<td>2,599,814 2,600,013 0.0%</td>
</tr>
<tr>
<td>Total</td>
<td>4,177,214 4,179,619 0.1%</td>
<td>3,792,508 3,773,641 -0.5%</td>
</tr>
</tbody>
</table>

These results are well within acceptable ranges, and we believe the valuation is accurately reflecting the plan provisions from the Denver Revised Municipal Code. Our recommendations in this report will focus on our review of assumptions and methods, as well as other potential work for Cheiron that might add value to the intended users of their report.

The following are comments and recommendations for possible improvements or areas where further review may be warranted:

1. The valuation report is generally in compliance with the Actuarial Standards of Practice (ASOPs), including ASOPs 4, 27, 35, 41, and 44.
2. We conclude that in general the assumptions and methods are reasonable and accurately reflect the best estimate of the cost of the plan. We have noted below certain assumptions that should be reviewed and/or disclosed in the valuation report.

3. For some members, unused sick and vacation hours are added to pay when determining Highest Average Salary (HAS). HAS is assumed to increase by 5.00% or 2.25% depending upon benefit type to account for this feature. As it is a material feature, we think there should be an explanation of the rationale for the assumption. We did not see that this was an assumption covered by the 2018 experience study.

4. The Society of Actuaries (SOA) recently completed a public sector plan mortality study and has produced base mortality rates for public sector pension plans. We recommend that Cheiron review this as an option for future changes in mortality assumptions.

5. We recommend that Cheiron update future valuation reports to include all relevant assumptions with respect to the pension and retiree medical valuation. For example, the retiree medical election percentage was not included in the 2019 valuation. We had to rely on prior valuation reports and the 2018 experience study to obtain this assumption.

6. We believe the election by the Retirement Plan Board to change to the Entry Age Normal (EAN) funding method and standard five-year smoothing asset method was appropriate. The EAN funding method produces a level normal cost with respect to payroll and is a good budgeting tool for plans that fund based on a percentage of payroll. Entry Age Normal is also model practice under the 2014 Conference of Consulting Actuaries (CCA) White Paper on actuarial funding policies and practices for public plans.

7. We believe the change from a 30-year to 20-year amortization was appropriate and avoided negative amortization. We suggest a shorter amortization period be established for future benefit improvements (if any), because it is better to have the policy in place before any changes are made.

8. We believe the report does an excellent job of complying with ASOP 51 risk disclosure requirements. The growing leverage ratio chart on page 26 of the valuation report and the stochastic projections on page 21 show a good picture of risk. It is our understanding that the trustees and the City have reviewed these projections with Cheiron and encourage that regular discussions of any concerns and future potential risk-reduction measures continue. Reducing risk often means higher current contributions and are beyond the scope of a valuation but not the skills of the plan actuary.

9. The January 1, 2019 valuation was produced on July 11, 2019 and provided the actuarially determined contribution for calendar year 2019. It is our understanding that for 2020 the budgeted contribution rate will be the projected rate from the 2019 valuation. We agree that this approach is correct; however, we recommend that Cheiron provide the Plan with the complete development of the 2020 contribution rate for its records and that future reports be modified to reflect the complete development of the actuarially determined contribution for the upcoming year, including the normal cost and amortization.

10. We recommend that clarification be given to the assumptions used in the Governmental Accounting Standards Board (GASB) report. The notes to the schedules reference the January 1, 2017 Actuarial Valuation but the assumptions listed are from both the 2017 and 2018 report. This recommendation is

Comments on the Retiree Deferred Retirement Option Plan (DROP)

We understand that the DROPs ended in 2003, but retirees had the option to leave their balances in the plan and continue to earn interest. While not material, we would like to point out the following:

1. Giving participants the option to receive their balances at any time represents a small cash flow risk, i.e., many participants could elect to receive a lump sum at the same time and assets could be depleted more rapidly than expected. The current balances are about $118 million which is close to annual 2018 employer and employee contributions totaling $134 million; however, only $8 million in DROP balances was withdrawn in 2018. Based on past experience, the cash flow risk is small, and the balances do not represent a large percentage of assets. We recommend monitoring the level of DROP balance distributions.

2. A few DROP retirees are over their minimum required distribution age. The plan says: “Deferral of any payment(s) from the account. If a deferral of payment(s) is selected, the participant may select one (1) of the following distribution methods at any time. Distributions may start no earlier than sixty (60) days following employment termination and must start no later than April 1 following the year in which the participant attains the age of seventy and one half (70 ½).” We have not tested to see if this is being followed.

3. The liability seems to be based solely on the current account balance of $118 million, which is a common practice. We suggest this be added to the assumption section of the report.

4. The interest crediting rate varies depending on whether this is a DROP I or DROP II account balance. The DROP I interest is based on “the plan’s actuarial assumption rate for investment return,” which we assume is the current 7.5% assumption. For DROP II, the “interest on the DROP II account shall accrue at the plan’s investment earnings rate provided that it shall be not less than three (3) percent per annum and not more than the plan’s then current annual, actuarial assumption for the rate of return. Such accruals to the DROP II account shall continue until the entire balance of the DROP II account is distributed.” We suggest this be added to the summary of plan provisions.

5. The municipal code requires the following: “Annually, the board shall seek a report from its actuary to ascertain the actuarial soundness of DROP II. Based on this annual report the board may recommend to the city council a termination or modification of DROP II by enactment of ordinance.” While the DROP has been closed since 2003, we suggest consideration be given to continuing this requirement, even if limited in scope, or the municipal code be updated to remove this requirement as it may no longer apply.
PURPOSE & PROCESS

Purpose of the Audit

The City and County of Denver retained Bolton to conduct an independent audit of the Denver Employees Retirement Plan. The purpose of this audit is to collect and validate all source information, produce independent models to verify computational and procedural accuracy, and provide feedback on models’ strengths and weaknesses and recommendations for improvements.

At a minimum, the audit should address the following:

- Appropriateness of the actuarial cost method used to calculate the normal cost and actuarial accrued liability;
- Appropriateness of the method used to develop the actuarial value of assets;
- Appropriateness of the assumptions used in the actuarial valuation;
- Completeness of the valuation report and any additional items that the reviewing actuary believes should be included in future valuation reports and also items that could be omitted from future reports;
- Whether the valuation meets all statutory requirements, the provisions set forth in the Denver Revised Municipal Code, and relevant Actuarial Standards Board Standards of Practice; and
- Other items or issues that the Actuary believes should be addressed.

Our assistance could be considered similar to a Level 1 Actuarial Audit (as defined by the Government Finance Officers Association (GFOA)), as we reviewed the plan provisions and actuarial valuation reports, including the methods and assumptions, and replicated the liability and cost calculations.

Scope of the Audit

For this actuarial audit, we focused first on the application of the plan’s benefit provisions, methods and assumptions, and Cheiron’s model reflecting these factors. We evaluated whether the assumptions and methods are appropriate, given prior experience as reflected in the 2018 experience study and the Actuarial Standards of Practice.

The objectives of this audit are to:

- Determine whether the actuarial methods, considerations, and analyses used by the Plan’s actuary in preparing the most recent actuarial valuation are reasonable and consistent with generally accepted actuarial standards and practices as promulgated by the Actuarial Standards Board.
- Assess if the actuarial results are appropriate for the structure and funding objectives of the Plan.
- Determine if the actuarial results are in compliance with Governmental Accounting Standards Board (GASB) reporting and disclosure requirements.
- Review and analyze the Net Pension Liability valuation results, including an evaluation of the data used for reasonableness and consistency, as well as a review of mathematical calculations for completeness and accuracy.
- Verify that all appropriate pension and post-employment health benefits have been valued and valued accurately.
• Verify that the data used by Cheiron is consistent with the data provided by DERP. (The scope of this study is a high-level review of the data and does not include an audit of participant data.)
• Assess that the actuarial cost, asset valuation, and amortization methods used are appropriate and in accordance with applicable standards.
• Verify the reasonableness of the calculation of the unfunded actuarial accrued liability and amortization period.
• Determine if the appropriate discount rate was used to measure the total pension liability, as well as review the sensitivity analysis performed by the actuary.
• Fully replicate the January 1, 2019 actuarial valuations.
• Analyze the valuation results and reconcile material differences, if any.
• Analyze the actuarial written work product.
• Provide an opinion as to whether the actuarial report conforms to appropriate Standards of Practice as promulgated by the Actuarial Standards Board and is comprehensive. In addition, provide recommendations for improvement or changes to the actuarial report, if any.

Methodology of the Audit for the 2019 Actuarial Valuation

The purpose of this audit is to express an opinion regarding the reasonableness of the actuarial assumptions, methods, and valuation results and whether the January 1, 2019 Actuarial Valuation Report adequately documents the results of the valuation so that the reader may understand the funding issues facing the Denver Employees Retirement Plan. This is achieved by the following:

1. Review of Data and Assumptions – Collecting and reviewing all source data, assumptions, methods, etc. used to produce the 2019 valuation results;
2. Replication of Valuation Results – Producing independent models to verify computational and procedural accuracy; and
3. Review and Recommendations – Provide review of assumptions and methods and provide feedback on models’ strengths and weaknesses and recommendations for improvements.

Assumptions Analysis

One of the most critical components in assessing the reasonableness of the funding levels is the selection and application of the actuarial assumptions. With respect to the assumptions, we:

1. Reviewed the economic assumptions and assumptions used by other plans to determine the reasonableness of these assumptions.
2. Reviewed the demographic assumptions and assumptions used by other plans to determine the reasonableness of these assumptions.
3. Reviewed the last experience study covering experience specific to this plan but did not perform an audit of the study.

Methods Analysis

The second component in assessing funding levels is the selection and application of the actuarial cost method (including the method for amortizing the unfunded actuarial accrued liability) and the asset valuation method (including smoothing techniques). Here, we also considered the recommendations made in the 2014 Conference of Consulting Actuaries’ “Actuarial Funding Policies and Practices for Public Pension Plans.”
REVIEW OF DATA AND ASSUMPTIONS

Introduction

To produce the actuarial results and total contribution rates, we obtained the following:

- Participant information (obtained from both DERP and Cheiron)
- Plan terms
- The plan’s investment policy statement
- DERP’s funding policy
- Documentation of assumptions and methods set by the Board

The Actuarial Standards of Practice (ASOPs) provide guidance on the measurement of pension obligations. The relevant ASOP for measuring pension obligations is ASOP 4 (Measuring Pension Obligations and Determining Pension Plan Costs or Contributions). ASOP 4 also references ASOPs 27 (Economic Assumptions), 35 (Demographic Assumptions), and 44 (Asset Valuation Methods).

Participant Information

We received source data from DERP and valuation data from Cheiron. We did not perform an audit; however, we did perform a high-level comparison of the source data to the valuation data and found no discrepancies.

Plan Terms

We compared the Denver Employees Retirement Plan section of the Denver Revised Municipal Code to the plan provisions outlined in the actuarial valuation report. We found no discrepancies and were able to replicate the key valuation numbers within a reasonable threshold.

Investment Policy

We have reviewed the investment policy for reasonableness. The primary objective of the investment policy is for the Trust to provide a net realized rate of return meeting or exceeding the actuarial assumption of 7.50%. We feel this objective is reasonable given the current rate of return assumption but would like to note that if the plan implements a de-risking strategy in the future that would lower the rate of return assumption then the investment policy will need to appropriately reflect the new objectives and policy. Investment policy should be based on the level of risk that the trustees think is appropriate for the City to take and should not be set to match a targeted discount rate. Levels of risk change over time even if the investment mix does not change.
Funding Policy

The funding policy is outlined in Section 18-407 of the Denver Employees Retirement Plan section of the Denver Revised Municipal Code. In summary, the funding policy is to contribute regularly to the plan such amounts as are necessary to maintain or assist in maintaining the plan on a sound actuarial basis. The 2019 valuation says the funding policy is to collect contributions equal to the sum of the normal cost under the actuarial funding method and amortization of the unfunded actuarial liability. We agree that this is a reasonable funding policy. We recommend that the actuarial valuation report fully disclose the components of the actuarially determined contribution (ADC) rate that is the basis for the upcoming year’s budgeted contribution. Future valuation reports should be revised to reflect the new procedures (e.g., the January 1, 2020 valuation report should fully disclose the development of the 2021 ADC) and contain the full development of the 2021 contribution rate, including the normal cost and amortization.

Economic Assumptions

Section 3.6 of ASOP 27 states that each economic assumption selected by the actuary should be reasonable. For this purpose, an assumption is reasonable if it has the following characteristics:

1. It is appropriate for the purpose of the measurement;
2. It reflects the actuary’s professional judgment;
3. It takes into account historical and current economic data that is relevant as of the measurement date;
4. It reflects the actuary’s estimate of future experience, the actuary’s observation of the estimates inherent in market data, or a combination thereof; and
5. It has no significant bias (i.e., it is not significantly optimistic or pessimistic), except when provisions for adverse deviation or plan provisions that are difficult to measure are included and disclosed, or when alternative assumptions are used for the assessment of risk.

Section 4.1 (Communications) of ASOP 27 states that any actuarial report communicating work subject to this standard should contain the following disclosures:

1. Assumptions Used: The actuary should describe each significant assumption used in the measurement of the obligations.
2. Rationale for Assumptions: The actuary should disclose the information and analysis used in selecting each economic assumption that has a significant effect on the measurement.

The 2019 actuarial report contains a section labeled “Actuarial Assumptions,” which states “The assumptions used in this report reflect the results of an Experience Study performed by the prior actuary covering the period from January 1, 2013 through December 31, 2017 and adopted by the Board for the January 1, 2018 Actuarial Valuation. More details on the rationale for the demographic and economic assumptions can be found in the Actuarial Experience Study dated May 18, 2018.”

We agree with Cheiron’s approach to not change certain assumptions until they had the opportunity to conduct an updated experience study. While we identified no assumption that seemed unreasonable, we will point out that the actuarial standards require the plan actuary to use reasonable assumptions, which could mean not waiting to change assumptions until the next experience study. As will be discussed in later sections, there are some assumptions that have been excluded from the experience study and should be reviewed and updated as appropriate. The municipal code requires that an experience study be done at least every five years. We recommend an experience study be done every three to five years.

Discount Rate/Rate of Return and Administrative Expenses
The National Association of State Retirement Administrators publishes statistics of the discount rate used in public sector pension plans. The latest average is from February 2019 and is presented below. The median for public sector plans is 7.25%:

The valuation uses a discount rate of 7.50% (net of investment and administrative expenses). This assumption was reviewed in the 2018 experience study. The recommendation was to maintain the current assumption of 7.50% (5.00% real return plus 2.5% inflation). This assumption is the net of all expenses, investment and administrative. The 5% real rate of return is likely aggressive, but it has not been determined that this assumption is unreasonable.

It is common to see this assumption as the net of investment expenses only with an administrative expense amount added to the normal cost. Based on the experience study, on average 0.18% of each year’s investment return is assumed to pay administrative expenses. This expense load is consistent with the actual return experienced in 2018. The investment return net of administrative and investment expenses is -3.54%, and the investment return net of only investment expenses is -3.35%, a difference of 0.19%.

Cost-of-Living/Inflation
The inflation assumption is 2.50%. This assumption was evaluated in the 2018 experience study by reviewing averages in the consumer price index and forecasts from investment consulting firms. We reviewed the study and have no reason to conclude that the results are not reasonable.

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1 The full report from NASRA is available on its website: https://www.nasra.org/files/issue%20Briefs/NASRAInvReturnAssumptBrief.pdf.
**Increases in Pay**
The pay increase assumption is the sum of two components—wage inflation and a merit scale (longevity and promotion increases). The wage inflation component generally remains constant throughout the working lifetime of an employee. The merit component is generally higher for younger employees and decreases throughout the life of employment. The wage inflation assumption is 3.00%. The merit scale for non-DHHA longevity and promotion increases is based on service. The merit scale for DHHA longevity and promotion increases is based on age. The 2018 experience study reviewed both the wage inflation and the merit assumptions. The wage inflation component is the inflation of 2.50% plus a productivity component of 0.50%. We reviewed the pay increases from the valuation data. The average of the recent salary increases (adjusted for decreases and outliers) is slightly lower for short-service employees and slightly higher for longer-service employees. Actual year-to-year changes in compensation likely have a high variance, and by using a longer exposure period, the experience study compensates for this variance and reduces the overall volatility of the resulting assumption. Despite the differences in recent experience, we have no reason to conclude that the salary increase assumption is not reasonable.

**Payroll Growth**
Payroll is assumed to increase by 3.00% per year. The projections use an assumed payroll growth of 3.00% per year for the non-DHHA group (page 14 of the valuation). We note that the 3.00% rate is more than the inflation assumption of 2.50% implying an assumption of some level (0.50%) real wage growth. We saw 3.00% rates more commonly in the past than we are seeing them currently. Rates closer to 2.50% are now more common.

We do recognize that the actual increase in payroll is 7.00% from last year’s valuation. We noted that some of this is due to an increase in head count of 1.30% (page 49 of the valuation) and salary increases greater than expected (page 2 of the valuation). The growth assumption is the overall increase to payroll due to salary increases and turnover (older, higher-paid employees retire while younger, lower-paid employees are hired). The 2018 experience study mentions payroll growth but does not directly say how it is derived; however, it is most likely set equal to the wage inflation assumption.

**Post-Retirement COLA**
The post-retirement cost of living increase is assumed to be 0.00%. Per the provisions section of the 2019 valuation report, no post-retirement increases have been given since 2002.
Demographic

ASOP 35 provides actuaries guidance for the selection of demographic assumptions. Section 3.3.5 provides the criteria for a reasonable assumption:

a. It is appropriate for the purpose of the measurement;
b. It reflects the actuary’s professional judgment;
c. It takes into account historical and current demographic data that is relevant as of the measurement date;
d. It reflects the actuary’s estimate of future experience, the actuary’s observation of the estimates inherent in market data (if any), or a combination thereof; and
e. It has no significant bias (i.e., it is not significantly optimistic or pessimistic), except when provisions for adverse deviation or plan provisions that are difficult to measure are included (as discussed in section 3.10.1) and disclosed under section 4.1.1 or when alternative assumptions are used for the assessment of risk.

Unused Sick and Vacation Hours

For members hired prior to January 1, 2010 and certain members regardless of hire date, the valuation assumes that unused sick and vacation hours are converted into pay for benefit calculation purposes. The valuation loads the final average compensation by 5.00% for active retirement benefits and 2.25% for active ordinary death and termination benefits for eligible members. This assumption was not reviewed in the 2018 experience study. The loading factor can have a significant impact on the valuation results, because it is directly applied to the calculation of expected benefits. Therefore, we recommend reviewing this assumption.

Family Composition

The family composition assumption is 75% of males are assumed to be married, and 60% of females are assumed to be married. The 2018 experience study stated there was not sufficient data to recommend a change to this assumption. Additionally, the 2018 experience study and 2018 actuarial valuation stated that males are assumed to be the same age as the spouse and also stated that there was not sufficient data to recommend a change to this assumption. However, the 2019 valuation report states males are assumed to be one year older than their spouses, even though this report states the valuation assumptions are based on the 2018 experience study. This change in the age difference assumption will not produce material differences in valuation results, plus it is common to see an assumption of males being one to four years older than the spouse. However, the 2019 valuation report should document and support the basis for any assumptions that differ from the 2018 experience study.

Termination Assumption

The termination rate assumption is based on the 2018 experience study. Termination rates are based on service and gender for non-DHHA members. Termination rates are based on age for DHHA members. We reviewed the study and have no reason to conclude that the results are not reasonable.
Disability Assumption
The disability assumption is based on the 2018 experience study. Disability rates are based on age. We reviewed the study and have no reason to conclude that the results are not reasonable.

Mortality Assumption
The mortality assumption uses RP-2014 mortality tables with generational projections using the ultimate MP scale. Inactive members have a load of 110% for males and 105% for females (disabled members have no load). The 2018 experience study suggested incorporating future mortality improvements to the calculations. ASOP 35 states that "the actuary should reflect the effect of mortality improvement both before and after the measurement date." The use of RP-2014 and a generational projection incorporates these improvements both before and after the measurement date. The Society of Actuaries (SOA) recently completed a public sector plan mortality study and has produced rates developed using data collected from public sector pension plans, with separate tables for teachers, public safety, and general employees. We conclude that the current mortality assumption is reasonable; however, we recommend that the plan’s actuary review the SOA public mortality study for future changes in mortality assumptions. Use of the ultimate MP scale to project future improvements in longevity is a reasonable assumption. However, it is more common for plans to use the entire two-dimensional projection scales as published.

Retirement Assumption
The retirement assumption is based on the 2018 experience study. Non-DHHA members are assumed to retire based on age until they are eligible under the "rule of retirement." DHHA members are only assumed to retire under the rule of retirement (no retirement rates are used before eligibility under the rule of retirement). We reviewed the study and have no reason to conclude that the results are not reasonable.

Medical Benefits
We recommend that the actuary expand the actuarial assumptions disclosure in the valuation report to document any additional assumptions used for the retiree medical plan. We relied on the 2018 actuarial valuation and 2018 experience study for the retiree medical election percentages. Using these sources, our model assumed that 85% of members who retire elect medical benefits, 30% of members who terminate elect medical benefits, 80% of beneficiaries elect medical benefits, and 80% of members who leave as disabled members elect retiree medical benefits. Additionally, the benefit is limited to the monthly premium elected. The assumptions should reference a maximum amount used for valuation purposes, if any.

Funding Method
Actuarial Cost/Funding Method
The Board elected to change the funding method from Projected Unit Credit (PUC) to Entry Age Normal, Level Percentage of Pay (EAN). The reasons the Board made this decision were to achieve level contributions (with respect to pay), the prevalence of this funding method in the public sector, and to match the requirements of GASB. Many public sector plans contribute and budget their contributions based on a percentage of payroll. The purpose of the EAN funding method is to produce level normal cost expressed as a percentage of pay. Keep in mind that the actual amount of contribution will increase due to pay increasing over time and gains/losses that the plan may experience (both in the assets and liabilities). Because the percentage is level, it makes for a better budgeting tool.

2 While separate base mortality tables have been developed for public sector plans, the MP improvement scale is appropriate for use with both public- and private sector base mortality tables.
The PUC method will produce a lower normal cost when the average age of active employees in the plan is lower and will increase as the plan matures and the average age increases (meaning lower payments early on and higher payments later). This method is harder to budget as a percentage of pay. Because PUC produces lower contributions early on, when a plan switches methods it is expected to have a higher unfunded liability. This is because under the EAN method the costs would have accrued at a higher rate. This unfunded amount is amortized into the future. The contribution will also increase as a result of both the higher amortization payment (to catch the plan up) and the increase in normal cost (explained below). These observations generally hold true, but depending on the maturity of the plan and plan demographics, some plans can experience differences.

Section 3.13 of ASOP 4 defines the guidelines for selecting a funding method as follows:

When assigning periodic costs or actuarially determined contributions to time periods in advance of the time benefit payments are due, the actuary should select an actuarial cost method that meets the following criteria:

a. The period over which normal costs are allocated for a participant should begin no earlier than the date of employment and should not extend beyond the last assumed retirement age. The period may be applied to each individual participant or to groups of participants on an aggregate basis.

When a plan has no active participants and no participants are accruing benefits, a reasonable actuarial cost method will not produce a normal cost for benefits. For purposes of this standard, an employee does not cease to be an active participant merely because he or she is no longer accruing benefits under the plan.

b. The attribution of normal costs should bear a reasonable relationship to some element of the plan’s benefit formula or the participant’s compensation or service. The attribution basis may be applied on an individual or group basis. For example, the actuarial present value of projected benefits for each participant may be allocated by that participant’s own compensation or may be allocated by the aggregated compensation for a group of participants.

c. Expenses should be considered when assigning periodic costs or actuarially determined contributions to time periods.

d. The sum of the actuarial accrued liability and the actuarial present value of future normal costs should equal the actuarial present value of projected benefits and expenses, to the extent expenses are included in the actuarial accrued liability and normal cost. For purposes of this criterion, under a spread gain actuarial cost method, the sum of the actuarial value of assets and the unfunded actuarial accrued liability, if any, shall be considered to be the actuarial accrued liability.

The funding method used is reasonable and meets the criteria outlined in ASOP 4.
Asset Smoothing Method

Asset Valuation Method
The Board elected to change the actuarial value of asset (AVA) method from a formula of Expected AVA EOY + 20% x (Actual Market Value EOY – Expected AVA EOY) to a more common five-year smoothing method. The standard five-year smoothing method will calculate the expected asset value at the end of the year using the discount rate of 7.5% compared to the actual asset value using actual return on assets. The difference between the two is the (gain) or loss on assets. Twenty percent of this (gain) or loss is recognized each year. This is a very acceptable method of determining the actuarial value assets, and we are able to replicate the AVA value of $2,255,412,003 for the pension plan and $73,706,458 for the retiree medical plan. A feature of the actuarial value of assets should be a reversion to market value in a reasonable period of time. The standard five-year smoothing allows for a reversion to market value, while the prior method was asymptotic in nature and never really got back to market value even if the fund always earned the assumption. An item to note is that on pages 31 and 32 of the valuation report the actual return is not net of administrative expenses. The actual return on page 33 is net of administrative expenses, which is the assumption elected by the Board. The AVA is calculated correctly based on the assumption; however, this discrepancy may cause confusion.

The actuary’s guide for determining the reasonableness of an asset smoothing method is Actuarial Standard of Practice (ASOP) No. 44. The following is an excerpt from this ASOP that establishes the qualities a reasonable asset smoothing method must exhibit:

3.3 Selecting Methods Other Than Market Value – If the considerations in section 3.2 have led the actuary to conclude that an asset valuation method other than market value may be appropriate, the actuary should select an asset valuation method that is designed to produce actuarial values of assets that bear a reasonable relationship to the corresponding market values. The qualities of such an asset valuation method include the following:

a. The asset valuation method is likely to produce actuarial values of assets that are sometimes greater than and sometimes less than the corresponding market values.

b. The asset valuation method is likely to produce actuarial values of assets that, in the actuary’s professional judgment, satisfy both of the following:

1. The asset values fall within a reasonable range around the corresponding market values. For example, there might be a corridor centered at market value, outside of which the actuarial value of assets may not fall, in order to assure that the difference from market value is not greater than the actuary deems reasonable.

2. Any differences between the actuarial value of assets and the market value are recognized within a reasonable period of time. For example, the actuary might use a method where the actuarial value of assets converges toward market value at a pace that the actuary deems reasonable, if the investment return assumption is realized in future periods.

In lieu of satisfying both (1) and (2) above, an asset valuation method could satisfy section 3.3(b) if, in the actuary’s professional judgment, the asset valuation method either (i) produces values within a sufficiently narrow range around market value or (ii) recognizes differences from market value in a sufficiently short period.

Two key principles for asset smoothing that arise from ASOP 44 include: (1) the smoothed asset values must fall within a reasonable range around market value and (2) differences between the actuarial and market value of assets must be recognized in a reasonable period of time. In lieu of satisfying both of these principles, a smoothing method could satisfy the requirements if, in the actuary’s professional judgment, the range around market value is sufficiently narrow or the differences are recognized in a
sufficiently short period.

The method adopted by the Board meets both of these objectives and is one of the most common asset smoothing methods used for public pension plans. We find the method to be reasonable and would not recommend any changes.

**Unfunded Liability Amortization Method**

**Amortization Method**

The Board elected to decrease the amortization of all unfunded accrued liability sources from 30 years to 20 years and will use a “layered” approach. This will increase the amortization payment to pay off the unfunded liability quicker. Additionally, the amortization payments increase with payroll growth assumptions each year to keep up with a level percentage of pay approach.

We would suggest (1) a review of the 3.00% assumption used for payroll growth and (2) a shorter amortization period be established for future benefit improvements (if any), because it is better to have the policy in place before any changes are made.
REPLICATION OF VALUATION RESULTS

We validated the accuracy of the 2019 Actuarial Valuation Report by replicating key results. Below is a summary of the results with all numbers presented in $1,000s. The acceptable tolerance for replicating present value of future benefits, accrued liability, and normal cost is within a range of 4.0%.

Combined Pension and Retiree Medical Results:

<table>
<thead>
<tr>
<th>Table 2</th>
<th>Present Value of Future Benefits (PVFB)</th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(in $1,000s)</td>
<td>2019 Valuation</td>
<td>Bolton Replication</td>
<td>Difference (%)</td>
</tr>
<tr>
<td></td>
<td>Actives</td>
<td>1,577,400</td>
<td>1,579,606</td>
<td>0.1%</td>
</tr>
<tr>
<td></td>
<td>Inactives</td>
<td>2,599,814</td>
<td>2,600,013</td>
<td>0.0%</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>4,177,214</td>
<td>4,179,619</td>
<td>0.1%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>Accrued Liability (AL)</th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(in $1,000s)</td>
<td>2019 Valuation</td>
<td>Bolton Replication</td>
<td>Difference (%)</td>
</tr>
<tr>
<td></td>
<td>Actives</td>
<td>1,192,694</td>
<td>1,173,628</td>
<td>-1.6%</td>
</tr>
<tr>
<td></td>
<td>Inactives</td>
<td>2,599,814</td>
<td>2,600,013</td>
<td>0.0%</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>3,792,508</td>
<td>3,773,641</td>
<td>-0.5%</td>
</tr>
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</table>

<table>
<thead>
<tr>
<th></th>
<th>Normal Cost (NC)</th>
<th></th>
<th></th>
<th></th>
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</thead>
<tbody>
<tr>
<td></td>
<td>(in $1,000s)</td>
<td>2019 Valuation</td>
<td>Bolton Replication</td>
<td>Difference (%)</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>58,472</td>
<td>59,293</td>
<td>1.4%</td>
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</table>
Pension Results:

Table 3

<table>
<thead>
<tr>
<th></th>
<th>Present Value of Future Benefits (PVFB)</th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(in $1,000s)</td>
<td>2019 Valuation</td>
<td>Bolton Replication</td>
<td>Difference (%)</td>
</tr>
<tr>
<td>Actives</td>
<td></td>
<td>1,516,580</td>
<td>1,517,303</td>
<td>0.0%</td>
</tr>
<tr>
<td>Inactives</td>
<td></td>
<td>2,479,044</td>
<td>2,479,625</td>
<td>0.0%</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td>3,995,624</td>
<td>3,996,928</td>
<td>0.0%</td>
</tr>
</tbody>
</table>

|                  | Accrued Liability (AL) |                   |                   |                   |
|                  | (in $1,000s)           | 2019 Valuation    | Bolton Replication| Difference (%)    |
| Actives          |                         | 1,144,627         | 1,125,020         | -1.7%             |
| Inactives        |                         | 2,479,044         | 2,479,625         | 0.0%              |
| **Total**        |                         | 3,623,671         | 3,604,645         | -0.5%             |

|                  | Normal Cost (NC)        |                   |                   |                   |
|                  | (in $1,000s)            | 2019 Valuation    | Bolton Replication| Difference (%)    |
| **Total**        |                         | 56,397            | 57,221            | 1.5%              |
Retiree Medical Results:

### Table 4

<table>
<thead>
<tr>
<th></th>
<th>Present Value of Future Benefits (PVFB)</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(in $1,000s)</td>
<td>2019 Valuation</td>
<td>Bolton Replication</td>
</tr>
<tr>
<td>Actives</td>
<td></td>
<td>60,820</td>
<td>62,302</td>
</tr>
<tr>
<td>Inactives</td>
<td></td>
<td>120,770</td>
<td>120,388</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>181,590</td>
<td>182,691</td>
</tr>
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</table>

### Table 5

<table>
<thead>
<tr>
<th></th>
<th>Accrued Liability (AL)</th>
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<th></th>
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</thead>
<tbody>
<tr>
<td></td>
<td>(in $1,000s)</td>
<td>2019 Valuation</td>
<td>Bolton Replication</td>
</tr>
<tr>
<td>Actives</td>
<td></td>
<td>48,067</td>
<td>48,608</td>
</tr>
<tr>
<td>Inactives</td>
<td></td>
<td>120,770</td>
<td>120,388</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>168,837</td>
<td>168,996</td>
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</table>

### Table 5 (continued)

<table>
<thead>
<tr>
<th></th>
<th>Normal Cost (NC)</th>
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<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(in $1,000s)</td>
<td>2019 Valuation</td>
<td>Bolton Replication</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>2,075</td>
<td>2,072</td>
</tr>
</tbody>
</table>

Additional Summary Statistics:

### Table 5 (continued)

<table>
<thead>
<tr>
<th></th>
<th>2019 Valuation</th>
<th>Bolton Replication</th>
<th>Difference (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of Participants (Pension)</td>
<td>25,273</td>
<td>25,272</td>
<td>0.0%</td>
</tr>
<tr>
<td>Number of Participants (Retiree Medical)</td>
<td>22,535</td>
<td>22,531</td>
<td>0.0%</td>
</tr>
<tr>
<td>Average Active Age</td>
<td>44.2</td>
<td>44.2</td>
<td>0.0%</td>
</tr>
<tr>
<td>Average Service</td>
<td>9.3</td>
<td>9.3</td>
<td>0.0%</td>
</tr>
<tr>
<td>Valuation Salary</td>
<td>692,150,700</td>
<td>691,922,048</td>
<td>0.0%</td>
</tr>
</tbody>
</table>

The key purpose of the independent models is to audit the actuarial liabilities of the valuation report and verify the Actuary’s calculations. We created independent actuarial models in ProVal, the same valuation software used by Cheiron for the valuation report.

We concluded that the benefit provisions, methods, and assumptions were appropriately used by Cheiron to determine the liabilities, normal cost, and employer pension contributions for the 2019 valuation and encountered no significant errors.
REVIEW AND RECOMMENDATIONS

This section will review the objectives from the scope of the audit and review and recommend as necessary.

Assumptions and Methods

We have reviewed the actuarial assumptions and methods for the 2019 actuarial valuation. We additionally reviewed the 2018 experience study, which was the basis for the valuation calculations. While an audit of the 2018 experience study is out of scope, we have reviewed the methods and results from the study for reasonableness. We conclude that the assumptions and methods are generally valid and reasonable.

We conclude that the change from a 30-year to 20-year amortization is appropriate. This change avoids negative amortization. Negative amortization occurs when the payment pays only a portion of the interest due and the outstanding balance of the unfunded liability increases over time. We additionally encourage a short amortization period to be established for future benefit improvements. It is recommended to have a policy in place before any such changes are made in determining how to fund these increases.

We conclude that the change in funding method from Projected Unit Credit (PUC) to Entry Age Normal (EAN) is reasonable and appropriate. The EAN method is appropriate for plans with benefits based on salary and plans that contribute as a percentage of pay. The primary goal of the EAN funding method is to determine costs as a level percentage of pay with minimal gains and losses.

We conclude that the change in asset method to a standard five-year smoothing method is appropriate. This method is very common for public sector plans and recognizes gains and losses in a reasonable period of time.

We conclude that the cost-of-living increase assumption of 0.00% is reasonable. The provisions state that no increases have been given since 2002.

We feel that the unused sick and vacation leave assumption should be reviewed as this can have a material impact on the valuation results. The current load assumptions apply either a 5.00% or 2.25% to the final average compensation. The 2018 experience study did not address this assumption. We recommend to review the frequency and amount of unused sick and vacation leave that is used to determine an appropriate assumption.

We feel that the retiree medical election assumption should be reviewed, as this assumption would have a material impact to the valuation results. This assumption was not changed per the 2018 experience study and does not appear to have been reviewed.

The only discrepancy we noticed between the 2018 experience study and the 2019 report is the age difference assumption between males and females. The experience study stated that the males are assumed to be the same age as females, and the report stated that males are assumed to be one year older. This will not produce any material differences, but this should be reviewed by Cheiron.

We conclude that the discount rate assumption is reasonable but would like to note a few items. It is common for this assumption to be only the net of investment expenses; however, based on the 2018 experience study and the results from the 2019 valuation, it does not appear to be unreasonable for this assumption to be net of both investment and administrative expenses.

We conclude that the current mortality assumption is reasonable and appropriately reflects mortality improvement both before and after the measurement date. The use of a generational morality table starts...
with a base table that reflects mortality at a specified year. The valuation uses a table with rates based on year 2014. This is a very common base table used in all pension sectors. The generational piece of the calculation will apply improvement (reflect that participants live longer over time) first to the current year of valuation and additionally reflect improvements past the valuation date. A basic example is that a 55-year-old in 2025 will have a greater chance at survival than a 55-year-old in 2019 due to medical advancements, changes in health, etc. The use of generational mortality captures this to reduce actuarial gains and losses from longevity risk. We also encourage that Cheiron review the recently published public sector mortality study by the Society of Actuaries to determine if there are any appropriate future changes to the mortality assumption.

We conclude that the assumptions and methods are adhering to the Actuarial Standards of Practice (ASOPs) 4, 27, 35, 41, and 44 appropriately. ASOP 4 defines the guidelines for selecting funding methods. ASOP 27 defines the guidelines for selecting economic assumptions, ASOP 35 defines the guidelines for selecting demographic assumptions, ASOP 41 defines the guidelines for actuarial communications, and ASOP 44 defines the guidelines for asset valuation methods.

**GASB Reporting and Disclosure Requirements**

We additionally reviewed the Governmental Accounting Standards Board (GASB) calculations as of December 31, 2018 (contained in a separate report) and conclude that the calculations are performed correctly.

We recommend clarification on the assumptions used for the report and FYE2018 contribution rate. The notes to schedules included list that the valuation date is January 1, 2017 and then proceeds to list key assumptions that appear to be used in either the January 1, 2017 valuation or the January 1, 2018 valuation. Based on the rest of the information in the report, it appears that the date for the valuation should be edited from January 1, 2017 to January 1, 2018. Appendix B looks correct in referencing the January 1, 2018 report.

**Valuation and Reporting**

We have reviewed the provisions in the 2019 valuation report and the Denver Revised Municipal Code and conclude that all appropriate pension and retiree medical benefits are being valued accurately. Our calculations of the present value of future benefits, accrued liability, normal cost, actuarial value of assets, and amortization of unfunded liabilities are all within accepted tolerances and follow standards set forth by the Actuarial Standards of Practice (ASOPs). We performed a high-level review of the source data file provided by DERP to the valuation data used by Cheiron and found no errors or discrepancies.

We additionally have reviewed the DROP lump sums and liabilities reported by the valuation. The DROP I and II programs ended in 2003, but retirees had the option to leave their balances in the plan. These balances accrue interest until the amount is paid to the retiree. Given that the DROP balances are $118 million and total contributions (for 2018) are $134 million, this introduces a cash-flow risk should members elect to receive their balances in a small time window (which may be unlikely). We additionally noticed that the municipal code requires distributions to be no later than age 70.5; however, we noticed some retirees beyond this required age. We have not tested to see if this is being followed. Also, we recommend that DROP assumptions and provisions be added to the valuation report. The DROP I program uses the investment return assumption (currently 7.5%) to credit interest, and DROP II uses the plan’s investment earnings with a minimum of 3% and a maximum of the investment return assumption. The DROP liability is also reported as the current account balance. Finally, per the municipal code, the Board should seek a report annually on the actuarial soundness of DROP II. We suggest that consideration be given to continuing this requirement even though the DROP has been closed since 2003, even if the report is limited in scope, or that the municipal code be updated to remove this requirement.
We recommend that future reports list all assumptions and methods used by the Actuary to calculate pension liabilities not currently listed in the report and provide all assumptions used for the valuation of the retiree medical benefits. We relied on the prior valuation report for the retiree election assumptions for the retiree medical plan.

ASOP 51 provides guidance to actuaries regarding the assessment and disclosure of risk, particularly with calculating the actuarially determined contribution for the plan. We feel that the report does an excellent job of disclosing these risks and the trustees should continue to review and discuss mitigation of these risks with Cheiron.

Page 40 shows that other than investments, there were no material gains or losses. However, most items were losses. If the plan continues to see only actuarial losses, then this can be addressed with another experience study. The purpose of setting the correct assumptions is to produce minimal gains and losses and correctly estimate behavior in the long run. The “leakage” of small losses for new entrants is common. While not material, it can be addressed with a normal cost load, if desired.

The “reported assets” shown on page 46 (Table VI-1(a)) and later in Table VI-1(b) are the actuarial value of assets. This is the GASB basis and should be used. However, we think it should be disclosed as not being the market value. Table VI-2(a) does not have this issue.
CONCLUSION

Based on our audit, we concluded that:

1. The valuation report is generally in compliance with the ASOPs, including ASOPs 4, 27, 35, 41, and 44. We have reviewed the assumptions and methods and conclude that these are appropriate in determining the liabilities of the plan. We conclude that the recent adoption of the Entry Age Normal funding method, along with the standard five-year asset smoothing method, are appropriate methods to determine the costs of the plan. We also agree with the reduction to the amortization period from 30 years to 20 years. **We recommend that an amortization policy be adopted for future benefit increases and that this policy be tied to average future working lifetime for current employees impacted by the change.** Please see Appendix A for a link to the relevant ASOPs and Appendix B for a link to the CCA White Paper on “Actuarial Funding Policies and Practices for Public Pension Plans.”

2. The actuarial valuation appropriately uses the most recent assumptions set forth in the 2018 experience study. **We recommend that any assumptions not reviewed as part this study be reviewed during the next experience study as they may have a material impact to the liabilities, such as the unused sick and vacation leave loads.**

3. The valuation report provides a very detailed and well-communicated section regarding ASOP 51 (assessment and disclosure of risk). The board should continue to review any concerns and potential mitigation strategies with respect to these risks with the plan actuary.

4. The values of the results of our replication are within acceptable ranges, and we have concluded that the benefits outlined in the Denver Revised Municipal Code are being valued appropriately. We valued both the pension benefits and retiree medical benefits and conclude that there are no significant valuation errors.

5. **We recommend that the January 1, 2019 valuation report be supplemented to include the full development of the 2020 proposed budgeted contribution rate and that future reports be revised to provide the details of the development of the actuarially determined contribution used for the budgeted contribution rate.** We understand that after the January 1, 2019 valuation report was issued, the plan elected to use the projected 2020 contribution rate from the report for the 2020 proposed budgeted contribution rate. We support this change; however, the plan should request further details supporting the 2020 contribution rate. Future reports should be revised accordingly. For example, the January 1, 2020 valuation report should contain the full development of the 2021 contribution rate, including the normal cost and amortization.

6. **We recommend that Cheiron review all provisions and assumptions for both the pension and retiree medical benefits and update the appropriate sections of future valuation reports.** This includes the DROP program as well. **We recommend documenting any assumption used for the retiree medical valuation.**

7. **We recommend clarification of the assumptions shown in the GASB report to ensure the assumptions correspond to the calculations in the report.**
ACTUARIAL CERTIFICATION

The undersigned credentialed actuaries meet the Qualification Standards of the American Academy of Actuaries to render the actuarial opinion contained herein. They are currently compliant with the Continuing Professional Development Requirement of the Society of Actuaries. We are not aware of any direct or material indirect financial interest or relationship, including investments or other services, that could create a conflict of interest that would impair the objectivity of our work.

We are available to answer any questions on the material in this report to provide explanations or further details as appropriate.

BOLTON

Ann M. Sturner, FSA, EA, MAAA
Senior Consulting Actuary

Ellen Kleinstuber, FSA, EA, FCA, MAAA
Chief Actuary

Colin Slovenkay, FSA, EA
Actuary

Thomas Lowman, FSA, EA, FCA, MAAA
Principal, President of Bolton Retirement
APPENDIX B – ACTUARIAL FUNDING POLICIES AND PRACTICES

See link at:
October 30, 2019

Auditor Timothy M. O’Brien, CPA
Office of the Auditor
City and County of Denver
201 West Colfax Avenue, Dept. 705
Denver, Colorado 80202

Dear Mr. O’Brien,

The Office of the Auditor tasked Bolton to perform an audit of Denver Employees Retirement Plan actuarial valuation.

This memorandum provides a written response for each reportable condition noted in the Auditor’s Report final draft that was sent to us on October 4, 2019. This response complies with Section 20-276 (c) of the Denver Revised Municipal Code (D.R.M.C.).

CONCLUSION
Bolton conducted an audit of Denver Employees Retirement Plan actuarial valuation and made the following recommendations.

RECOMMENDATION 1
We recommend that an amortization policy be adopted for future benefit increases and that this policy be tied to average future working lifetime for current employees impacted by the change.

<table>
<thead>
<tr>
<th>Agree or Disagree with Recommendation</th>
<th>Target date to complete implementation activities (Generally expected within 60 to 90 days)</th>
<th>Name and phone number of specific point of contact for implementation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Agree</td>
<td>June 2020</td>
<td>Heather Darlington (303) 839-5419</td>
</tr>
</tbody>
</table>

Narrative for Recommendation 1
While benefit enhancements are not currently being considered, and will not be considered until the Plan is fully funded, an amortization policy will be formalized during the next Actuarial Valuation process. The 1/1/2020 Valuation will be finalized in June, 2020.

RECOMMENDATION 2
We recommend that any assumptions not reviewed as part of the latest experience study be reviewed during the next study as they may have a material impact to the liabilities, such as the unused sick and vacation leave loads.
<table>
<thead>
<tr>
<th>Agree or Disagree with Recommendation</th>
<th>Target date to complete implementation activities (Generally expected within 60 to 90 days)</th>
<th>Name and phone number of specific point of contact for implementation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Agree</td>
<td>January 2023</td>
<td>Heather Darlington (303) 839-5419</td>
</tr>
</tbody>
</table>

**Narrative for Recommendation 2**
The unused sick and vacation loads are reviewed by DERP’s actuary, Cheiron, as part of their Annual Valuation process. In addition, as recommended, the unused sick and vacation loads will also be included in the next Experience Study. The last Experience Study was performed in January, 2018, so the next study is slated for January, 2023.

**RECOMMENDATION 3**
We recommend that the January 1, 2019 valuation report be supplemented to include the full development of the 2020 proposed budgeted contribution rate and that future reports be revised to provide the details of the development of the actuarially determined contribution used for the budgeted contribution rate.

<table>
<thead>
<tr>
<th>Agree or Disagree with Recommendation</th>
<th>Target date to complete implementation activities (Generally expected within 60 to 90 days)</th>
<th>Name and phone number of specific point of contact for implementation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Agree</td>
<td>June 2020</td>
<td>Heather Darlington (303) 839-5419</td>
</tr>
</tbody>
</table>

**Narrative for Recommendation 3**
Going forward, Cheiron will provide documentation for the full development of the future year’s contribution rate, which is used for the City’s budget. For example, the 1/1/2020 Actuarial Valuation will include the details associated with the 2021 actuarially determined contribution rate.

**RECOMMENDATION 4**
We recommend that Cheiron review all provisions and assumptions for both the pension and retiree medical benefits and update the appropriate sections of future valuation reports. This includes the DROP program as well. We recommend documenting any assumption used for the retiree medical valuation.

<table>
<thead>
<tr>
<th>Agree or Disagree with Recommendation</th>
<th>Target date to complete implementation activities (Generally expected within 60 to 90 days)</th>
<th>Name and phone number of specific point of contact for implementation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Agree</td>
<td>June 2020</td>
<td>Heather Darlington (303) 839-5419</td>
</tr>
</tbody>
</table>
Narrative for Recommendation 4
Cheiron currently reviews all provisions and assumptions as part of their Annual Valuation process. These will all be documented in the next Actuarial Valuation report. The 1/1/2020 Valuation will be finalized in June, 2020.

RECOMMENDATION 5
We recommend clarification of the assumptions shown in the GASB report to ensure the assumptions correspond to the calculations in the report.

<table>
<thead>
<tr>
<th>Agree or Disagree with Recommendation</th>
<th>Target date to complete implementation activities (Generally expected within 60 to 90 days)</th>
<th>Name and phone number of specific point of contact for implementation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Agree</td>
<td>August 2020</td>
<td>Heather Darlington (303) 839-5419</td>
</tr>
</tbody>
</table>

Narrative for Recommendation 5
Assumptions will be clarified in future GASB reports. The next GASB reports will be finalized in August, 2020.

Please contact Dawn Wiseman at 720-913-5069 with any questions.

Sincerely,

Heather K. Darlington
Executive Director

cc: Valerie Walling, CPA, Deputy Auditor
    Dawn Wiseman, CRMA, Audit Director
    Vilma Balnyte, CPA, MBA, Lead Auditor
The Auditor of the City and County of Denver is independently elected by the citizens of Denver. He is responsible for examining and evaluating the operations of City agencies and contractors for the purpose of ensuring the proper and efficient use of City resources. He also provides other audit services and information to City Council, the Mayor, and the public to improve all aspects of Denver’s government.

The Audit Committee is chaired by the Auditor and consists of seven members. The Audit Committee assists the Auditor in his oversight responsibilities regarding the integrity of the City’s finances and operations, including the reliability of the City’s financial statements. The Audit Committee is structured in a manner that ensures the independent oversight of City operations, thereby enhancing citizen confidence and avoiding any appearance of a conflict of interest.

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We deliver independent, transparent, and professional oversight in order to safeguard and improve the public’s investment in the City of Denver. Our work is performed on behalf of everyone who cares about the City, including its residents, workers, and decision-makers.